

RETHINKING INDUSTRIAL POLICY

by **Philippe Aghion**

Harvard University and Bruegel
paghion@fas.harvard.edu

Julian Boulanger

Université Catholique de Louvain
julian.boulanger@bruegel.org

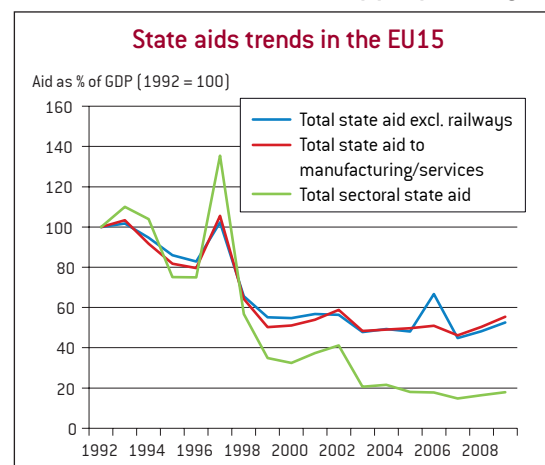
and **Elie Cohen**

CNRS-Sciences-Po
elie.cohen@sciences-po.fr

THE ISSUE Industrial policy has a bad name: ‘picking winners’ and thus distorting competition, while exposing government to capture by vested interests. But there are reasons for a rethink. First, climate change: without government intervention to jump-start massive private investment in clean technologies, governments, by default, encourage investment in dirtier technologies. Second, a new post-crisis realism: laissez-faire complacency by many governments has led to mis-investment in the non-tradable sector at the expense of growth-rich tradables. Third, China – and some other emerging economies – are big deployers of growth-enhancing sectoral policies. The challenge for Europe is how it can design and govern sectoral policies that are competition-friendly and thus growth-enhancing.

POLICY CHALLENGE

Our new evidence on the effectiveness of government intervention should lead policymakers to revisit industrial policy. If the EU is to grow and compete globally, there is a case for the European Commission to allow national or EU sectoral aid, if it is appropriately designed and governed to encourage



Source: Bruegel based on DG Competition State Aid Scoreboard.

the redirection of innovation and production. Horizontal support and sectoral aid for upstream research and development are on their own not sufficient to foster the transformation of the European economy. A robust competition policy remains essential to avoid rent-seeking and to favour entry. But it should go hand in hand with greater government economic activism.



SINCE THE 1980s, industrial policy – government grants of subsidies, concessional credit, privileged access to public tenders or trade protection targeted at particular firms or industries – has fallen into disrepute among academics and policy advisers. The main argument against it is that it prevents competition and allows governments to pick winners (and, more rarely, to name losers) in a discretionary fashion, thereby increasing the scope for capture of governments by vested interests.

However, three globally significant factors have recently gained importance, inviting a rethink of the issue:

- First: climate change and the increasing awareness that without government intervention to encourage clean production and clean innovation, global warming will intensify and generate negative externalities (drought, deforestation, migration, conflict) worldwide.
- Second: the recent financial crisis, which revealed the extent to which laissez-faire policies had led several countries, in particular in southern Europe, to allow the uncontrolled development of non-tradable sectors (in particular real estate) at the expense of tradable sectors that are more conducive to sustainable growth and competitiveness. This experience has resulted in an increasing number of governments departing from this laissez-

faire attitude.

- Third: China, which has become prominent on the world economic stage and is a keen practitioner of industrial policy. Which role this policy has played in its economic success is a matter for discussion. But the reality is that this very success has wiped out the stains from previous economic failures and made industrial policy legitimate again. Many governments in the world, especially in emerging and developing countries, now want to emulate China.

Meanwhile, more scholars (particularly in the US) are also denouncing the danger of laissez-faire policies that lead developed countries to specialise in upstream research and development and in services, while outsourcing manufacturing to countries where unskilled labour costs are lower. These scholars point to countries such as Germany or Japan, which have better managed to maintain intermediate manufacturing segments by pursuing more active industrial policies. This in turn has allowed them to benefit more from outsourcing the other, less human-capital intensive segments¹.

In this Policy Brief we argue that the debate should no longer revolve around the question of whether sectoral policies are justified at all, but should rather be about how such policies should be designed and governed so

that they complement competition policy in fostering innovation. In particular, sectoral aid targeting green technologies, or skill-intensive and competitive sectors, and which is not biased towards individual firms within the sector, might help achieve high and sustainable levels of growth.

OLD ARGUMENTS REVISITED

The most recurrent argument against industrial interventionism is that it is 'picking winners'. According to this, government is, at best, ill-placed to assess chances of commercial success more effectively than the market. At worst, government is captured by the interests that benefit from its intervention. True, industrial policy is always about 'picking winners' to some extent, and this always involves the risks of misjudgement and capture.

'Global factors invite a rethink of industrial policy.'

A second criticism of traditional industrial policy is that it involves a risk of capture and rent-seeking. There have been many examples of costly rent generation, not least the failed import-substitution policies of developing countries in the 1960s and 1970s. This is, however, less an argument against any type of intervention at all than an argument for clear principles for the selection of sectors and for the governance of support to these sectors.

There are also strong arguments in favour of growth-enhancing

1. See, for example, Susanne Berger's intervention at the conference *Les États Généraux de la France*, Paris, December 2010.



sectoral policies. A major theoretical argument is the existence of *knowledge spillovers* across companies, namely, when choosing where to produce and innovate, companies do not internalise the positive or negative knowledge externalities their choices might generate for other companies and sectors.

A reinforcing factor is the existence of capital market imperfections and credit constraints, which may further limit or slow down the reallocation of firms towards new (more growth-enhancing) sectors. When capital markets function efficiently they contribute effectively to the allocation of investment to new sectors, as demonstrated by the US experience with the ICT and biotech sectors. But incomplete or underdeveloped financial markets hamper such reallocation, which justifies state intervention.

On the empirical front, to our knowledge the most convincing study in support of properly designed industrial policy is by Nunn and Trefler (2010). They measure if tariff protection is biased in favour of activities and sectors that use more highly skilled workers, and find a significant positive correlation between productivity growth and the 'skill bias' of tariff protection. Moreover, they show that at least 25 percent of the correlation corresponds to a causal effect. Overall, their analysis suggests that adequately designed (here: skill-intensive) targeting may actually enhance growth, not

only in the sector that is being subsidised, but also the country as a whole. In the next section we stress the importance of sectoral policies that are not only adequately targeted but also properly governed².

WHAT THE EVIDENCE SAYS

In this section we provide additional empirical support for adequately targeted and properly governed industrial policy. In particular, while the traditional view tends to see industrial policy and competition policy as being in opposition, we argue that one can reconcile them. Furthermore, we argue that they should be regarded as complementary rather than, as generally the case, substitutes.

In particular, we argue for intervention targeted at areas in which competition and innovation play a key role, and for intervention to be governed so that it is both competition and innovation friendly. We consider five channels of sectoral intervention and report on recent research assessing the impact of government policy. Each of these instances can be read as illustrating the existence of knowledge spillovers that are not properly internalised by private firms and sectors.

a Directed technical change: the case of green innovation

The first argument is that the path dependence of innovation, might lead firms to innovate in the 'wrong' direction under laissez-

faire conditions. Clean innovation is a case in point: because of knowledge spillovers, in the absence of intervention, innovation tends to be biased towards existing dirty technologies.

Aghion *et al* (2010a) explore a cross-country panel data-set of automotive industry patents to establish 'clean-versus-dirty' innovation path dependence³. In their baseline empirical exercise, they regress the ratio between the current flows of clean-versus-dirty patents on the fuel price, the firm's stocks of (past) clean and dirty patents, and interaction terms between the fuel price and patent stock variables. The regressions control for country and year fixed effects.

Table 1 shows the results: (i) higher fuel prices encourage firms to redirect innovation towards clean patenting and (ii) the firms' propensity to pursue clean innovation positively correlates with their existing stock of clean patents, and negatively correlates with their existing dirty patent stock. Thus, there is indeed path-dependence in clean-versus-dirty innovation. Firms with a history of dirty innovation tend to continue along the

Table 1: Redirecting technological change

Variable	
Fuel price	[+]***
Stock of clean patents	[+]***
Stock of dirty patents	[-]***

Source: Estimates from Aghion *et al* (2010a). The sign of the coefficients is given in parenthesis. *** indicates significance at 1 percent, ** indicates significance at 5 percent, * indicates significance at 10 percent.

2. An adequately targeted policy is, in principle, one that targets a particular market failure (such as knowledge externalities or financial market imperfections). Markets that suffer from imperfect competition make particularly interesting cases: by subsidising its domestic industries, a government may give a strategic advantage to domestic firms and allow them to gain market share at the expense of foreign competitors. This approach, suggested by Brander and Spencer (1985), suffers from serious limitations, but could in principle be used to target 'key' industries by looking at their structure. For a seminal contribution, see James A. Brander and Barbara J. Spencer (1985) 'Export subsidies and international market share rivalry', *Journal of International Economics*, vol. 18(1-2), pp 83-100. For further insights, see James A. Brander (1995) 'Strategic trade policy', *Working Papers* 5020, National Bureau of Economic Research.

3. The data, from the European Patent Office's World Patent Statistical Database, is annual and covers 80 countries from 1978 to



2007. The dataset covers about 12000 patents in 'clean' technologies (eg electric vehicles, hybrid vehicles, fuel cells) and about 36000 patents in 'dirty' technologies related to development of combustion engines. The database also reports the names of patent applicants and allows clean and dirty patents to be matched to patent holders, each of which has its own history of clean-versus-dirty patenting. One can thus relate the current flows of clean-versus-dirty patenting to the stock of clean-versus-dirty patents accumulated by the corresponding innovator, to determine if there is path-dependence.

4. For a simple presentation, see Philippe Aghion and Reinilde Veugelers (2009) 'No Green Growth Without Innovation', *Policy Brief* 2009/07, Bruegel.

5. See Raghuram G Rajan and Luigi Zingales (1998) 'Financial dependence and growth', *American Economic Review*, vol. 88(3), pages 559-86, and Matias Braun (2002) 'Financial contractibility and asset hardness', working paper.

same path, while firms with a history of clean innovation tend to continue to develop clean technologies.

This path-dependence, combined with the historical dominance of dirty innovation, implies that in the absence of government intervention, economies will tilt towards dirty innovation to a socially suboptimal extent. In particular Aghion *et al* (2010b) show that the laissez-faire equilibrium will typically lead to environmental disasters, in which environmental quality falls below the level at which it can be regenerated. Hence, there is a role for government intervention to redirect technological change towards clean innovation.

This can be achieved through a horizontal policy that allocates carbon permits or taxes carbon emissions. However, Aghion *et al* (2010b) show that the economic cost of the transition towards clean development can be reduced if public intervention combines an across-the-board carbon tax (or permits) with direct clean-innovation subsidies. In other words the targeted approach that relies on two instruments is superior to the purely horizontal approach that relies only on the carbon tax. At least two instruments are needed (carbon taxes and clean R&D subsidies), rather than just a carbon tax, because there are two externalities to be dealt with: the environmental externality and the knowledge externality, whereby firms that follow dirty innovation paths do not inter-

nalise the effect this will have on other firms' innovation strategies⁴.

b Sectoral policy to compensate for insufficient financial development

A second rationale for sectoral intervention is that even though some sectors exhibit high growth potential and, through the diffusion on knowledge, display high positive effects on the rest of the economy, credit constraints may limit capital inflows to these sectors. In particular, high-tech firms often show low levels of asset tangibility, which in turn makes access to credit more difficult⁵. Because their assets are intangible, they cannot post the collateral that would facilitate access to credit. This effect is likely to be stronger in more financially primitive economies where bank credit is the primary channel of company financing. Our conjecture is thus that sectoral policy supporting innovation is likely to be more growth-enhancing for the economy as a whole in less financially developed countries.

To test this hypothesis, we look at manufacturing and services exports by EU15 countries from 1992-2008. We regress the overall share of exports of a country in the sample to total EU15 exports (we call this variable 'market share'), on: (i) total sectoral state aid in that country to industry and services, in € millions (our variable 'SA'); (ii) financial development in the country, measured by the ratio of private credit by deposit-taking

banks and other financial intermediaries to GDP (our variable 'private'); (iii) the interaction between these variables. Table 2 shows the results. In particular, the fifth row indicates that the less financially developed a country is, the more positively correlated state aid is with its overall market share in exports. This confirms our conjecture that in less financially developed economies, state aid is more effective in promoting exports.

Table 3 repeats the exercise, but with patenting in the country as the endogenous variable (our variable 'patents'). Again, this is consistent with the view that sectoral state aid enhances patenting more in less financially developed countries.

Our results confirm that the case for sectoral intervention is

Table 2: State sectoral aid and credit constraints		
Log (market share)	(1)	(2)
Log(SA)	0.14*** (0.048)	0.168*** (0.049)
Log ² (SA)	-0.008*** (0.003)	-0.009*** (0.003)
Log(Private)	0.135** (0.067)	0.128* (0.067)
Log ² (Private)	0.044*** (0.013)	0.049*** (0.014)
Log(SA) *Log(Private)	-0.02** (0.009)	-0.016* (0.01)
Observations	213	213

Source: DG Competition State Aid Scoreboard, OECD Structural Analysis (STAN) Databases and Beck *et al* (2000), revised November 2010. Note: (1) Fixed effects regression, without any controls. (2) Fixed effects regression, controlling for time effects. In both (1) and (2), a constant was included.



Table 3: State aid, credit constraints and patenting	
Patents	
SA	0.041 (0.066)
Private	-372.5759 (299.2163)
SA * Private	-0.157* (0.084)
Observations	199

Source: DG Competition State Aid Scoreboard, OECD Patent Statistics and Beck *et al* (2000), revised November 2010. Note: Fixed effects regression, controlling for time effects and BERD. A constant was included.

stronger when firms are more credit-constrained. Indeed, credit constraints prevent efficient resource reallocation towards activities with higher growth potential, in particular activities with high-potential spillovers to the economy as a whole. This implies that the case for industrial policy is stronger in less advanced economies, which are also less developed financially, whereas capital markets can be expected to play a more significant and effective allocation role in more advanced economies.

c Sectoral policy works better when more decentralised

An objection to these arguments is that government intervention may in fact be driven by political economy rather than pure economic considerations. However, the objection that industrial policy may result in the arbitrary selection of a national champion in the corresponding sector(s) is presumably less applicable when state aid is more decentralised, the idea being that, in the worst

case, each region will choose its own 'champion', which in turn is more likely to result in several different firms getting the state subsidies in the country in question. Analyses reported in Tables 4 and 5 confirm this intuition.

Table 4 gives the results of regressing the countries' export shares on state aid, a proxy for the extent to which state aid is decentralised (our variable 'decent'), and the interaction between these two variables. Our decentralisation variable is taken as the ratio of subsidies to the economic activity at local or regional levels to the sum of those subsidies from central, regional and local government. The sample is composed of 12 EU countries over the period 1995-2008⁶. Both 'market share' in Table 4 and 'patent' in Table 5 are positively correlated with the interaction term between state aid and our proxy for decentralisation of that aid. This in turn suggests that the more decen-

Table 4: Sectoral aid, decentralisation and market share	
Log[Market share]	
Log[SA]	0.167*** (0.063)
Log ² [SA]	-0.011*** (0.004)
Decent	-0.153** (0.05)
SA * Decent	1.22e-05*** (4.48e-06)
Observations	202

Source: DG Competition State Aid Scoreboard, OECD Structural Analysis Databases and OECD National Accounts. Note: Fixed effects regression controlling for time effects, initial GDP, and labour costs. A constant was included.

Table 5: Sectoral aid, decentralisation and patenting	
Patents	
SA	-0.268*** (0.034)
Decent	703.4102 (1224.247)
SA * Decent	0.632*** (0.101)
Observations	176

Source: DG Competition State Aid Scoreboard, OECD Patent Statistics and OECD National Accounts. Note: Fixed effects regression controlling for time effects, initial GDP, and BERD. A constant was included.

tralised state aid is, the more positive the effect of (sectoral) state aid on a country's export and innovation performance.

d Sectoral policy works better when implemented in more competitive sectors

Governments advocating industrial policy often oppose competition policy because it prevents them from supporting national champions. Arguments between successive French governments and the European Commission illustrate this. Conversely, competition advocates generally dismiss industrial policy as ineffective. However, sectoral policy should not be systematically opposed to competition policy. Aghion *et al* (2010) argues that targeted subsidies could be used to induce several firms to operate in the same sector, and that the more competitive the sector, the more these firms will be encouraged to innovate in order to 'escape competition' (Aghion *et al*, 2005).

6. More precisely, EU15 except Greece, Ireland and Portugal due to data availability.



Of course, effectiveness depends upon the design of industrial policy, which should target sectors, not particular firms. This in turn suggests new empirical studies could be carried out, in which productivity growth, patenting, or other measures of innovativeness and entrepreneurship would be regressed over some measures of sectoral intervention taking into account the degree of competition in the sector, and the extent to which intervention in each sector is not concentrated on one single firm, but rather distributed over a larger number of firms.

Data showing how much state aid each sector receives are unfortunately not available for EU countries. Thus, to look at the interaction between state subsidies to a sector, and the level of product market competition in that sector, we use Chinese firm-level panel data. More precisely, we look at all industrial firms from the Chinese National Business Survey over the 1988-2007 period⁷. Table 6 shows that Total Factor Productivity (TFP), TFP growth and product innovation (defined as the ratio between output value generated by new products to total output value) are all positively correlated with the interaction between state aid to the sector and market competition in the sector.

Thus the more competitive the recipient sector, the more positive the effects of state subsidies to that sector on TFP, TFP growth, and product innovation in that sector. In fact, Aghion *et al*

Table 6: Sectoral aid and competition	
ln TFP	
Ratio subsidy	(-) ^{***}
Competition	(+)
Interaction	(+) ^{***}

Source: Estimates from Aghion *et al* (2010).
Note: The sign of the coefficient is given in parenthesis. *** indicates significance at 1 percent for the corresponding coefficient. A constant, as well as fixed and time effect, are included.

(2010) show that for sectors with a low degree of competition, the effects are negative, whereas the effects become positive in sectors with sufficiently high degrees of competition.

This is important from a policy standpoint because it indicates that the controversy between advocates of competition and supporters of industrial policy is misplaced: rather than alternatives, these two policies are more likely to be complementary.

e Sectoral policy works better when subsidies are less concentrated

Finally, regressions by the same authors show that the interaction between state aid and product market competition in the sector is more positive when state aid is less concentrated. In fact, if we restrict our attention to sectors where state aid is not very concentrated (in practice the second quartile in terms of degree of concentration of state aid), we find that state aid has a positive effect on TFP and product innovation in all sectors with more than median level of product market competition.

This result suggests that the extent to which sectoral state aid can be growth enhancing depends significantly on the way sectoral aid is governed. In particular, sectoral aid that enhances within-sector competition by not focusing on one (or a small number) of firms, is more likely to be growth-enhancing than more concentrated aid.

REDIRECTING EUROPEAN PUBLIC POLICY

Our findings suggest that the discussion on the role and legitimacy of industrial policies should be revisited by policymakers, in particular in the EU. First, there is a case for sectoral state aid aimed at redirecting production and innovation towards green technologies, or for policies that target skill-intensive sectors. Second, targeted state support should not be seen as antagonistic to competition, rather it is more likely to be growth enhancing in the context of (within-sector) market competition. The question is, what changes should on this basis be made to the policy framework?

We do not advocate curbing the powers of competition authorities. On the contrary, we think that Europe needs strong EU and national competition watchdogs to overrule frequent rent-seeking leniency on the part of national governments. It is not by favouring incumbents that Europe will regain a competitive edge, it is by stimulating entry and exit and this is precisely one of the roles of competition authorities⁸.

7. This is an annual survey of all firms with sales of more than 5 million RMB. The survey contains information on inputs and outputs, firm-level state subsidies, and other variables. Product market competition is measured by 1 minus the Lerner index, which in turn is calculated as the ratio of operating profits minus capital costs over sales.

8. See our own work on competition and innovation, for example Philippe Aghion and Rachel Griffith (2005) *Competition and Growth: Reconciling Theory and Evidence* MIT Press.



By the same token, however, we recommend to competition authorities a more evidence-based approach. Competition policy must be based on clear and uniform legal rules and principles but it should also ensure that decisions are based on an economic rather than on a purely legalistic approach. In other words competition policy should (i) take better account of the economic situation of sectors and the contribution that more vibrant competition can make to productivity, innovation and growth and (ii) take into account the justification and potential role of state aid when assessing if aid should be tolerated.

The European Commission already recognises the importance of sectoral focus when defining its innovation strategy. The 'Innovation Union' communication of October 2010⁹ said the Commission would clarify "which forms of innovation can be properly supported, including for key enabling technologies and innovations addressing major societal challenges". What the Commission calls 'key enabling technologies' include industrial biotechnology, nanotechnology, advanced materials, photonics, micro- and nano-electronics. In fact it is speaking of sectors. Similarly, the Commission's October 2010 Communication on industrial policy¹⁰ considered sector-specific initiatives and listed criteria for the selection of the corresponding sectors.

Yet, sectoral state aid by member states is currently perceived by

European authorities as a threat to European integration, which explains the fussy checks by European competition authorities on all efforts to support industrial activities. As shown by Buigues and Sekkat (2011), there is a general tendency in the EU towards reducing state aid.

Against this background, our first conclusion is that the Commission should become less a priori biased against the use of state aid while at the same time setting new and clear guidelines for the allocation and governance of that aid. In particular, sectoral state aid should target skill-intensive and competitive sectors and/or be allocated evenly within the sector, rather than to one or several pre-selected firms. Ideally, sectoral aid should be provided at EU level using earmarked funding from the EU budget, as contributions by individual EU members raise at least two issues: (i) individual countries are unlikely to finance more than a few firms in a sector where production and/or entry involves major fixed costs, and are therefore less likely to reconcile industrial policy and competition policy; in particular they are more likely to fail existing dominance criteria; (ii) some governments may have a bias against funding production and entry by foreign-owned firms.

Second, our analysis suggests that sectoral intervention should promote competition between firms for access to public support, and should not involve clauses that automatically

favour incumbents. In fact, depending on the sector and the fixed costs involved in the corresponding activity, and in order to preserve competition, sectoral intervention may need to be carried out at European, national or regional level, and the firms benefiting from such intervention may be innovative start-ups, expanding SMEs, or firms involved in growing new markets in developing economies.

Third, European authorities underestimate the danger of a specialisation whereby the most advanced countries focus on upstream R&D and services, while outsourcing everything else to emerging economies. This has been highlighted by scholars who praise the German model, in which public support is given not only to upstream (laboratory) research, but also to research down to the stage of industrial prototype. Indeed, it is often in the transition from laboratory to factory that critical skills for competitive advantage are developed, and the development of these skills also involves significant knowledge externalities. Maintaining a too-restrictive view of where to allocate research subsidies might prevent Europe from competing with other regions or countries that engage more openly in sectoral support to manufacturing.

CONCLUSION

In this Policy Brief we have argued that the debate on climate change, the recent financial crisis, and the new

9. SEC (2010) 1161.

10. European Commission (2010) *An integrated industrial policy for the globalisation era*.



Chinese dominance of the world market, mean there is a need to revisit the role and design of industrial policy.

We fully believe in the importance of product market competition and trade liberalisation for fostering innovation and growth, particularly in the EU¹¹. Our revisiting of the role and design of industrial policy is intended to reinforce rather than mitigate the impact of competition policy, and to provide potentially useful guidelines for EU competition authorities.

- First, we have suggested criteria for suitably targeted sectoral intervention, in particular the degree of skill-intensity and the degree of competition within the sector.

- Second, we have argued in favour of targeted government intervention to redirect production and innovation towards clean technologies.
- Third, we have advocated proper governance of industrial policy to make it more competition-friendly and more innovation-enhancing. Thus, we have argued that sectoral state aid should not favour one particular firm within a sector, but that support should be provided on equal terms to any firm in the sector in question.
- In the same vein, we believe that industrial policies should be designed such that projects that turn out to be non-performing will not be refinanced, for example through co-financing between

public and private sources.

- Finally, we call for a less legalistic and more pragmatic, evidence-based approach from European competition authorities when analysing costs and benefits of sectoral state aid, and when assessing the consistency of sectoral and competition policies.

More generally, the debate should no longer be for or against industrial policy, which is being implemented in any case in one form or another by many countries globally¹². Rather, the issue should be on how to avoid first order mistakes through proper policy design and governance.

The authors are grateful to Gianmarco Ottaviano and Paul Seabright for their comments.

REFERENCES:

- Aghion, Philippe, Mathias Dewatripont, L. Du, Ann Harrison and Patrick Legros (2010) 'Industrial policy and competition', *Working Paper*, Harvard
- Aghion, Philippe, Antoine Dechezlepretre, David Hemous, Ralf Martin, and John Van Reenen (2010a) 'Carbon taxes, path dependency and directed technical change: evidence from the auto industry', working paper
- Aghion, Philippe, Daron Acemoglu, Leonardo Bursztyrn and David Hemous (2010b) 'The environment and directed technical change', *Working Papers* 2010.93, Fondazione Eni Enrico Mattei
- Aghion, Philippe, Nick Bloom, Richard Blundell, Rachel Griffith and Peter Howitt (2005) 'Competition and innovation: an inverted-U relationship', *The Quarterly Journal of Economics*, MIT Press, vol. 120(2), pages 701-728
- Beck, Thorsten, Asli Demirgüç-Kunt and Ross Levine (2000) 'A new database on financial development and structure', *World Bank Economic Review* 14, 597-605 (November 2010 update)
- Buigues, Pierre-André and Khalid Sekkat (2011) 'Public subsidies to business: an international comparison', *Journal of Industry, Competition and Trade*, Springer, vol. 11(1), pages 1-24
- Nunn, Nathan and Daniel Trefler (2010) 'The structure of tariffs and long-term growth', *American Economic Journal: Macroeconomics*, American Economic Association, vol. 2(4), pages 158-94

11. See our own work on competition and innovation, for example Philippe Aghion and Rachel Griffith (2005) *Competition and Growth: Reconciling Theory and Evidence* MIT Press.

12. See the Report of the Spence Growth Commission (2008), available at <http://www.growthcommission.org/>