



Corruption and Innovation Capability: a correlation analysis in 140 countries and its implications in international business

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“Economic growth is neither a mechanical nor a smooth process. Institutions and regulations play a crucial role in determining the path of growth. But if the “rules of the game” start being perceived as blurred and non-transparent, capital deepening and productivity enhancements may suffer.”

- Ignazio Visco, OECD Chief Economist from 1997 to 2002

Introduction

How can we increase the output of an economy?

The accumulation of physical and human capital is one of the basic determinants of growth, which often goes together with a high level of innovation, another key force for pushing economic growth (Solow, 1957; Kogan et al., 2017; Chang et al., 2018). In other words, we basically have two options. We may increase the number of inputs (ressources) by hiring more employees, getting more land and machinery, or we may try to get more outputs from the existing inputs. This is where technological innovation is involved in the production process.

According to Tong (2005), “high tech, high-capability firms are observed in modern high-income economies because they are the cause, rather than the consequence, of those countries’ high incomes”. The first industrial revolution, between the 18th and the 19th century, occurred with a set of great innovations such

as the invention of the steam engine which resulted in higher productivity for the concerned companies and economic growth for industrialised countries.

In this context, one might want to determine what fosters innovation, goes along with or prevents innovation from emerging. With innovation being particularly sensitive to rent-seeking possibilities, corruption can play an important role in determining a country’s evolution. Research has put forward two major theories that support the view that corruption impacts innovation. The first one reports that corruption is like “*grease*” for a company’s growth, thus benefiting the economy while the second describes corruption as “*sand*”, meaning corruption is costly for economic activity (Xia et al., 2018).

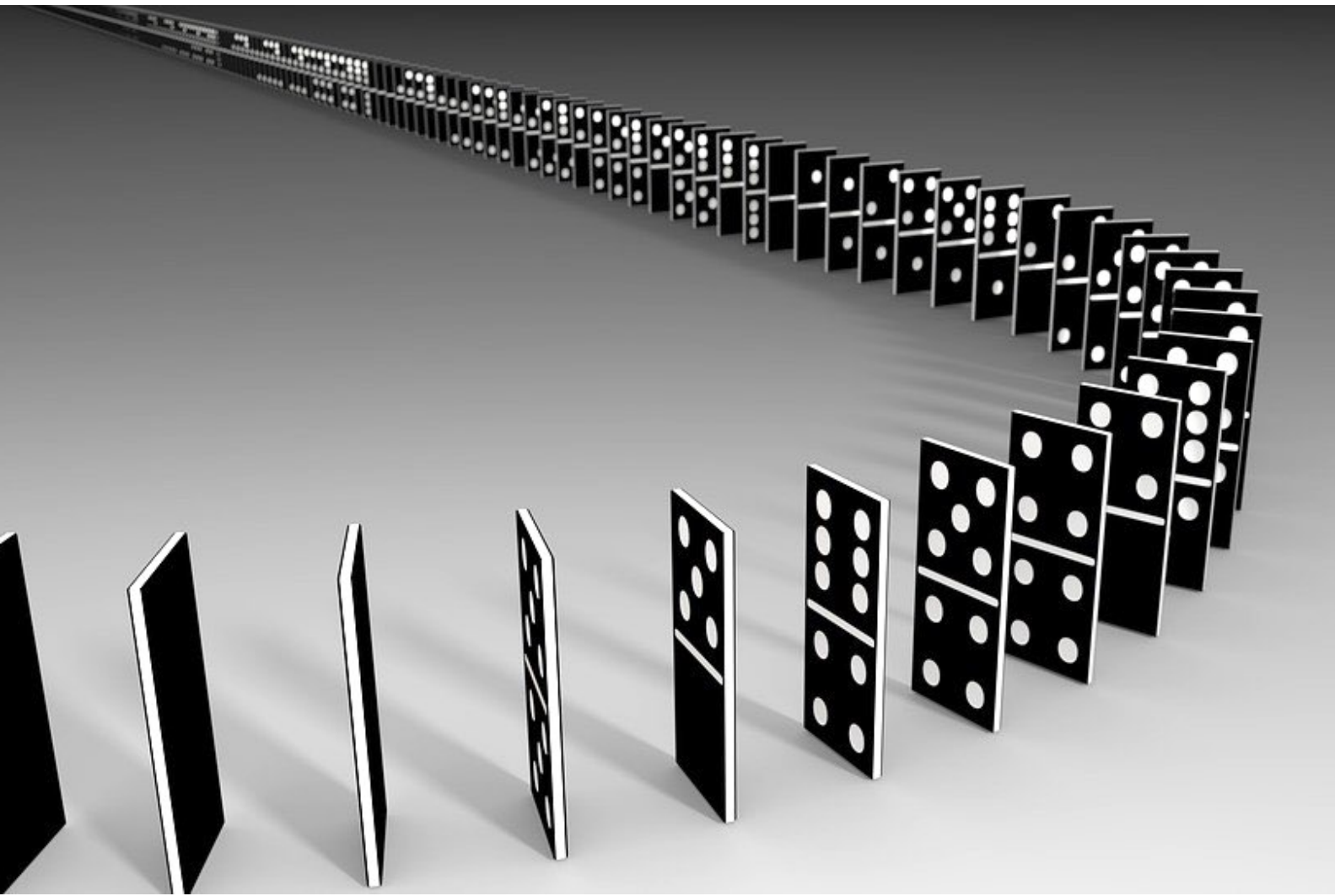
The impact of corruption on innovation is thus unclear. Does corruption help companies to avoid complex bureaucratic limitations and thus facilitate market entry strategies? Or does corruption affect economical outcomes through a decline of innovation, competitiveness and productivity?

1. Measuring Corruption and Innovation Capability

Be it « *sand* » or « *grease* », the first question that arises in considering the links between corruption and innovation is:

Up to what extent does a country's level of corruption and innovation show Interdependence?

In order to determine the scope of the relationship, an empirical test was performed based on two datasets used as proxies: the first one relates to innovation, measuring the innovation capability of each country, and the second one to corruption, here understood in a broad sense that includes money-laundering and terrorism financing. A correlation analysis allows to determine if there exists an association between these two variables but also the type of relation that applies.



1.1 Innovation capability

The Innovation Capability measure is extracted from the Global Competitiveness Index 4.0 2018 produced by the World Economic Forum (WEF).

This index aims to measure the competitiveness landscape of 140 economies. The WEF defines competitiveness as the “set of institutions, policies and factors that determine a country’s level of productivity”. In this regards, the Global Competitiveness Index provides an overview of the 12 drivers of economic growth considered.

The Innovation Capability measure represents the 12th pillar of the Global Competitiveness Index. It enables for an assessment of each economy’s innovation ecosystem. Innovation Capability aims to measure the “soft” and “intangible” aspects of innovation, that is “the extent to which a country’s environment encourages collaboration, connectivity, creativity, diversity and confrontation across different visions and angles; and the capacity to turn ideas into new goods and services”.

The best and least performing countries in Innovation Capability are the following:

| Rank / 140 | Country / Economy | Score 0-100 (best) | Rank / 140 | Country / Economy | Score 0-100 (best) |
|---------------|-------------------|-----------------------|---------------|------------------------|-----------------------|
| 1 | Germany | 87.5 | 140 | Angola | 16.8 |
| 2 | United States | 86.5 | 139 | Congo, Democratic Rep. | 18.8 |
| 3 | Switzerland | 82.1 | 138 | Haiti | 20.3 |
| 4 | Taiwan, China | 80.8 | 137 | Cape Verde | 21.4 |
| 5 | Sweden | 79.8 | 136 | Chad | 21.6 |
| 6 | Japan | 79.3 | 135 | Liberia | 22.0 |
| 7 | United Kingdom | 79.2 | 134 | Eswatini | 22.7 |
| 8 | Korea, Rep. | 78.2 | 133 | Yemen | 22.8 |
| 9 | Netherlands | 77.5 | 132 | Lesotho | 23.7 |
| 10 | Finland | 76.3 | 131 | Burundi | 23.8 |

Source: World Economic Forum, Global Competitiveness Report 2018

1.2 Corruption

Corruption is a complex social, economic and political issue that is more or less prevalent depending on the countries. Corruption is also complex to estimate given its secretive nature which makes it impossible to be directly measured.

Being vague and hard to tackle, corruption has only become a seriously explored phenomenon in the last 20 to 25 years. Several methods of estimating corruption have emerged since then, including the recently released Global Corruption Index (GCI) 2019.

This composite index allows to determine the level of corruption in a broad sense. The GCI includes both the public and private sectors as well as other white collar crimes such as money-laundering and terrorism financing.

199 countries and territories are given a score, a rank and risk evaluation ranging from very low to very high in order to allow users to estimate the exogenous risk they are exposing themselves to when dealing with a specific country.

| ISO Code | Country Name | Region | Rank | Score |
|----------|----------------|---------|------|-------|
| FIN | Denmark | Europe | 1 | 9.39 |
| DNK | Finland | Europe | 2 | 9.49 |
| NOR | Norway | Europe | 3 | 10.1 |
| NZL | Sweden | Europe | 4 | 12.27 |
| CHE | New Zealand | Oceania | 5 | 12.32 |
| SWE | Switzerland | Europe | 6 | 14.36 |
| NLD | Estonia | Europe | 7 | 15.56 |
| ISL | Netherlands | Europe | 8 | 15.66 |
| GBR | Luxembourg | Europe | 9 | 16.81 |
| CAN | United Kingdom | Europe | 10 | 17.81 |

| ISO Code | Country Name | Region | Rank | Score |
|----------|----------------------|--------|------|-------|
| SOM | Somalia | Africa | 199 | 87.39 |
| PRK | Korea, Dem. Rep. | Asia | 198 | 84.15 |
| SYR | Syrian Arab Republic | Asia | 197 | 82.54 |
| GNQ | Equatorial Guinea | Africa | 196 | 78.14 |
| LBY | Yemen, Rep. | Asia | 195 | 77.38 |
| AFG | Libya | Africa | 194 | 75.84 |
| YEM | Congo, Dem. Rep. | Africa | 193 | 74.79 |
| IRQ | Iraq | Asia | 192 | 73.95 |
| KHM | South Sudan | Africa | 191 | 73.37 |
| SSD | Cambodia | Asia | 190 | 72.99 |

Source: Global Risk Profile, GCI 2019

2. Results and discussion

The degree of interdependence between innovation and corruption is determined by Pearson's correlation, which is defined as the covariance of the two variables X and Y by the product of their standard deviations:

$$\rho_{X,Y} = \frac{\text{cov}(X,Y)}{\sigma_X \sigma_Y} = \frac{E[(X - \mu_X)(Y - \mu_Y)]}{\sigma_X \sigma_Y}$$

The result obtained from this analysis (approx. 0.82) indicates an important correlation which can be understood as a high interdependence between innovation capacity and corruption, provided that the two indexes are associated in a rectilinear form.

This result is depicted in the graph presented in the next page which displays that countries rated as highly corrupt are also rated as less likely to benefit from a large innovation capability. Although this general result does not allow to infer any causal relationship, corruption is actually related to poorer levels of innovation capacity at the country level.

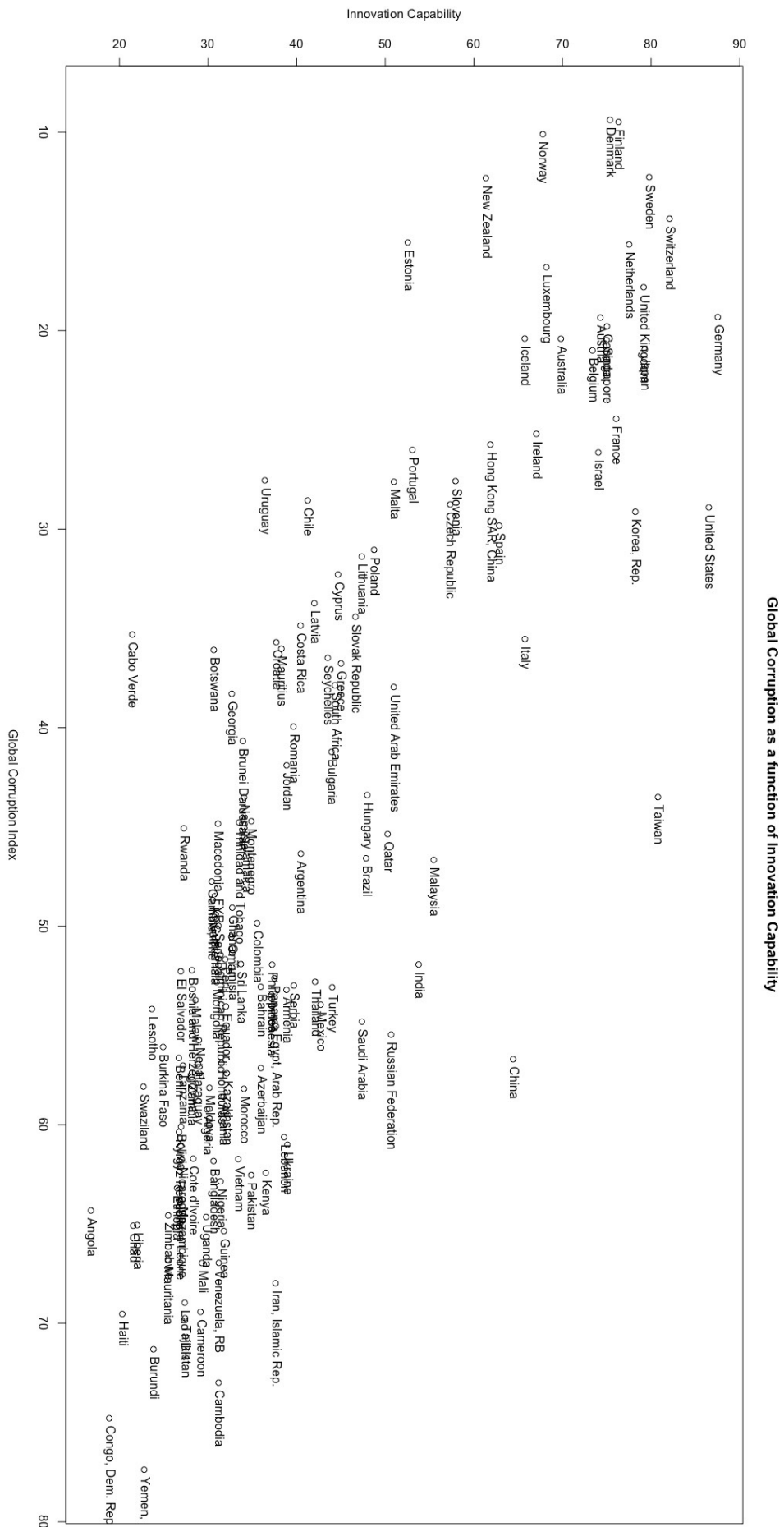
China, an interesting result

Still, some cases do not follow the logic of this relationship. China, for example, appears in a very good position for innovation, ranked 24 out of 140 (very high innovation capability) but on the contrary appears near the bottom of the list related to global corruption, numbered 97 out of 140, with a GCI score of 56.7, corresponding to a high risk.

According to a 2015 survey conducted by Charney Research, up to 35% of Chinese companies admitted they had paid bribes or given gifts to government officials to operate, with a higher prominence in two specific industries: real estate and manufacturing.

But does this mean that China is an example of the opposite theory: the “grease” effect?

China figures among the countries investing the most in R&D and the trend is undoubtedly growing. On the other side, China also faced rampant corruption, now spread on the news with arrests, chases and posthumous disgraces.



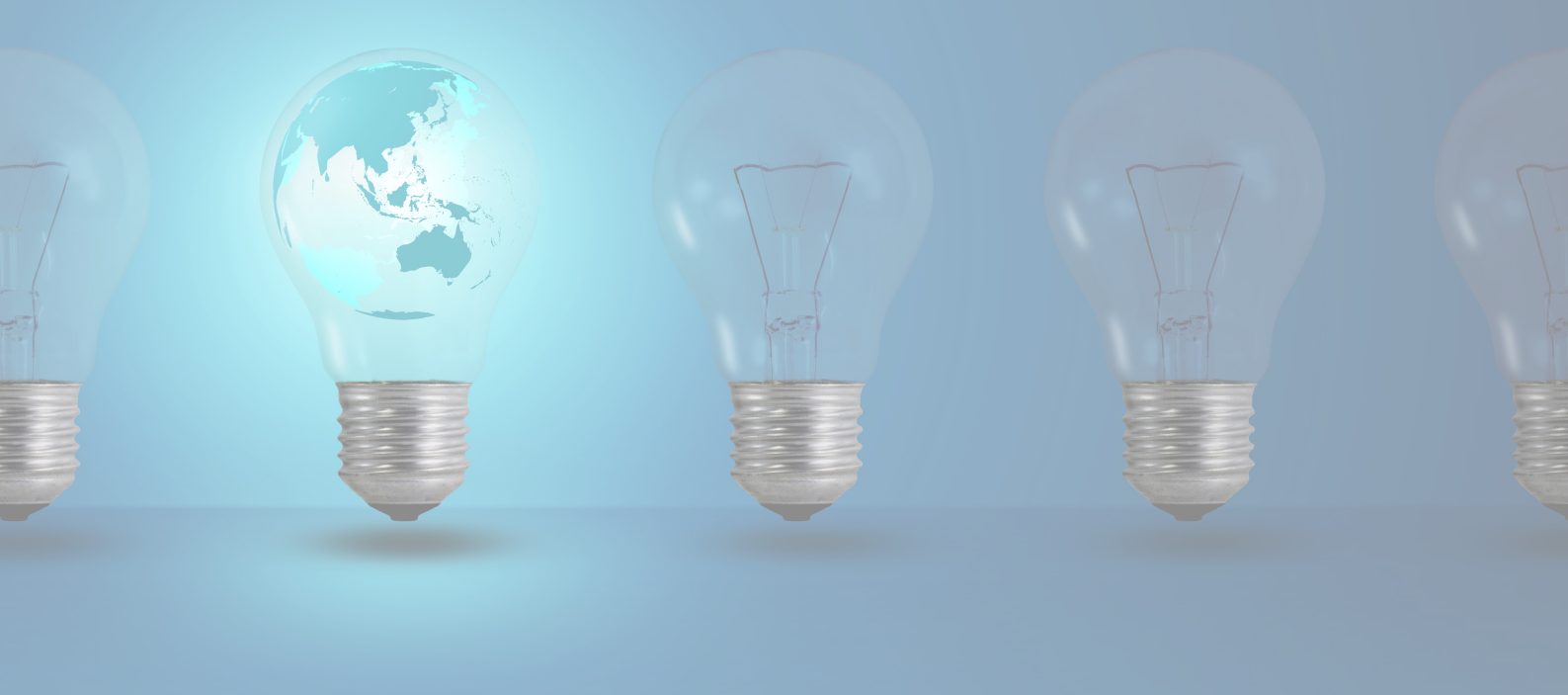
This trend traces back to 2012 with the beginning of a strong anti-corruption campaign carried out by Xi JINPING, China's President. This sudden and unprecedented change of the *status quo* represents an interesting playground for researchers, as it allows them to compare the impact of the changes that occurred. The results presented by Fang et al. (2018) suggest that subsidies became more merit-based and also more strongly related to future innovation incomes after the campaign than before it. Many links between companies and bureaucrats that were impacting how government subsidies were granted had been broken following the anti-corruption campaign.

In the same spirit, Gang Xu and Go Yano (2016) have shown through statistical studies that stronger anti-corruption efforts "makes firms in China more likely to acquire external funds, mainly the long-term debt". They show that "firms located in provinces with stronger anti-corruption efforts invest significantly more of their newly acquired funds in R&D and generate more patents". Further empirical tests suggest that this benefit comes entirely from the current massive anti-corruption campaign.

How does corruption get to impact innovation?

Entrepreneurs and innovators are concerned about the possibility that the individuals with whom they are dealing will try to appropriate the profits they are entitled to. According to Anohkin et al. (2008), the higher the level of corruption, the higher the fear: "in the absence of impersonal enforcement of the law, it becomes risky to rely on legal contracts and / or signals about the reliability and integrity of the providers upon whose services and goodwill entrepreneurs and innovators must rely". The lack of institutional background such as the rule of law is a barrier of trust, thus preventing economic activities that are tricky to monitor - such as investment in innovation - to flourish.

"Corruption undermines the foundations of institutional trust that are needed for the development of trade and entrepreneurial and innovative activity"
(Anokhin et al., 2008)



The gains that can be obtained from innovation derive from the possibility for firms to obtain patents and quality certificates. In her paper, Paunov, C. (2015), has analyzed company data for 48 developing countries and found the following evidence :

- Corruption impacts the smaller firms relatively more than the others, drastically reducing their possibilities to own internationally recognized quality certificates. Publicly owned companies do not face this issue.
- The impact of corruption could be lowered by a more clearly and objectively defined framework. As a matter of fact, corruption has less impact on patents than quality certificates given that patents would rely on more objective criteria, weakening the corruption scope by raising officials' risk of being caught.

In the specific case of China, Gang Xu et al show that “only firms without political connections, non state owned enterprises, firms operating in non-regulated industries and younger firms benefit from the stronger anti-corruption efforts”.

These findings raise awareness on the negative impacts of corruption and the necessity for a firm to evolve in an environment where the rule of law is properly defined and encourages trust, both for entrepreneurs and innovators.

As our data have already shown an important interdependence between corruption and innovation, as proxied, the next objective is to determine a causal inference and go beyond this observation. Although our analysis only relies on two variables, it **shows a strong interaction between corruption and innovation**.

How do these variables interact with each other?

We first perform a visual test of the linearity of the relationship through a LOWESS (Locally Weighted Scatterplot Smoothing) procedure, which is a non-parametric method fitting a smooth curve through a scatter plot. Figure 2 represents the fitted curve in dotted points (middle curve) as well as its confidence intervals, materialized by two additional dotted curves (at each side). The continuous line represents a simple linear regression derived from the data, suggesting **that the more a country is corrupt, the less likely it is to experience innovation capacity.**

We can see that this regression is almost always comprised within the limits of the confidence intervals, up until very high levels of corruption (\approx above 70). The result supports the assumption that the relationship is to a certain extent linear with numerous third factors that may influence this relation, possibly in a cause-effect chain of events.

From a mathematical perspective, Figure 2 suggests that there would be a highly significant relationship between these two variables, at a 99% confidence interval and that 66% of the variance of innovation capability would statistically be linked to the variance of corruption. A conclusion that however depends on the models' fit.

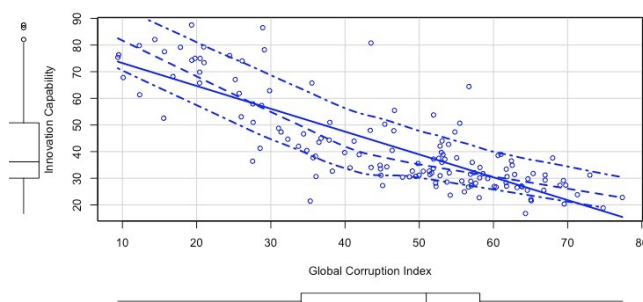
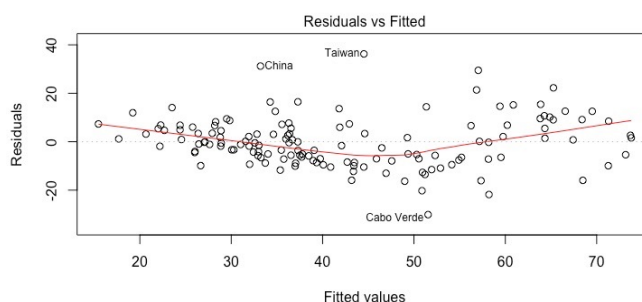


Figure 2.

As expected, an analysis of the residuals (cf. Figure 3) further indicates that other variables are involved into explaining countries' innovation capabilities, such as wealth and income (WEF 2018).

Figure 3.



These results offer a good basis for further research in order to determine the underlying connections and maybe layers between corruption and innovation.

This analysis already allows for the inference that the more a country is corrupt, the less likely its economy is capable to innovate.

Sources

Anokhin, S., Schulze, W.S., Entrepreneurship, innovation, and corruption, J. Bus. Venturing (2008)

Chang, Xin and McLean, R. David and Zhang, Bohui and Zhang, Wenrui, Do Patents Portend Productivity Growth? Global Evidence from Private and Public Firms (July 29, 2018).

Charney, C., and Qazi, S., 2015, Corruption In China: what companies need to know. Charley Research. White Paper No. 1.

Fang, Lily H. and Lerner, Josh and Wu, Chaopeng and Zhang, Qi, Corruption, Government Subsidies, and Innovation: Evidence from China (September 17, 2018). Harvard Business School Entrepreneurial Management Working Paper No. 19-031; Harvard Business School Finance Working Paper No. 19-031.

Kogan, L., Papanikolaou, D., Seru, A., Stoffman, N., 2017. Technological innovation, resource allocation, and growth. The Quarterly Journal of Economics, 132(2), 665–712

OECD, The sources of Economic Growth in OECD Countries, 2003. OECD library.

Paunov, C. (2016). Corruption's asymmetric impacts on firm innovation. Journal of Development Economics, 118, 216–231.

Romer, P., 1990. Endogenous technological change. Journal of Political Economy, 98(5, Part 2), S71–S102

Tong, J. (2005). High-tech and high capability in a growth model.. International Economic Review, 46(1), 215–243.

Xia, H., and Tan, Q., and Bai, J., 2018, Corruption and technical innovation in private small-medium scale companies: does female top management play a role ?. Sustainability.

Xu, G., and Go Y., 2017, How does anti-corruption affect corporate innovation ? Evidence from recent anti-corruption efforts in China. Journal of Comparative Economics, 498 - 519.

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