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Who will end the leaded petrol death trade?

Contents

Editorial - Who will be the champion of a world free from leaded petrol?	2
Supply Chain for the Lead in Leaded Petrol	3
News. Urgent need to cut the leaded petrol supply chain	5
The six countries where leaded petrol is possibly still sold for road use	6
Six countries still use leaded petrol. Why?	7
Countries where leaded petrol is possibly still sold for road use	8
How the various factors relate to the continued use of leaded petrol	9
Democracy and the Elimination of Leaded Petrol in 2006	11
Per Capita Gross Domestic Product (GDP) and the Elimination of Leaded Petrol in 2006.....	14
Free Subscription to e-Newsletter Notifications / Membership & Donation Forms	21
Acknowledgement and Disclaimer	21



Editorial - Who will be the champion of a world free from leaded petrol?

by Elizabeth O'Brien and Anne Roberts



Ivan Glasenberg

Ivan Glasenberg, Australia's 2nd - most wealthy citizen, resident of Switzerland, CEO of Xstrata, whose Mt Isa Queensland lead mine supplies the UK's smelter with lead that is sold to Innospec, maker of the lead-petrol additive?

David Cameron, Prime Minister of the UK, who could ban the manufacture and export of the lead additive for petrol, banned in the UK for nearly 10 years?



David Cameron



Julia Gillard

Julia Gillard, Prime Minister of Australia, who could declare a moratorium on lead exports destined for the UK and being made into lead petrol additive by Innospec?

Barack Obama, President of the USA, by demanding an end to the sale of lead additive for petrol? The US was the first to begin phasing out leaded petrol – in 1972. The US has prosecuted Innospec – a US corporation – for bribery which had resulted in lead petrol being sold in Iraq, and also in Indonesia - where it is officially banned. Obama has the power to direct the US Securities and Exchange Commission (SEC) to demand that Innospec cease selling the lead additive for road use and take back all stocks.



Barack Obama



Micheline Calmy-Rey

Micheline Calmy-Rey, President of Switzerland? The Swiss company Alcor, a wholly owned subsidiary of Innospec, was involved in bribing officials in Iraq and Indonesia in order to sell leaded petrol beyond the phase-out date in those countries. The Swiss company Xstrata mines the lead and owns the smelting company that smelts all the lead that is later manufactured into the lead additive for leaded petrol. Surely a President can require better stewardship from companies incorporated in her country?

Patrick Williams, Innospec's CEO, who has the power to re-write the Tetra-ethyl lead (TEL) supply policy of Innospec's Stewardship programme? In order to champion corporate stewardship, the policy would need to state that TEL will no longer be manufactured or exported and that all stocks currently overseas will be bought back and safely managed by the company.



Patrick Williams

Supply Chain for the Lead in Leaded Petrol

By Anne Roberts, Editor, LEAD Action News, and Elizabeth O'Brien, Partner, UN Environment Programme's Partnership for Cleaner Fuels and Vehicles (UNEP PCFV)



Steps for getting lead into leaded petrol: the lead is mined in Australia, smelted in the UK, and manufactured into the Lead additive, Tetra-ethyl Lead (TEL) in the UK. The Lead additive is then distributed by a Swiss company, and added to petrol at refineries in the six countries still selling leaded petrol for road use: Afghanistan, Algeria, Iraq, Myanmar (Burma), North Korea and Yemen.

The six people whose photos appear on our front page could step in at various stages of the supply chain, and put an end to the remaining use of leaded petrol in the world.

Australian and Swiss connections

(Where Julia Gillard and Micheline Anne-Marie Calmy-Rey come into the picture.)

Xstrata, a Swiss-owned company, mines the lead at Mt Isa, Queensland, Australia.

UK and Swiss connection

(Where David Cameron and Micheline Anne-Marie Calmy-Rey come into the picture.)

Xstrata ships the lead to the UK, to a lead smelting company, Britannia Refined Metals Ltd.

Britannia Refined Metals Limited is a wholly owned subsidiary of MIM Holdings Limited, a company now owned by Xstrata Plc. Britannia Refined Metals has treated the lead and silver output of Mount Isa and subsequently the output of the two M.I.M. owned Zinc Smelters in Avonmouth & Duisberg.

Britannia Refined Metals Ltd supplies the lead to Innospec in the United Kingdom.

UK and USA connection

(Where David Cameron, Barack Obama and Patrick Williams come into the picture.)

Innospec, a UK company, incorporated in the USA, is the only company in the world making tetraethyl lead, the additive that turns unleaded petrol into leaded petrol. Innospec is thus the only tetraethyl lead manufacturer and all refineries supplying leaded petrol to the six countries which are still selling leaded petrol for road traffic, must purchase their tetraethyl lead either directly or indirectly from Innospec.

Innospec has pleaded guilty to bribery charges brought by the US Serious Fraud Office, for bribery in Iraq and Indonesia. **An abridged version of the case follows**, from the FBI report on the case <http://www.fbi.gov/washingtondc/press-releases/2010/wfo031810.htm>

March 18, 2010

WASHINGTON—Innospec Inc., a Delaware corporation, pleaded guilty today to defrauding the United Nations (UN), to violating the Foreign Corrupt Practices Act (FCPA)...

Innospec pleaded guilty ...to 12-count information charging wire fraud in connection with Innospec's payment of kickbacks to the former Iraqi government under the UN Oil for Food Program (OFFP), as well as FCPA violations in connection with bribe payments it made to officials in the Iraqi Ministry of Oil...

UK and Swiss connection

(Where David Cameron and Micheline Anne-Marie Calmy-Rey re-enter the picture.)

'According to court documents, from 2000 to 2003, Innospec's Swiss subsidiary, **Alcor**, was awarded five contracts valued at more than €40 million to sell tetraethyl lead to refineries run by the Iraqi Ministry of Oil under the OFFP. To obtain these contracts, Innospec admitted that Alcor paid or promised to pay at least \$4 million in kickbacks to the former Iraqi government...

Innospec acknowledged in court documents that it paid approximately \$2.9 million in bribes to officials of the **Indonesian** government to secure sales...

Innospec's British subsidiary, Innospec Ltd., pleaded guilty...in connection with the corrupt payments to Indonesian officials...'

Statement by Innospec on its website, regarding the lead additive

(<http://www.innospecinc.com/octane-additives.html> , accessed 22 June 2011)

'Our Octane Additives business is the world's only manufacturer of tetra ethyl lead (TEL). For over 60 years we have been producing this highly effective octane enhancer for automotive and aviation gasoline and our knowledge of the product is unrivalled in the industry.

'The addition of tetra ethyl lead (TEL) to gasoline was designed to deliver superior engine performance and reduce engine maintenance. Engines can operate at higher compression ratios without knocking. It remains an essential ingredient in aviation fuel.

'However as a responsible organisation, we recognise the importance to the environment of reducing lead in automotive fuel so we are supporting the global phase-out programme for TEL in two important ways.

'Firstly, we recognise that the economies of some countries continue to depend on this product. They do not have cars with catalytic converters capable of running on unleaded fuel so TEL remains by far the most cost-effective octane enhancer available.

'With our extensive market knowledge, built up over many years, we are in a great position to help these countries make the transition to unleaded fuel smoothly. We will ensure the continuity of tetra ethyl lead (TEL) supply during their phase-out period and provide comprehensive advice and guidance on how best to manage the changeover.

'Secondly, once a customer's lead alkyls blending plant is no longer required, we offer a complete remediation service to clean up redundant plants and leading facilities through our growing Innospec Environmental business. This includes safety training, technical and engineering support.'

News.

Urgent need to cut the leaded petrol supply chain



In April 2011 the United Nations Environment Programme's Partnership for Clean Fuels and Vehicles (UNEP PCFV) included the following link in their *Partnership Newsletter*, Volume 9 Issue 1:

http://www.unep.org/Transport/PCFV/PDF/leadEvaluation_summaryreport.pdf

The following compelling reasons for immediately ending the era of leaded petrol are taken directly from that link:

The estimated global annual impacts of lead in fuels were found [by Hatfield and Tsai in a report currently being peer-reviewed and expected to be published in 2011] to be significant:

- *Close to 1.1 million deaths;*
- *A loss of 322 million IQ points;*
- *Close to 60 million crime cases;*
- *Economic loss of USD 2.4 trillion per year (4% of global GDP)*

For Africa the study concluded that the phase out of leaded gasoline had resulted in benefits amounting to USD 92 billion per year.

A 1985 report by US Environmental Protection Agency (EPA) found that the estimated benefits of phasing out leaded gasoline exceeded the costs more than 10 times in the United States.

The six countries where leaded petrol is possibly still sold for road use

(not shown in scale to each other)



Afghanistan



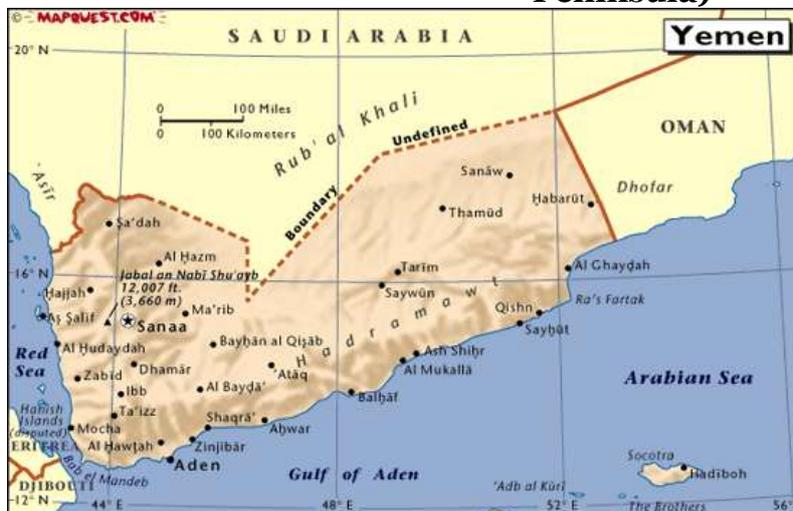
Burma (Myanmar)

Algeria



**North Korea
(top part, Korean Peninsula)**

Iraq



Yemen

Reference:

http://www.lead.org.au/fs/Leaded_Petrol_Possibly_Still_Sold_for_Road_Use_20110617.pdf

Six countries still use leaded petrol. Why?

By Anne Roberts, Editor, LEAD Action News, based on the research paper by Danielle Cooper, LEAD Group Intern and Social Inquiry and International Law student, University of Technology Sydney (UTS), with additional research by Anne Roberts

Danielle Cooper has written a fully-referenced research paper, “Leaded Vehicular Fuel and the Global Effort to Eliminate Lead Poisoning”, in which she subjected the countries which still permit the sale of leaded petrol to a statistical analysis to find out which, if any, of seven likely factors could be shown to be preventing the countries from banning lead in petrol. [See www.lead.org.au/reports.html]

For countries with leaded petrol for which indices had been compiled, the following likely factors were examined: degree of corruption, of democracy, press freedom, GDP per capita, economic freedom, ‘human development,’ and peacefulness within each country.

Creating an ‘index’ for a particular factor in a particular country means assigning the country a number, according to the degree which it manifests the presence or absence of some factor. Some measuring organisations used a high number to stand for a high level of a factor one would consider good – let’s say, for example, ‘trust’ (this is not one of the factors used); whereas other measuring organisations have used a low number to stand for a high level of something good.

Fortunately, this is not something that readers of this article have to think about – it’s all taken care of in Cooper’s academic article - but just to give a couple of examples: Transparency International (TI) have used a *high* score to indicate the *lack of something bad* (corruption). TI states ‘The 2010 Corruption Perceptions Index shows that nearly three quarters of the 178 countries in the index score below five, on a scale from 10 (highly clean) to 0 (highly corrupt). These results indicate a serious corruption problem.’

Also counter intuitively, Reporters without Borders has used a *low* score to indicate a high level of something good, namely, press freedom.

Cooper analysed results from 2006 and 2010 in relation to the use of leaded petrol by each country, and also compared 2006 results with those of 2010 to see if the connection – if any – between the factors and the use of leaded petrol had changed –e.g., got stronger.

Correlation and Causation

Even though *this* article, whose starting point was Cooper’s, is not heavy with statistical analysis, there are two concepts which it is essential to explain, because they occur in the quotes taken from Cooper. These concepts are ‘correlation’ and ‘causation,’ and their verbs, ‘correlate’ and ‘cause.’ If something ‘correlates’ with something, it means it occurs together with it. It does not, by itself, prove that it *causes* the other thing. Further studies may be necessary.

‘In general, it is extremely difficult to establish causality between two correlated events or observances. In contrast, there are many statistical tools to establish a statistically significant correlation.’ (George Mason University, n. d.) A statistically significant correlation is one which does not occur by chance.

Note: ‘Determining whether there is an actual cause and effect relationship requires further investigation, even when the relationship between A and B is statistically significant...’ (Wikipedia)

Cooper: ‘The test of statistical significance was used to determine whether the relationship between lead status and the isolated determinant (evident in the frequency histograms and box plots of the datasets) had emerged by chance or was indicative of a direct relationship between the two variables.’

Unless noted otherwise, all passages quoted in this article are from Cooper’s research paper.

The following are the indexes used by Cooper

1. The ‘Corruptions Perceptions Index’ compiled by Transparency International,
2. The ‘Index of Democracy’ compiled by The Economist Intelligence Unit,
3. The ‘Press Freedom Index’ compiled by Reporters Without Borders,
4. Per Capita Gross Domestic Product data compiled by the International Monetary Fund,
5. The ‘Index of Economic Freedom’ compiled by The Heritage Foundation with the Wall Street Journal,
6. The ‘Human Development Indicators’ compiled by the United Nations Development Programme ; and
7. The ‘Global Peace Index’ compiled by the Institute for Economics and Peace.

Countries where leaded petrol is possibly still sold for road use

These are down to 6, according to a list compiled by Robert Taylor and Zac Gethin-Damon of The LEAD Group, and as at June 17, 2011:

Asia, including SE and NE Asia:

Afghanistan

Burma (official name ‘Myanmar’)

North Korea (official name ‘Democratic People’s Republic of North Korea’)

North Africa:

Algeria

Middle East:

Iraq and Yemen

National flags, left to right:



How the various factors relate to the continued use of leaded petrol

1. Corruption

Transparency International (TI) analysed corruption in the *public* sector. It ‘defines corruption as the abuse of entrusted power for private gain.’



Burma (Official name, Myanmar)

In 2006, of those countries for which data was available, Myanmar and Iraq were ranked equal 2nd-last worst, at 160. Algeria was at 84 and Yemen at 111 with 9 other countries. In 2010, Afghanistan and Myanmar were 2nd-last worst, at 176. Worst was Somalia. *Please note that these numbers do not represent the ‘score’ given by TI, but how the countries rate in relation to each other.*



Iraq

From Cooper’s report:

‘In 2006, corruption data was available for the following countries which continued to use lead additives in their vehicular fuels: Algeria, Bosnia-Herzegovina, Egypt, Iraq, Jordan, Kazakhstan, Macedonia, Morocco, Myanmar, Serbia, Tajikistan, Tunisia, Turkmenistan, Uzbekistan and Yemen. Data was not available for **Afghanistan, North Korea, Palestine or Western Sahara.**

The Corruption Perceptions

Index for 2006 assessed the corruption levels in 163 countries throughout the world (Transparency International 2006).’

‘In 2006, it could not be concluded with confidence that the practical difference in corruption levels between the leaded and unleaded countries was substantial.

‘From the [statistical] results, it could be confidently asserted that in 2006 the likelihood that a country would continue to be reliant on leaded vehicular fuels was related to its level of corruption, and that leaded countries were more likely to be corrupt than unleaded countries, although the practical impact of this increased tendency towards higher levels of corruption could not be described as substantial. *While it was not possible ... to definitively state that the relationship between high corruption levels and continuing use of leaded vehicular fuels was causative in nature, it is clear that a close relationship between the two existed.* [Ed’s italics] These results provide some support for the conclusion that failures to address high levels of corruption in countries that continued to rely on leaded petrol may have been inhibiting the global effort to eliminate lead additives from vehicular fuels in 2006...

To put some meat on these bones, try the following:

The blog, 'Rule of Lords,' at www.ratchasima.net concentrates on Burma and Thailand, and has very many accounts of public corruption, especially for the Burmese judiciary. See also:

Asian Human Rights Commission, Hong Kong: <http://www.humanrights.asia/countries> (Under 'countries', see Afghanistan and Burma/Myanmar)

Cooper: 'It is noted that Algeria is the only country among the leaded dataset which has committed to a phase out date (*UNEP PCFV* 2011: 7), and that with a score of 2.9, Algeria exhibited the lowest levels of corruption within the leaded dataset...

'...it was possible to conclude with confidence that, as in 2006, a relationship existed between corruption values and the elimination or non-elimination of lead additives from vehicular fuels in 2010...the relationship between lower corruption values (indicating higher levels of corruption) and a failure to eliminate lead from vehicular fuels in 2010...did not emerge by chance...'

'It can be confidently asserted that the likelihood that a country is leaded is related to its level of corruption, and that the relationship between corruption levels and the elimination of leaded petrol operated throughout the period 2006 to 2010. It is clear that leaded countries are substantially more likely to be corrupt than unleaded countries, and as time has progressed this trend has become even more pronounced. While ... no definitive statement can be made as to whether the relationship between high levels of corruption and an increased tendency towards reliance on leaded fuels is causative in nature, the strength of the relationship provides considerable support for the proposition that failures to address high corruption levels in countries that continue to rely on leaded petrol may be inhibiting the global effort to eliminate lead additives from vehicular fuels. As the correlation between high corruption levels and reliance on leaded petrol became more pronounced in 2010 than it was in 2006, it can be asserted that the need to address the high levels of corruption present in leaded countries in order to further the global effort to eliminate lead additives from vehicular fuels was more compelling in 2010 than it was in 2006.' [End of extracts from Cooper]

Democracy

Democracy is not difficult to define, until you try. The Economist Intelligence Unit (EIU) has a long discussion on defining democracy, but these are the five areas they have chosen as essential: 'Even if a consensus on precise definitions has proved elusive, most observers today would agree that, at a minimum, the fundamental features of a democracy include government based on majority rule and the consent of the governed, the existence of free and fair elections, the protection of minorities and respect for basic human rights. Democracy presupposes equality before the law, due process and political pluralism.'

The EIU asks, 'Is reference to these basic features sufficient for a satisfactory concept of [democracy?](#)'

In 2010, out of 167 countries, Iraq was equal 111 with Haiti; Algeria was at 125, Afghanistan at 150, Myanmar at 163 and North Korea last at 167. *Please note that these numbers do not represent the 'score' given by EIU, but how the countries rate in relation to each other.*

Democracy and the Elimination of Leaded Petrol in 2006

Cooper:

‘In 2006, democracy data was available for the following countries which continued to use lead additives in their vehicular fuels: Afghanistan, Algeria, Bosnia-Herzegovina, Egypt, Iraq, Jordan, Kazakhstan, North Korea, Macedonia, Morocco, Myanmar, Palestine, Serbia, Tajikistan, Tunisia, Turkmenistan, Uzbekistan and Yemen. Data was not available for Western Sahara. The Democracy Index for 2006 assessed the democracy levels of 167 countries throughout the world (Economist Intelligence Unit 2007)...

‘ more countries which had eliminated lead from their vehicular fuels displayed higher democracy values than countries which had not eliminated lead from their vehicular fuels...The four leaded countries returning democracy values above 5.5 were Macedonia, Serbia, Palestine and Bosnia-Herzegovina.

‘...it was possible to conclude with confidence that a relationship existed between democracy values and the elimination or non-elimination of leaded additives from vehicular fuels.

‘From these findings, it can be confidently asserted that in 2006 the likelihood that a country was leaded was related to its level of democracy, and that leaded countries were substantially less likely to be democratic than unleaded countries.’

[As with corruption, it is not possible to state that the connection is causative], however,

‘These findings provide strong support for the proposition that failures to address the low levels of democracy present in countries that continued to rely on leaded petrol may have been inhibiting the global effort to eliminate lead additives from vehicular fuels in 2006.’

2010 data on democracy and the use of leaded petrol



Korean Peninsula. North Korea was least-worst on the Press Freedom Index

‘...it can be confidently asserted that the likelihood that a country is leaded is related to its level of democracy, and that the relationship between democracy levels and the elimination of leaded petrol operated throughout the period 2006 to 2010. It is clear that leaded countries are substantially less likely to be democratic than unleaded countries, and that as time has progressed this trend has become even more pronounced.

Again, in the absence of time series data, no causative relationship can be confidently stated, nevertheless [Ed's italics] it can be asserted that the need to address the low levels of democracy present in leaded countries in order to further the global effort to eliminate lead additives from vehicular fuels was more compelling in 2010 than it was in 2006.

Press Freedom

Definition of Press Freedom

A definition in one sentence might go something like this ‘Journalists are able to do their work without being subject to intimidation or actual violence, and able to report freely without censorship.’

In 2006, the ranking, out of 168 countries was as follows: Algeria, least worst of the leaded group (126), Afghanistan (130), Yemen (149), Iraq (154), Myanmar (164) and North Korea (168). *Please note that these numbers do not represent the 'score' given by Reporters Without Borders (RWB), but how the countries rate in relation to each other.*

In 2010, of the 6 countries currently (2011) judged to still have leaded petrol, Iraq was least worst (rank 130 of 178), Algeria next (133), Afghanistan (147), Yemen (170) Myanmar (174) and North Korea (177). *Please note that these numbers do not represent the 'score' given by RWB, but how the countries rate in relation to each other.*

Reporters Without Borders' questionnaire for their 2010 survey on press freedom contained *forty-three* questions, each of which is relevant to a reporter being able to do their job properly. To give you an idea, here is a small selection of the questions:

Questionnaire for compiling the 2010 Press Freedom Index

The period runs from 1 September 2009 to 31 August 2010

Physical Violence 6 questions, which including

...any cases of journalists:

Being tortured or mistreated during detention?

Being kidnapped or disappearing?

Being illegally detained (without an arrest warrant, for longer than the maximum period of police custody, without a court appearance etc.)?

Armed militias or clandestine organisations regularly targeting journalists?

Journalists who had to have bodyguards or use security measures (such as wearing bullet-proof vests or using armour-plated vehicles) in the course of their work?

Number of Journalists Murdered, Detained, Physically Attacked or Threatened, and Role of Authorities in This

8 questions, including

...how many journalists, media assistants or press freedom activists:

Were killed in connection with their work?

Were killed in situations in which authorities (police, soldiers, central or local government officials, ruling party activists etc) were involved?

Were detained or jailed (for more than 24 hours)?

Were still in prison at the end of this period as a result of receiving a long jail sentence (more than a year) for a press offence?

Were physically attacked or injured?

Did representatives of the state carry out any or all of these acts of violence?

Cooper:

'In 2006, press freedom data was available for the following countries which continued to use lead additives in their vehicular fuels: Afghanistan, Algeria, Bosnia-Herzegovina, Egypt, Iraq, Jordan, Kazakhstan, Macedonia, Morocco, Myanmar, North Korea, Palestine, Serbia (under the name 'Serbia and Montenegro'), Tajikistan, Tunisia, Turkmenistan, Uzbekistan and Yemen. Data was not available for Western Sahara. The 'Press Freedom Index' for 2006 assessed press freedom levels in 168 countries throughout the world (Reporters Without Borders 2006).

'...more countries which had eliminated lead from their vehicular fuels displayed higher levels of press freedom than countries which had not eliminated lead from their vehicular fuels.

'From the finding of a statistically significant difference between the two datasets, it was possible to conclude with confidence that a relationship existed between press freedom values and the elimination or non-elimination of lead additives from vehicular fuels. The finding of the statistical significance of the difference between the datasets for leaded and unleaded countries indicated that the relationship between higher press freedom values (denoting lower levels of press freedom) and a failure to eliminate lead from vehicular fuels in 2006 (evident in the frequency histogram of the two datasets) did not emerge by chance.'

Once again, Cooper notes that 'While it is not possible... to definitively state that the relationship between low press freedom levels and continuing use of leaded vehicular fuels was causative in nature, it is clear that a close relationship between the two existed. These findings provide strong support for the proposition that failures to address the low levels of press freedom present in countries that continued to rely on leaded petrol may have been inhibiting the global effort to eliminate lead additives from vehicular fuels in 2006.'

In 2010, press freedom data was available for the following countries which continued to use lead additives in their vehicular fuels: Afghanistan, Algeria, Iraq, Myanmar, North Korea and Yemen. The 'Press Freedom Index' for 2010 assessed press freedom levels in 178 countries throughout the world (Reporters Without Borders 2010b).

Cooper:

'...it was possible to conclude with confidence that, as in 2006, a relationship existed between press freedom values and the elimination or non-elimination of leaded additives from vehicular fuels in 2010. The finding of the statistical significance of the difference between the datasets for leaded and unleaded countries indicated that the relationship between higher press freedom values (denoting lower levels of press freedom) and a failure to eliminate lead from vehicular fuels (evident in the frequency histogram of the two datasets) did not emerge by chance...

' it can be concluded not only that a significant difference existed in the press freedom values of leaded and unleaded countries in 2010, but also that the practical difference in press freedom levels between the two was very substantial. Furthermore, this result indicates that the divergence in the press freedom values of leaded countries as compared with unleaded countries was even greater in 2010 than it was in 2006.'

Again, '... it can be confidently asserted that the likelihood that a country is leaded is related to its level of press freedom, and that this relationship between press freedom levels and the elimination of leaded vehicular fuels operated throughout the period 2006 to 2010. It is clear that leaded countries are substantially less likely to exhibit press freedom than unleaded countries, and that as time has progressed this trend has become even more pronounced.'

Again, '... no definitive statement can be made as to whether the relationship between low levels of press freedom and an increased tendency towards reliance on leaded fuels is causative in nature, the strength of the relationship provides considerable support for the proposition that

failures to address low press freedom levels in countries that continue to rely on leaded petrol may be inhibiting the global effort to eliminate lead additives from vehicular fuels. As the correlation between low press freedom levels and reliance on leaded petrol became more pronounced in 2010 than it was in 2006, it can be asserted that the need to address the low levels of press freedom present in leaded countries in order to further the global effort to eliminate lead additives from vehicular fuels was more compelling in 2010 than it was in 2006.'

Per Capita Gross Domestic Product

Gross Domestic Product (GDP) is 'The total market value of all final goods and services produced in a country in a given year, equal to total consumer, investment and government spending, plus the value of exports, minus the value of imports.' A 'final good or service' is 'consumed by the end user and [does] not require any further processing.' (InvestorWords.com) 'Per Capita' includes children.

Cooper:

Per Capita Gross Domestic Product (GDP) and the Elimination of Leaded Petrol in 2006

Of the list of leaded petrol countries (except North Korea), Algeria had the highest per capita GDP at 92 out of a list of 183 countries, Iraq was 121, Yemen 137, Myanmar 156 and Afghanistan 168. *Please note that these numbers do not represent the 'score' given by the IMF, but how the countries rate in relation to each other.*

'In 2006, per capita GDP data was available for the following countries which continued to use lead additives in their vehicular fuels: Afghanistan, Algeria, Bosnia-Herzegovina, Egypt, Iraq, Jordan, Kazakhstan, Macedonia, Morocco, Myanmar, Serbia, Tajikistan, Tunisia, Turkmenistan, Uzbekistan and Yemen. Data was not available for **North Korea**, [Ed's bolding] Palestine or Western Sahara. In 2006, the IMF provided data about per capita GDP for 179 countries throughout the world (International Monetary Fund 2011).

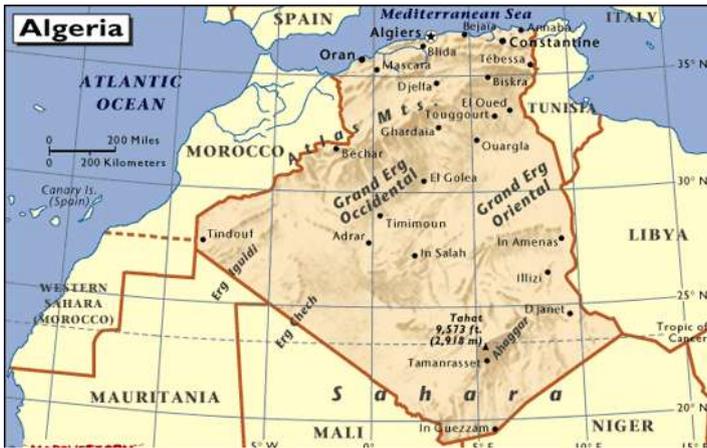
'Visual comparative analysis of the frequency histogram generated by the data contained in the per capita GDP Index 2006 indicated that more countries which had eliminated lead from their vehicular fuels displayed higher per capita GDP values than countries which had not eliminated lead from their vehicular fuels.'

NOTE PARTICULARLY – low GDP was not shown by the results to be a barrier to eliminating lead from petrol. If there's a statistical relationship it is a result of chance, not causation.

Cooper:

'The finding that the datasets [per capita income and lead petrol status of the country] were statistically equal meant that it could be concluded with confidence that any relationship which may have been observed between per capita GDP and a failure to eliminate leaded petrol in 2006 ... emerged by chance. The finding that no ... correlation exists between the factors makes it possible to conclude with confidence that the slightly lower median levels of per capita GDP observable in leaded countries as compared with their unleaded counterparts...was not acting as a barrier to the global effort to eliminate lead additives from vehicular fuels in 2006.

'In 2010, per capita GDP values were available for the following countries which continued to use lead additives in their vehicular fuels: Afghanistan, Algeria, Iraq, Myanmar and Yemen. Data was not available for **North Korea**.' [Ed's bolding] IMF 2010 listed per capita GDP for 183 countries. Algeria 100, Iraq 128, Yemen 138, Burma 163, Afghanistan 173.



Algeria: Highest per capita GDP of leaded petrol countries for which 2010 data was available on IMF index

Cooper: (2010 data) 'It can be concluded with confidence that there is no causative relationship between per capita GDP levels and the elimination of lead additives from vehicular fuels, and that the per capita GDP values present in countries still reliant on leaded fuels today is not acting as a barrier to the global effort to eliminate lead additives from vehicular fuels.'



Afghanistan: Lowest per capita GDP of leaded petrol countries on IMF 2010 index

Economic Freedom (The following information is from Wikipedia, accessed on June 18, 2011. Hyperlinks removed.)

The Heritage Foundation and the Wall Street Journal created the Index of Economic Freedom in 1995. According to Heritage, the creators of the Index took an approach similar to Adam Smith's *The Wealth of Nations* that "basic institutions that protect the liberty of individuals to pursue their own economic interests result in greater prosperity for the larger society." The authors of the 2009 Index of Economic Freedom are Kim Holmes and Ambassador Terry Miller.

The Index's 2008 definition of economic freedom is the following; "The highest form of economic freedom provides an absolute right of property ownership, fully realized freedoms of movement for

labour, capital, and goods, and an absolute absence of coercion or constraint of economic liberty beyond the extent necessary for citizens to protect and maintain liberty itself." The index scores nations on 10 broad factors of economic freedom using statistics from organizations like the World Bank, the IMF and the Economist Intelligence Unit.

The 10 factors which make up the index of economic freedom:

- 1. Business Freedom** - Business freedom is a quantitative measure of the ability to start, operate, and close a business that represents the overall burden of regulation as well as the efficiency of government in the regulatory process.
- 2. Trade Freedom** - Trade freedom is a composite measure of the absence of tariff and non-tariff barriers that affect imports and exports of goods and services. Different imports entering a country can, and often do, face different tariffs.
- 3. Monetary Freedom** - Monetary freedom combines a measure of price stability with an assessment of price controls. Both inflation and price controls distort market activity. Price stability without microeconomic intervention is the ideal state for the free market.

4. Government Size/Spending - This component considers the level of government expenditures as a percentage of GDP. Government expenditures, including consumption and transfers, account for the entire score.

5. Fiscal Freedom - Fiscal freedom is a measure of the tax burden imposed by government.

6. Property Rights - The property rights component is an assessment of the ability of individuals to accumulate private property, secured by clear laws that are fully enforced by the state.

7. Investment Freedom - In an economically free country, there would be no constraints on the flow of investment capital. Individuals and firms would be allowed to move their resources into and out of specific activities both internally and across the country's borders without restriction.

8. Financial Freedom - Financial freedom is a measure of banking efficiency as well as a measure of independence from government control and interference in the financial sector.

9. Freedom from Corruption - Corruption erodes economic freedom by introducing insecurity and uncertainty into economic relationships. The higher the level of corruption, the lower the level of overall economic freedom and the lower a country's score.

10. Labor Freedom - The labor freedom component is a quantitative measure that looks into various aspects of the legal and regulatory framework of a country's labor market.

The 10 factors are averaged equally into a total score. Each one of the 10 freedoms is graded using a scale from 0 to 100, where 100 represents the maximum freedom. A score of 100 signifies an economic environment or set of policies that is most conducive to economic freedom. The methodology has shifted and changed as new data and measurements have become available, especially in the area of Labor freedom, which was given its own indicator spot in 2007.

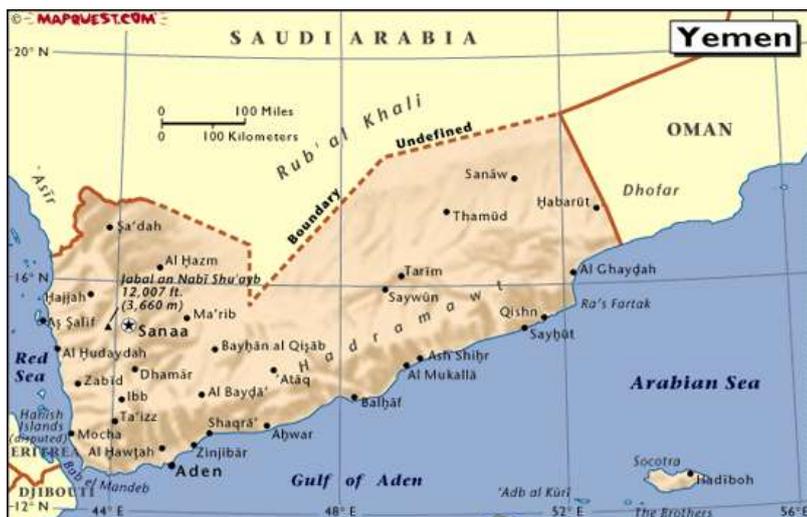
Economic Freedom and the Elimination of Leaded Petrol in 2006 Cooper:

'In 2006, economic freedom data was available for the following countries which continued to use lead additives in their vehicular fuels: Algeria, Bosnia-Herzegovina, Egypt, Jordan, Kazakhstan, North Korea, Macedonia, Morocco, Myanmar, Serbia, Tajikistan, Tunisia, Turkmenistan, Uzbekistan and Yemen. Data was not available for **Afghanistan, Iraq**, [Ed's bolding] Palestine or Western Sahara. The Economic Freedom Index for 2006 assessed the economic freedom levels of 157 countries throughout the world (The Heritage Foundation 2006).

'...more countries which had eliminated lead from their vehicular fuels displayed higher economic freedom values than countries which had not eliminated lead from their vehicular fuels...The outlying leaded country returning an economic freedom value of 4.0 was North Korea.

'...it was possible to conclude with confidence that a relationship existed between economic freedom values and the elimination or non-elimination of leaded additives from vehicular fuels. .. the relationship between lower economic freedom values and a failure to eliminate lead from vehicular fuels (evident in the frequency histogram of the two datasets) did not emerge by chance.'

Economic Freedom and the Elimination of Leaded Petrol in 2010



The ranking, out of 179 countries was as follows: Yemen, least worst of the leaded group (127), Algeria (132) Burma 174 and North Korea last at 179. Data for Afghanistan and Iraq was not available. *Please note that these numbers do not represent the 'score' given by The Heritage Foundation and The Wall Street Journal, but how the countries rate in relation to each other.*

Yemen – highest ranked for economic freedom of the 4 out of 6 leaded petrol countries for which data was available in 2010

'In 2010, economic freedom data was available for the following countries which continued to use

lead additives in their vehicular

fuels: Algeria, Myanmar, North Korea and Yemen. Data was not available for **Afghanistan** or **Iraq**. [Ed's bolding] The extremely small sample size associated with the leaded dataset limits the reliability of any analysis that can be conducted in relation to economic freedom data in 2010

'...it was possible to conclude with confidence that, as in 2006, a relationship existed between economic freedom values and the elimination or non-elimination of leaded additives from vehicular fuels in 2010. The... relationship between lower levels of economic freedom and a failure to eliminate lead from vehicular fuels... did not emerge by chance.

Human Development

The United Nations Human Development Index - Dimensions of human development:

- Empowerment ['Empowerment and agency: enabling people and groups to act—to drive valuable outcomes.']
- Sustainability and vulnerability
- Human security
- Perceptions of individual well-being and happiness
- Civic and community well-being
- Demographic trends
- Decent work
- Education
- Health

Ranking of the six remaining leaded petrol countries in the composite United Nations Human Development Index: Afghanistan 155, Algeria:84, Iraq (NA),North Korea (NA), Myanmar (Burma) 132, Yemen 133. For comparison, Norway was 1 and Australia 2. The United States was 4.

Cooper:

Human Development and the Elimination of Leaded Petrol in 2006

'In 2008, human development data relating to 2006 was available for the following countries which continued to use lead additives in their vehicular fuels: Algeria, Bosnia-Herzegovina, Egypt, Jordan, Kazakhstan, Macedonia, Morocco, Myanmar, Palestine, Serbia, Tajikistan, Tunisia, Turkmenistan, Uzbekistan and Yemen. Data was not available for **Afghanistan, Iraq, North Korea** or Western Sahara. The Human Development Index for 2008 (which reported on 2006 data) assessed the human development levels in 179 countries throughout the world (United Nations Development Programme 2008b).

'From the finding that the datasets were statistically equal, it was possible to conclude with confidence that any relationship which may have been observed between economic freedom values and a failure to eliminate leaded petrol in 2006 (e.g. in the histograms or box plots generated by the data) *emerged by chance*. [Ed's italics]

'The finding that no such correlation exists between the factors makes it possible to conclude with confidence there was no causative relationship between a country's human development levels and its status in relation to the elimination of leaded vehicular fuels. It was therefore possible to conclude with confidence that the human development levels that were present in countries still reliant on leaded petrol was not acting as a barrier to the global effort to eliminate lead additives from vehicular fuels in 2006.

Human Development and the Elimination of Leaded Petrol in 2010

'In 2010, human development data was available for the following countries which continued to use lead additives in their vehicular fuels: Afghanistan, Algeria, Myanmar, and Yemen. Data was not available for **Iraq** or **North Korea**. The extremely small sample size associated with the leaded dataset limits the reliability of any analysis that can be conducted in relation to human development data in 2010. The Human Development Index for 2010 assessed the human development levels of 169 countries throughout the world (United Nations Human Development Programme 2010).

'The absence of a correlation between a country's human development levels and status in relation to the elimination of leaded fuels denies the possibility of a causal relationship between the factors...*therefore that the human development levels present in countries reliant on leaded petrol is not acting as a barrier to the global effort to eliminate lead additives from vehicular fuels.*' [Ed's italics]

Peacefulness

The Global Peace Index (GPI) is a numerical measure of how at peace a country is with itself and other countries. A staggering 33 indicators are used.

Key Findings from the 2011 Global Peace Index, from The Institute for Economics and Peace

'The top five nations (from most to least peaceful) are Iceland, New Zealand, Japan, Denmark and the Czech Republic. The least peaceful nations (from 153rd to 149th) are Somalia, Iraq, Sudan, Afghanistan and North Korea.'

The ranking, out of 153 countries was as follows:

Algeria, least worst of the leaded group (129), Myanmar (133), Yemen (138), North Korea (149) and Iraq (152). *Please note that these numbers do not represent the 'score' given by The Institute for Economics and Peace, but how the countries rate in relation to each other.* Of all 153 countries, Iceland was top, New Zealand second, Canada 8, Australia 18, the UK 26 and the USA 82.

Peacefulness and the Elimination of Leaded Petrol in 2008

Cooper:

'In 2008, peacefulness data was available for the following countries which continued to use lead additives in their vehicular fuels: Afghanistan, Algeria, Bosnia-Herzegovina, Egypt, Iraq, North Korea, Macedonia, Morocco, Myanmar, Serbia, Tunisia, Turkmenistan, Uzbekistan and Yemen (Taylor 2008; Vision for Humanity 2008). Data was not available for Kosovo, Montenegro, Tajikistan or Western Sahara (Taylor 2008; Vision for Humanity 2008). The Global Peace Index for 2008 assessed the peace levels of 140 countries throughout the world (Vision for Humanity 2008).

'A majority of countries which had eliminated lead from their vehicular fuels fell to the left of the histogram (indicative of high levels of peacefulness), while the countries which had not eliminated lead from their vehicular fuels were spread more evenly along the histogram, with a tendency to fall to the right of the histogram (indicative of low levels of peacefulness). The leaded country exhibiting the lowest levels of peacefulness in 2008 was Iraq.

'Recalling that lower peacefulness values denoted higher levels of peacefulness, it can be confidently asserted from these findings that in 2008 the likelihood that a country was leaded was related to its level of peacefulness, and that leaded countries were substantially less likely to be as peaceful as unleaded countries. While it is not possible in the absence of comparable time series data to definitively state that the relationship between low peacefulness levels and continuing use of leaded vehicular fuels was causative in nature, it is clear that a close relationship between the two existed. *These findings provide strong support for the proposition that failures to address the low levels of peacefulness present in countries that continued to rely on leaded petrol may have been inhibiting the global effort to eliminate lead additives from vehicular fuels in 2008.* [Ed's italics.]

Peacefulness and the Elimination of Leaded Petrol in 2010

'In 2010, peacefulness values were available for the following countries which continued to use lead additives in their vehicular fuels: Afghanistan, Algeria, Iraq, Myanmar, North Korea and Yemen. The Global Peace Index for 2010 assessed the peacefulness levels of 149 countries throughout the world (Vision for Humanity 2010).

'From the finding of a statistically significant difference between the two datasets, it is possible to conclude with confidence that, as in 2008, a relationship existed between peacefulness values and the elimination or non-elimination of leaded additives from vehicular fuels in 2010. The finding of the statistical significance of the difference between the datasets for leaded and unleaded countries indicates that the relationship between higher peacefulness values (indicative of lower levels of peacefulness) and a failure to eliminate lead from vehicular fuels (evident in the frequency histogram of the two datasets) did not emerge by chance.

'Furthermore, this result indicates that the divergence in the peacefulness values of leaded countries as compared with unleaded countries was even greater in 2010 than it was in 2008.

'From these findings, it can be confidently asserted that the likelihood that a country is leaded is related to its level of peacefulness, and that the relationship between peacefulness levels and the elimination of leaded petrol operated throughout the period 2008 to 2010. It is clear that leaded countries are substantially less likely to be peaceful than unleaded countries, and as time has progressed this trend has become even more pronounced.

'As the correlation between low peacefulness levels and reliance on leaded petrol became more pronounced in 2010 than it was in 2008, it can be asserted that the need to address the low levels of peacefulness present in leaded countries in order to further the global effort to eliminate lead additives from vehicular fuels was more compelling in 2010 than it was in 2008.

'The study indicates high levels of correlation between continuing use of leaded vehicular fuels and levels of democracy, levels of corruption, levels of press freedom, levels of economic freedom and levels of peacefulness. [Ed's Italics] While the absence of comparable time series data precludes a definitive determination of whether observed relationships between isolated determinants of environmental policy and the elimination of lead additives to vehicular fuels are causative in nature or simply highly correlative, it is possible to determine that these relationships did not emerge by chance, and that these relationships are of substantial practical effect. Read in light of the wider body of literature, these results provide strong support for the proposition that failures to address the high levels of corruption and low levels of democracy, press freedom, economic freedom and peacefulness present in countries reliant on lead additives to vehicular fuels may be inhibiting the global effort to eliminate lead additives from vehicular fuels.'

Summing up

The data examined by Cooper indicate a relationship between five factors examined – namely, corruption, democracy, press freedom, economic freedom and peacefulness, and whether or not a country still had leaded petrol. Those with high degrees of corruption, and low degrees of the other 4 factors, were likely to still use leaded petrol. On the other hand, two factors – namely per capita GDP, and human development, if there appeared to be a relationship, it was by chance.

In conclusion

Afghanistan, Algeria, Burma (Myanmar), Iraq, North Korea and Yemen, it seems fair to say, have more on their minds than a switch to unleaded petrol. *Therefore the only way seems to be to cut off the supply of lead additives.*

Cooper:

Directions for future research on factors preventing countries switching to unleaded petrol

'The inability of this study to definitively characterise the relationships between determinants and the global effort to eliminate lead additives from vehicular fuels as causative or merely correlative is a serious limitation of this paper. A study that was able to produce comparable time series data in order to develop a definitive test of causality would have considerable value in further illuminating existing barriers to the global effort to eliminate lead additives from vehicular fuels. An analytical framework built on multiple regression analysis would aid in this endeavour, and would also enable a comparison of the relative influence of each potential determinant as a barrier to environmental reform in the area of the elimination of leaded vehicular fuels.'

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