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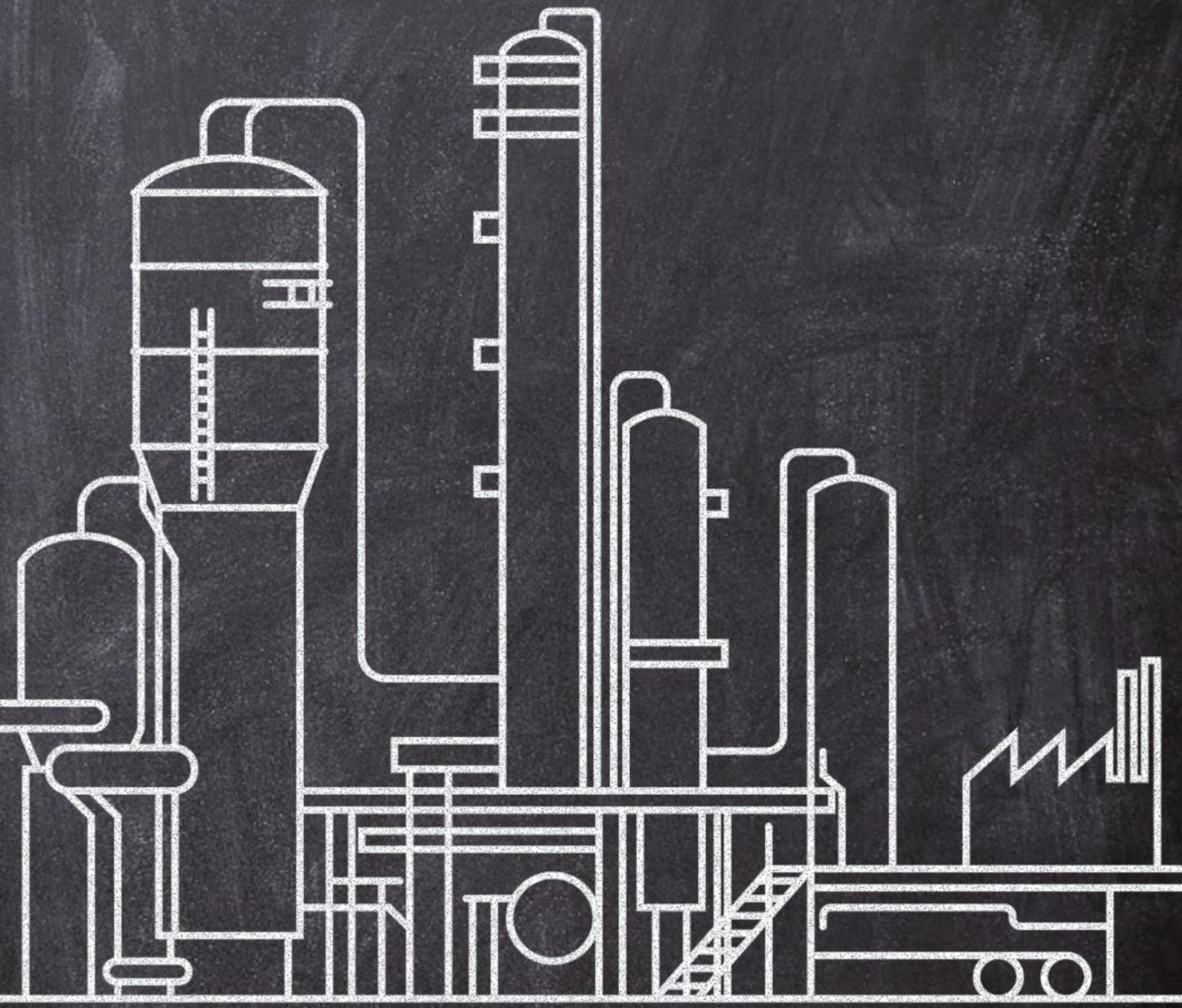

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Editorial

A Complex Machine

In our first issue published last term, we focused on a fairly new interest within modern economics, social mobility. In the second and last issue of Rationale 2015-2016, we focus instead on a topic that has occupied a lot of interest in economics throughout the years: industrial policy. Industrial policy is a divisive topic which continues to draw ideological, historical, and other forms of debate. This is justified, as the economy is a complex machine, and how the government should tweak it is a difficult question to answer. Within industrial policy, we focus on three different areas: development, technology, and policy within specific sectors. We also have a section of misfits, articles that don't fit in within the mould but are nonetheless important in giving a complete picture.

The first section is on the often-debated area of development. We start with Konstantin Born's passionate argument on why we should abandon a traditional view held about industrial policy. Then, we look at Kavya Saxena's evaluation of infant industry protection. My article follows, featuring a perspective on how countries may escape the middle-income trap with state direction. Next, Robin Park draws from her personal experience with another interesting article, on looking at grassroots development in India.

Issues about technology are pervasive and interesting, which is why we feature a section on this topic. Nadine Nikolova's article presents a view on the tradeoff between innovation and market power in the technology sector. Louis Ariss provides recommendations for sensible innovation policies in the UK. Then, Lukas Raynaud gives us insight into the exciting field of nanotechnology, especially about how the US can learn from failed policies in Russia.

'New Perspectives' is a smorgasbord of articles. It features our interview with Professor Alessandro Gavazza, where we get an interesting perspective into the life and work of an industrial economist. Stephen Chandler's article follows it up with an interesting analysis of Public-Private Partnerships in infrastructure. Then, Vaishali Mullapudi provides recommendations for Los Angeles on how it can deal with congestion issues. Finally, we have Benjamin Aw's work on the possibility and features of an international tax system.

Finally, we look at articles targeted at specific industries. Jaume Vives looks at the internet search industry, and how it may be regulated. Then, we have two articles on policy regarding sustainability. Chris Curfman provides a critical view on the Obama administration's achievements, and Martin Kabrt's looks at how Germany fares. Lastly, we have Edward Hockin's topical article on how the British government should deal with the dying steel industry.

I must end by thanking everyone who was involved in this endeavour. The issue would not have been possible without the LSESU Economics Society, and in particular I would like to thank Kaman Liang and Fiona Tan from the Executive. Most importantly, I thank the *Rationale* team: the writers, editors, and designers, who are credited at the end of the issue, for their great work. It's been an absolute pleasure working with this team and producing two great issues. We are proud to present to you Issue 2, 2015-2016 of *Rationale*, and hope you enjoy it. Best of luck for exams!

PUJAN MODI

INDUSTRIAL POLICY AND DEVELOPMENT

Getting Industrial Policy Right in Developing Countries

The need for comprehensive industrial policy frameworks

by **KONSTANTIN BORN**

For several decades, the word 'industrial policy' and the ideas it represented was one of the most shunned on the international economic policy stage and in the lecture halls and journals of the world's leading economics departments. Although influential researchers have presented strong and nuanced cases for the use of state-led industrial policy to promote chosen industries and speed up economic development for decades, the global neoliberal consensus that stressed the need for increasing market liberalization and lower levels of state interference in the economy made a constructive debate about industrial policy nearly impossible.

However, since the early 2000s, debates about industrial policy have seen a significant resurgence in the public policy debate around the continued quest for economic growth and the creation of employment in both developed and developing countries. Now, even the World Bank, which spearheaded and formed the decades-long ideological quest against the use of industrial policy and for years worried more about 'government failure' caused by corrupt and inefficient state bureaucracies, rather than market failures, is now recommending its use again.

Nonetheless the debate around industrial policy is still characterized by ideological mudslinging over differing interpretations of the desired role of the state in the process of development and structural transformation. This is especially evident when it comes to the use of industrial policy to influence the economic development and growth trajectories of the least and less developed countries. Unfortunately, the after-aches of failed import substitution industrialization strategies and the following wave of neoliberalism and its countless warnings of the dangers of letting states pick 'winners and losers' still induce a narrative that makes many mainstream economists and policy makers perceive large-scale state intervention in countries with low levels of institutional capacity and high levels of corruption and patronage as too risky and even detrimental to development.

Given this history, the re-emergence of the debate around industrial policy can most definitely be seen as a step in the right direction. However, it ignores several essential facts and is often held back by futile discussions that distract from what should be the main goal of scholarship and thinking on industrial policy: understanding the dynamics of industrial policy in order to make them successful, rather than socially and economically expensive failures.

One of these futile and in many ways misguided discussions is the debate about the role that industrial policy has played in historical processes of now advanced capitalist countries. Whereas the proponents of industrial policy point out that the countries which are now considered developed have all routinely relied on comprehensive industrial and investment plans to become developed, their opponents dispute this interpretation and point towards the power of trade and free market economics to draw in the much needed foreign investments and open or enlarge the accessible markets for potential new industries in developing countries.

Yet, many well renowned economists - such as Ha-Joon Chang, Dani Rodrik and Joseph Stiglitz, to name only a few - have presented very compelling evidence that every country that can now call itself a member of the relatively small and illustrious club of the highly-advanced economies, has used and still uses comprehensive industrial policies extensively in order to create new technological capabilities, structurally transform their economy towards higher-value added industries and support the growth of competitiveness and productivity.

Thus, instead of having a futile debate on whether and under which conditions developing countries should develop comprehensive industrial policy frameworks, we should acknowledge the overwhelming evidence that all now advanced economies have used industrial policy in the past and are still widely doing so. The most famous example was without doubt the industrial revolution in Britain, which was to a large extent made possible by the first launch of a comprehensive infant industry protection program under the Walpole government in 1721. Following the British experience of rapid growth and industrialization, industrial policies were adopted by other major European powers, most notably France and Germany, but also by the USA, Japan and the East Asian NICs (newly industrialized countries) in the next century. In Europe, after the Second World War, selective industrial policies played an important part in reconstruction, as they also did in Japan, and state ownership and economic planning were key industrial policy instruments which were employed extensively to regain competitiveness after the devastating effects of the war. By the end of the 1970s, most Western European states had nationalized substantial proportions of their industries and Japan had created a novel institution in charge of large-scale industrial planning, the now famous and much studied Ministry of International Trade and Industry (MITI).

Accordingly, the main focus of the debates and discussions around industrial policy should rather be a substantial inquiry of what constitutes an 'intelligent' industrial and investment policy and how such a policy can be successfully put in place.

Here, evidence from the unprecedented rise of the newly industrialized 'Asian tiger' states points towards the importance of constructing comprehensive long-term national development goals, designed and enacted by independent monitoring and enforcement agencies that resemble 'pockets of efficiency' with the capacity to autonomously plan, monitor and enforce integrated industrial policies.

By no means does this imply that the state should lead the market and invest into areas where the country has no comparative advantages. Rather, it should follow the market and nudge its existing industries through clearly regulated and monitored incentive structures towards higher productivity.

However, as the previously mentioned examples from Europe, East Asia, and recently also Brazil and Chile show, creating industrial policy that only focuses on the existing comparative advantages is not enough and all examples of successful industrial policy have involved structural transformation. According to Justin Lin of the World Bank and Ha-Joon Chang of the University of Cambridge, whose perspectives are comparable but not identical, a country thus has to use its comparative advantage in the short-run to ultimately defy its current advantages and push into new, uncompetitive sectors in order to get on the way towards the structural transformation necessary to move up the ladder of development.

Because despite the power of the market to create competitive efficiency and its ability to often lead to better outcomes than non-market state monopolies, the high risk and cost for individual entrepreneurs to unilaterally push into new, higher value added industries holds investment back . Hence, without state-intervention, many developing countries will stay stuck in a 'bad equilibrium' and keep relying on their current advantages, which can mostly be found in low value added primary commodity sector.

Chile, for instance, moved from basic industries such as mining, forestry, fishing and agriculture to aluminium smelting, salmon farming and winemaking, thanks to a number of government initiated long-term plans. South Korea has a similar track record of using the revenue from industries exploiting existing comparative advantages such as cheap labour input to transform its economy by investing rigorously into formerly completely unproductive and uncompetitive industries that could offer a long-term growth momentum through forward and backward linkages. In this way, South Korea managed to move from one of the most unproductive and uncompetitive steel producers in the world with a production volume of less than 1% of the world market in the 1970s to producing almost 15% of the world's steel output by the 1990s, which in turn supported newly emerging industries such as automobiles, shipbuilding and construction.

The lessons of the past are clear. First, without a well-planned comprehensive policy framework no country has ever managed to move up the ladder of development into higher value added industries, as the need to defy comparative advantage constitutes in almost all instances a market or coordination failure that has to be addressed by the state.

Second, in order to use the initial comparative advantages to push the boundary of their technological capabilities outwards and start defying its comparative advantage, long-term comprehensive policy frameworks are indispensable for governments of developing countries. Hence, the claim that developing countries with low institutional capacities and high levels of corruption are 'not ready' to use industrial policy is at its core very problematic. This effectively means that a country will be stuck in this 'bad equilibrium' of market and coordination failures with very little chance to move up the ladder of development.

Therefore, it is imperative to focus our efforts on finding 'intelligent' ways to improve the institutional arrangements and pick the right policy instruments that can facilitate, monitor and enforce these comprehensive long-term plans. We must do this in order not to repeat the mistakes that led to the failures of a range of earlier state-led attempts to create higher-value industries, such as the unsustainable import substitution industrialization models that failed in Latin America and Africa in the 1970s and 80s.

Infant Industry Protection

by **KAVYA SAXENA**

Industrial policy as we know it today tends to understate the importance of protection for infant industries. Given the effects of international competition on growth that are hardly easy to fathom, this is somewhat surprising. Competition can as easily drive innovation as it can give negative incentives to firms that wish to enter a market. Yet resorting to infant industry protection through tariffs and other trade barriers is hard to advocate when so many caveats apply for the success of such a policy. During a course on the economic history of India, Prof. Divya Mishra, a proponent of big government, admitted the many caveats to industrial policy, particularly how such protection must be merely temporary. This admission, in the context of India's first post-independence developmental model, furthered my interest in the Bastable-Mill criterion. John Stuart Mill, in his landmark work, *Principles of Political Economy*, cautioned that protection ought to be merely temporary. Just as you would not expect a parent to take care of his or her child forever, it is not possible for a government to protect its industries from competition even after they have reached a level of competitive maturity. Charles Bastable completed Mill's advice with the condition that the cumulative net benefits provided by the protected industry exceed the cumulative costs of protection as necessary. In this article, I wish to briefly look at the theoretical arguments for and against infant industry protection, and the example of South Korea as a case study in how protection can be perilous if these propositions are not taken into account.

Free trade comes with the promise of efficiencies through knowledge dispersion of the techniques and efficient tools of production within an industry. The dispersion occurs from countries and regions that got there first to the disadvantaged ones who didn't. The simplicity of the argument seems to work in its favour - except that the cost of actually obtaining such knowledge spillovers may be too high for an industry that is still in its early stages of development. Many of these industries tend to face increasing returns to scale. Their initial small size may not allow them to invest or to continue production once they enter the market, since the costs of doing so outweigh the private return. Industrial policy thus becomes necessary to finance the increase in scale of production in order to be able to compete and benefit from increased trade, with certain caveats attached.

At the crux of the infant industry debate are learning economies: whether only the firm that invests reaps the benefits or the entire industry does. The distinction makes for quite different implications. In the former, only one firm reaps the benefits of innovation, while in the latter, other firms, upon seeing the learning externalities complemented by government intervention, are incentivized to enter. In certain extreme cases, when there is no cost to reaping the benefits, no firm would invest in increasing the scale, or perhaps even entering, since others can free ride on the benefits from innovation.

Is such trade policy that too much to expect from a young and developing nation? On the one hand, the social benefits of protecting a nascent industry may be huge, with increased employment and demand for goods across several supply chains. However, the high cost that often results from distortions in the financial system as well as inefficiencies in providing protection through tariffs or quotas or production subsidies may outweigh the many benefits. As Arvind Panagarhiya points out in his criticism of the 'infant protection' argument, with a well-developed financial sector an industry can internalize the knowledge spillovers of free trade without the need for government intervention.

Yet Panagarhiya's condition is very big in this case. Since the private return on entry may be much lower than the social return, the cost of borrowing for such an industry may be sufficiently high to make the case for government protection, especially for those nations with shallow or incomplete capital markets. And even for those nations that are now developed and face the consequences of global trade, which has left many of their traditional industries flailing, it may perhaps be an important time to question the sanctity of laissez-faire policies when protection could be the saviour for potential high-growth indus-

tries with high capital requirements and/or high levels of investment uncertainty in the short-run, such as, as Phillipe Aghion points out, the many sectors involved in green energy infrastructure.

Indeed, the theoretical arguments for and against infant industry protection are legion, and each in turn more compelling than the last. However, perhaps economic history may be a better guide to policy. The biggest challenge to infant industry protection is of course the question of the ability of governments to identify which industries satisfy the Bastable-Mill criterion. In many cases, it is hard to evaluate whether certain interventions were motivated by market failures or by rent-seeking and the pressure of special interest groups on trade policy. The lobbying power by such groups has, in many instances, more than not motivated industrial protection. Since Mill's pre-requisite requires industrial policy to be only temporary, it also becomes important for policymakers to recognize when to stop protection, which is a tough task for a developing nation that may not have good access to data and research. It also should be noted that protection through import-substitution may not in fact allow a country to develop its infant industries. This could be why, as Yoo Jung Ho speculates, South Korea's decades-long experiment with infant protection succeeded, while India's did not. Its exports amount today to one-third of the country's GNP. Since protection of an exporting industry does not automatically mean an increase in profits for a supplier as they still have to ensure differentiation to sell in the global market unlike import substitution policy, there is less dependency on inefficient protection and more incentive to increase export sales by an entrepreneur.

"the theoretical arguments for and against infant industry protection are legion"

South Korea's political economy may have allowed its protective scheme to be successful. The many facets of its institutions - the strong role of an economic bureaucracy and its protection from the influence of special interest groups, as well as the influence of the Japanese model which also incorporated industrial protection made its protection policy more efficient than is usually seen. That is not to say that Korea did not face difficulties along the way. Its heavy and chemical industries were protected in the 1970s through a combination of easy credit and interest rate policy, tax incentives, and protection through tariffs and quotas. This led to excess investment in those industries favoured by the policy and rapid deterioration of economic performance of the economy. It is seen as one of the main causes of the real decline in exports in the late 1970s and the negative economic growth in 1980. This led to liberalization in the 1980s, with strongly competitive industries (and those which weren't competitive at all) facing free trade first, while those industries in the middle were given a few more years of protection. Korea's experience belies the need to understand how choosing the right industries to protect and the right time to stop is necessary.

Infant industry protection remains one of the big historical and economic questions that lack a straightforward answer. The most compelling arguments against it have been empirical. For every successful case, there is another that has allowed inefficiencies to persist in the long-run. However, using these cases as arguments could be short-sighted, since each country and industry's political economy differs hugely. Sadly, the counterfactual for infant industry protection or its absence is also not available. The visible hand of infant industry protection remains a hard to defend yet extremely relevant puzzle for international economics today.

The East Asian Miracle?

How countries struggling with the middle income trap should proceed with industrial policy

by **PUJAN MODI**

The term middle-income trap was coined in 2007 by Indermit Gill and Homi Kharas in their report for The World Bank titled *An East Asian Renaissance*. The trap refers to the phenomenon of slowdown in a country's growth once it reaches middle-income status. The report came at the peak of the growth boom around the world and especially in Asia, just before the financial crisis hit. Much work was done since then to try and identify whether or not such a trap exists. But this does not seem to be the issue. Kharas describes the exercise of trying to identify and prove that middle income traps exist, using historical data, as trying to identify whether there exist hazards on a golf course, simply by looking at the golfer's final score. Good golfers are able to avoid the hazards, but this

won't show up merely from an analysis of the trajectory of their scores. The key, then, is to find out what exactly better golfers do in order to avoid the hazards, so that others can emulate their modus operandi.

The World Bank, in its 1993 report *The East Asian Miracle* (of which *An East Asian Renaissance* was follow up) attempted to explain the success in 9 of the fastest growing East Asian Economies: Japan, China, Singapore, South Korea, Taiwan, Hong Kong, Malaysia, Indonesia and Thailand. Crucially, this growth had simultaneously reduced inequality and improved most demographic welfare indicators. The report concluded that in addition to getting the basics right, namely high rates of investment (particularly unusually high levels of private investment), widely accessible public education, and improved productivity, "the government intervened systematically and through multiple channels-to foster development, and in some cases the development of specific industries."

With this in mind, we must ask, what specifically is the role of industrial policy in helping propel economies from middle income to high income status? *The East Asian Miracle* focuses heavily on the export push amongst the aforementioned countries as a key policy factor that led to growth in these countries in earlier stages of development. However, simply following the same policies may not be helpful in countries which face substantial difficulty in breaking out of their middle-income status. This is particularly because exports are now seen to have a selection effect: a sign that a company is successful, rather than the reason for a company's success. So pushing exports may raise revenues for companies but may not encourage innovation or entry into new industries.

Typically, the solution to the middle-income trap is understood as incentivising research and innovation, which entails the development of new or better products and production methods that exploit comparative advantages. But comparative advantage alone does not explain why Taiwan specialises in making bicycles (with companies such as Giant and Merida being two of the best bicycle manufacturers in the world) and South Korea in microwaves, although they have very similar strengths. Many new industries in particular countries develop because of the exploits of single entrepreneurs, such as the revival of the cotton industry in India, or due to pushes from the government, such as the tulip industry in Taiwan. Furthermore, counter to what classical theories of international trade may suggest, it has been reported in a few important studies that specialisation and focusing on comparative advantage may not be the key in reaching high-income status. Most countries in fact heavily diversify the number of sectors they participate in during their middle-income years and only specialise once they gain high-income status. So our answer is likely in the method of how a state can push diversification.

"comparative advantage alone does not explain why Taiwan specialises in making bicycles and South Korea in microwaves"

Hausman et al provide clues, in "What you export matters", as to which products a middle income government should target in order to move up the income ladder. The main finding of the paper is, "Everything else being the same, countries that specialize in the types of goods that rich countries export are likely to grow faster than countries that specialize in other goods." The authors find that middle-income countries which produce 'rich-country products' tend to become successful and countries which continue to produce 'poor-country products' are unable to raise income levels to the same degree. The authors hypothesize that this occurs because the world demand for 'rich-country products' is elastic, which would allow a developing country to produce and export large quantities of such goods without significantly harming the terms of trade, which is the relative value of exports in terms of imports. Essentially, this means that by being able to sell large quantities of goods abroad without a significant change in export price (elastic demand), countries can reduce the negative impact of the relative value of the goods that they export (terms of trade). How should a government go about targeting entry to these industries? In "Industrial Policy in the Twenty First Century", Dani Rodrik outlines what he believes is the ideal framework for a country to follow when deciding on its industrial policy.

One of the roots of the problem is that diversification may not occur naturally - entrepreneurs looking for new industries to work in will not necessarily know the potential profits following entry, since market prices of resource allocations that do not yet exist will be uninformative, or nonexistent. Another major issue is that massive quantity of coordinated investments are needed for a new industry to develop. It may be extremely difficult for a single actor to overcome this coordination problem. Governments should focus on fixing these key market failures.

In *Asia's Next Giant: South Korea and Late Industrialization*, Alice Amsden attributes South Korea's meteoric rise to this very phenomenon, which is termed as 'late industrialization'. A prominent aspect of Korea's entry into the high-income club has been the strength of the *chaebol* (conglomerates). They exhibit the type of diversification that would be counter to neoclassical economic logic. Comparative advantage cannot explain why a company would be involved in construction, electronics and insurance, and be immensely successful in each venture, but Samsung does it. Further, Amsden argues that the state should attempt to deliberately distort the prices (through tariffs, export subsidies, etc.), in new industries in order to provide the in-

centives to create activity in them. Although South Korea used these extensively to develop new industries this claim cannot hold in the modern context where protectionist policies are difficult to implement due to many trade agreements. International treaties must recognize that middle-income countries need sufficient industrial policy space in order to develop further.

Rodrik suggests that the correct way to do industrial policy is not to focus only on taxes or subsidies. Instead, governments should work closely with the private sector to find areas where they can collaborate to overcome the most significant obstacles to the problems of restructuring. His most important claim is that states should not focus on particular policy outcomes whose success is unknowable prior to implementation, instead to follow the process of reducing the aforementioned externalities whose presence leads to the retardation of diversification. Further to promoting new industries that are successful, there must also be a willingness on the part of the government to let ventures that do not work out fail. This was exhibited in South Korea as well, with inefficient and mismanaged *chaebol* such as the Korea Shipbuilding and Engineering Company and the Kujke-ICC group, which were allowed to fail or were broken up.

Rodrik provides some concrete examples of processes that might help incentivise overcoming the market failures. One is the setting up of a competitive self-discovery process that subsidises the earliest stages of cost discovery in a new industry. Some criteria that could be used in choosing proposals could include learning spillovers to others in the economy, and a willingness to submit to collaboration with and oversight from the government. A second is the need to develop systems which provide capital for higher-risk ventures, which is usually required for exploring new industries, but commercial banks are reluctant to provide. Examples are development banks, venture funds that are publicly funded but managed professionally and government backing for longer term loans. Thirdly, the best way to internalize coordination externalities is to develop a culture of accountability and transparency in the relationships between governments and private sector entities. Chambers of commerce and labour associations can play an instrumental role in this. There are many other mechanisms that can be put forth, but one of the important parts of the process is to recognise that unlike what was the assumption for most of the 90s, industrial policy is alive and well in most developing countries: the tools simply need to be redeployed in order to meet the goal of breaking into the high-income status, as Korea was able to.

The East Asian 'miracle' was hardly a miracle. It involved conceited efforts on the parts of the governments that managed to get their countries to grow very rapidly. Evidently, through effective use of industrial policy, Korea was able to break into the high-income group. It will take the rest of the East Asian countries a similar approach to score a par.

Incorporating Grassroots Action

A new approach to rural development in India

by **ROBIN PARK**

I found myself in India in the summer of 2015, for a summer research project on organised atheism. As part of my project, I was staying at the Atheist Centre in Vijayawada, Andhra Pradesh, where the Goras, a historically atheist family since the Gandhian era, runs a series of charitable NGOs without ties to religion. One of the organisations, called Arthik Samata Mandal (ASM) focuses on bridging the economic gap between rural and urban India. As an economics student, I expressed particular interest in ASM, and the Goras agreed to take me to the rural areas in the Srikakulam district, some 150 km outside Vijyawada, to see some of the projects in motion.

The distinguishing characteristic between metropolitan and rural areas is, surely, the quality and quantity of infrastructure. Villages in India lack even the most seemingly basic infrastructure such as sewage, irrigation, and paved roads. We drove two hours on a dirt road by the river watching half-built concrete structures and barefooted vendors selling colourful fruit dotting the bank pass by. Arriving at the edges of Srikakulam, it was exciting to see the changes brought by the NGOs juxtaposed by the many thatched-roof houses and crumbling mud fences in the district.

I was first shown a hospital and led to a housing campus for tea, where the volunteers usually come to stay. Then we visited a couple of newly built schoolhouses, a specialised weavers' colony filled with wooden looms of all sizes, and a sprawling marketplace which seemed like a maze, all of which were funded by the organisation. The most fascinating of all the projects, however, were the Ecosan toilets at a particular village called Regullanka.

It is famously difficult to encourage Indian villagers to use toilets. Villagers view toilets as impure and prefer open defecation, even though there are serious dangers associated with it, such as pollution of groundwater and danger of injury or rape, especially for women. The toilets at Regullanka were built

after months of trust building between the organization and the villagers, and demonstrating their benefits, which are many. The concrete outhouses are multifunctional and can double up as storm shelters during monsoon season. No water is necessary to use the toilets - all the wastewater is collected and taken to the fields to serve as fertiliser, and ash is sprinkled on the toilets after use to dry up any remaining wastewater and banish any odour. By the end of their project, ASM had built a toilet for every household in Regullanka, which made headlines in national newspapers. Mrs. Nau Gora, secretary of ASM, informed me that the government had taken notice and begun to build roads into the village, which stretched into to the metropolitan areas.

The miraculous development and economic growth of Regullanka due to the support of ASM has earned it the structural connection to the metropolitan areas. However, the sustainability of its growth depends on the choices and behaviours of its inhabitants, many of whom are reluctant to leave their rooted ways of life, due to religious and family traditions, the rejection of foreign influences, and a general disinclination to deviate from habits. As mentioned before, the toilets of Regullanka were not built overnight—the villagers had to be convinced about their benefits and prodded to accept change. ASM's successful projects, which have generated economic activity and development in Srikakulam district, together with their persistent efforts to educate the villagers about health and sanitation, is ultimately what won over the villagers. Given the publicity received by the village, the government has built roads, but again, the initial challenge lies in encouraging the villagers to utilize them.

Furthermore, even if the villagers can be convinced about the benefits of new infrastructure (as in the case of Regullanka), they are unable to pay for the infrastructure as long as it is not also accompanied by a rise in income. Subsidies and freebies are unsustainable in the long-term; the villagers must find a way to fund their own development in order to generate the sustained growth it needs. The second hurdle, then, is for the villagers to actively utilise the provided infrastructure and realise their own potential for economic progress. Infrastructure must be accompanied by education on how to take proper advantage of it—just like handing out car parts is useless without instructions on how to properly assemble them. It is important to note that the marginal willingness to pay for infrastructure is as much dependent on behavioural constraints as it is on income.

As it stands, the government often employs the top-down strategy in funding rural development projects, like with the roads to Regullanka. However, just because the scale of the project is macroeconomic does not mean that the microeconomic constraints disappear. Prime Minister Narendra Modi has made it his primary goal to revive India's road infrastructure, pledging to invest over ten billion dollars in the road sector in the annual budget. However, lack of private sector participation and lower than expected traffic has bogged down debts and created indefinite halts in the process. This problem persists in already urbanised areas and is even worse in the villages, where behavioural constraints are stricter, as previously described.

Hence, the issues extend much deeper than just supply side constraints - funding or manpower. The fundamental problem of rural development India is the incorrect assumption that villagers are eagerly awaiting rescue from their current ways of life. Rural development NGOs such as the Swades Foundation have found that despite the fact that 19% of the Indian population needs spectacles or cataract surgeries, the villagers will not show up for free eye clinics that it provides. Similarly, the mere existence of school facilities does not guarantee the children's attendance. In fact, they are more likely to not attend, spending time earning wages for their families instead. In order for sustainable growth to occur, the villagers must be guided to realize their own potential for growth. ASM has worked to build a weavers' colony in one of the Srikakulam villages, supplying looms, connecting artisans with merchants, and facilitating transport to get the goods to the urban markets. The process is now largely self-sufficient without the supervision of the organisation and has drastically improved the quality of food, clothing, and health of the villagers in the colony. Only after the villagers are educated and convinced about the benefits of the proposed infrastructure will they mobilize to create the change that they need to sustain a higher quality of life, and the top-down method may see more success.

It is possible for the government to allocate rural task forces to take on a more holistic approach to development, rather than merely setting aside money towards projects without considering the behavioural responses. However, there are already NGOs and social enterprises that are familiar with these behavioural obstacles that have been focused on providing the required level of time and effort. Encouraging these existing key players by providing adequate funding and recognition could be the pivotal move that gets rural India the infrastructure and economic growth that it needs.

TECHNOLOGY

Finding Balance

Innovating antitrust policy in technology

by **NADINE NIKOLOVA**

Amazon is being investigated by European regulators over their possible monopoly in the e-book industry. Google received an antitrust complaint from the Federal Trade Commission on claims that they shut out rival search engines. Qualcomm is under investigation from EU Commissioners over whether they abused their market position to undercut their competitors after previously being fined $975 million in order to settle a Chinese antitrust investigation. Apple was under scrutiny for its tax arrangements in Ireland, potential antitrust violations with regards to their music streaming network, and their dominant position in the mobile software market. Facebook is having their privacy settings examined by regulators. Microsoft had to pay fines of $1.8 billion for violating European competition rules. Wondering about other tech giants like Intel and IBM? They are involved in a probe from the US Department of Justice over whether their hiring practices violate antitrust laws. Everywhere one turns, there is yet another tech giant facing charges or investigations into whether they abused their market power or took advantage of their consumers. If the charges are validated, the company is hit with massive fines. Even if found not guilty, the years spent embroiled in legal proceedings take a toll on the company's productivity and bottom line. This is all done in the name of protecting the consumer, but in the long run, we must consider just how beneficial all this regulation really is. Just like the laws of physics dictate that with every action comes an equal and opposite reaction, does government regulation come with a tradeoff to innovation? More than half of the growth in productivity is credited to technological change, and with so much weight hanging in the balance, it is of great importance to understand the repercussions of regulating such a significant sector.

Every story has two sides, and looking to classical economic theory for answers to the question of regulating innovation yields a bleak answer. A main argument against regulation stems from the belief that in an effort to comply with regulations, companies face a cost burden that redirects their resources and investment potential away from innovation and into compliance. Many of the major tech companies have banded behind this argument and have formed lobbying groups to fight regulation. The Internet Association is an example of such a group of giants within the technology industry fighting regulation

"Europe has tried and failed both to match the strength of the US's Silicon Valley"

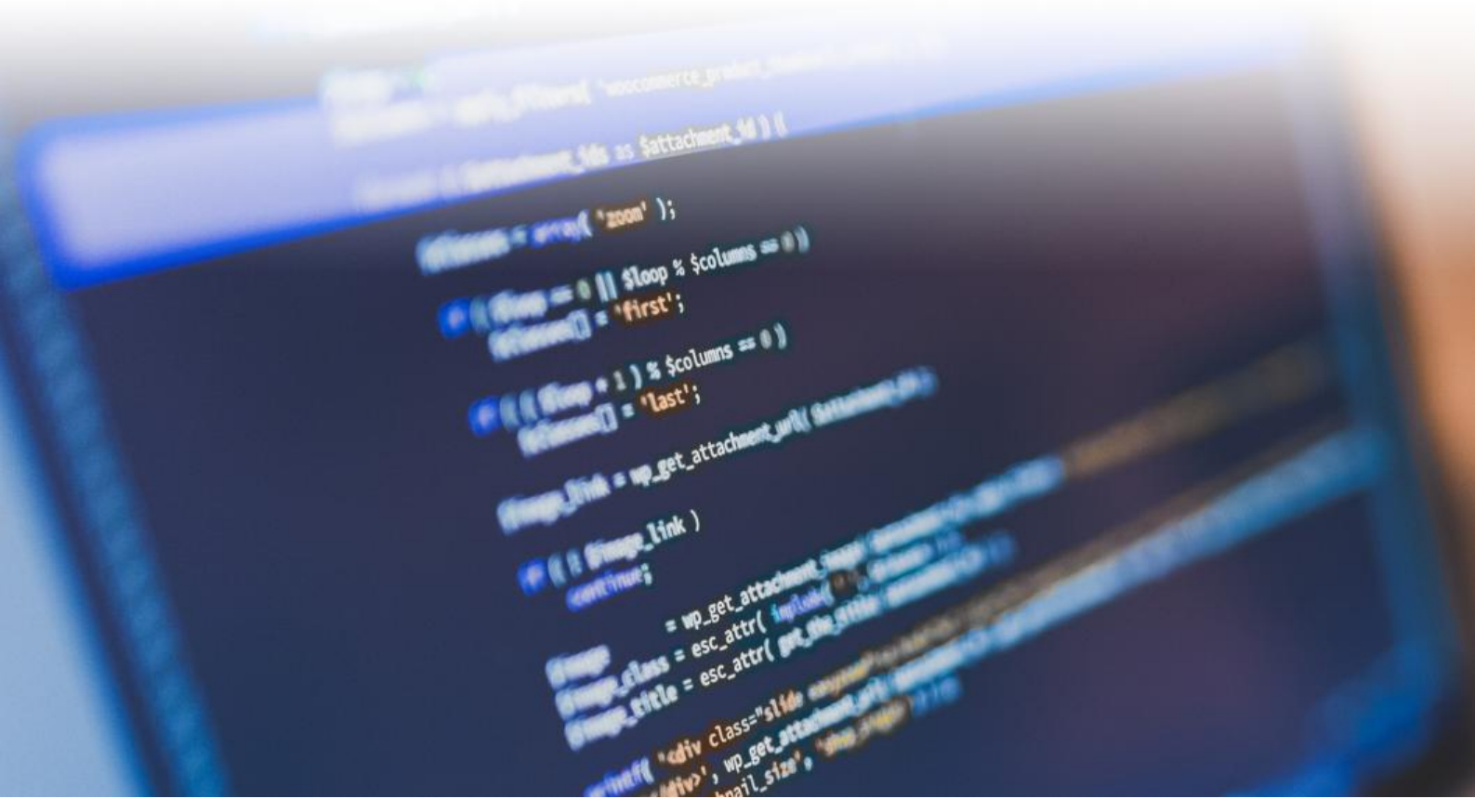
such as privacy legislation and online sales tax reform under the pretext that this sort of legislation impedes innovation. With names such as Google, Facebook, Amazon, and eBay in the mix, they present a formidable opposition. They claim that the Internet, when free from regulation, has "unleashed unprecedented…innovation" because of its ability to offer low-to-nonexistent barriers to entry. On the flip side, regulators are not so convinced of the loss to innovation, and even where economic inefficiency might arise, they insist that it is a sacrifice that must be made in the name of social welfare. Proponents of the Porter Hypothesis assert that environmental, health, and safety regulation can actually increase competitiveness within an industry and thus innovation because it mandates a higher quality of product being produced. So how should better regulation be formed?

The effects of economic regulation as a whole on technological innovation tend to fall on either side of the argument, but there are certain forms of regulation which are less costly to innovation than others, and more welcomed by technology companies. Regulation that forms a partnership or supportive framework for tech products proves to be more beneficial than backward looking, punitive regulation. Additionally, the most effective regulations at stimulating innovation require what is known as compliance innovation and simultaneously minimize the associated compliance burden and risk of producing failed technologies. Where compliance innovation is not required to meet the new regulations, innovation will be stifled and only circumventive innovation may prevail. Key features of regulations that aid innovation are a greater flexibility in allowing for various implementation paths towards compliance and more complete innovation. The trade-off between the imposed compliance burden and subsequent innovation must also be considered as well as the degree of policy uncertainty. When uncertainty in a policy is high, firms will delay innovation investment until the policy becomes more certain or may reject the idea of innovation in the uncertain direction entirely. In addition, regulation with moving targets will encourage incremental innovation which comes at lower cost and risk whereas sudden, disruptive regulation will force a higher compliance burden on firms and increase the likelihood of failed inventions. In short, the ideal form of regulation should be flexible, expedient, and unambiguous.

An interesting macro level comparison of regulation policies and innovation in technology arises between Europe and the United States. In terms of research prowess and scientific might, both countries are relatively well matched. However, Europe has tried and failed both to match the strength of the US's Silicon Valley, and establish such a center of technological innovation for themselves. This inability to pioneer disruptive innovation in the manner of the US stems from several causes, but one that cannot be ignored is the difference in attitudes over regulation. Companies in Europe have the ability to innovate on the same level as those in the US, but they are missing the government support and initiative prevalent in the US. Whereas a "fearless culture" fuels the US technology giants, Europe finds itself caught in an antitrust fervor against the likes of Apple, Google, and Facebook. While the major barriers might stem from cultural factors, these are ultimately magnified and represented in government regulation. Europe faces rigid employment laws that restrict growth, more punitive bankruptcy codes, and a relatively unwelcoming environment for the new and disruptive. When Uber began to make inroads into Europe, it was received "like the arrival of a virus" due to the strong taxi unions. Just looking at the top ten companies by market capitalization in the United States versus those in Europe highlights this discrepancy. In the US, three of the top ten companies are tech companies while no tech company is represented in the top ten of Europe. Nokia used to be a global leader in the mobile tech industry and had all the same technology and resources at their disposal as companies like Apple and Google did, but put it all together too late to be a major player in the space, thereby losing their market share. Nokia's failure to retain their market share is just one example of how European infrastructure to support innovation is simply not as strong as that in America. Furthermore, the attitudes of most European governments are not supportive enough to embrace disruptive innovation. Dublin, however, proves there is hope for Europe provided that changes in regulation take place. Through a combination of a competitive tax system, a reduction in regulatory red tape, and a strong system of innovation support, Dublin has become a new international tech capital as companies like Google, Facebook, Twitter, and Microsoft have all expanded into Dublin.

Looking to the US for examples of *better* innovation legislation yields the example of Section 508 of the Rehabilitation Act. The strict accessibility standards found in Section 508 do not regulate the technology industry, but rather shape the direction in which companies develop their products if they want to sell them to government agencies. With this heightening of acceptable standards, tech companies must innovate their products to meet the accessibility requirement if they want to keep selling their products to the biggest purchaser of tech, the US government. Microsoft applauded these measures when they were passed in 2002, stating that the measures would encourage the industry "to compete more vigorously to develop innovative technologies" because it refocuses technology companies on "competing on the basis of accessibility" which ultimately benefits people with disabilities.

That is not to say that the United States is free from issues plaguing innovation. In fact, the opposite is true. The trend in tech innovations over the past half-century was focused on the creation of revolutionary products such as the iPhone and the 360 computer coming from the titans of the tech industry, Apple and IBM respectively. However, that trend has now turned towards these giants buying out smaller startups and incorporating them into their businesses. Facebook, recognized as the most innovative company of the past decade, is a prime example of this behavior, buying WhatsApp for $19 billion and Instagram for $1 billion. Similar trends are found



in Apple and Google's business dealings. So why are such companies failing to bring innovation to market like they used to? One reason is the high amounts of regulation these companies face, restricting them from innovating at the same speed as smaller startups. They face greater scrutiny from regulators, a wall of compliance procedures, and regularly have their investments diverted from radical, new innovations. Government regulation has pushed the focus away from creating the next big thing and instead towards improving yesterday's big thing to make it greener or cheaper. In addition to the heightened scrutiny, the bigger the tech companies become, the more they are legally responsible to do what is right by their shareholders. One does not have to look much further than the separation of Google from Alphabet to see this in play. This is not to say that government regulation necessarily facilitates innovation in smaller technology companies, but rather places a burden on larger companies that effectively slows their rates of innovation and makes it more attractive to buy smaller companies faced with fewer barriers.

So where does that leave us with the regulations of late? The higher profile cases have been punitive in nature, delayed in response, and their effects have been resoundingly ambiguous. In many cases, it seems that regulation cannot keep up with innovation. It took European regulators 14 years to impose a $1.1 billion fine on Microsoft for abusing its dominant position in the market. The Justice Department in the US claimed the antitrust suit they brought against Microsoft removed their monopoly and created the greater competition seen today which resulted in products such as cloud computing and mobile devices. However, the evidence instead points toward a rather detrimental effect this regulation had on Microsoft in slowing its innovation in the face of the regulatory scrutiny and legal investigations. The very nature of the technology market tends to be monopolistic in nature as companies regularly introduce new products and services that grab the attention of the market before being replaced by the next new product. Essentially what regulations so far have achieved is to remove monopoly power from one tech giant by crippling their operations through investigations and fines and instead pass the monopoly power on to another one of the giants in the field. When the Justice Department accused Apple of fixing its e-book prices to beat the discounts offered by Amazon and began imposing regulatory actions on Apple's behavior, this effectively shifted market dominance directly to Amazon, the only other major competitor in the space. Inherent to the tech industry is what economists call "network effects" which entrench the big players of the consumer tech industry, the more people use their products. These companies are so well insulated against competition that regulations against them cycle through and pass market dominance from one to the other. Thus, regulation does nothing to push innovation out of the large companies, and does little to encourage innovation from smaller upstarts which innovate at the same rate as before. Rather, it creates an environment in which large technology companies jockey to out-do their nearest competitors by taking away their market share and resort to buying innovation instead of creating it.

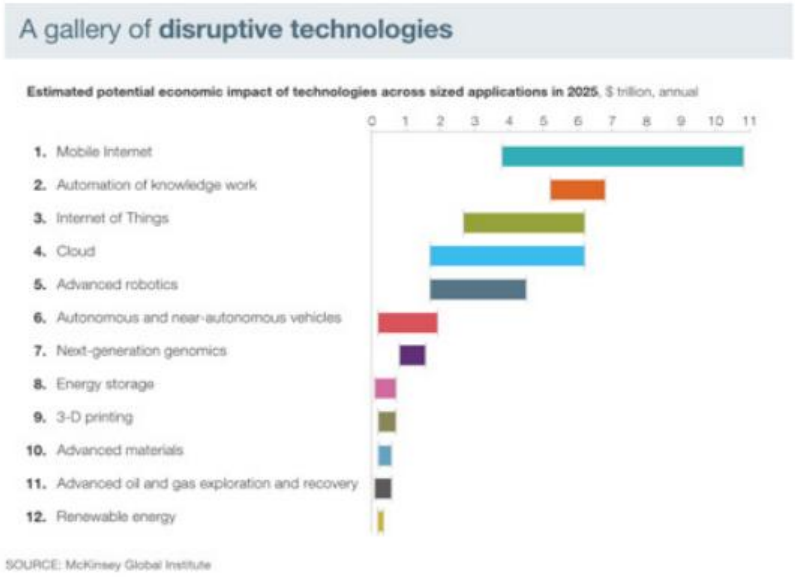
In the end, it is the larger firms who have the money to innovate but are under less pressure to innovate while the smaller technological firms face greater competition to innovate but lack the resources to do so. Rights such as patents and copyrights that have been traditionally used to encourage innovation have now been turned into a path towards monopoly and have created a barrier to collaborative innovation. The real avenue government regulation should be pursuing with respect to the technology industry should be the creation of an institutional structure that encourages and rewards policy innovation, rather than trying to limit market share or power.

An Urgent Challenge in Britain

Making sure that the technologies of tomorrow benefit us all

by **LOUIS ARISS**

The British government should actively ensure that future growth – driven mainly by technological progress – is both sustainable and inclusive. On the one hand, the UK, along with the rest of the global economy, faces significant challenges which will accentuate over time: food, water and energy shortages; climate change and rising sea levels; the ineffectiveness and limitations of domestic policymaking in a globalized world economy. On the other hand, as shown below, the McKinsey Global Institute estimates that a group of industries labelled the "disruptive dozen" – which include IT, robotics, renewable energy, bioscience and materials – could, together, generate $14-33bn per year by 2025.



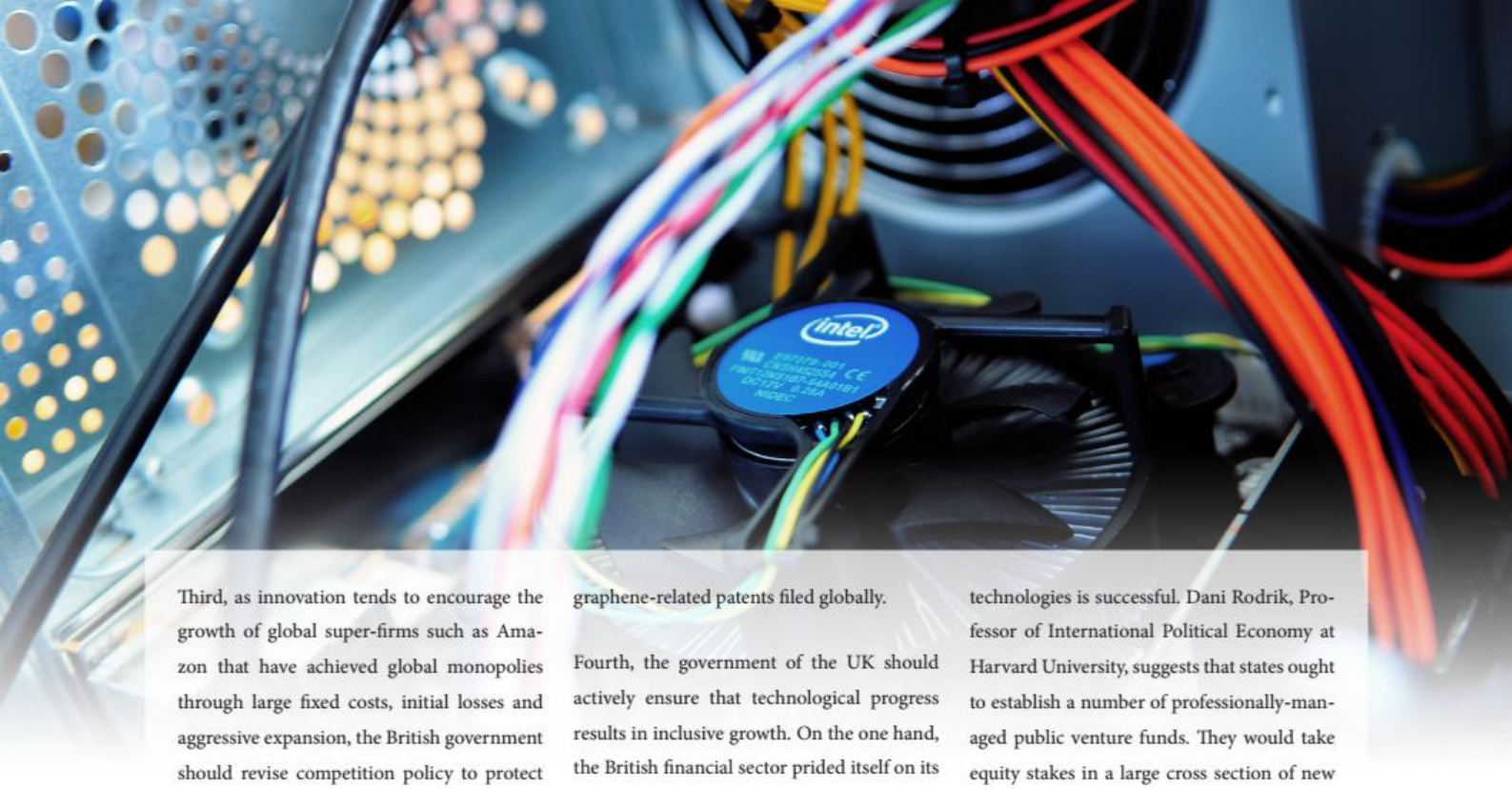
In light of both these challenges and opportunities, the state has the potential to complement the market mechanism that, by itself, has not generated sustainable, inclusive and desirable outcomes.

Indeed, the underperformance of the UK in innovation relative to other advanced economies highlights the urgency of active innovation policy. As shown on the graph below, the UK has consistently spent less as a percentage of GDP on R&D than the other advanced economies (except Italy). Productivity growth grew at a fairly constant trend of 2% per year since the 1970s, but has stalled since 2008. The Office of Budgetary Responsibility states that, if productivity remains stagnant until 2020, "The government would miss all of its current and proposed fiscal targets".

First, the British government can generate demand for new technologies by creating and shaping markets. Transformative innovation often does not meet the risk-reward benchmarks set by angel investors and venture capital funds. Consumer demand is far less predictable, and so much riskier than, government projects. In other words, the government can provide a vision that transcends the economic fundamentals and incorporates the social benefits of technologies. Governments can provide direct support to innovators by funding the R&D throughout the entire development process. For example, the US Department of Defense was the only consumer for integrated circuits in 1962, initially to develop technology to put someone on the moon. However, by the early 1970s, this technology allowed radios and pocket calculators to be created, and eventually paved the way for the Internet.

Second, the British government should tackle directly the structural impact of "creative destruction" on the labour market. New technologies have disrupted certain sectors at an unprecedented speed. For example, Uber has threatened the traditional taxi industry. Google's self-driving cars may, in turn, threaten Uber's business model. However, intensive investment in education can create a resilient labour force with skills that are transferable across different sectors of the economy, such as problem solving, effective communication and critical thinking. Furthermore, university degrees that complement the "disruptive dozen", notably biomedical sciences, engineering and computer sciences, should be strongly encouraged. This combination of relevant and flexible skills would allow workers, coupled with strong social safety nets, to manage the transition to future jobs.

"the state has the potential to complement the market mechanism"

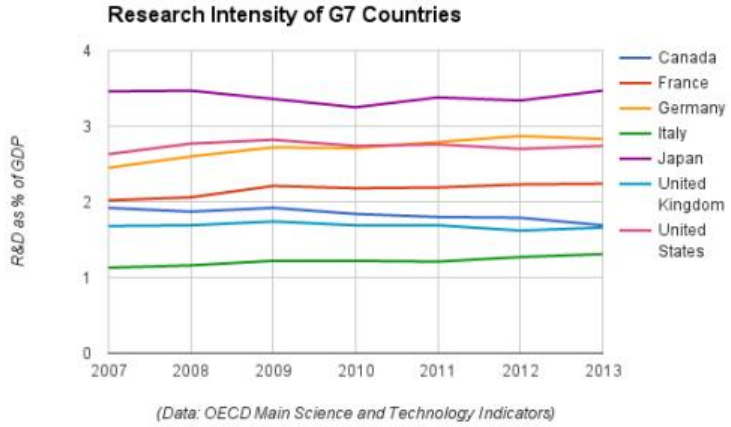


Third, as innovation tends to encourage the growth of global super-firms such as Amazon that have achieved global monopolies through large fixed costs, initial losses and aggressive expansion, the British government should revise competition policy to protect consumers, and domestic firms, against the potential price discrimination and unfair market power. International cooperation should also be strengthened in order to prevent widespread tax evasion by multinationals.

This phenomenon reflects how easily ideas, capital and products move across national boundaries. The British government should encourage more companies like Dyson and Vodafone, where the ideas, and subsequent value creation, remain as long as possible within national borders from inception to commercialization. For example, the Manchester University physics lab discovered graphene in 2004 – a material that is incredibly light and strong, an efficient conductor of both heat and electricity, and with applications such as foldable phones and stronger aircraft wings. However, the UK has since accounted for less than 1% of the graphene-related patents filed globally.

Fourth, the government of the UK should actively ensure that technological progress results in inclusive growth. On the one hand, the British financial sector prided itself on its increasingly creative and complex financial instruments, at least until the collapse of Lehman Brothers in 2008. As a result, resources flowed towards this sector. Following the large social costs of the financial crisis, the net social contribution of this innovation was negative. The excessive transfer of capital towards sectors that generate relatively little social return can be tackled by government supervision and regulation.

On the other hand, the government rarely benefits when the commercialization of new technologies is successful. Dani Rodrik, Professor of International Political Economy at Harvard University, suggests that states ought to establish a number of professionally-managed public venture funds. They would take equity stakes in a large cross section of new technologies. These funds would operate on market principles, and work much like a central bank – independent of, but accountable to, the government. Society – through the government – could end up as a co-owner of the next generation of technologies.



(Data: OECD Main Science and Technology Indicators)

The British state is in a unique position to shape the impact of the "disruptive dozen" by addressing directly their challenges and seizing their opportunities. Given the low productivity growth and R&D expenditure over the last few years, the British government should create an environment that is conducive to private sector innovation, provide direct and long-term demand for technology that will tackle climate change and the low-carbon future, and empower citizens to navigate their way through this era of constant adaptation.

"the government rarely benefits when the commercialization of new technologies is successful"

Making Sense of Nanotechnology

Using sensible policy to unleash the potential

by **LUKAS RAYNAUD**

Not too long along, nanotechnology was a playful Hollywood concept: microscopic shrinking to explore the human body, superpowers granted from robotic devices in our blood streams, nano-viruses utilized for mind control—the possibilities were endless. But science fiction is quickly becoming a reality. In the scope of today's technological revolution, nanotechnology has become the modern day steam engine, whose invention will drive and reconfigure the global economy for decades to come. Leading nations in the global nanotechnology market are realizing the lasting macroeconomic benefits from their investment in the industry, while developing countries also look to harness the same stimulus. Naturally, policy makers must be quick and careful to react to this still young and growing industry. This involves not only working to generate as much economic growth as possible, but also treading the fine line of economic reconfiguration that is the notorious and often unnoticed repercussion of such creative destruction.

To understand the role and direction of industrial policy in nanotechnology, it is first important to understand the nature of the industry, and why it has seen such fast growth. The National Nanotechnology Initiative (NNI) in the United States defines nanotechnology as the "understanding and control of matter at dimensions of roughly 1–100 nm, where unique phenomena enable novel applications". These novel applications are extremely broad: health care (nanoelectronic biosensors), agriculture (nanomaterials to deliver disease and pest control), security (nanosenors to detect explosives, radiation, and biochemical contamination), energy (nanotechnology to improve solar-cells), manufacturing (new materials discovered on nanoscale manipulation of carbon), military (nanoscale explosives), aerospace (improved materials for weight and durability), transportation (innovations in automobile safety and emission sensors), etc. With this breadth of influence, we can begin to see the importance of nanotechnology as not only a standalone industry, but as a catalyst for the development of other sectors in the broader economy

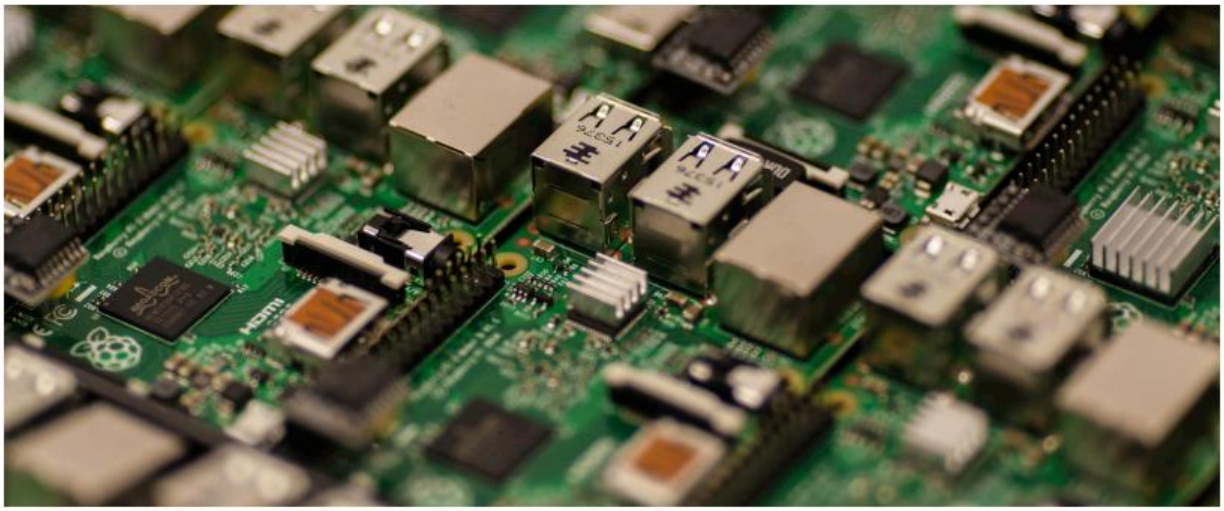
"science fiction is quickly becoming a reality"

Nanotechnology is undoubtedly pervasive, but as an industry itself is it effective? A more mathematically and empirically rigorous approach can be taken to analyse the nanotechnology industry via an application of the Solow Growth Model. Utilizing a Cobb-Douglas production function fit with real industry data, one can derive the "Solow Residual" using logarithmic manipulation and illustrate the contribution to production not accounted for by changes in labour and capital accumulation, but by the nature of the technology itself. This residual, referred to as "total factor productivity" (TFP), is often interpreted to indicate the level of "innovation" within an industry. More specifically, it represents how productive the industry is, how promising its growth is, and the importance of research and development both at the firm and industrial level. Using this type of analysis, policy makers can not only pinpoint which industries to focus resources (innovative or otherwise) towards, but can also understand the nature of the industry and how to accordingly guide it through policy decisions.

Using statistical software and industry data on changes in capital stock, employment, and value added to GDP, the equation can be completed to calculate the % change in the TFP. However, this model does not fully address the endogenous nature of capital and labour allocations, and instead treats them as independent of factors that are not captured within this framework. Nevertheless, taking the input allocations as exogenous and simplifying the mathematics still allows us to find an initial estimate of the percent change in TFP. Such estimates can give economists an indication of slowdowns or increased productivity within a given industry over time, and can influence significant policy measures as well.

With all the media, academic, and industrial hype over nanotechnology, one would initially assume promising forecasts for the sector as a whole. The industry has undoubtedly grown over the past decades, and the continual entry of countries and firms serves as a clear indication of the confidence investors and governments have in the technology. Market research even estimates a $75.8 billion global nanotechnology market for the 2015-2020 period. However, bandwagons can fall apart easily; analysis of the United States semiconductor industry (a major sect of the broad scope of nanotechnologies) illustrates a more sobering story. The industry saw positive change in TFP during the 1984-1994 period, but decreases in productivity through the 1995-2003 and 2004-2009 periods. Comparatively, the software development and reproduction industry has seen positive changes in TFP over the entire

period, as well as randomly selected example industries (chemical manufacturing, and firearm manufacturing). Yet, despite these numbers, lobbying continues in the United States to fund nanotechnology centres on national and local levels. Policy makers, amidst the seducing promise of futuristic technologies, can fail to understand the lag between technological revolutions and changes in the skill of labour. In developed countries like the United States, nano-policy comes in the form of financing "nanocenters of excellence" rather than training the existing workforce; these institutions—often backed by corporate sponsors—employ PhD level technology experts to push R&D, while the majority of the workforce does not possess the skill to utilize these new technologies. This discrepancy between the technology and the worker can cause the loss of TFP seen in the United States; it is important to understand that the health of the industry is not entirely correlated to the growth of the technology. Regardless, the 2001-2008 period saw a tripling of nanotechnology investments in the United States from $450 million to $1.5 billion, and US government science agencies saw their nanotechnology budgets increase drastically during this period. The loss of "innovation" within the industry was overlooked by policy makers, as the implications of becoming the global leader in nanotechnology appeared to be much more lucrative.



The issue of Russian industrial policy in regards to nanotechnology is not one of employment skill, however, but rather of overzealous targets and a lack of infrastructure. According to Richard Connolly's 2013 paper titled "State Industrial Policy in Russia: The Nanotechnology Industry", Russian investment in the sector began picking up pace shortly after the turn of the millennium. In 2004, nanotechnology was first mentioned in the Federal Targeted Programs (FTP) report; in 2007, the FTP report further outlined the necessities of Russia joining the global nanotechnology market. According to Connolly, the Russian government assigned a $3.3 billion budget to the nanotechnology supervision council in the hopes of increasing the sales of Russian nano-products from $0.7 billion to $1.5 billion. However, despite having the largest amount of public spending on nanotechnology in the world, Russia's nanotechnology industry ranks extremely low in global market influence, output, and innovation. This is largely due to the fact that the over-ambitious levels of growth envisioned by the Russian government could not possibly be met by the nation's extremely underdeveloped nanotechnology infrastructure. In 2008, only 14,500 R&D personnel existed in Russia (3.9% of all researchers) compared to 150,000 in the United States. Russian policy makers mistakenly focused on creating governing bodies to administer and oversee these economic plans without first understanding the discrepancy between what they wanted to achieve and what was actually plausible.

This excessive ambition is typical of technological revolutions, and the mirage of nanotechnology as an economic goldmine proved to be nothing but an economic ditch for Russia. However, despite the failure of policy makers to accurately assess infrastructure capabilities or appropriately assign funding to labour skill development instead of pure R&D, nanotechnology continues to hold priority in various economic strategy reports around the world. Still, this wishful thinking is not without reason. Given the right blend of capital and labour requirements, both developing and developed countries can reap the benefits of the inherent innovation and economic productivity that the nanotechnology industry has to offer.

"the mirage of nanotechnology as an economic goldmine proved to be nothing but an economic ditch for Russia"

NEW PERSPECTIVES

IN CONVERSATION

with Professor Alessandro Gavazza

by **PUJAN MODI & TRAVIS JAMES**

Dr. Alessandro Gavazza is a Professor of Economics in the Department of Economics at the LSE. He completed the MSc in Econometrics and Mathematical Economics at the LSE and his PhD in Economics at New York University. His main research interests lie in industrial organization and applied microeconomics. He teaches class at the undergraduate, masters, and PhD level for the department. In this interview with Rationale, we speak with him about his foray into industrial organization, his recent work, and what he thinks about industrial policy.

» **Pujan Modi (PM): We have heard from students that you are a very engaged teacher, but you also publish very regularly in top journals. How do you effectively balance research and teaching?**

Alessandro Gavazza (AG): Well that's my job! It's important to establish some clear boundaries. These term breaks and the summer term really help to focus on and make good progress on research papers. During the term it is usually much more difficult to do intensive research because of other commitments. There is the teaching, there are seminars, I like to spend quite some time with my PhD students, and I try to spend one or two days a week working from home just to make sure that my research progresses while I devote most of my time to other activities. Whereas the summer is exactly the time when I am able to really push forward with some of my research activities. And the Easter break for me is like the start of the summer. It's really about allocating your time efficiently.

» **Travis James (TJ): Based on your experiences at LSE and NYU, what advice would you give to current students considering graduate and doctoral studies in economics? Specifically distinguishing between the lifestyle, study and course material.**

AG: Firstly, it depends on the subjects. I can only confidently speak about economics. Most of what I will say will also broadly apply to related areas such as public policy or finance, but only partly. I came to the LSE because I wasn't exactly sure that doing a PhD was the right thing for me. This was a great opportunity to have an intermediate step between an undergraduate education and my PhD. When I started my PhD, I had a clearer sense that that was exactly what I wanted to do. I would strongly recommend those who are really motivated and passionate about research and studying economics to go directly to a PhD program, you don't need an MSc.

Life as a PhD student is really intense, the coursework is not only difficult, but it's really a full immersion, like a bootcamp! During my first year of the PhD, I was spending 80-100 hours per week on it. You wake up, and then either you go to class or you work really hard. You need a lot of discipline relative to here. In the US, there is the advantage that the pace of the course gives you discipline. You have midterms, finals every quarter, you have weekly problem sets, and it's a big investment on behalf of the faculty to train a PhD student. They want to make sure it is paying off. Therefore, if people don't show up, or don't submit problem sets, or your performance is not up to the standard, you're going to get warnings early on. So these really help you to be disciplined, because you have continuous testing.

So the first year is really intense and you learn a lot of things. You learn a lot of maths and theory, usually. Then during the course of the PhD, most people transition towards the applied. Economics is a great applied discipline, and amongst the social sciences, the most successful in combining theory and data. In particular, we have a simple model that guides our empirical

analysis- rational choice, and the role of markets in allocating goods, and so on. And therefore empirical analysis always thinks about why certain individuals would do certain things, or why certain products would emerge in the marketplace. This methodology has allowed economics to expand into other social sciences. Therefore, although you start training in a mainly methodological manner, during your PhD, you get to expand into more applied topics. And a lot of economists who publish, do so in an applied manner.

> **"economics has a simple way to think about any problem**

» **TJ: What drove you to do research in economics, and specifically in industrial organization?**

AG: I think I was really passionate about economics as a wonderful way to look at the world, and to think about the interaction between individuals. Markets are for individuals. There is a consumer's need and a supplier's ability to help the consumer fulfil this need. I really like, as I mentioned before, the fact that economics has a simple way to think about any problem. A consumer is trying to achieve a goal: that is what maximization is about. You go to the supermarket, you're not blindly shopping. You like cereals, you like cookies, and that's how you think about breakfast. You like Chinese food, I like French food and that's how we think about restaurants. There is demand from us consumers, there are firms that try to cater to the preferences of these individuals, and through empirical analysis, I was really curious and interested in thinking about how markets work. And that's basically what I do in my research everyday- I think about specific markets, and how consumers and suppliers are interacting. And I really enjoy studying different issues and markets. And I enjoy communicating it to students at different levels: I teach undergraduate, masters, and PhD students so I have a whole array of people to whom I try to communicate how to look at the world through the lenses of a simple model. I definitely like being on the supply side of teaching!

» **PM: Empiricism in industrial organization (IO) has gained a lot of momentum in recent years. Would you like to describe some current research trends, and where do you see research in this field going in the near future?**

AG: As you say, IO in the US, which from an academic economics point of view, is the leading country, has become mainly empirical. I was mentioning before that applied research tries to think about policy problems as well, and tries to think about how markets are evolving. So, in the past twenty years in IO, there has been a lot of emphasis on building empirical models which allow researchers to study individual markets. There has been a lot of work done on studying consumer demand, and empirical models that try to capture the richness of the market and products offered in the market. Cars are a great example of that: trying to understand a market with a variety of products that are offered in the car market, likewise some sophisticated models of consumer demand. Similarly, there has been a lot of emphasis on understanding suppliers' incentives: what are the costs of suppling certain products? What are the substitution patterns? Is this product likely to be launched by a rival? So there are a lot of questions on the working of individual markets.

A lot of these methodological tools have now been applied to policy questions and studying new markets, such as the internet markets. Examples include the effect of the internet on hotels, ride sharing in cities, or how the internet affects the information that consumers get about a particular product. From a policy point of view, the traditional questions that economists try to focus on are antitrust questions: the likely impacts of mergers on consumers, such as through prices or product variety. Similarly, the effects on consumers and rivals when there are vertical agreements between firms. Combining theoretical analysis with data and therefore putting together a simple model that is able to speak to the first order issues in the data is the way IO is today. There are a lot of applied questions, and another example is that now a lot of people in the US focus on healthcare markets, where there are more healthcare markets than in the UK where the NHS is dominant. So there are lots of interesting questions about the role of the insurance industry, the role of hospital groups, negotiation over fees and the role of Medicare. Similarly, there are lots of research possibilities in the entertainment industries nowadays. How is the internet changing the TV market, such as through Netflix? How has it changed the role of distributors? How the consumer bypassing the cable companies is really affecting the equilibrium in the market. There are also antitrust issues. Regarding Google, for example, whether they are leveraging market power through their search engine, and how this is affecting their other businesses. There are questions related to credit cards and whether we should charge merchants or consumers. Can a merchant choose a different price for a debit and credit card? Economists are really helping solve these issues, or at least address them by combining theory and data.

» PM: Increased use of the internet and 3rd party websites and software in the real estate market led to significant welfare gains for homebuyers by removing the domain knowledge that real estate agents had. Do you see a similar impact in the used car market?

AG: In a lot of cases, the first order effect of the internet in the market was to give the consumer more information. The example that you gave about real estate is a wonderful one. Now websites such as Rightmove or Zoopla will give you a much broader overview of the market rather than visiting individual real estate agents, which was the case previous to the existence of the former. There are interesting questions of trying to understand who is getting these gains. The consumers are searching better, but perhaps the sellers, or landlords, also have more access to buyers, and are able to extract better prices. More generally, we think that all these information effects should lead to a better allocation, with the gains being spread between buyers and sellers and both gain from having a thicker market. The buyer is able to get a house that they really like and therefore the seller of the house may be able to charge a higher price. So everybody is better off by having more information.

“we think that all these information effects should lead to a better allocation

The used car market is a great example. There is a lot more information about individual goods, and inventories that suppliers have. This has reached the point where you can buy cars on the internet, for example, through eBay motors. A lot of people

are comfortable buying cars online because these websites provide such reliable information that you don't even need to test-drive the car anymore. This is one fundamental way in which the internet is affecting lots of markets.

"by increasing penalties, you may make long-term relationships between buyers and sellers in the illicit drug market stronger"

» **TJ: A lot of your recent work has focused on market failures in specific industries. What role do you see the government having in reducing the frictions in, say, the health insurance, or financial markets in the US?**

AG: There are a lot of situations in which providing information to consumers is a very cheap way of intervening in these markets. For example, the recently introduced health insurance platforms in the United States under 'Obamacare', where consumers are easily able to compare the prices and characteristics of the products they are buying. Think about the labels we have on many of the products we buy in the supermarkets. They convey very useful information to consumers. This is simple regulation which is relatively inexpensive. It is a very useful way to give information to consumers. When you open a credit card account, the fact that some information about the financial products is standardized is so you have an interest rate that is comparable across banks. There are similarly simple ways to provide information that are not too intrusive, where the products may be otherwise difficult to compare.

» **TJ: In your upcoming paper on the sale of illicit drugs, you find interesting effects of increasing the penalties in buyers and sellers. What do you think this means for policy makers who are trying to reduce drug use in the country?**

AG: It's a difficult question. What the paper suggests is that by increasing penalties, you may make long-term relationships between buyers and sellers in the illicit drug market stronger. So each seller will have less competition, and will be more willing to invest in a relationship with a buyer, which in the drug market means you reduce price or supply purer drugs, and so the buyers get better deals. If you think getting a deal to a buyer is a way of attracting more buyers into the market, which is a standard assumption in economics, then by increasing penalties, you may have some additional buyers entering the market because they get a better deal. It's very difficult to have data which speak directly to this issue. In the paper, we point out this possibility. We have some time series data which suggests that this may be a contributing factor but it is very difficult to quantify this effect directly. But nonetheless, the role of a researcher is to point out some possibilities. This is a theoretical possibility, which our model is highlighting. Hopefully, we can get better data in the future, which is able to better quantify our findings. On this term, my main policy advice is to always collect more good quality data. Currently, I am not in the position to make very clear policy statements because I don't think we have a clear sense of the magnitude of the effect. But generally, collecting more data is a fundamental way in which policy should be pursued, since it leads to more informed, research-based decisions which is something any economist would suggest.

» **PM: What do you see is the role of an academic economist in driving industrial policy?**

AG: You can be an advisor to perhaps the government or an agency, or a Central Bank. You can be a consultant for a company. More generally, I think our fundamental role is to be educators of students. I really see myself in that position mostly, where I just try to convey and teach a way to think about the world and a way to use data to solve a problem. That's what education is about, making society better, by giving more information and tools to individuals. As a result of that, we will make better decisions if we are more educated. Of course this is a long-term plan, but I really think this is the main role that academia has. And then there are some people who spend more time giving advice to policymakers, regulators and firms, and that's perfectly fine. But I see really our role as an institution and faculty to teach our students. Doing our research and work outside of school allows us to become better teachers. And better teachers mean that the students we are teaching are more informed, and they can make better choices in their life.

"our fundamental role is to be educators of students"

Learning to Let Go

Beijing must loosen its reins in order to reap the rewards of private-sector provision of infrastructure

by **STEPHEN CHANDLER**

"Thrift should be the guiding principle in our government expenditure", wrote Chairman Mao in 1934 as he outlined his economic vision for a socialist China. Eighty years later, the wheel of China's fiscal stance appears to have come full circle. In 2014, Beijing announced a strict imposition of limits to local government borrowing amidst growing concerns of a debt binge. Thrift indeed this may be. However, China's twenty-first century style thrift seems to have taken much more of a capitalist flavour than ever before and has given rise to an exciting phenomenon of state-market interaction: the Public Private Partnership (PPP).

The PPP is certainly not a new concept and has been a feature of public policy in much of the developed world, including the controversial PFIs (Private Finance Initiatives), widely used in the construction of hospitals and transport infrastructure in the United Kingdom. Neither is it a new project in China, where the Shaoji Power plant in Shenzhen is considered to be the first PPP, operating in 1988. However, the current debt structure of local governments combined with growing infrastructural pressure puts China in a unique position whereby centralised government is, for the first time, encouraging the private sector to meet the country's infrastructural needs. To understand why, we need to look at financing from the position of local government.

Since 1994, local governments have been forbidden to borrow money directly, for example by issuing new bonds or raising new taxes. Instead, taxes are introduced centrally and national revenues are divided between central and local governments, the latter being responsible for over 80% of total government expenditure. To meet the shortfalls in funding, local governments have either relied on transfer payments from central government, or have increased off balance-sheet borrowing from the shadow banking sector, often with high rates of interest and short maturities. These practices have resulted in a swelling of local government debt, the true size of which can only be estimated at $3 trillion. However, many analysts predict it to be higher, due to the opacity of much of the off balance-sheet shadow banking debt. Concerned by this burgeoning debt, Beijing has been clamping down on shady off balance-sheet methods, allowing local governments to raise their own revenue by issuing bonds for the first time in 2014. A further debt-swap programme was introduced in March 2015, allowing local government to turn 1 trillion yuan (£108 billion) worth of high-yielding debt into lower-yielding municipal bonds.

"Beijing has been clamping down on shady off balance-sheet methods"

These measures, however, will not be enough to help fund the long-term infrastructural requirements of China, whose government is aiming 60% of the population to be living in urban areas by 2020 (a target that will result in roughly 100 million new urban residents). By the Ministry of Finance's own estimates, providing basic infrastructure and public services will cost at least 42 trillion yuan (£4.5 trillion). Enter the private sector. The Third Plenum of the 18th Communist Party Central Committee marks out this need clearly: "Private capital is also expected to take part in infrastructure investment and operation, a boon for local governments with heavy funding burdens". By 2015, the National Development and Reform Commission released a list of 80 projects in which the private sector could participate.

In a public-private partnership, the government and a private party engage in a long-term contract to provide a public service or infrastructure. The management responsibility lies with the private party and funding for the project is either shared or stumped up solely by the private party. The success of PPP's in theory relies on the fact that the state can harness the efficiencies of the private sector powered by the profit motive, whilst saving on the costs of the project, which are often borne by the private party. Why not just privatise a project and let the private sector take care of the rest? Because of uncertainty, which plays a very important role in the decision to invest in a huge infrastructural project. Few companies would be prepared to fork out the initial investment (it took close to 735 million yuan to construct line 4 of Beijing's Subway) without the certainty of a future return. The state, with its power and credibility, can eliminate this uncertainty by guaranteeing future purchase agreements at a pre-determined price or guaranteeing subsidies if future costs exceed revenue. For example, the construction of line 6 of Beijing's Subway system was a joint project between the Hong-Kong based MTR Corporation and Beijing's municipal government. The PPP agreement guaranteed a minimum price of 2 yuan per ticket throughout the duration of

the 30 year operating franchise and additional tariff top-ups to MTR Corp if costs exceeded this price.

Yet, in great irony, it is precisely the state's power and strength in China that is its biggest shortcoming. The Chinese state has, in a sense, become too powerful to be trusted by the private sector. In April 2015, a survey carried out by China Confidential (a research arm of the Financial Times) found that only 42% of private companies that have invested in PPP projects would be willing to invest again. Why? Government interference and poor investor rights surface as the top two reasons for this reluctance. Simply, the Chinese state can decide to do what it wants, when it wants, to the peril of all in a PPP deal. The Ensen care home for the elderly in Changzhou is a pilot project designed to showcase how private investors can provide a public service. Yet, just before opening, the city government decided to impose an ad hoc advance tax, in order to top up its depleting funds. In the southern city of Quanzhou, the Citong toll-bridge was built as a PPP project where tolls would generate revenue. Halfway through the contract period, the local government built seven toll-free bridges surrounding Citong, drastically diminishing its profitability. This disregard for investor rights, together with poor local financing methods, has meant that PPP has not become the infrastructural panacea that China once hoped for.

Yet even private-sector involvement has been exaggerated. Under Chinese classification, and unlike most other countries, private participation in Public Private Partnerships can include State-Owned Enterprises (SOEs). Another survey carried out by China Confidential in 2015 revealed that at half of all PPP developments, the "private" partner was in fact the state. Only 22% of projects actually had investment from a fully private company. This seems rather counterintuitive. How can the state enter into a contract with itself to ensure that the profit motive can deliver cost-efficient projects? There is no answer. When taken from a broader perspective, the initial fiscal gain from having a private party fund a project is completely lost. Infrastructure-related debt is simply shuffled in the state's books from local government debt to SOE debt. While this might improve the look of local governments' finances, it contributes nothing to the country's overall fiscal position, and adds to the pot a host of corruption-related costs including bribes between officials during the tender of a project.

"PPP has not become the infrastructural panacea that China once hoped for."

The recent need for Public Private Partnerships has brought to light China's recurrent problematic and reciprocally sceptical conflict between state and market. Yet with growth rate slowing to 7% this year, the lowest rate in six years, and with Beijing already having injected a huge stimulus to boost output during the 2008 global slowdown, officials are realising the important role that a market has to play in future infrastructural needs. Yet in order for this to be effective, China must relinquish its tight grip on the private sector and divert these resources to improving a judicial system adequate enough to uphold contractual agreements. Legal constraints on local governments remain weak and are often unenforced. PPP's have the power to remove so many of the inefficiencies that are currently visible in China's public services. Yet as long as the private sector is never really in charge, these gains will be muted. Judicial independence will be necessary for China to increase the confidence of private investors, not just in Public Private Partnership projects. Otherwise the future could hold real thrift, one not seen since the founding of the Republic under Mao.

Reducing Automobile Congestion

Guiding transportation policy in Los Angeles

by **VAISHALI MULLAPUDI**

Carmaggedon is coming. According to the U.S. Department of Transportation, Americans drove over 3 trillion miles in 2015. As the United States recovers from the Great Recession, GDP growth, increased investment, and employment growth have made people feel richer. Subsequently, Americans have been splurging on cars and petrol, resulting in increased gridlock and its associated costs.

Last year, congestion cost Americans $160 billion, according to the *Urban Mobility Scorecard* by the Texas A&M Transportation Institute. Congestion causes aggregate economic loss from the fall in labour force productivity, inflated transportation costs, and the carbon-equivalent cost of fumes. INRIX, a big data company that analyses road traffic, and the Centre for Economics and Business Research projects that this number will rise to $192 billion by 2020, due to population growth, GDP growth, falling fuel prices, and a rise in car ownership. This is predicted to cause a 50% increase in gridlock in the United States.

This cost is distributed unevenly among different regions—the average cost per commuter is $960, but this value skyrockets in Los Angeles where traffic costs residents $6,000 each, totalling $23 billion for the entire metropolitan area. Los Angeles has long been famous for its car culture, but this reputation comes at a cost - arguably the worst traffic congestion in the country. According to *Forbes*, Los Angeles accounts for nearly 20% of the country's congestion costs. Southern California drivers spent 80 hours each in traffic in 2014. Overall, they spent 6.9 billion extra hours stuck in traffic—42 hours per rush hour commuter. This figure is projected to rise to 8.3 billion (47 per commuter) by 2020. Not only are drivers wasting more than

"Carmaggedon is coming"

3 billion gallons of fuel, they are also falling victim to high traffic fatality rates.

The city of Los Angeles experienced its most rapid growth in the era of mass automobile ownership. In the United States in general, the auto industry took off after World War II with the building of interstate highways. In the 1950s, the Interstate Highway System got substantial funding support, leading to the construction of thousands of miles of highways. This turned the car into the preferred mode of ground transportation. The Highway Trust Fund was created, relying on gasoline taxes. This remains the main highway funding source to this day. The introduction of fuel efficient and electric cars has limited the revenue collected from the gas tax. In the summer of 2014, the Highway Trust Fund almost ran out of money.

Unlike the extensive rail networks of Japan, Western Europe, the United Kingdom, China, Turkey, Russia, and Iran, no bullet trains or high-speed rail over long distances was built in the Western part of the United States. In fact, over 1,100 miles of track were ripped up in Southern California in the 1960s to make way for car lanes. The train tracks that remained maintain a one-size-fits-all philosophy, where the tracks are shared by freight, inter-city passengers, as well as commuters. Transportation infrastructure did not manage to keep up with the rapid growth of the late 1990s.

The product of this history can be seen most clearly in the state of L.A.'s public transportation today. Despite the fact that over 1.3 million Angelenos take the Metro bus and rail every weekday, the network does not provide access to crucial access points—there is no direct metro connection to LAX (Los Angeles International Airport) and the promised "Subway to the Sea" terminates nearly six miles from the ocean. The extra "15-minute" shuttle needed to get to LAX sticks passengers right back in to the traffic they were trying to avoid. According to *Slate*, commuters' dependence on mass transit is increasing more quickly (10.7%) than their dependence on driving (3.6%). The city can fix this problem by taking advantage of its long straight boulevards which make it ideal for buses.

The importance of addressing the city's transportation problem cannot be ignored. Eliminating serious congestion could return $8 for every $1 spent. Road building and other related activities would create jobs primarily in construction and manufacturing—two industries that were disproportionately affected by the recession. A third of all carbon dioxide emissions, which are especially bad for children's health, are from fossil fuel combustion caused by transportation. Mental and physical health effects, such as stress and neck and back issues), should also be added to the list of problems caused by long commutes. Costs of borrowing through the issuance of municipal bonds are at historic lows. And, as bond revenues are the primary source of infrastructure finance at the state and local levels, the city should act sooner rather than later.

Unfortunately, Los Angeles faces quite a few

obstacles to enhancing transportation in the city. NIMBYism (NIMBY is short for 'not in my backyard') is rampant, with many local communities opposing the construction of new or expanded roads in their neighbourhoods for social, health, or environmental reasons. There is very little space to add more road capacity in areas where congestion is the most, and it must be noted that L.A.'s road network is already the most extensive in the nation. Finding the money to fund this construction is yet another obstacle. The local government has been struggling with raising the sales tax to 9% in the city to fund their transportation infrastructure plans. L.A.'s Mobility Plan 2035 plans to build hundreds of miles of new bicycle and bus-only lanes. It also lays out the building of more roads and widening existing ones to encourage more cars on the road.

Even if seemingly relevant and beneficial legislation is passed, congestion-reducing strategies often don't work in the long run. Travelers who have altered their routes to avoid congestion will notice the improvements and return to the previously busy routes during peak hours. This phenomenon is referred to as triple convergence, where commuters shift from different travel times, routes, and modes of transportation. This explains the short-term results of new highways lanes, but the long-term return to equilibrium. Congestion pricing may be the only long-term solution.

Singapore's Electronic Road Pricing (ERP) program varies the prices based on traffic conditions and by vehicle type, time, and location. A cash card is inserted into the on-board unit, and the ERP charge is deducted automatically when entering Singapore's business centre and using the expressways leading into the city. The system is revised quarterly to ensure optimal use of road space and to maintain optimal speeds. There was an almost immediate 45% reduction in traffic and 25% decline in vehicle crashes, and average travel speeds increased from 11 miles per hour to 21. Reduced traffic has led to a 176,400 pound reduction in CO_2 emissions. The ERP program cost $125 million and nets $40 million in annual profits; the system has already paid for itself. The revenue is then used to construct and maintain roads and public transportation. This could be the perfect solution to Los Angeles's double bind of crumbling infrastructure and budget deficits.

"Technology has a key role to play here"

Technology has a key role to play here. Congestion can be minimized through better data—with traffic being managed like the Internet. L.A. has already taken the initiative on this by implementing the Automated Traffic Surveillance and Control System (ATSAC), controlling and syncing all of the traffic lights in the city to fight traffic jams. The next step would be to incorporate dynamic traffic signal timing to take specific sporting events or concerts into account.

ABI Research finds that 80% of cars on the road in the U.S. and Western Europe will be connected and a source of real-time data by 2017. Denmark has already taken advantage of this to alert drivers of traffic jams in real-time and provide re-routing options. INRIX has begun launching its On-Street Parking Solution in upcoming BMW models to reduce time spent looking for a parking space; 30% of all urban traffic is caused by drivers looking for parking.

L.A. should consider these and more, such as dynamic high-occupancy vehicle lanes, and congestion-based pricing—where road users are charged for traveling at peak hours. Other technological changes that may affect the flow of traffic include ridesharing services (Uber Pool and Lyft Line) and the future of self-driving and electric cars.

Good Fences Make Poor Neighbours

Can the international tax system be saved?

by **BENJAMIN AW**

Too often it is the case that the road to hell is paved with good intentions. Certainly, Her Majesty's Revenue and Customs (HMRC) found that out for itself in January, when it gleefully announced the fruits of its labour: the payment of £130 million in back taxes by Google's subsidiary in the UK. Before the tax administration could pat itself on the back for a job well done, its officials were getting blasted for making a "sweetheart deal" with the devil, and before long, segments of the public were calling for more blood on the world's largest company by market capitalisation. Regardless of whether the criticism - that the deal was too little and came too late - was justified, it would be difficult to argue that the work on six years of audits by HMRC has not been undermined as a result of the negative press. So how did this belief that Google has been avoiding taxes in the UK come about?

One reason is that the media has been playing up the difference between the tax paid

by Google and the revenue it received in the UK. If a company is successful, should it not be paying a greater contribution to the public finance system to benefit the public? have argued we should be paying much more tax given the sales we make in the UK. But that is just not how the tax system works." Mr Brittin's defence would probably have placat- controlled in tax-free Bermuda (this technique is known as the "double Irish with a Dutch sandwich"). These sophisticated techniques have the added benefits of being, once

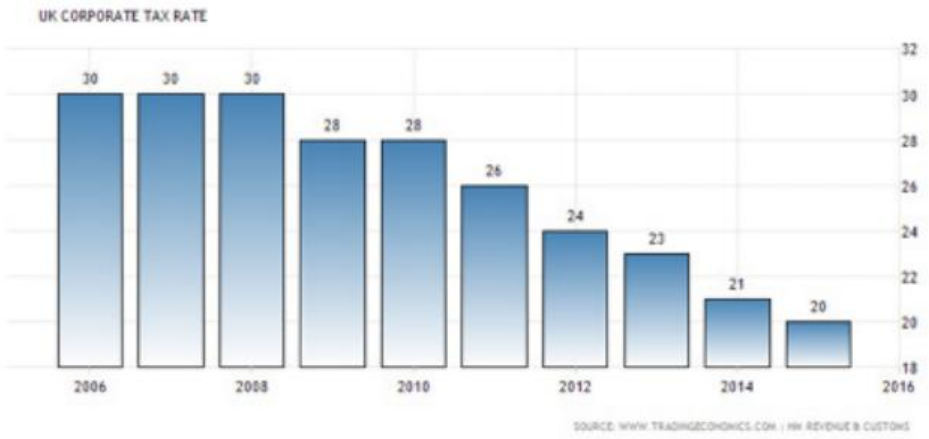
"the media has been playing up the difference between the tax paid by Google and the revenue it received in the UK"

Apparently not. For example, in 2012, Google UK reported £396 million in revenue, an accounting profit of £31 million, and yet a corporation tax receipt of just £6 million. It was later revealed that Google's UK operations had generated £4.9 billion in revenue, all of which went to Google Ireland, which then paid Google UK for intercompany services provided. Given that Ireland's corporation tax rate was far lower than that of the UK then, all of this was perfectly legal. This mismatch was thus quickly interpreted as an accounting sleight-of-hand.

Such a view may prove to be relatively simplistic, considering that general rules for corporate tax both domestically and internationally attribute profit to where economic value is added, and not to where sales are made. "As much as I would like Google to have been created here in Britain, the fact is that Google is a US company," lamented Matt Brittin, Google's head of EMEA business and operations, in defence of this mismatch. Pointing out that Google bears the most investment risk in the US (curiously, he did not mention Ireland), he added, "Some here in Britain ed the public if not for the fact that Ireland and other low-tax jurisdictions have been at the forefront of Google's "tax strategy" for the last decade or so.

Another reason behind the public's outrage is that Google has quite evidently made excellent use of the tools of the international financial system to minimise its tax payments. These loopholes appear to be obeying the letter of the law, even if they may not be obeying in spirit. Among other things, it has transferred most of its intellectual property rights in Europe to Ireland and other low-tax jurisdictions, even if these rights did not originate from these places. This has given Google two major advantages over the taxman in Britain. First, because these economic assets are in a low-tax jurisdiction, it could ascribe its generation of economic value to this jurisdiction and hence pay lower corporate taxes overall. Second, until very recently, Irish tax law made it possible for Google to slash its tax incidence in Ireland by paying its revenue received as "royalties" to a subsidiary in the Netherlands, which then pays them to another subsidiary incorporated in Ireland but again, fully legal, and out of reach of the vast majority of smaller companies and individuals, and these taxpayers, sensing inequality, naturally cry foul as a result.

Governments, especially those running budget deficits, find it a politically safe and expedient tool to blame them publicly, while recognising the need to attract their investments in their jurisdiction. This dilemma is probably what underscores the newly-introduced Diverted Profits Tax (also known as the "Google Tax", for obvious reasons) in the UK, a 25% charge on profits diverted due to "transactions lacking economic substance", which, unfortunately for the HMRC, were defined very broadly. Most peculiarly, given the HMRC's lack of information, it requires companies with operations in the UK to admit to having made these "diverted profits", and then justify that the actual amount of these profits is not higher than what was declared originally. A law meant to patch up loopholes will be ineffective if it is also riddled with loopholes; indeed, if any of the policymakers thought of it as a panacea to tax avoidance, their hopes might have evaporated when Paul



UK corporation tax rates, 2006 - 2015
Source: tradingeconomics.com, HM Revenue & Customs

Johnson, director of the Institute of Fiscal Studies, criticised it as "introduced before it has been fully thought through".

It is clear that the international tax system today is in a sorry state. Legislatures and tax administrations across the world have not been able to keep up with the pace of globalization that has enabled an increasing number of multinational companies to move and hide their profits in some corner of the globe. How might this system be reformed?

Some insight might be provided within the standard mainstream economic literature on tax evasion, as pioneered by Allingham and Sandmo in their 1972 paper. Simply put, their model suggests that a decrease in tax evasion will result from a decrease in tax rates if and only if the substitution effect, which causes the taxpayer to not cheat or to cheat less because the marginal benefit of cheating is lower, is greater than the income effect, which causes the taxpayer to be better-off and thus more willing to cheat (assuming that he/she has decreasing absolute risk aversion). According to Mr Sandmo in 2005, this finding appears to be supported by empirical evidence insofar as personal income taxes are concerned. However, even as we see more and more of the developed world lower corporation tax rates (the UK lowered its rate from 30% in 2008 to 20% in 2015), it remains to be seen whether the model's prediction can be extrapolated to explain corporate taxation. Crocker and Slemrod, in their 2003 paper, point out that the difficulty in extending the model arises from the separation of ownership and control. As managers are not directly penalised by their choice of the amount of taxes to evade, it is possible that they may choose to evade more taxes as a result.

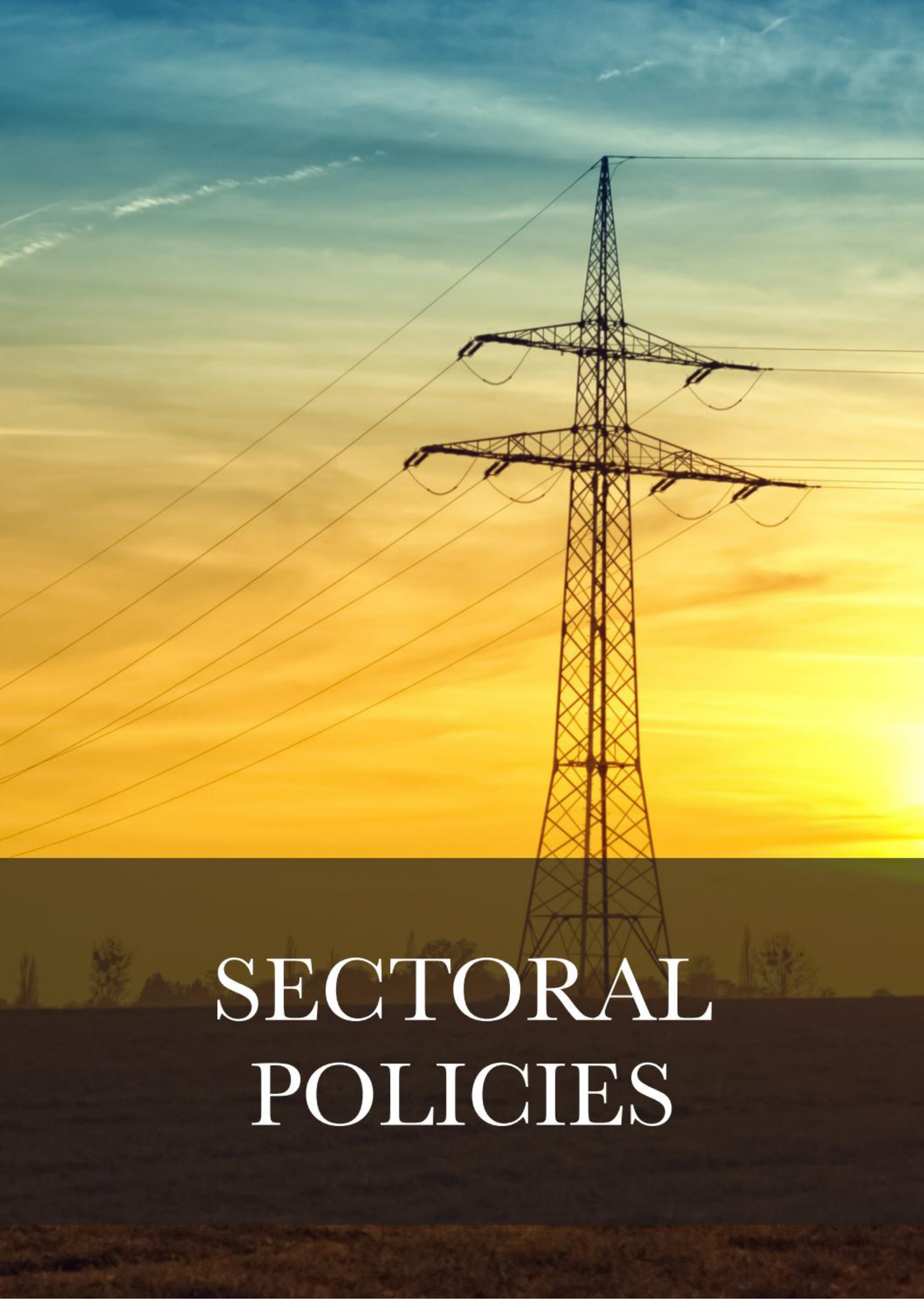
The bigger (and more insidious) problem in the international tax system, however, is the still-legal act of tax avoidance, precisely because it is "the thickness of a prison wall" that differentiates between this and its illegal cousin tax evasion. Tax avoidance results because companies can take advantage of the heterogeneity in legal systems across different jurisdictions. Suppose there is a multinational corporation that has dealings in three different jurisdictions: A, B, and C. Jurisdiction A is where the company is legally established and where all its shareholders reside. Jurisdiction B is where the company produces all its products, all of which it exports to jurisdiction C. Jurisdiction C is where the company sells all its products, all of which are consumed within said jurisdiction. If this company were to make profits, in which jurisdiction should it be taxed?

If we think of taxes as payments to the government in exchange for the benefits enjoyed under that jurisdiction, then all three jurisdictions can make an economically legitimate claim to this, and they use different means of taxation to do so. If all three jurisdictions only had personal income taxes, then the only taxes paid would be those on the dividend payments of shareholders in jurisdiction A. Likewise, if all three jurisdictions only had corporate income taxes, then the only taxes paid would be those on the profits of the subsidiary in jurisdiction B, where the company "created" its economic value (assuming jurisdiction A does not tax profits from foreign sources). Finally, if all three jurisdictions only had value added taxes, then the only taxes paid would be those on the consumption of the goods in jurisdiction C. If these jurisdictions are identical to one another save for their tax rates, then the company can simply choose to relocate its places of legal establishment, production, or sale where the respective tax rates are the lowest. In an era when taxation is regarded by governments to be a largely domestic matter, the fundamental problem hence arises when governments cannot find grounds of agreement in what to tax and how much to tax it.

"It is clear that the international tax system today is in a sorry state."

Already, inter-governmental organisations have made advances towards a solution to this. Focusing on the need to ensure that multinational corporations cannot hide their economic profits for long, the Organisation for Economic Co-operation and Development (OECD) has developed a Common Reporting Standard (CRS) for tax administrations in most of the developed world to exchange information automatically and systematically, with the aim of uncovering tax evasion. This is complemented by more general "anti-abuse rules", which member states can incorporate into their legislation to target the most common tricks used by multinational corporations, such as those exploiting the intangibility of intellectual property as described above. These plans have yet to be fully implemented (the CRS only kicks in two years from now), so it remains to be seen whether they will have a substantial impact, if at all.

While ambitious, the solutions of the OECD may still be unable to keep up with advances in the international financial system or the creative ideas of tax consultants across the world. Perhaps a more radical solution would be to have a global administration in charge of taxation of selected multinational companies deemed large enough, made up of representatives from tax administrations of the jurisdictions these companies have legal establishment, production, and/or sales in. Together, these representatives can take a bird's eye view of the operations of multinational corporation, and apportion its profits based on where economic value is added, and these companies would pay a single tax bill to this administration. Rather than watching administrators in France (and possibly more jurisdictions to come) demanding more than €500 million from Google for the same reasons as the UK did, or the US and the EU tussle with each other over who is treating each other's companies more unfairly, if the international tax system is to be saved, governments need to stand together, more than ever.



SECTORAL POLICIES

Greetings Earthlings!

Creating sensible antitrust policy for internet search

by **JAUME VIVES**

'Greetings earthlings!' This is how Robert Shrimsley, Managing Editor of the Financial Times, imagines a letter from the tech world leaders to the rest of 'mortals' would begin. The ironic piece aspires to highlight the main issues concerning the meteoric rise of the internet giants. From tax efficiency to competition policy, it seems that the main debate is whether such considerations can be overlooked in the face of a commitment to improve and advance society through innovation and technological progress. Is Google's added value to society enough to justify the suspension of the competition laws that apply to most markets? In this article I review the components of industrial economics which influence competition law, to try to understand if a monopoly in the internet search industry is detrimental or beneficial for society. The two issues to analyse are whether Google's behaviour in the search industry distorts competition and how the existence of a monopoly affects this market.

"Is Google's added value to society enough to justify the suspension of the competition laws that apply to most markets?"

It is clear that Google is a dominant player in the search industry with around 65% of the global market share and up to 92% for the EU (according to Net Market Share analytics). However, legal cases against Google usually are not concerned with competition in the search market. From a microeconomic lens, it is tempting to think that since Google has a large share of the market, it also has a lot of market power and so can distort the prices. But, how does one interpret market power and make inferences about it in such an industry? The service provided by Google is advertisement through a search engine. That is, access to an ordered set of users that can see your ad when searching for results in the network. The key is that consumer choice lies in which platform/network to choose to advertise its business or website. There are other, significantly smaller networks that provide similar services; Bing, Yahoo, Baidu etc. Google's market power comes from the fact that Google's product is differentiated from the others. Mostly because of the size of Google's network of users; the more users the network has, the larger the benefit for each user when using the network. Also, the underlying algorithm of Google's engine is seen as more efficient and better suited for the type of results users are looking for when using a search engine. This allows Google to set the price schedule of ads knowing that its competitors will be heavily influenced by its decision and that the demand for ads won't change significantly. It is reasonable to assume that the demand for using Google's network is fairly independent (inelastic) of the price of ads because consumers choose Google having in mind the benefit of gaining access to the largest network of users.

However, this doesn't seem to be a problem that concerns policy makers. Mostly, because Google prices its advertisements according to auctions. Imagine that there is a website that rates restaurants in London. Every restaurateur wants their restaurant to be the topmost result when a person searches for 'Restaurants in London' in Google. In order to bid for this place, the restaurateurs enter an auction in Google AdWords. Hal Varian, Emeritus Professor at Berkeley and Google's Chief Economist, designs such auctions such that the price paid (the winning bid) for the top position also depends on other factors such as ad quality or expected impact of extensions. Not only does the bid matter, but also the value added of the website to the network of users (Google quantifies these value added by investigating why users use your website, what your website offers and so on). This system introduces a form of quality control that helps users sort through the information more easily. So the fact that Google can set higher prices is not intrinsically a flaw in competition policy. Since the auction process is repeated for every search position, each independent auction can have potentially different results depending on the intensity of competition at the moment. Other search engines operate with similar methods and therefore whether there is a market leader or not doesn't influence the price of the 'good' in a restrictive manner. One might think that this is not true because Google's competitors are only able to attract the firms that did not get their desired search spot in Google's search process, as Google is seen as the market leader. However, it is likely that this distortion (smaller, less resourceful firms not being able to bid in Google's system) is overtaken by the fact that having a suboptimal spot in Google's search engine might still be marginally better than having the best spot in a competitor's engine. As a result, the ordering of sites in Google (if no further distortions are considered) is likely to be reflective

of the productivity and significance of the bidders, which is what users are looking for when using the engine.

Despite this, the EU is fighting an open legal battle against Google over antitrust concerns since 2010. The European Competition Authority claims that Google is being unfair by biasing its searches towards its own products; some Google products are not ranked according to the auction mechanisms. Specifically, Google Shopping has been consistently favoured although competitors such as Amazon or eBay should be ranked higher due to their larger user base. If these claims are true, then the market for ads that Google administrates within its network is not fair. Since the quality controls are dynamic, a website that consistently ranks in the top spot for a specific search is more likely to be able to bid lower prices for such a position. Essentially, the ranking is self-enforcing in quality. A higher quality site ranked number 1 for a certain search criterion will have to pay less to maintain its ranking and so might be able to spend more on consumer satisfaction or amplifying its user base. This allows the site to reinforce some of the aspects that Google takes into account in the auction process, and, therefore, gives the site a comparative advantage. This can be understood as Google effectively distorting incentives in its market by restricting competition. Imagine once again that you bid for the first spot with your restaurant website and you pay what usually would get you the first spot, but instead the Google Restaurants website (fictitious) appears first. Consequently, your user base drops by a small amount as consumers shift to Google Restaurants. If this drop is significant enough, you might be forced to raise prices to maintain the revenue or cut some of the services offered. The costs haven't changed, but if you hike prices or cut quality, then your perceived value added to the network drops and hence you might need to pay more to retain this second spot. So, Google's distortion of the market is clearly reducing your ability to compete with Google's prices and services in the restaurant market. This is where the issue with competition lies. Google might not be unfair in the search industry as a whole, but such practices in the markets within Google's network grant Google the ability to set more competitive prices and hence gain market share. In practice, we could ask ourselves, what happens when the rank is biased towards certain websites owned by Google? As a matter of fact, not that much happens. Google shopping is still a small player in the market and is not growing very fast. Either it hasn't reached the necessary critical mass of users or the fact that it is ranked first doesn't matter that much as users would rather go to eBay or Amazon to buy goods. These distortions seem small at the moment and don't seem to create a significant adverse environment for competition. However, in the future, this might change, and when it does the cost of regulating competition within Google's network will increase significantly.

"If these claims are true, then the market for ads that Google administrates within its network is not fair"

Given that Google can create these sort of distortions in the markets it participates in, we assess the value added to an economy by Google. Google's Economic Impact report for the US in 2014 claims that it helped provide $131 billion, equivalent to the GDP of Hungary, for business, website publishers and non-profit organisations in 2014. More interestingly, they estimate that for each $1 spent on Google AdWords, a business generates $2 in revenue, and businesses receive on average 5 clicks on their search results for every 1 click on their ads. That is, if search clicks brought in as much revenue as ad clicks then businesses would effectively be making a profit of $11 on average for each $1 spent on Google AdWords. This return seems incredible, but we have to keep in mind that presence on Google is more or less a require-

ment for most businesses if they don't want to lose market share. The most important fact about Google is that it unifies the process of gathering and displaying information. Were we in a more competitive environment in the search industry, there would be an added cost to selecting between search engines without necessarily knowing which businesses are in each network. In the perfectly competitive case, if all networks are exactly the same, then it means that businesses have to pay to be in every network, otherwise there would be some preferred networks and we wouldn't have perfect competition anymore. So, it seems that the fact that Google is the most widely used browser is beneficial for consumers as it reduces search costs and for businesses as it reduces the costs of having to be in multiple networks, and so facilitates transactions between businesses and consumers. Another very important part of Google is the so called "moonshots"; there exist black swans and there exist moonshots. In the same way that we tend to underestimate the gravity of events that only happen with very small probabilities, we tend to optimistically magnify the probability of events that we believe would have an incredible impact on the world. Such discussions are common in the media. Many large tech companies invest billions in research that has no direct application currently, but might someday transform the world we live in. I am talking about artificial intelligence, space tourism… - all of which seems good for society. At the end of the day, if large multinationals don't invest in this kind of research who is going to do so? However, what happens if such a moonshot becomes a reality? A new market will have been created, granting monopoly power to its creator and a nightmare for unexperienced regulators. The patent system needs to develop a very clear set of guidelines to prevent future competition issues in these new markets.

In order to have a healthier digital market, regulators have to work towards two goals. One is to ensure that the allocation mechanisms within search engines are fair and don't distort incentives. The second is that new legislation has to be set in order to have a general rule-book specifying protocols in case Google creates a new market within its own network. It cannot be disputed that these internet giants provide very useful services, but this doesn't mean that efficiency in these markets cannot be increased. It does mean, however, that in doing so we might have to change the way these markets allocate services within the user base.

Seven Years of Change

An economic analysis of US President Obama's sustainability initiatives

by **CHRIS CURFMAN**

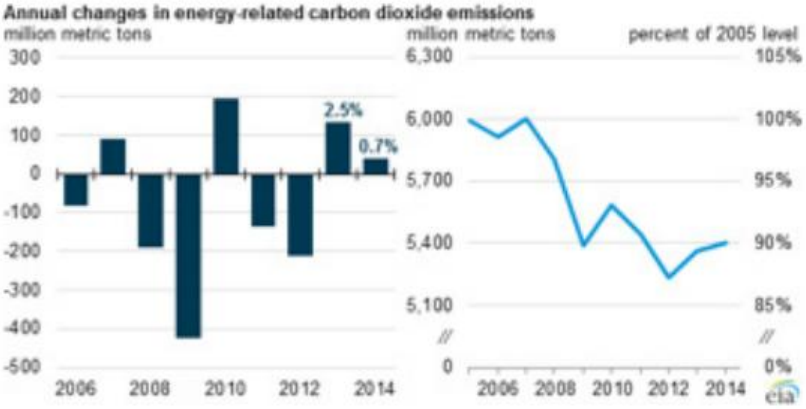
Over the past few years, there has been a heavy policy focus on innovation and sustainability as countries have begun to realize their old models of growth will fail to be as effective in the 21st century. Composing roughly 20% of world GDP and 15% of global greenhouse gas emissions, the policies of the United States in these areas have a large impact not only domestically, but abroad as well. For these reasons, as he enters his eighth and final year in office, there is a collective interest in evaluating the policies of U.S. President Barack Obama on their effectiveness in promoting environmental sustainability.

As can be seen in the adjacent chart, CO_2 emissions began falling in 2007 before President Obama was elected in 2008 and assumed office in 2009. This fall in emissions corresponds to a contraction in economic output of 4.2% from Q4 2007 to Q2 2009 (Bureau of Economic Analysis). Thus, the true policy debate is over the period from 2009 to 2014, over which changes in emissions have been a net wash.

One of the first programs introduced during the Obama administration was the cash-for-clunkers program (also known as the Car Allowance Rebate System (CARS)). This program allows consumers to trade in older, less fuel-efficient vehicles for vouchers to be applied toward the purchase of newer, more fuel-efficient transportation. Meanwhile, the traded-in older models were destroyed to prevent resale. From a sustainability point-of-view, by increasing the fuel efficiency of cars on the road, CO_2 emissions should fall. This is exactly what the program accomplished, albeit not on the scale for which the administration had hoped. Shanjun Li, Joshua Linn, and Elisheba Spiller found in their evaluation of the program that CO_2 emissions fell by 8.58 million tons to a total of 28.28 million tons, or 0.1-0.5% of current US CO_2 emissions. This amounts to between 2.4 to 7.9 days' worth of current U.S. gasoline consumption. Ted Gayer and Emily Parker also note in their own research that the price tag associated with the program totals $3 billion, or $91 to $301 per ton. This is an inefficient use of fiscal resources when federal agencies estimate the social cost of CO_2 emissions at $38 per ton.

Another area of focus over the past eight years has been electricity generation. Jayant Kairam of the Environmental Defense Fund (EDF) says the United States' "electricity system accounts for 40 percent of carbon emissions, and we have the opportunity to make it cleaner, more resilient, more affordable, and less reliant on fossil fuels." With this in mind, the American Recovery and Reinvest-

ment Act (ARRA) of 2009 was introduced in the same stimulus package as CARS. ARRA were a series of production and investment tax credits for renewable energy production. These tax credits were designed to increase clean energy output by decreasing the cost of production and encouraging companies to undertake investment that otherwise would not have been profitable. Last year, the U.S. Energy Department reported that from 2008 to 2015, the amount of power provided by wind in the US tripled and the amount from solar grew 20 fold. The Energy Information Administration notes the US now consumes 22% of global non-hydroelectric, renewable energy.



Source: U.S. Energy Information Administration, Monthly Energy Review

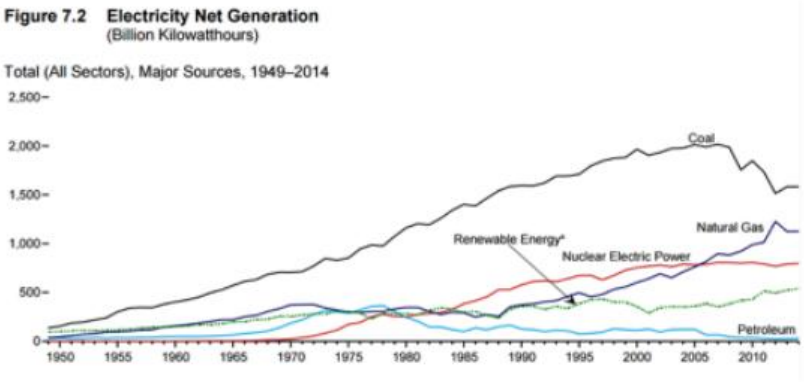
It is likely these tax credits played a role in the dramatic increase in solar and wind power production over the last seven years, but at what cost? A National Academy of Sciences (NAS) study published in the American Economic Review tried estimating this cost and found these tax credits reduced CO_2 emissions at an average cost of $250 per ton. The NAS study found that the high cost of reduction was mainly due to the substantial level of funding provided by the credits, and the fact that 29 states and the District of Columbia had already set Renewable Portfolio Standards (RPS). These standards require a certain percentage of participants' electricity output be produced from renewable sources by a certain date. The authors estimate that ultimately the tax credits only reduced CO_2 emissions by 0.3%, but in the absence of the state RPS they would have reduced CO_2 emissions by 0.5%. From this, we conclude that there was a fair amount of redundancies produced by the ARRA. This study also examined another series of tax credits created in this legislation for renewable transportation fuels. They found that the credits actually increased emissions by lowering the price enough that the costs from increased consumption outweighed the benefits from blending renewable fuels with gasoline/diesel fuel.

There is little doubt among economists that emissions taxes (i.e. Pigouvian taxes) or an emissions-trading scheme (ETS or "cap-and-trade") would be much more efficient and effective at reducing emissions than subsidizing renewable electricity production. By allowing electricity generating firms to utilize the most efficient means of emissions reduction, these market-level methods achieve their goal while minimizing the negative impact on GDP. In fact, as Harvard economist Robert Stavins notes, the US has undertaken ETSs several times in the past to reduce leaded-gasoline, chlorofluorocarbons (CFCs) and halons (ozone destroyers), sulphur dioxide (SO_2 – causes acid rain), and nitrogen dioxide (NO_2) emissions. The use of cap-and-trade to limit CO_2 emissions has largely been confined to the EU, South Korea, New Zealand, and California. A 2009 US effort to implement an ETS for CO_2 emissions, the American Clean Energy and Security Act (H.R. 2454), passed the House of Representatives but died in the Senate. Gayer and Parker estimate the cost per ton of CO_2 reduced would have been $14.95 under the cap-and-trade bill, making it far more efficient than any subsidies or even a carbon tax. For this reason, economists continue to advocate for an ETS. In the US, however, cap-and-trade programs remain a far-fetched political dream, in spite of their efficiency and effectiveness in reducing carbon emissions.

This raises the question, at what point do economists stop advocating for first-best, efficient methods of emissions reduction and use their skills to improve upon second or third-best solutions? For instance, improving clean energy subsidies by helping the government tailor them to geographical areas where renewable energy is unlikely to take hold, or designing a provision that allows companies to claim a tax break if they reduce emissions by a certain amount. Since it is usually difficult to change existing policies or introduce wholesale new regulation, another second-best solution is developing efficiency improvements for existing systems. The Congressional Budget Office, a non-partisan entity working for the U.S. Congress, found that the Department of Energy funding and research for early-stage technological developments produced economic benefits substantially outweighing their initial costs. Several such programs have been implemented under the Obama administration, likely

"It is likely these tax credits played a role in the dramatic increase in solar and wind power production over the last seven years"

Figure 7.2 Electricity Net Generation
(Billion Kilowatthours)



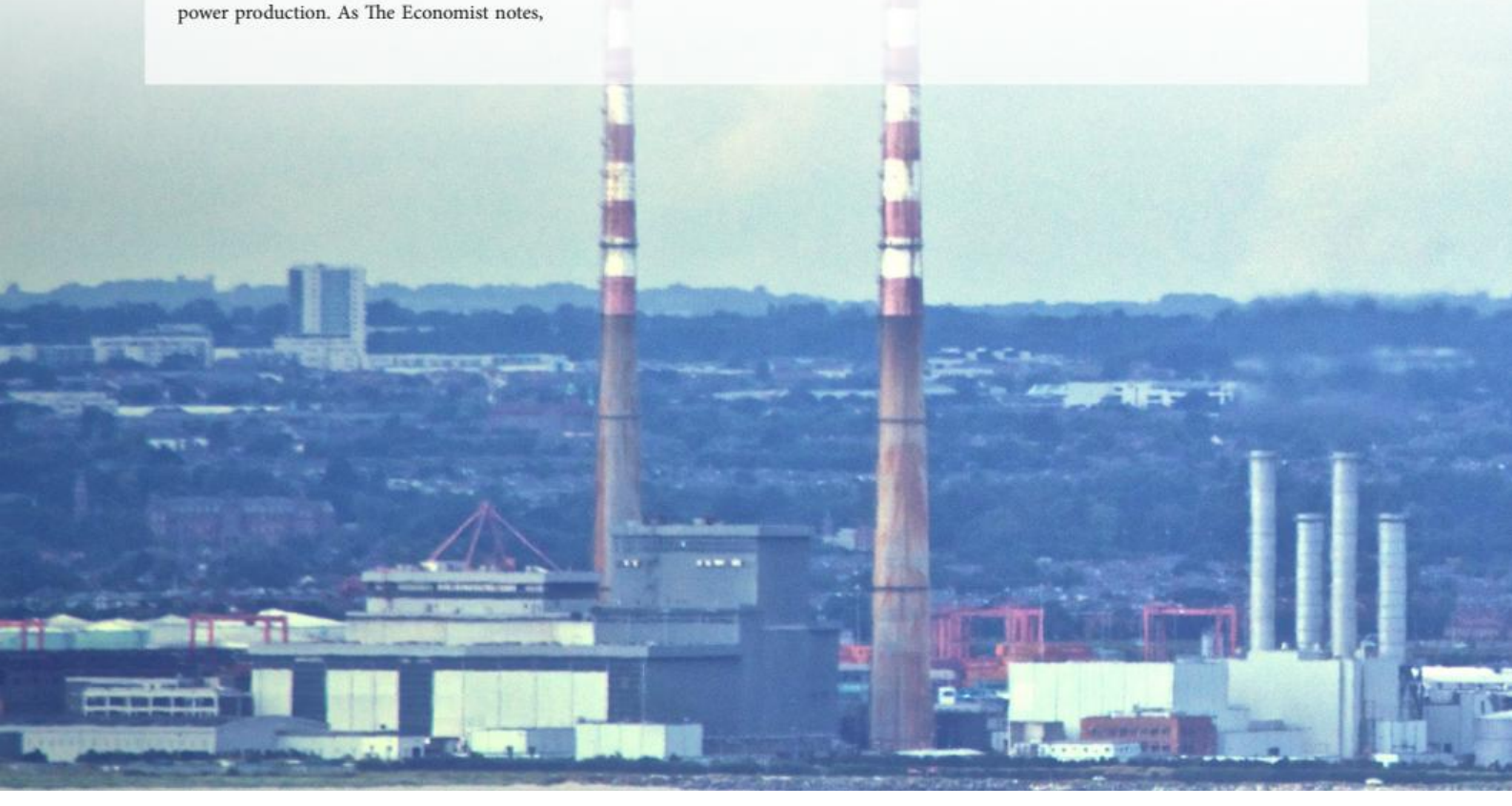
Source: U.S. Energy Information Administration / Monthly Energy Review January 2016

contributing to the 80% fall in the price of solar panels, 90% fall in the price of LEDs, and 40% fall in wind and battery prices. During austerity regimes, solutions such as these can provide governments better value for their money while reducing both domestic and foreign emissions (assuming the technology travels). They can also generate technological spillovers, which help other areas of the economy tangentially related to that of the technological innovation.

Another great example of an alternative solution is clean coal technology. Contributing almost 80% more emissions than natural gas and accounting for 77% of US CO_2 emissions from electricity generation, many environmentalists find the idea of investing more money into coal-fired power distasteful. Still, coal remains the cheapest source of fossil fuel energy, accounting for 41% of world power production. As The Economist notes, a perverse side-effect of the rapid increase in clean energy production in Germany, and the corresponding low cost of production and generous energy subsidies, has resulted in an increase of coal-fired power plants. As it turns out, coal is the only type of fossil fuel able to compete with the very low marginal cost of solar and wind power. Similarly, beginning in 2012 the US saw an uptick in electricity from coal and a downtick in electricity from natural gas, coinciding with an increase in renewable energy production. The Environmental Protection Agency (EPA) estimates clean coal technologies have already decreased CO_2 output from coal-fired electricity by 77%. By investing in early-stage, clean coal technologies, the government has an opportunity to make a meaningful reduction in emissions from an area that is, for all intents and purposes, politically untouchable in the US Congress.

"Another great example of an alternative solution is clean coal technology."

It is neither fair nor reasonable to judge the current administration's environmental policies on their failure to implement the most economically efficient solutions of reducing US emissions. While many of their environmental programs were not cost-effective, they did reduce emissions, and the administration deserves credit for investing money in research areas that could produce emissions savings down the road. There are, however, less-glamorous and politically palpable areas of efficiency and sustainability improvement that appear to have been neglected over the last eight years. It is these areas in which the next administration should consider investing, and for which economists should be advocating.



So Far So Good

Review of the progress of the German energy revolution

by **MARTIN KABRT**

"Growth and Prosperity Without Oil and Uranium," read the subtitle to a 1980 study by the German Institute for Applied Ecology. This influential publication, reflecting the era's arisen awareness of environmental impact of human activity, argued that economic growth is compatible with lower energy consumption and a transition to renewable energy resources. Thirty-five years later, these two objectives constitute the foundation of Germany's largest infrastructural project since the Second World War. The title of the 1980 study even gave the policy a name: *Energiewende*, energy transition.

Though rooted in a long pedigree of conservation movements, energy efficiency initiatives, schemes to support renewables and German deep and widespread anti-nuclear sentiments, the notion of *Energiewende* is now mostly used to refer to the ambitious plan of the then conservative-liberal coalition government, introduced in 2011. The policy should bring a radical shift in energy supply away from nuclear and fossil fuels towards a system characterised by energy efficiency and the use of renewables. The main pillars of the strategy are a complete phase-out of nuclear from the energy mix by 2022 and a gradual reduction in greenhouse gas emissions by 40% (of 1990 levels) by 2020 and 80-95% by 2050. The missing capacity should be replaced primarily with solar and wind power, so that the share of renewables in total power generation is 55-60% by 2035 and as much as 80% by 2050. In parallel to this process, primary energy consumption should halve between 2008 and 2050.

"The policy should bring a radical shift in energy supply away from nuclear and fossil fuels"

By comparison, the common EU targets, already considered very bold by global standards, only prescribe 40% emissions reduction, 27% share of renewables and 27% reduction in energy consumption by 2030. It comes as little surprise then that the German plan is widely seen as unrealistic or even outright ludicrous. Nevertheless, under Angela Merkel's leadership, the government continues to silence the critics by, for the most part, meeting the self-imposed deadlines. Since 2000, the renewable share of all electricity consumed climbed from 6% to 28%; energy consumption is at its lowest level since the German reunification and nuclear reactors are being steadily taken off the grid. The country stays on track in all areas except the emissions target.

Energiewende has a broad support of the public and of all major political parties. It is viewed as a solution that discharges Germany from the safety and security risks of

nuclear power plants, while at the same time combats climate change, provides long-term sustainability and reduces the country's dependence on geopolitically risky regions. The strategy raises controversy, however, on the academic soil and among businesses. Critics point to the exorbitant costs – north of 1 trillion euros according to government estimates, comparable in Germany's recent history only with the cost of the country's reunification in 1990s. This bill, covering mostly infrastructure costs and green subsidies, is ultimately footed by households and firms through higher end-customer electricity prices. Further criticisms, championed for example by the German celebrity economist Sinn, include harmful incentive distortions by subsidising renewables, frictions with the European trade in emission allowances or the negative impact on neighbouring countries (e.g. through driving down wholesale power prices). Proponents of the policy, on the other hand, maintain that in the long-run the energy transition is cheaper than continued reliance on conventional fuels. A recent study by the research institute Frauenhofer estimates that by 2030 the benefits will have already outweighed the costs. A range of government-commissioned publications also find the policy will lead to net job creation.

"the price that the most energy-intensive German businesses pay for electricity is still one of the highest in Europe"

The vast scale of *Energiewende* and its status of a never before tested experiment understandably invite ample amounts of research on the possible effects and a heated debate on the desirability of any of its parts – for example, there seems to be far less consensus internationally on the need to limit the use of uranium than to curb carbon emissions. My ambition in the rest of the article is humbler. I want to briefly assess two claims frequently made about the effects the policy *has already had*. First, it is often claimed that the nuclear phase-out inevitably led to a return to coal (which would explain why the emissions target is the one that seems elusive). Second, it is claimed that electricity prices, high due to the green subsidies, represent a heavy financial burden for households and threaten international competitiveness of businesses.

Green or Brown Germany?

A simple look at the shares of energy sources used in Germany's electricity generation shows that the rapid increase in the production of renewable energy just about suffices to balance the drastic drop in the use of nuclear power. The shares of coal and lignite have not significantly changed since 2010. If nuclear is to be out entirely by 2022, one can only expect this trend to continue. Since 2011, when Germany took 8 oldest reactors off the grid in response to the Fukushima disaster, the country's carbon emissions have not decreased until 2014 and Germany will most likely not meet its target for a 40% reduction by 2020 (now about 27%). In fact, the consumption of coal slightly increased between 2012 and 2013 and moreover, new thermal power stations were opened and still other are being built. It is easy to see how these facts could lead one to suspect there is a trade-off between commitment to a nuclear-free and a carbon-free energy mix. Phasing out nuclear, it is often argued, has led Germany to increased dependence on fossil fuels.

To a certain extent, this is true. Despite its swift rise to prominence, renewable energy could not at the same time replace both fossils and nuclear fuel and in this sense, the energy transition is slower than the policy makers hoped. It is also true that the priority status of renewables on wholesale markets and their downward push on spot electricity prices have made gas – the expensive, but (relative to coal) low carbon emitting fuel – uncompetitive. The idea that coal and lignite are somehow on the rise in Germany, however, seems grossly overstated at best. According to a study by Poyry consultancy commissioned by the UK government, the increase in coal consumption and openings of new coal-powered plants did not signal a return to fossil fuels, but rather originated from unique market conditions in 2007/8 (when the projects for the new plants were created) and the reluctance or inability of developers to cancel projects after major unfavourable changes. The building of all new thermal power stations began before 2011 and since the introduction of *Energiewende,* no new construction started. On the contrary – a lot of projects were scrapped. The rise in coal consumption in 2012-13 was a consequence of the post-crisis positive turn in business cycle and the decrease in relative coal price following the shale revolution in the US. (The US turned to cheap shale gas, exporting its coal surpluses to Europe and thus driving down the European coal price.) In the same year, carbon emissions increased even in France or the US. In fact, the increasing capital costs, powerful local and environmental opposition, state support of renewables, low wholesale electricity prices and the expectation of an increase in the price of emission allowances make an investment in coal-powered plants very unattractive. Since 2007, four projects on lignite-powered plants were put on hold and 22 cancelled. Rather than becoming an attractive investment, fossil fuels have become a necessary part of the system, supplementing weather-dependent renewables and waiting to be to a large extent replaced as well.

An expensive experiment

As a result of the combination of colossal in-

vestment in renewable power generation and stagnant consumption, wholesale electricity prices in Germany are among the lowest in Europe. This development, however, did not translate into low prices for end-use customers. The reason is simple. The subsidies that renewables still need to compete with conventional fuels are costly. Implemented through feed-in tariffs, these expenses are carried forward to firms and households. Energy is a factor of production, so – like labour costs – it affects the firm's competitiveness in global markets. This can be particularly worrying in Germany, whose economy relies heavily on exports of its energy-intensive industrial backbone. Unlike households, however, businesses pay reduced energy tax and lower charges for power transmission and distribution. Moreover, the more energy intensive firms also receive a partial exemption from the Renewable Energy Resources surcharge (*EEG Umlage*), proportional to the firm's electricity consumption. Despite all this, the price that the most energy-intensive German businesses pay for electricity is still one of the highest in Europe, though lower than in for example the UK or Italy. Partially in response to this worry, Germany recently reformed the EEG surcharge system, letting the producers of renewable energy carry more investment risk and compete against each other. The policy has already borne fruits, with the EEG surcharge component of the price of electricity falling for the first time in 2015 after increasing every year since its introduction in 2000. Critics complain, however, that the new policy only mounts further barriers to entry for new producers of renewables and the end-customer price halt comes at the cost of obstructing the progress of the energy transition.

While it may be true that energy prices the end-use customers face have already stabilised, it could still be argued that they are nevertheless unfairly high, particularly for the households who the government does not protect by lower charges and exemptions. In 2015, German households paid the second highest rate per kWh in the EU, twice as much as the French and three times as much as American households. This is almost entirely due to the EEG surcharge, with its share of the total price increasing from 1% in 2000 to 21% in 2015. While this may indeed seem like a heavy price to pay for a giant leap of faith that *Energiewende* undoubtedly is, the size of the electricity bill as a percentage of median disposable income has actually increased by far less than electricity price and is still below the average of EU-15 (EU before the 2004 eastern enlargement). Germans now spend on electricity about 2.5% of their income, same as in the 1980s and only 0.5% more than in the last decade. Even in absolute numbers the financial burden seems less than impressive. Thanks to more energy efficient electrical appliances, better insulation and more frugal behaviour, the average German electricity bill is comparable to that of an American household, despite the triple price per kWh. This can explain the continuing strong public support for *Energiewende*. Without an excessive strain on their wallets, Germans might think, the country is paving the way towards a safe and sustainable energy policy.

The UK Steel Industry

An appropriate industrial policy response

by **EDWARD HOCKIN**

When it comes to industrial policy, few current events have tested the ability of government to support manufacturing as much as the Steel crisis currently facing the UK.

I refer to this as a 'crisis' simply because the potential repercussions of the collapsing global steel prices are significant. Job losses will amount to 2200 in Redcar, 900 in Scunthorpe, and nearly 800 across plants in Wales. On a national level the crisis could see the UK lose one of its last bastions of manufacturing. On a regional level, the crisis could be devastating as so many towns are very reliant on the industry. As with the closure of coalmines in the 1980s, there is a fear that long-term unemployment and regional economic decline may plague towns across Northern England, Scotland and Wales should the factories fall silent.

So what are the causes of this problem and what role is there for industrial policy in trying to prevent or mitigate the decline in steel production?

"there is overwhelming evidence that Chinese state owned steel producers are dumping on world markets."

At the heart of the problem is the fall in commodity prices. Brent crude, copper and, yes, steel have all seen seismic declines in prices as demand from the emerging world (particularly China) falls. The problems caused by a fall in selling prices are only exacerbated by pre-existing systemic issues that the UK

steel industry faces. Steel producers in the UK face some of the highest energy costs of any steel-producing nation and there is overwhelming evidence that Chinese state owned steel producers are dumping on world markets.

Industrial policy has already been playing a role here. The government has already unveiled several schemes designed to support the industry to help the industry. Changing the rules of government procurement (so that they can choose suppliers based on non-price factors, thus prioritising domestic producers for government infrastructure projects), reducing energy bills by relieving energy intensive industries of the indirect costs of the Renewable Obligation Policy (extra charges on energy ills to invest in Green Technology), and delaying the deadline by when UK steel plants must meet new EU Industrial Emissions Directive regulations. But the policies don't go nearly far enough to help the UK steel industry become more efficient and competitive to ensure they're protected from predatory trade practices.

All of these actions will obviously do *something* to help however more can be done. Many industry experts say that a possible solution is for UK steel plants to diversify their products and produce higher-grade steel. This better quality product will be more profitable than the ordinary stuff that Chinese plants are perpetually pumping out and flooding world markets with. The role of industrial policy here will be in government grants for steel producers to invest in research and development of new high-grade steel products and the capital needed to create these products.

There is also a strong argument for import tariffs on Chinese steel exports. While the mere suggestion of tariffs would disappoint proponents of free trade, it must be argued that global competition is already distorted by the dumping of steel on world markets. When Chinese state-owned steel manufacturers sell their products at below their cost of production, this undercuts other producers, forcing many to shut down, in turn harming global competition. China has been producing at less than costs with steel makers posting losses of $10 billion last year. This predatory practice designed to increase long-term market share by making temporary losses to drive out competition, is especially serious for the steel industry. Once a plant closes it tends not to reopen simply because once a plant is decommissioned it is no longer viable and the sunk costs of building a new plant are extremely high. Tariffs are therefore needed precisely to ensure fair competition.

This action has to be taken at EU level and so far has been a painfully slow process. The Commission has voted for import tariffs on some types of Chinese steel exports, but nowhere near high enough to have any meaningful effect. Rather than renegotiating pitiful changes to migrant benefits, why isn't Mr Cameron campaigning for substantial sanctions on Chinese steel, an area where he is likely to find greater consensus given it's a threat to steel production across Europe.

Although there is scope for further industrial policy to help ease the crisis we must, however, know the limitations. The suggestions made so far are about putting UK steel on a level playing field with its global competitors and to prevent anti-competitive trade practices. Good industrial policy should be about making our industries more competitive, not protecting them from competition (an important distinction).

So what industrial policies should we not pursue? Some have advocated temporary nationalisation of steel plants (the SNP, Plaid Cymru, some on the left of Labour party etc.). Such a policy approach is not economically proven to work well and can be costly. There is no evidence whatsoever that government ownership will cut production costs for steel plants and make them more competitive. Furthermore, it is essentially a huge gamble (with taxpayers' money) on the collapse in steel prices being temporary. The government may accrue huge losses and if this continues for a long period of time, steel plants may still end up closing and the impact of the policy would just have been to delay the event at huge cost.

"we may have to accept that saving the industry is no longer as desirable as managing the decline"

To conclude, there is far more, in terms of industrial policy, that can be done at both EU level and national level to ensure that British steel is operating on a level playing field with its competitors. However, if these policies do not work, then we may have to accept that saving the industry is no longer as desirable as managing the decline - with steel worker retraining programs and investment in the worst hit communities required (a lack of such programs being perhaps the biggest failure of UK governments presiding over deindustrialisation in the past).

Good industrial policy should be about helping firms to cut costs and ensuring fair competition. It should not be about saving an industry no matter the cost.

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