Policies to enhance Australia's growth: A U.S. perspective

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Based on the largest advanced economies and regions there is a very serious problem of slow economic growth. Japan has had slow growth since its boom ended around 1990 and over the ten years from 2005 to 2015 Japanese GDP grew at an annual rate of 0.48 percent a year.[1] Germany has been the powerhouse of Europe but its growth rate for 2005-15 was a rather modest 1.38 percent a year. The euro area as a whole in 2015 had a GDP that only fractionally exceeded the level it achieved in 2007. Its growth rate for 2005-15 was a very weak 0.7 percent a year. UK growth over the decade was 1.23 percent. The United States experienced a large drop in GDP following the financial crisis and a rather sluggish recovery. Its growth over the 2005-15 decade was 1.39 percent, right in line with Germany.

Lawrence Summers views this pattern of slow global growth and concludes that there is *secular stagnation.*[2] This was a problem identified prospectively by Alvin Hansen[3] when he feared that the economic weakness of the Great Depression might become a chronic problem. The build-up of arms before the war and then the demands of wartime production pulled the gobal economy out of the Great Recession and kept it at full employment during the war, but the concern Hansen had articulated in 1938 returned as the war ended. Of course the fear of secular stagnation turned out to be unfounded as the advanced economies experienced a golden era of strong economic growth after the War that lasted into the new century. Summers argues that the problem that Hansen warned about has now become a reality for Europe, Japan and the United States and his concerns have struck a chord with many advanced economy policymakers.

Australia's recent growth stands in contrast to the other advanced economies as it suffered only a small slowdown as a result of the global recession and averaged 2.72 percent GDP growth over the decade 2005-15, more than a percentage point faster than Germany or the United States. In part this is because Australia's population and labor force have continued to grow strongly, unlike in Europe. In addition, there was a massive rise in the terms of trade following the rapid growth in demand for Australian coal, iron ore and other resources. Australia invested heavily to develop its mining and energy resources in response to the commodity boom. The jump in the terms of trade provided big increases in purchasing power and that, in turn, supported consumption, part of which has been channeled into housing. Increased housing demand resulted in large increases in house prices, since the elasticity of supply is low in the short run and, with this, an increase in household debt. This buildup of household debt is of concern to growth going forward. The two speed economy is also an important part of the picture, with manufacturing adversely impacted by the rise in the

1 The data in this section was obtained from Haver Analytics.
2 Summers, Lawrence H. "The Age Of Secular Stagnation: What It Is And What To Do About It". Foreign Affairs 2015. Web. 16 Sept. 2016.
3 Hansen, Alvin H. Full Recovery Or Stagnation?. New York: W.W. Norton, 1938. Print.

Australian dollar. The question for the future is how well Australia will be able to sustain its economic growth in the face of slow growth or even secular stagnation in the advanced economies, and slower growth in China. The housing boom in Australia may eventually come to an end, although that does not seem to be close, given the continuing strength of home prices.

Australia is celebrating 25 years without a recession; it avoided the pitfalls created by the global financial crisis and has not experienced major banks failures. Inflation has not been a problem and the unemployment rate has stayed within a relatively narrow band of 4.0 percent to 6.3 percent.[4] Real GDP growth in the first half of 2016 was over 3 percent. On the micro side, the economy was liberalized in the 1980s introducing a floating exchange rate and a more effective competition policy. Australia has run sizable current account deficits for over 50 years and the deficit as a percentage of GDP averaged 4.4 percent over the ten years through 2015. This has resulted in a negative net foreign asset position of close to AU$1 trillion by the end of 2015. The trade balance on goods and services has fluctuated between surplus and deficit in the past 10 years, although it has swung to larger deficits most recently as demand from China has slowed. And while the rapid growth in commodity trade in prior years provided a large boost to Australia's overall exports, it also impacted the exchange rate of the Australian dollar and contributed to large deficits in trade in manufactured goods. The exchange rate has declined with the end of the mining boom, helping exports of tourism, education services and manufacturing. However, currency-adjusted real wage indexes remain above the levels of the late 90s and early 2000s in mining, manufacturing and services so that competitiveness may still be a challenge.[5]

Australia needs to make a transition towards new drivers of growth. Real incomes in Australia were positively impacted by the improvement in the terms of trade in the mining boom and are threatened today. In response to the economic opportunities and challenges it faces, the government of Australia has launched a policy effort to enhance the performance of its economy by making it more productive, innovative and competitive.

The agendas for stronger performance in Australia are described in the Industry Innovation and Competitiveness Agenda and the National Innovation and Science Agenda. The National Innovation and Science agenda points to areas of strength of the economy but also highlights four obstacles to be overcome: insufficient access to early stage capital; a lack of collaboration between industry and university researchers; weakness in student science, technology, engineering and maths (STEM) skills;[6] and a failure of government to lead on innovation in its own operations. The Industry Growth Centres, originally announced in the IICA, identify six sectors in the private economy where public private partnerships could enhance growth and competitiveness. These are advanced manufacturing; cyber security; food and agribusiness; medical technologies and pharmaceuticals;

4 There has been an increase in part-time work with hours worked per employee in Australia declining 6.4 percent since 2000 compared with an OECD average decline of 4 percent. https://stats.oecd.org/Index.aspx?DataSetCode=ANHRS

5 Data from the Australian Bureau of Statistics reported in the presentation by AlphaBeta Strategy and Economics, Industry and Innovation Summit, September 2016.

6 This paper will not address the skills issue. A recent report from the Australian Council of Learned Academies found that business skills and ability to worth together in teams are just as important as STEM skill. See http://www.acola.org.au/index.php/projects/securing-australia-s-future/saf10

mining equipment, technology and services; and oil, gas and energy resources.

This Paper

The paper looks in Section II at industry policies, what is the rationale for such policies in the economics literature, what are the most important criticisms? What is the nature of a well-designed industry policy? Next the paper turns to competitiveness using a new measure of a country's structural competitiveness and looking at data for the Australia and the United States. Section IV examines the issue of productivity, looking both at the aggregate and broad industry level and seeing which industries have performed strongly and which seem to be laggards. Section V looks at innovation policies in the United States and includes insights into the drivers of innovation coming from the two experts Robert Atkinson and Robert Litan with the former stressing the importance of government support of technology development, while Litan examines the role of university technology transfer offices. Section VI tries to pull the lessons from competitiveness, productivity and innovation into the Australian context. There is a brief conclusion.

II. Innovation and Industrial Policies: Analysis and Lessons Learned

The Case for Good Industrial Policy

One of the key arguments for using industrial policy as a tool to speed economic development has been presented by Harvard Professor Dani Rodrik (2004, 2008, 2010).[7] More recently, J. Esteban, Joseph E. Stiglitz and Justin Y. Lin co-edited *The Industrial Policy Revolution I: The Role of Government Beyond Ideology,* New York, Palgrave Macmillan, 2013. Lin is the Chief Economist of the World Bank. In their introductory chapter Stiglitz, Lin and Celestin Monga lay out a revised case for industrial policy that, they argue, goes beyond the Rodrik framework.

Industrial policy has had its critics; including academics based on theoretical grounds, arguing that the markets have ways of overcoming the claimed market failures without the need for government intervention. And also there are claims that such policies have not worked in practice. I will look at the criticisms in the next section of this paper.

The essence of the Rodrik argument is that there are two significant market externalities that work to hold back private market agents from investing in industries or activities that have the potential to be profitable for the investor and that would contribute to a country's economic growth. The first externality arises when entrepreneurs weighing where to invest do not know whether or not the price at which they can produce domestically will allow them to be competitive internationally and still be profitable. Rodrik and co-author Ricardo Hausmann stress the importance of "self-discovery" whereby economic agents in an economy discover which economic activities will be profitable and can expand and grow and which will turn out to be uncompetitive and unprofitable. They point out that much of economic activity only becomes price competitive once it has reached a minimum efficient scale. And for some production, there is "learning by doing" which means that costs fall the greater is the amount of output produced. Rodrik stresses that the process of self-discovery for an economy implies an externality. If one brave entrepreneur starts producing and, over time, she finds that her chosen product is indeed profitable and competitive, that will allow other entrepreneurs to copy and bring their own production on line, thereby driving down the profitability of the first innovating entrepreneur. Knowledge about which goods in an economy are globally competitive is very valuable, but like most such knowledge, the benefits cannot be appropriated by the innovator. The spillovers from R&D spending are one example of information externalities that have been met in many countries by both direct government support of technology development and subsidies for

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7 Dani Rodrik, Industrial Policy for the Twenty First Century, John F Kennedy School of Government, Harvard University, 2004; Normalizing Industrial Policy, Commission on Growth and Development, Working Paper No. 3, 2008; The Return of Industrial Policy, Project Syndicate, 2012, available at:
http://www.business-standard.com/article/opinion/dani-rodrik-the-return-of-industrial-policy-110042000055_1.html

private R&D[8]. Rodrik is careful to emphasize that there must always be a clear plan to withdraw any subsidies that are provided and there must be eligibility criteria to limit rent-seeking behavior by the private sector.

The second externality that Rodrik sees as of importance is coordination. It is often the case that an entrepreneur cannot produce a particular product or service unless there are other industries and activities in place to support that production. Rodrik sees the absence of a supply chain as something that holds back entrepreneurs from investing and developing new lines of business. This could be the lack of availability of components, or of a distribution system or inadequate transportation infrastructure to enable country wide or global sales. This issue is not new, as Rodrik notes, and was stressed in a 1943 article by Paul Rosenstein-Rodan (a former teacher of mine). Rosenstein-Rodan argued that economic development required a "big push" where a number of related industries were developed at the same time, so their interaction would benefit all of them. More recently, the importance of economic clusters has been stressed by Michael Porter of the Harvard Business School. Paul Krugman, the trade economist, has also pointed to the apparent advantages of co-location even when the local economy is more diverse.[9] Agglomeration externalities have become an important part of mainstream economic analysis, although the most recent view of international trade looks at global production models where different pieces of the value chain are produced in different countries. This last point is of particular relevance for Australia and is discussed in Section VI.

The first of Rodrik's arguments for industry policy does not seem very relevant for Australia, which is a high-income economy that is unlikely to find new global comparative advantage in the mass production of standardized products. Rodrik's second argument does seem relevant to Australia, however, as it looks to develop new clusters or to expand on the clusters it has already, such as medical devices. In that context, regulatory policies may also be an important class of industrial policies, ensuring these do not create undue barriers to growth. Facilitating regulations are also important, such as agreements on standards.

Nobel prizewinner Joseph Stiglitz, World Bank Chief Economist Justin Lin and Celestin Monga, make a broader case for industrial policy than does Rodrik. The justification of industrial policy goes well beyond coordination failures and conventional externalities, they say. Markets are not likely to produce sufficient growth enhancing investments, such as learning, knowledge accumulation and research. An important aspect of industrial policy involves fostering the diffusion of best practices throughout an economy. This is important to avoid the widening of the productivity gap between the "frontier firms," those firms at the top of the productivity distribution, and the rest of the firms. Stiglitz et al. also point to the policies of the Obama Administration in setting up manufacturing hubs and funding energy research as examples of industrial policy.

Does the theory work in practice? The argument often cited for the success of industrial policy comes from the experience of the fast-growing Asian economies. Japan emerged from the

8 For empirical analysis of Australia's business R&D, refer to Chapter 4 of research by Australia's Department of Industry, Innovation and Science's: http://www.industry.gov.au/Office-of-the-Chief-Economist/Publications/Documents/AIR2015.pdf

9 Paul Krugman Increasing Returns and Economic Geography, Journal of Political Economy, 1991, vol. 99, no. 3, pp.483-99.

Second World War with its economy destroyed and yet by the early 1960s its economy was achieving double-digit growth rates. South Korea was left devastated after the war with the north and was one of the poorest countries in the world, lacking the level of industrialization that had been achieved in Japan. Its period of rapid growth took place later than in Japan but by the 1980s Korea was also taking on world class companies and starting to win. Its largest steel company Posco (Pohang Iron and Steel Company) was found to be the most productive in the world by a McKinsey study in the late 1990s. The successes in Japan and Korea, it has been argued, were the direct result of active industrial policies that used government support of industries with growth potential. In Japan, the Ministry of International Trade and Industry (MITI) guided industry investment and supported R&D. In Korea the economy was controlled by large industrial groups, Chaebols, that worked closely with the government and were given access to cheap capital.[10] Additional examples from Asia include special economic zones in China and the high tech corridor in Malaysia. It should be noted that industrial policy in Australia is unlikely to be as hands on as in these examples from Asia, but their experiences are still instructive for how to pursue similar policy goals.[11]

Critiques of Industrial Policy

Wharton economist Howard Pack, writing with different co-authors, has questioned the validity of the underlying theory behind industrial policy and questioned whether or not industrial policy was successful in practice, specifically, whether such policy accounts for the strong growth performances of Japan and Korea. The survey on industrial policy by Howard Pack and Kamal Saggi (2006) provides the most succinct and broad critical treatment of industrial policy in the development economics setting.[12] A more extensive critique of industrial policy in Asia is in Howard Pack and Marcus Noland (2003).[13] In their critique of industrial policy they set aside government interventions such as general support for education, or training or subsidies for R&D. These are general policies, they argue. Industrial policies, in their view, are those that provide specific support for individual firms or industries. These could be special tariffs or subsidies, or advantageous tax treatment for particular industries.

Pack and Saggi say that the period of discovery described by Rodrik as an externality problem for early-stage industries need not necessarily be a problem if financial institutions are well-developed and willing to fund entrepreneurs for the period needed while they seek out the best lines of business and move up to the productivity frontier. This point is not very compelling, however. It is hard enough to find a financial institution willing to take on serious level of risk in an investment project. Banks always look for collateral, so that they will be protected if the project fails. Angel investors and

10 The Asian model of economic development has been described as the "flying geese" model in which Japan led the way and then Korea and other Asian economies were pulled along, slipstreaming as it were, behind Japan. Akamatsu K.(1962): A historical pattern of economic growth in developing countries. Journal of Developing Economies, 1(1):3–25, March–August.

11 An interesting discussion of the use of industrial policies in East Asia is provided by Sanjaya Lall and Morris Teubal, ""Market Stimulating" Technology Policies in Developing Countries: A Framework with Examples from East Asia, *World Development* Vol. 26, No. 8, pp. 1369-1385, 1998

12 The case for industrial Policy: A critical Survey, paper supported by the Development Research Group of the World Bank, January 16, 2006.

13 *Industrial Policy in an Era of Globalization: Lessons from Asia,* Peterson Institute for International Economics, Washington DC, 2003.

Venture Capital funders are willing to take on risk but they typically require very high rates of return on their funding, usually demand a stake in the companies they support and Angel investors and Venture capitalists may not be available in Australia to the same extent as in Silicon Valley. Australia may not have enough risk-taking venture capital available to get the economic ball rolling.

Pack and Saggi then turn to one of most common forms of industrial policy used in practice, specifically a special tariff or subsidy used to support a favored industry. Can such policies be justified? Such industry-specific policies favor one industry but that comes at the expense of the other industries in the same economy.[14] A special tariff to protect a domestic industry is seen by its proponents as protecting against foreign competition, but trade theory argues that such a tariff actually should be seen as disadvantaging other *domestic* industries. As always in economics there are important assumptions that go into showing this result. In the simplest case, overall trade is balanced without a tariff and then rebalanced after the tariff is imposed. The effect of the tariff is to reduce imports of the favored good but reduce exports of other goods. Changing the assumptions used may or may not change the basic result. Even under more general assumptions, such as having an overall trade deficit in a country, the same logic applies. This theory also applies to industry-specific subsidies. They disadvantage the unsubsidized industries in the home country and have the additional cost of the taxes required to raise the funding for the subsidy.[15]

The obvious counterargument to this criticism is that perhaps it is the right policy to give some industries a leg up even if that comes slightly at the expense of other domestic industries. Self-discovery involves figuring out which are the industries or products where a country can compete globally and which products should shrink their production, or grow it more slowly. Traditional trade theory assumes that comparative advantage is fixed and intrinsic to an economy, but in many or most cases comparative advantage will depend as much on history and private and public choices as on intrinsic advantage. If a country is able to identify strategically important industries and nurture them into global competitors, then targeted assistance to these industries can allow the comparative advantage of the economy to evolve. In the case of Australia, the economy clearly has some areas of intrinsic comparative advantage, in the production of commodities, for example. But over time, Australia may be able to expand the range of products for which it has a comparative advantage that can then persist and expand. To the extent that industry clusters are important, this would indicate that assistance should be concentrated and not spread around too widely.

It is good to understand whether or not industrial policy is based on sound principles, but it is even more important to understand whether or not it has worked in practice and can work in the Australian context. Pack and his co-authors say that industrial policy has not worked. They argue that the Asian success stories of Japan and Korea were not achieved because of industrial policy but in spite of it. Pack and Saggi critique industrial policy in Japan by saying that 80 percent of the industry subsidies that were provided by the government were given to agriculture and mining, two

14 The data on Australian industry assistance is reviewed in The Australian Productivity Commission's "Trade & Assistance Review 2014-15": http://www.pc.gov.au/research/ongoing/trade-assistance/2014-15/trade-assistance-review-2014-15.pdf

15 Australia liberalized its trade and is not looking to turn back the clock on that issue. However, support for specific industries will impact trade patterns even if there are no tariffs or quotas.

industries where Japan was clearly uncompetitive. The idea that Japan provided significant subsidy support to the industries that became such strong global competitors, autos, steel, and machine tools, is a myth, they argue. Instead, Japan was propping up its old declining industries.

Despite the critique of industrial policy in Asia, one cannot say that the fast-growing countries of this region followed anything close to "Washington Consensus" policies of open trade and free investment. They had restrictions on their financial sectors which channeled high rates of national saving into industrial development and broad restrictions on imports and foreign direct investment in order to make sure their domestic companies had base of domestic demand for their products without facing foreign competition.[16] Japan had already reached a fairly high level of industrialization before World War II as evidenced by the potency of its military in that war. Korea had not developed to nearly the same extent as Japan and was a very poor country coming out of the Korean War. It followed a somewhat different strategy from Japan in that it allowed relatively free imports of capital goods for many years and relied quite heavily on foreign aid. For example, Posco, the state-owned Korean steel company had access to capital and then commissioned German companies to lay out the most productive steel plant they could construct using state of the art German machinery.[17]

It is reasonable to conclude from this that there is no silver bullet when it comes to industrial policy. The outcome of targeted industrial policy is contextual and different countries have used targeted assistance with varying degrees of success. Japan and Korea are unique in that large family conglomerates were the defining feature of these economies and these are largely absent elsewhere, notably in Australia. The experiences of these Asian countries should therefore be seen as informative, but should not be taken as a strict template for future policy in Australia. Industrial policy in Australia has not been defined within the narrow box of policies directed to a specific firm or industry. Good industrial policy is concerned with facilitating economic growth.

Industry Policy: Facilitating Adjustment and Creating New Jobs

Structural changes are both inevitable and a huge challenge for any economy. Consumer tastes change, technology changes, the relative strengths of particular companies alter, and the position of industries in international trade shifts. The result is that some companies and industries will expand and others contract creating a dilemma for industry policy. Each year more than a million workers in Australia change jobs, more than one tenth of the workforce and of course many of these job changes are voluntary as workers seek better opportunities.[18] These structural changes generate political pressure to support companies that are reducing employment and mitigate the negative impact on workers. The most difficult cases are in towns where a single employer is responsible for the economic viability of the whole community. The closing of a large plant can trigger not only the

16 Even though they did not adopt Washington Consensus policies themselves, Japan and Korea benefitted from the fact that other countries had such policies, allowing Japan and Korea to use an export-led growth strategy.

17 This section does not cover the range of different industrial policies that have been tried. One notable failure occurred in Brazil where imports of computers were restricted as a way to encourage domestic production. The result was that Brazilian businesses were forced to use inferior and expensive computers that hampered their own operations. On the positive side, Brazil has subsequently become a favored location for technical and computer support services.

18 What is the role of industry policy in the modern economy, January 2016, internal working paper of the Office of the Chief Economist, Department of Industry, Innovation and Science.

direct loss of jobs but the decline of supporting service industries like grocery stores or dentists.

Laid off workers may find the values of their homes have declined and, if they are over 50 years old, they will find it hard to retrain or obtain alternative employment at anything close to the same wage level as the jobs they lost, even if they move to a new location. David Autor, David Dorn and Gordon Hanson have documented the negative impact on communities in the United States from manufacturing plant closings.[19]

From the perspective of pure economic efficiency, there is a clear case for tackling stranded assets of people and capital by facilitating change. Workers can be given assistance to allow them to retrain and move to a different jobs that have a higher social productivity. Subsidizing additional capital investment in a production facility that has lost its competitive position, and is unlikely to regain it, represents a misallocation of scarce capital resources. However, that pure efficiency argument may not be dispositive in practice if the human cost of shutting down a production facility is too high. If it is determined for social and political reasons that established jobs are in danger and should be preserved, this should be done in a way that provides the most support to the people involved while minimizing the cost to taxpayers and insisting on a timetable for the withdrawal of support. This should be a time-limited expenditure, as Rodrik indicates in his discussion of industry policy. Workers and management can be given a chance to show that their operations remain globally competitive, and then they must make it on their own. Policymakers should not perpetuate the problem indefinitely by creating a new generation of workers that will then need financial support from taxpayers.

There is a question of whether or not efforts to preserve existing jobs should be considered industrial policy. De facto it is, but it would be better to keep this activity separate from industrial policies to enhance growth. Although the reality of budget making will create a tradeoff between support for old jobs and creating new jobs, it is better to keep the two in separate buckets. Compassionate policy making may dictate that support be given to preserve existing jobs, but good industrial policy should be mostly about expanding the number of jobs that are viable in the market economy.

Good industrial policy is about helping markets work better. One aspect of such a policy is to seek out *barriers* to the creation or expansion of economically viable activity and figure out how to remove them. Examples are such barriers are regulation, and skills and capabilities. Economic regulation is usually put in place for good reason, to improve worker safety or protect consumers, for example. Even necessary regulations are often not imposed in an efficient manner. They may end up favoring incumbent companies and discouraging the entry of new companies. They may discourage investment or innovation. One example from the United States concerns occupational licensing where almost 30 percent of jobs now require a license, up from 5 percent in the 1950s. Obviously some level of certification is necessary for, say, doctors and nurses, but licensing should

19 They blame the problem on the admission of China to the WTO in 2000, but similar problems have arisen as a result of the declining share of manufacturing in total employment that has persisted since the end of World War II. The biggest reason that manufacturing jobs in the U.S. slumped after 2000 is that total business sector employment grew at only 0.25 percent a year 2000-20015 compared to 1.65 percent a year 1990-2000. David Autor, David Dorn, and Gordon Hanson, "The China Shock: Learning from Labor Market Adjustment to Large Changes in Trade," 2016 forthcoming, Annual Review of Economics.

not be extended to florists or manicurists. Such licenses should not be used to restrict entry into the occupation or as a restraint on trade and that is happening in practice.[20]

At the same time, the application of standards for products or jobs can be important and positive. Standards are a good way of dealing with information asymmetry: the producer knows a lot more about their production function than the consumer, which means that price differences are no longer a signal of pure productivity or efficiency differences but capture other things that consumers may value but cannot be conveyed by price without additional summary information (like compliance with standards). This is efficient as long as the incremental costs and benefits are equated. As long as the incremental costs and benefits are equated, this is not inefficient, especially if consumers demand certainty and protection from harm due to malpractice etc. Losses and injuries due to malpractice are costs borne by the whole community, not just the individuals involved.

Lack of skills creates a barrier to growth in both Australia and the United States. Companies are unwilling to invest and create new jobs if they are unable to find people with key skills needed for growth and profitability. In both countries the lack of skills is framed as a problem with STEM education, and that is a valid concern given the need for digital literacy. But many jobs require practical skills that are not in STEM fields but are also in short supply, such as critical thinking, creativity, problem solving, presentation skills, team work, effective relationship building and communication skills.[21] The DIIS is not directly concerned with education and training in Australia, but industrial policy can play an important role in identifying the skill shortages that may be creating a barrier to investment and job creation. Many of the important skills will have to be developed by mentoring and training programs within companies. Other skills are best developed in partnerships between companies and public training institutions.

Reducing the barriers to growth just described falls into the categories of industrial policy that an internal working paper of the Office of the Chief Economist at the Department of Industry, Innovation and Science has labelled facilitative and enabling. The two other categories in the paper are also important, directional and transitional policies. Directional policies involve seeking out industries that are not currently competitive globally but that have the potential to be so. Examples include advanced manufacturing and space technology. In the section on innovation below, we point to the work of Robert Atkinson, who argues that many of the technologies used in successful high tech products developed by U.S. companies originated in government funded research. The Growth Centre Initiative of 2014 is an example of transitional industry policy. This initiative was intended to develop industry roadmaps to lift sectoral competitiveness, improve collaboration between industry and researchers and provide information and market connections for small and medium sized enterprises, allowing them to enter global value chains.

To summarize briefly the conclusions on industry policy. 1. Industry policy has a basis in economic theory, taking into account the existence of incomplete information and market failures. 2.

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20 See the discussion of this point in Martin Neil Baily, Why is Productivity Growth so Slow? Brookings, September 2016.
21 Alpha Beta Strategy Economics, "The New Basics", reported in the Industry and Innovation Summit, September 2016.

Preserving old jobs carries the risk that it perpetuates a problem and slows the inevitable adjustments that occur in all economies. 3. Given the extreme hardship that can accompany the loss of jobs in a community with no other major employer, it may be justified in social policy terms to the pay the price in terms of loss of economic efficiency by delaying plant closings. 4. Such policies should be time-limited and budget limited. 5. There are a set of industrial policies that are forward-looking and geared to job creation. The Office of the Chief Economist has classified these as enabling, facilitative, directional and transitional. These policies are where the main emphasis of industry policy should be placed.

III. Competitiveness

What is meant by competitiveness: The following description and definition comes from the Business Council of Australia, Building Australia's Comparative Advantages, July 2014, Exhibit 3.

Competitiveness can be a difficult concept to define and even more difficult to measure. At the sector level competitiveness is taken to refer to the ability of a sector's firms to produce goods and services that meet the test of international markets. For the traded sectors this means being able to produce and sell products into international markets at competitive prices. For the non-traded sector, this means having the ability to produce and sell goods as efficiently and effectively as those in leading nations. At the national level, being competitive means having competitive firms while maintaining or expanding the real incomes and wellbeing of its people. Competitiveness is a relative concept, and many things can impact on competitive performance, including currency fluctuations, which make one country's goods and services relatively more or less competitive as the relative value of a local currency increases or decreases. Tariffs, subsidies and other trade barriers can also increase or decrease a country's competitiveness. However, over the long term competitiveness is driven by productivity improvements – that is, the ability of a firm, sector or country to produce more or better goods and services for a given quantity or resources.

Current Account Surpluses and Deficits

A current account deficit is an increase in the net indebtedness of a given country to foreign entities. It indicates that the value of a country's imports of goods, services, and investment exceeds the value of its exports of goods, services, and investment. Australia currently has a current account deficit of 3.7 percent of GDP.[22] The United States also runs a large current account deficit with the figure in 2015 at 2.6 percent of GDP.[23] These deficits are chronic in both countries and the U.S. deficit was much larger prior to the financial crisis than it is today. Having a large current account deficit is something shared with the UK, Canada and New Zealand; by contrast, China, Japan, Germany, Korea and Taiwan have sizeable current account surpluses. The global pattern of current account imbalances has been viewed as problematic and as a factor that contributed to the financial crisis. This section looks at Australian competitiveness, whether or not the trade deficit and the associated current account deficit are problematic; and, if so, what can be done about them.

As a matter of arithmetic, a current account deficit must equal the inflow of capital to the country. Both Australia and the United States are running up debts to foreigners that will either have to be repaid in the future, or they will have to be serviced indefinitely. Because of the low rates of interest around the world, both countries have been able to borrow on very favorable terms.

The United States has a unique advantage in global capital markets because of its size and the importance of the dollar as a reserve currency. At the end of 2015 the United States was a net debtor to the rest of the world in the amount of $7.4 trillion dollars but, despite this fact, there was a positive net flow of investment income of $191.3 billion in 2015 because foreign entities (including foreign governments) have huge holdings of low-interest bonds whereas U.S. entities hold higher earning foreign assets, such as foreign direct investment. Even after subtracting net transfers of

22 Data was obtained from the Australian Bureau of Statistics.
23 Data was obtained from the Bureau of Economic Analysis.

$135.6 billion, the United States still received a net inflow of income of $55.7 billion in 2015.

Many people, including this author, are concerned about the ongoing, large accumulation of U.S. indebtedness but there is not an immediate crisis. Despite its huge net indebtedness, it seems safe to say that U.S. foreign borrowing will be able to continue in large amounts, at least for the next five to ten years. At some point, date unspecified, U.S. net foreign debts will become a significant burden and its ability to borrow will become an issue. The United States is a low saving economy[24] and the most direct way to increase national saving is to develop long run fiscal discipline and to set a path to reduce future federal budget deficits.

The situation of Australia is both similar and different. The large capital inflows of recent years have provided financing for the expansion of mining capacity and the development of natural gas resources, so there are real productive assets located in Australia that have been created through the use of foreign capital. Unlike the U.S., Australia has solid physical investments that effectively back some of the foreign borrowing. Moreover, the risks associated with fluctuating prices of raw materials and variations in the exchange rate of the Australian dollar are largely borne by the companies that have made the investments. Other private borrowing by the banks to relend mortgages is also part of the foreign debt. This leaves refinancing these debts a potential risk. Like the United States, Australia is running government budget deficits partially financed by foreign lenders.

Not everyone is concerned about the trade and current account deficits and the resulting impact on manufacturing. Comments made on an earlier draft of this paper suggested the discussion here was old-fashioned. I agree that trade deficits do not mean that a crisis is imminent and, certainly, there are policy measures that would be worse than simply allowing deficits to persist. Erecting trade barriers, for example, would not be a good solution to trade deficits, nor would it make sense to put an economy into recession in order to reduce a trade deficit. Trade is not a zero sum game, but a benefit to both trading partners even if trade is not balanced.

That said, the current account is important and large and persistent current account deficits mean that a country is accumulating net debt to the rest of the world, reducing its total wealth and hence its long run income (or "permanent income" in Milton Friedman's terms). International macroeconomists look for economies to achieve both internal and external balance, where internal balance means keeping the economy close to full employment with moderate inflation. External balance means a current account balance that is neither persistently positive or negative.[25] At the end of 2015 Australia had a net liability position to the rest of the world of AU$1,018 billion which represents about $42,000 per person.[26] This is still a manageable amount, particularly because much of it reflects business investments in Australia where the foreign owners take the risks.[27] Still,

24 Some of this is demographic – as the U.S. has a relatively young demographic profile compared to Germany and Japan and even Australia. But policy matters here – the promise of social security means less need to save for old age (unlike China).

25 Several countries have run persistent current account surpluses over time, notably China and Germany. Germany's current account surplus is running at 8.4 percent of GDP which imposes costs on its trading partners in the euro area that are struggling to recover from the financial crisis and the euro crisis.

26 The data comes from the Australian Bureaus of Statistics. The international investment position is given at series 5352.0. The population is estimated at 24 million.

27 It is a benefit to Australia that most of its foreign liabilities are denominated in Australian dollars. However,

it is a sizable burden on future generations. It is not the place of the current author to tell the people of Australia whether or not they should increase their national saving rate as a way of reducing their current account deficit. But it is important to be aware of the tradeoffs involved between spending today and spending tomorrow, as well as the impact of the trade deficit on the manufacturing sector. With the end of the wave of mining investment, there is a case for improving Australia's trade position and reducing its net foreign borrowing in relation to the overall size of its economy.

The Pattern of Trade and Current Account Deficits: U.S. and Australia

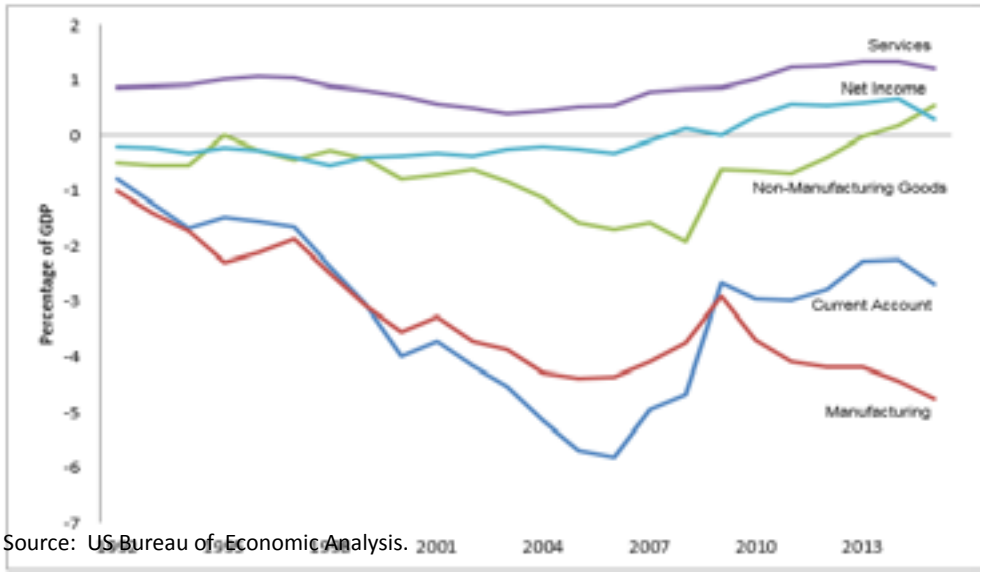
Figure III.1 below shows the composition of the U.S. current account and there are several striking features. First, trade in services has remained strong and there is a substantial trade surplus. Second, as noted, net income turned positive despite the large overall current account deficits. This was in large measure a benefit to the United States resulting from the financial crisis when foreign entities sought out safe dollar assets with low yields (a considerable irony given that the global crisis was triggered by excessive mortgage borrowing in the United States). Third, trade in non-manufacturing goods has moved into surplus. The U.S. has always been an exporter of agricultural products but relied on foreign sources for much of its oil consumption. Fracking has expanded oil and gas production, cutting the volume of imports and the fall in the price of oil has reduced the cost of those imports, pushing the overall trade position into positive numbers.

Fourth, the U.S. manufacturing trade deficit grows and grows, seemingly without limit, despite the relatively slow growth of GDP in recent years. The deficit was over $800 billion at the end of the period and looks headed for a trillion dollars. The manufacturing deficit of the United States is entirely in its trade with China, with manufacturing trade balanced with the rest of the world. China, of course, has become a powerhouse of manufacturing, although it should probably be described as a powerhouse of assembly. It has become the final stop in a large Asian supply chain that includes Japan, Korea, Thailand and other countries. Although most Americans, including some well-known economists, blame China for U.S. trade problems, comparisons with other countries and regions suggest the biggest concern about U.S. trade is the low level of U.S. exports.[28] Adding up the different components of trade and income gives the overall current account deficit, which was worsening rapidly until the financial crisis and has now flattened out, associated with the positive trade in services and the increase in oil and gas production.

the variability of the Australian dollar is a risk that foreign investors take when investing, which then provides some disincentive for future investments.

28 See Martin Neil Bail and Robert Z. Lawrence, "What Happened to the Great U.S. Job Machine: The Role of Trade and Electronic Offshoring," Brookings Papers on Economic Activity, 2, 2004. This paper includes a decomposition of U.S. trade performance into exports and imports.

Figure III.1 The Composition of the U.S. Current Account Deficit 1992 to 2015

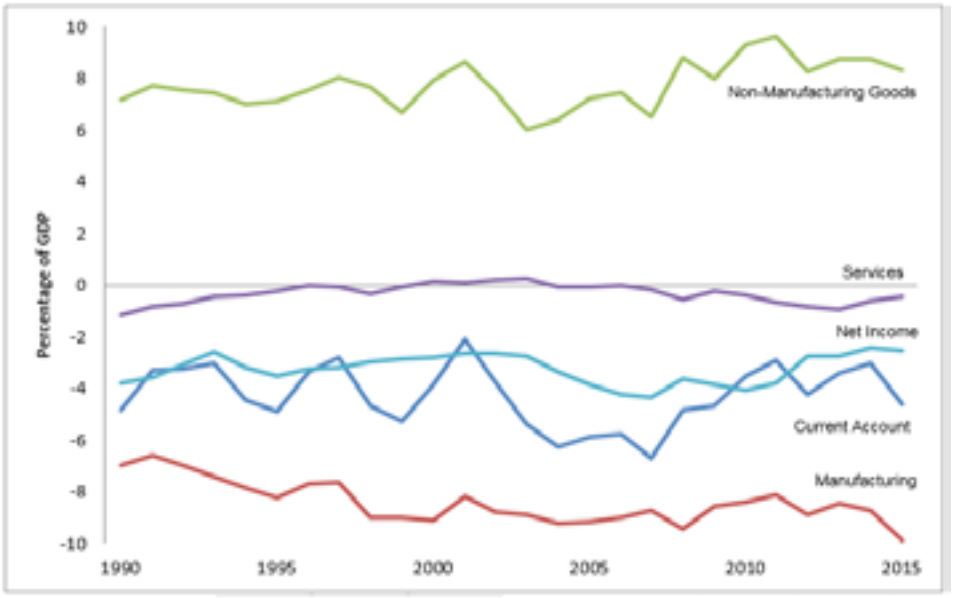


Source: US Bureau of Economic Analysis.

Figure III.2 below shows the comparable chart for Australia. As noted, Australia's situation is both different and similar. Australia has a much stronger comparative advantage in selling commodities: coal, iron ore, agricultural products and natural gas, with non-manufactured goods exports increasing as a share of GDP. Net income flows for Australia are negative, reflecting the net indebtedness (and Australian interest rates are higher, reflecting expectations about the future path of the currency[29]). Like the United States, the balance of trade in manufactured goods has moved strongly negative. One surprising difference between the two economies is that Australia has a trade deficit in services where this has been seen as a source of comparative advantage for Australia. Later in this section, I look in more detail at services trade.

29 A condition called "covered interest arbitrage" says that interest rates in Australia relative to rates in the United States should equalize the expected return on bonds in the two countries, adjusting for the expected change in the bilateral exchange rate. This condition abstracts from the risk of default in both countries.

Figure III.2 The Composition of the Australian Current Account Deficit 1990 to 2015



Source: ABS, Balance of Payments and International Investment Position, Cat. No. 5302.) and Merchandise Exports and Imports and Commodity Pivot Table cat no. 5368.0 January 2016.

Figure III.3 below shows another comparison between U.S. and Australian trade, giving a broad breakdown of the exports of the two economies. No surprise, Australian exports of energy and mining products are very much larger in relation to GDP for Australia, while exports of engineering products are larger for the United States. Interestingly, exports of services as a percent of GDP are at about the same level for the two economies even though services are in deficit for Australia.

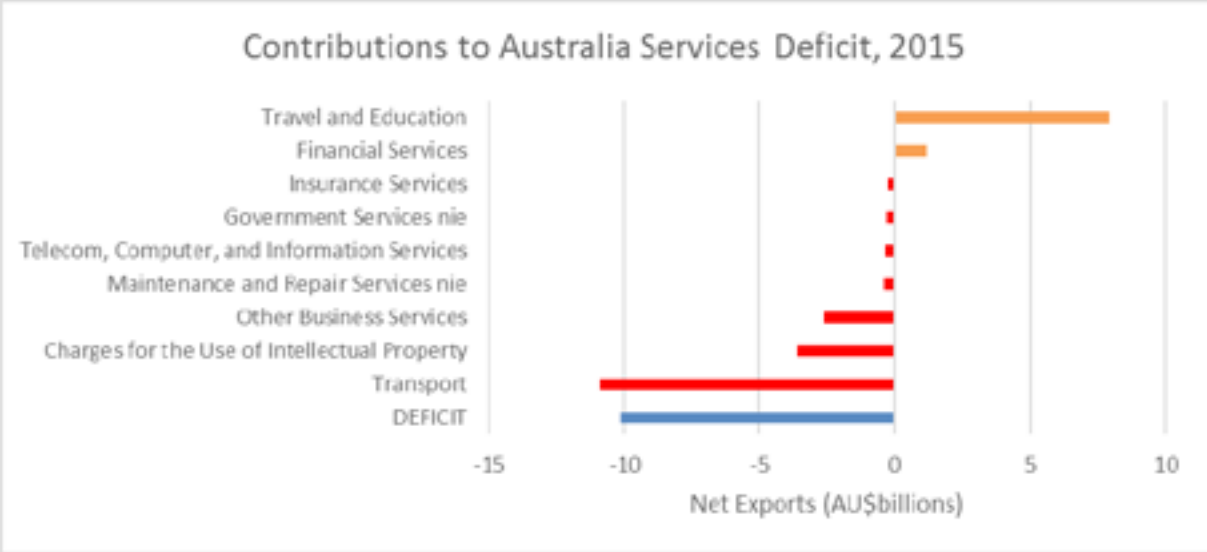
Figure III.3 The Composition of Exports: Australia and the U.S.

Source: Author's calculation based on ABS Export Merchandise Data and Haver Analytic Trade in Goods and Services Data.

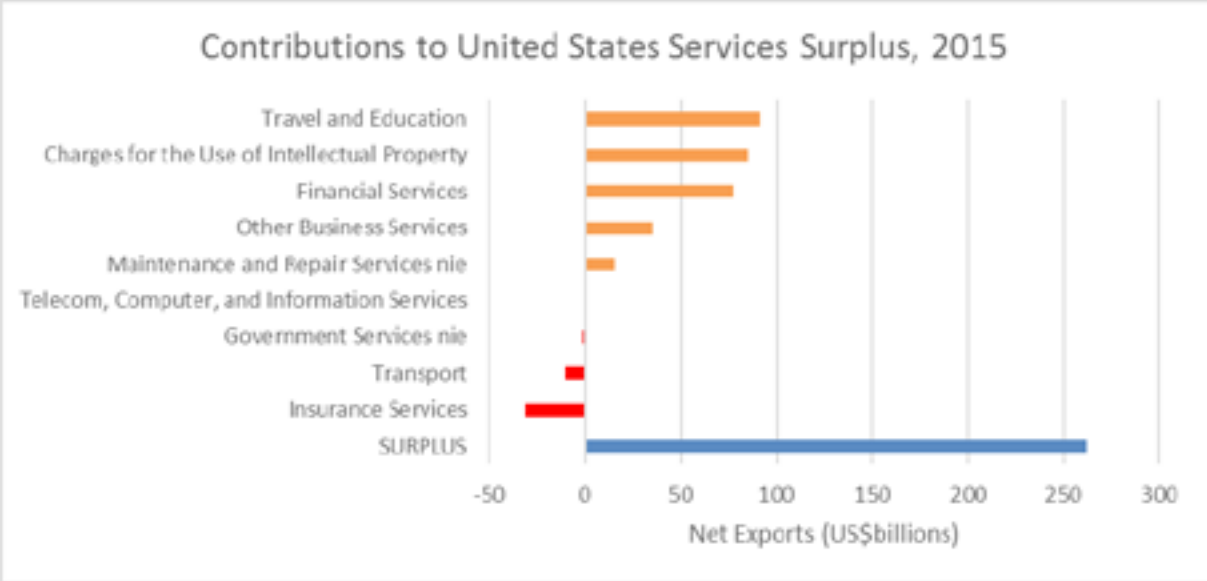
A Comparison of Services Trade in the U.S. and Australia

One surprising feature of the trade data for Australia is that services trade is in deficit. Business services is one area of the economy where Australia was thought to have a comparative advantage. Figures III.4 show the decomposition of Australia's (modest) trade deficit in services followed by the comparable decomposition for the United States.

Figure III.4 Decomposition of Services Trade, Australia and the United States



Source: Australian Government DFAT "Composition of Trade, Australia 2015.



Source: U.S. Census Bureau, Foreign Trade Data.

Travel and education show sizeable surpluses for both countries, reflecting that many foreign students come for their education to both places.[30] The largest item contributing to the Australian trade deficit

30 Travel and education are combined into a single grouping in the U.S. data and so they have been combined in the figures.

(more than 100 percent of the total) is transportation, also a negative for the United States but only a small component. This is because of the differences in commodity trade patterns. Australia is a major exporter of raw materials and buys transportation services to ship these.

Australia ran a small surplus in financial services but deficits in other business services. Professional services may be a potential source of comparative advantage for Australia in the future but that has not emerged in the data so far.

A Measure of Structural Competitiveness

For many people a country's competitiveness simply looks at whether or not there is a trade surplus or deficit, either for a particular product or the overall trade balance. The difficulty with this is that trade position is greatly impacted by the exchange rate. An overvalued exchange rate will turn a positive trade balance into a deficit if it persists. This difficulty in assessing competitiveness has led some trade economists to discard the idea altogether as not being a useful concept. In a study published in 2006, Robert Z. Lawrence and I suggested a way of looking at competitiveness in a very simple framework in which we parsed the impact of exchange rate changes and shifts in competitiveness. The idea is illustrated by Figure III.5 below which shows a relation between the trade balance and the exchange rate. The figure shows a solid red line as the baseline, plotting the trade surplus or deficit against the exchange rates, holding other factors constant.

Figure III.5 Trade Performance and the Exchange Rate: A Measure of Competitiveness

Source: Author's own graph.

The slope of the line indicates that a high value of a country's exchange rate is associated with a trade deficit, while a low exchange rate is associated with a trade surplus. Lawrence and I then suggested that the movements of this exchange rate line provided a measure of changes in a country's *structural*

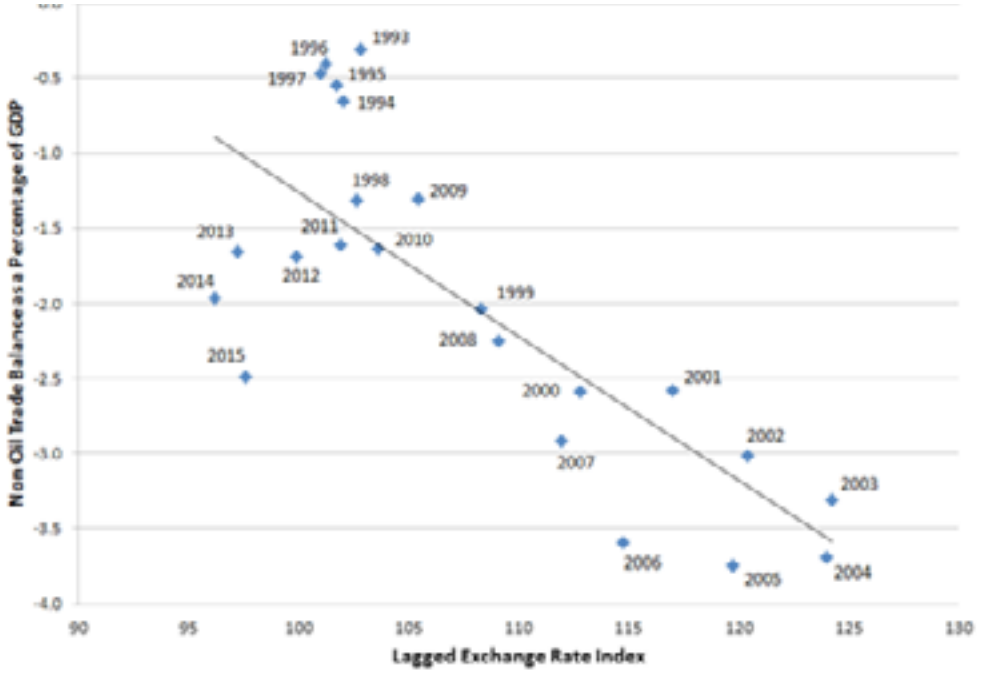
competitiveness—its trade performance after adjusting for exchange rate effects. Think of moving the line vertically upwards. This means that a country's trade surplus is increasing over time *for a given exchange rate.* We would describe this case as a sign of improving structural competitiveness. Declining competitiveness would be the case of a vertical shift downwards. Alternatively, one can think of moving the line horizontally.

Of course there is a basic arithmetic of trade and capital flows that must be satisfied in the pictured relationship. A country can only run a trade deficit if there is an equal and opposite inflow of funds coming from net income flows and capital inflows.

This definition is, I believe, consistent with the discussion of competitiveness given at the beginning of this section by the Business Council of Australia. They say: "For the traded sectors this means being able to produce and sell products into international markets at competitive prices…… Competitiveness is a relative concept, and many things can impact on competitive performance, including currency fluctuations, which make one country's goods and services relatively more or less competitive as the relative value of a local currency increases or decreases." By separating out the exchange effect, Lawrence and I hope to hone in on a measure of structural competitiveness. Of course, tariffs and trade policies will remain as factors at work that have not been separately accounted for.

Figure III.6 shows a scatter plot for the United States showing actual data for the non-oil trade surplus or deficit against the real exchange rate of the dollar. Recognizing the fact that

Figure III.6 United States: Non-Oil Trade Balance Against the Exchange Rate. Signs of Declining Competitiveness



Source: Author's own graph based on BEA Exports and Imports Data and FRB Real Broad Dollar Exchange Rate Index

the impact of exchange rate changes occurs with a lag, the exchange rate index is a three year moving average of the actual index in the current year and the two prior years. The first point to note is that there appears to be a strong relation in practice between the trade deficit and the exchange rate. Going back to the start of the flexible exchange rate era in the early 1970s, we found that periods of small trade deficits are always periods of low values of the real exchange rate and periods where the exchange rate is high are always periods of large trade deficits. Whatever else is going on, the exchange rate is extremely important. The line shown is a simple regression line.

The next striking fact about the figure is that it shows a marked pattern of movement over time. In the early and mid-1990s the points are above or to the right of the line. The points from 1999 through around 2012 are scattered around the line. After 2012 there seems to be a further movement downwards or to the left. In short, there is evidence in the figure of a deterioration of U.S. structural competiveness in non-oil trade over time. In our earlier work we looked at the 1970s and 80s and the pattern of deteriorating structural competitiveness is very clearly visible over the longer period. Somewhat surprisingly, the shifts do not seem to be continuous movements over time, but a series of downward or leftward movements followed by periods of relative stability.[31]

Figure III.7 shows the comparable figure for Australia looking at non-commodity trade against the exchange rate of the Australian dollar. As in the U.S. figure, it is a three year moving average of the exchange rate. As before, there is a very strong relationship there, indicative of the impact of the exchange rate on non-commodity trade. Whatever else is going on, the exchange rate is the dominant factor impacting this trade balance. Unlike the U.S. case, though, the points are scattered around the line with no evidence that the more recent years are below or to the left. The last year, 2015, is down or to the left, but the points for the immediately preceding years, 2010-14, are not. Global growth weakness is an obvious explanation for 2015. *A potentially important conclusion emerges, therefore, that Australia's persistent non-commodity trade deficits are the result of exchange rate movements and are* not *a sign of a structural weakness in competitiveness for these goods and services.* If this is correct, it means that a downward adjustment in the value of the Australian dollar would have a strong positive impact on the non-commodity tradeable goods sector (mostly manufacturing), although it would take several years for this work through.

Of course value of the exchange rate reflects all trade, including commodities, as well as capital flows, and the resulting elevation of the currency has been a problem for Australian manufacturing. One intriguing question to which this analysis does not have an answer is whether or not a more gradual increase in the exchange rate would have allowed time for manufacturers to adjust more easily and perhaps to improve their productivity enough to remain competitive.

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31 The movements of the U.S. structural competitiveness line are to be expected based on the "Houthakker Magee" effect identified in their 1969 study. They argued that the United States was losing competitiveness over time because the impact of increases in global GDP on U.S. exports was smaller than the impact of increases in U.S. GDP on imports. Using their coefficients did not work well. Their study implies a much faster rate of decline in U.S. structural competitiveness than is actually observed. Their study of U.S. trade preceded the flexible exchange rate period that started in the early 1970s and so they looked at price data. Prior to the early 1970s it was hard to separate out exchange rate effects from shifts in structural competitiveness because the real broad exchange rate of the dollar changed very little.

Another important issue is that these charts for the U.S. and Australia do not build in hysteresis. They do assume there is a lengthy lag before an exchange rate has had its full effect, but they do not allow for survival effects in which firms or whole industries shut down following a sustained rise in the exchange rate, making it difficult for the economy to retrace its steps. The idea of hysteresis in trade relationships is plausible, but there is no sign of it in these data so far, with points scattered around the line. Hysteresis could be an explanation of why 2015 is so far below the line, but it is too early to tell. From the perspective of policymakers, the possibility of hysteresis effects creates a rationale for good industrial policies that foster the growth of new firms or new lines of business to take advantage of changing opportunities.

Figure III.7 Australia: Non-Commodity Trade Balance Against the Exchange Rate. Signs of Declining Competitiveness

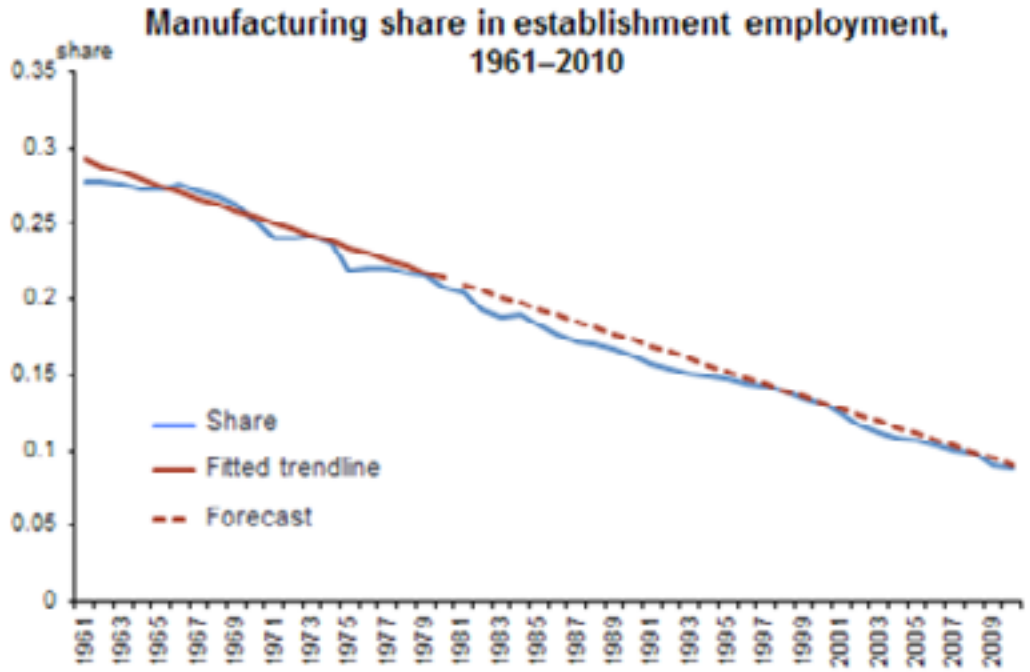
Source: Authors' calculations based on ABS (*Balance of Payments and International Investment Positio* December 2015) and ABS (*Merchandise Exports and Imports Country and Commodity Pivot table*, Cat. no. 536

Trade Performance and Employment

It is taken for granted by many Americans that the deterioration that has taken place in the labor market opportunities facing workers who lack advanced skills or education is the result of the large trade deficits that I have just described. And many people blame China and Mexico for both the trade deficits and the loss of jobs, just as they blamed Japan in an earlier period. Robert Z. Lawrence in a series of papers has pushed back against this conventional wisdom. Two facts are particularly compelling. First, the rate of decline of manufacturing employment as a share of

total U.S. employment has remained the same for the past 50 years at least. A trend-line fitted from 1961 through 1980 exactly tracks the line from 1980 to the present. Before 1980, China and Mexico were barely mentioned in the discussions about U.S. employment. See below Figure III.8.

Figure III.8 A Constant Rate of Decline in Manufacturing Employment Share

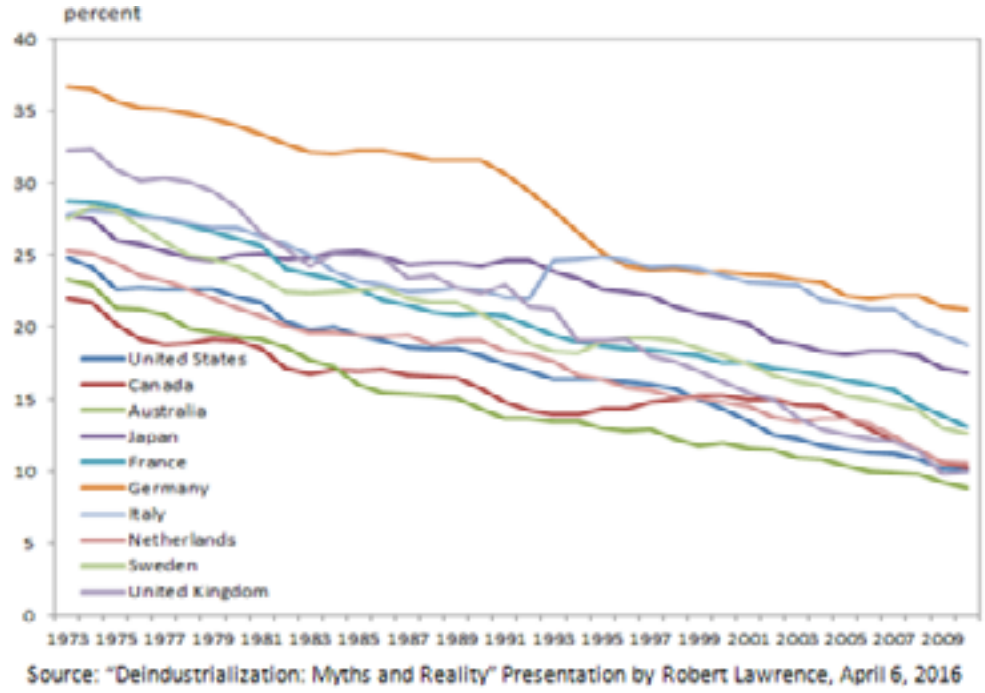


Source: "Deindustrialization: Myths and Reality" Graph based on Bureau of Labor Statistics, Presentation by Robe Lawrence, April 6, 2016

The second fact is that the rate of decline of manufacturing employment as a share of total employment is very similar for all the OECD economies. As well as Australia and the United States, this set of economies includes Germany, the manufacturing hub of Europe. Germany has a large trade surplus and a larger proportion of its workforce in manufacturing than most other advanced economies, but the role of manufacturing in the overall economy is declining just like everywhere else. See Figure III.9 below. These findings point strongly to powerful forces that are impacting all the advanced economies. In particular, manufactured goods are accounting for a smaller share of expenditure over time. Australia has directed over a half of its industry assistance to manufacturing but this has not been enough to overcome the underlying trend of share decline.[32]

32 See the Australian Productivity Commission, Trade and Assistance Review, 2014-15. http://www.pc.gov.au/research/ongoing/trade-assistance

Figure III.9 The Employment Shares in Manufacturing Decline Together



Source: "Deindustrialization: Myths and Reality" Presentation by Robert Lawrence, April 6, 2016

A quick *caveat* to this result. The differences in the shares of manufacturing employment are very large indeed. In 2010, Germany had 21.2 percent of its workforce employed in manufacturing, whereas Australia had only 8.9 percent. Adjusting for total employment size, Australia had a manufacturing workforce only 42 percent of the comparable workforce in Germany. Germany is more the odd man out than is Australia, although the Australian share is among the lowest.[33] The small relative size of Australian manufacturing reflects basic economic forces, such as the fact that Australia has very large exports of commodities, which is not the case for Germany. Germany is a manufacturing hub in the heart of the European Union, an economic entity with over 500 million people. Germany is running a current account surplus of 8.4 percent of its GDP.

Macroeconomic Factors and Australian Trade

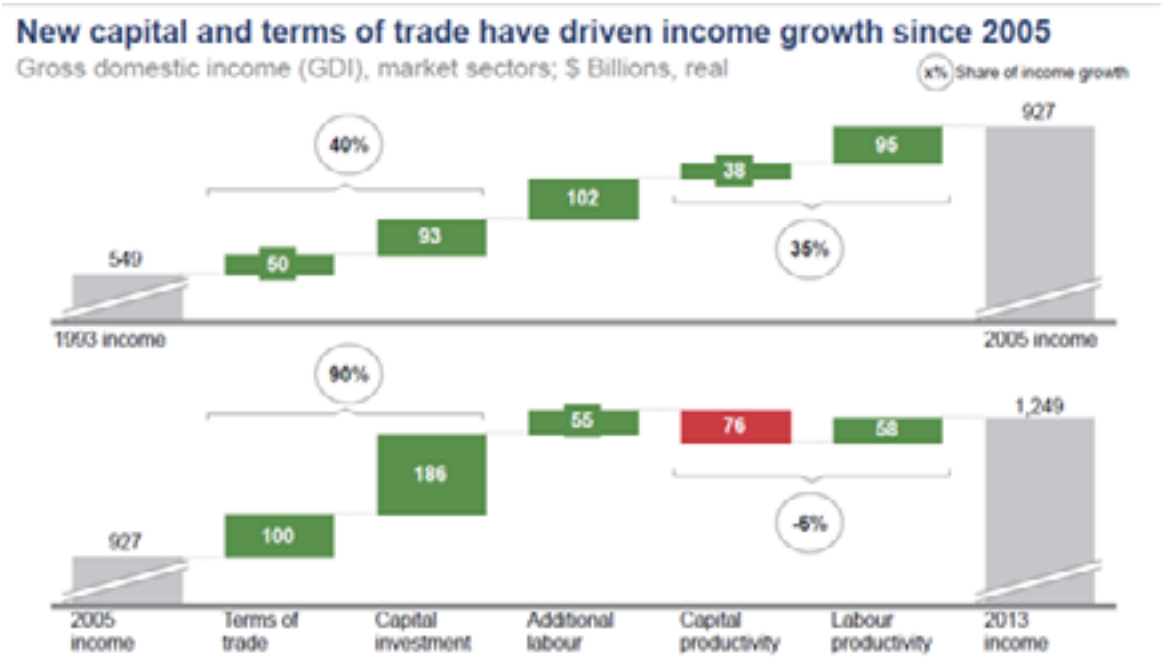
A country that discovers or exploits a natural resource can gain substantial benefits from this but can also face difficulties. The "Dutch Disease" afflicted Holland when large quantities of natural gas were found in its territorial waters, its exchange rate was elevated and its manufacturing sector had trouble competing. The UK developed a version of this same disease when oil and gas were found in the North Sea and manufacturing employment fell. Australia has faced this problem as a result of its success in developing its natural resources, an issue that was discussed by the 2014 Australian Industry Report.[34]

33 Employment share is only one indicator of the strength of the sector. Manufacturing real gross value added has been around A$100 billion since 2002-03, notwithstanding the falling GDP and employment shares. The only other market sector industries to record real gross value added of A$100 billion and above are *Mining*, *Construction, Financial & Insurance Services* and *Professional, Scientific & Technical Services*. Wages are also strong within manufacturing. A broader set of data present a more balanced picture of the relative performance of the different industries particularly manufacturing.

34 The 2014 Australian Industry Report has a section on Dutch Disease in Australia (Box 2.3, pg 83) which provides a helpful perspective for this section, and the story behind Figures III.7 and III.8. http://www.industry.gov.au/Office-of-the-Chief-Economist/Publications/Pages/Australian-Industry-Report.aspx#

Of course the same rise in the exchange rate that made it harder for manufacturers provided an increase in living standards for Australian consumers because they were able to buy foreign goods at lower prices. A 2014 study by the Sydney office of McKinsey & Company (Compete to Prosper) reported that the combination of a high level of investment together with the boost to the terms of trade resulting from the elevation of the exchange rate gave a big lift to Australia's national income 2005-2013. This is illustrated in Figure III.10.

Figure III.10 McKinsey Reported that Australian Income Received a Boost from Improvements in its Terms of Trade



Source: Australian Bureau of Statistics: McKinsey analysis

If the goal is to limit the adverse effects of the Dutch Disease on manufacturing and tradable service industries, it is important that the exchange rate be at a level that allows these industries to be price competitive. Of course that is easier said than done, but there are policies that would move the rate in that direction. Judging by Figure III.7 the exchange rate would have to drop by about one third to get back the non-commodity trade deficit Australia had in the late 90s and the early years of this century. Lowering an exchange rate means reducing the reliance on foreign capital flows to fund domestic consumption and government spending. Discouraging the capital inflows associated with the property boom would also allow the exchange rate to decline although any efforts to restrict capital flows are likely to do more harm than good. In the short term, monetary policy will have an impact on the exchange rate and recent rate adjustments of the Reserve Bank of Australia should weaken the Australian dollar a little. Of course, policy interest rates have to reflect the broader needs of the economy and the inflation outlook and the Reserve Bank, in setting interest rates, does not target a particular level of the exchange rate.

Policymakers should decide not to get the exchange rate back to its 2000 level as this would entirely give back the boost to livings standards that has come from cheap imports and would put upward pressure on inflation. Since the mining and natural gas sectors of Australia have been built up strongly, they will continue to export at high levels and it will not be necessary to go back to the exchange rate of twenty years ago in order to achieve overall external balance. However, it is important to acknowledge the macroeconomic reality involved in non-commodity trade. *Industry and innovation policies designed to help Australia's manufacturing and tradeable services sectors will have a much easier time if the value of the Australian dollar is less strong than it has been in recent years.*

Conclusion

Even though the analysis above did not suggest a structural decline in Australia's competitiveness, it is self-evident that any substantial improvement in the import-export imbalance will require considerable new investment, training of workers and development of overseas markets. Before talking about the policy issues in improving trade competitiveness at the industry level it will be helpful to look at productivity at the industry level.

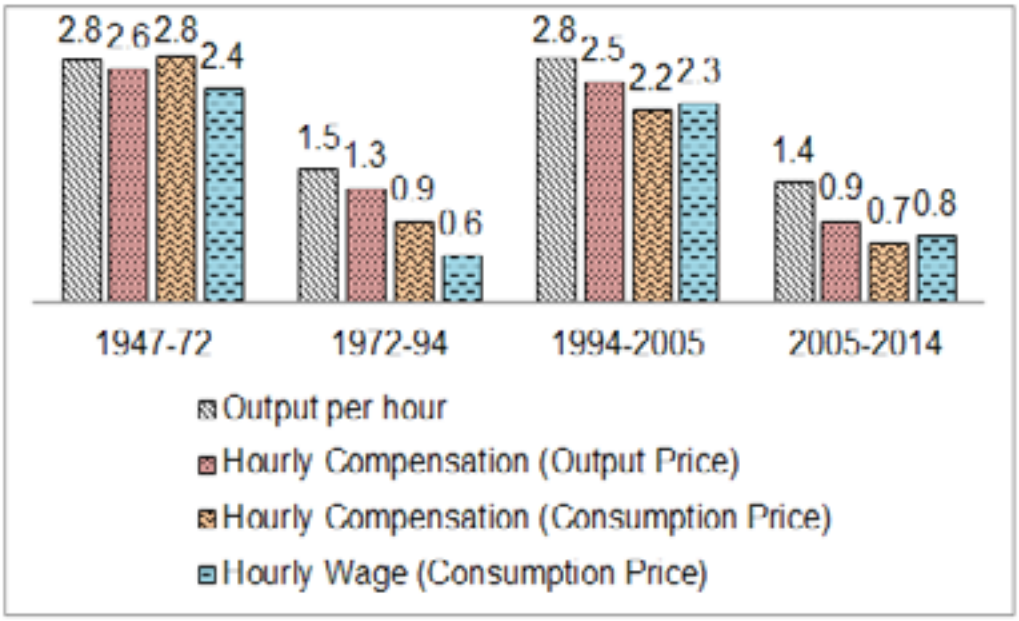
IV. Productivity Performance

Productivity isn't everything - but in the long run it's almost everything. - Paul Krugman, Nobel Prizewinning economist.

As Krugman says, in the long run the growth in labor productivity (output per hour) is the primary driver of the growth in livings standards. The ultimate goal of innovation and the diffusion of technologies is to enhance productivity. If productivity increases by 1 percent a year, this will allow living standards to double in 70 years; at 2 percent a year in 35 years and at 3 percent a year in 23 years.[35]

The impact of labor productivity growth on living standards can be seen clearly in data from the United States shown in Figure IV.1. Over the period from 1947 through 1972, output per hour grew at 2.8 percent a year and so did hourly compensation. Over the next 22 years both productivity and compensation slowed. When productivity growth picked up after 1994, so did compensation growth. And when the second productivity slowdown took place around 2005, there was a second slowdown in compensation growth. The figure shows the strong relationship between productivity growth and the growth of workers' compensation. (A gap has opened up between productivity and wages in the United States but that does not overturn the basic relationship). [36]

Figure IV.1 U.S. Productivity Growth Coincides with Wage Growth



Source: Barry Bosworth, Brookings Institution

35 Businesses generally do not manage to a metric of productivity. However, when businesses seek to increase efficiency to lower costs, or when they produce higher value outputs, this will raise productivity. One form of cost-cutting, using lower wage workers, will not improve productivity.

36 In fact, MFP captures more than technological change, also reflecting improvements in business processes and higher value products and services. In addition, MFP also picks up changes in the quality of natural resource inputs that affect the real cost of production. The impact of a decline in the quality of natural resource inputs is apparent in mining and electricity, gas and water. See the study by the Productivity Commission at http://www.pc.gov.au/research/supporting/mining-productivity.

I was not able to exactly match the U.S. chart for Australia, but Figure IV.2 plots earnings, labor productivity growth and unit labor costs for Australia and there is a connection between earnings and productivity shown in the figure. Productivity is shown inverted in the blue bars underneath (because productivity is a subtraction from unit labor costs), while earnings growth is shown by the orange bars. When productivity growth is strong it does generally show up in stronger earnings growth. The connection is not perfect, otherwise the unit labor cost line would be flat, but there is a correlation visible in the figure.

Figure IV.2 Earnings, Labor Productivity Growth and Unit Labor Costs, Australia

Sources: ABS; RBA

How has Australia's productivity performed? Figure IV.3 is taken from the Australian Productivity Commission and it shows summary statistics on aggregate productivity from 1973 through 2015. Overall, labor productivity growth has been very good at 2.3 percent over the entire period and since 2007-8. These growth rates are far above the comparable figures for the United States. The increase in labor productivity over the full time period was attributable to growth in multifactor productivity of 0.8 percent a year plus an additional 1.6 percent a year from an increase in the amount of capital per unit of labor, the contribution of capital deepening. For the more recent time periods, there is a clear indication of concern in that multifactor productivity growth (the economists' preferred measure of the contribution of innovation and technological change) fell to zero over the 2007/8 to 2014/15 period. This drop in MFP growth was offset by continued strong investment, which pushed the contribution of capital to 2.3 percent a year in the final period 2007/8 through 2014/15. The last few years of the period are shown individually and they show that MFP growth

has actually recovered, to 0.8 percent in the last year, but the growth of capital input is definitely slowing, adding only 1.1 percent to growth in the last year—still better than the United States.

Figure IV.3 Summary of Aggregate Productivity Performance for Australia, 1973-2015

Summary productivity statistics, 12-industry market sector[a,b]

Per cent

	Long term growth rate	Last complete cycle	Period since the last cycle	Latest years		
	1973-74 to 2014-15	2003-04 to 2007-08	2007-08 to 2014-15	2012-13	2013-14	2014-15
Output (GVA)	3.0	4.0	2.5	2.5	2.5	2.8
Total inputs	2.2	4.0	2.4	2.2	2.0	2.0
Labour input	0.7	2.4	0.1	-1.1	-0.1	0.9
Capital input	4.4	6.0	4.9	5.8	4.2	3.2
MFP	**0.8**	**0.0**	**0.0**	**0.3**	**0.6**	**0.8**
Capital deepening[c]	1.6	1.7	2.3	3.3	2.0	1.1
Labour productivity	**2.3**	**1.6**	**2.3**	**3.6**	**2.6**	**1.9**
Capital labour ratio	3.7	3.6	4.8	6.9	4.3	2.3

Source: Productivity Commission estimates based on ABS (Estimates of Industry Multifactor Productivity, 2014-15, Cat. no. 5260.0.55.002, December 2015).

As already noted, there were very large investments made in the mining and energy sectors to take advantage of the valuable deposits available in Australia and the fast growing markets of Asia. The fact that Australia moved aggressively to seize this opportunity was entirely appropriate and it provided a substantial boost to Australian living standards.[37] Going forward, sustained growth will, of course, require stronger MFP growth, both to contribute directly to economic growth and also to sustain the profitability of investment. I look next at a more disaggregated view of productivity performance, looking by industry. That will then lead into a discussion of policies.

Industry Productivity Performance

This section will take advantage of the work that has been done at the U.S. Bureau of Economic Analysis, and here at Brookings, on growth rates of multifactor productivity growth by industry. We have been able to match up the industry results in a number of cases with the multifactor productivity database created by the Australian Bureau of Statistics.

Although we do not have any updates since then on the comparative levels of productivity,

37 As a commentator on an earlier draft of this paper pointed out, Australian productivity would look even stronger abstracting from mining and utilities. The bulk of the economy has increased productivity strongly.

it is to be expected that Australia would have caught up to global productivity levels because of the competition policy that was started around that time as well as privatizations. To an extent that hypothesis can be checked by means of the productivity comparisons given next (although these are based on MFP growth).

Comparisons of Multifactor Productivity Growth by Industry.

The Australian Bureau of Statistics provides data on industry MFP growth that cover the period from 1989 through 2014, although with some gaps, and Figure IV.4 gives the first of three figures that look at these data. Comparisons are given for the same industries in the United States to provide benchmarking. The figure shows three sub-periods, from 1989-1995, from 1995-2004, from 2004-2014 and then the right hand side of the figure shows the entire period 1989-2014.

The first industry is agriculture and the performance in the two countries is comparable. The growth rates differ over sub-periods, but this industry is quite affected by weather over periods of a few years. Over the full time-period the growth rates in the two countries are very close, within the margin of error in such statistics. The U.S. agricultural sector has been an outstanding performer, the fastest pace of MFP growth of any broad industry and so the fact that Australia's growth is the same is a very positive indicator. The picture for mining is different, driven by the last time period, 2004-14. The U.S. industry over this last period benefitted from the development of fracking technologies that are less capital intensive than traditional oil and gas production, particularly less capital intensive than deep sea production. Australia, as we have already discussed, made very large capital investments in developing its natural resources and as of 2014 the payoff in higher output had not been fully realized. Also, Australia was developing some resources that were economically viable but that had lower yields than prior mines—brown-field mining of less rich adjacent areas. As prices drop so too does production from the more marginal areas and hence productivity should start to recover. The other problem with mining is the utilization rate where there are green-field mines but the price does not cover production costs. The industry over-capitalized and this will take some years to work through, so it is to be expected that investment will fall considerably once committed projects are completed.

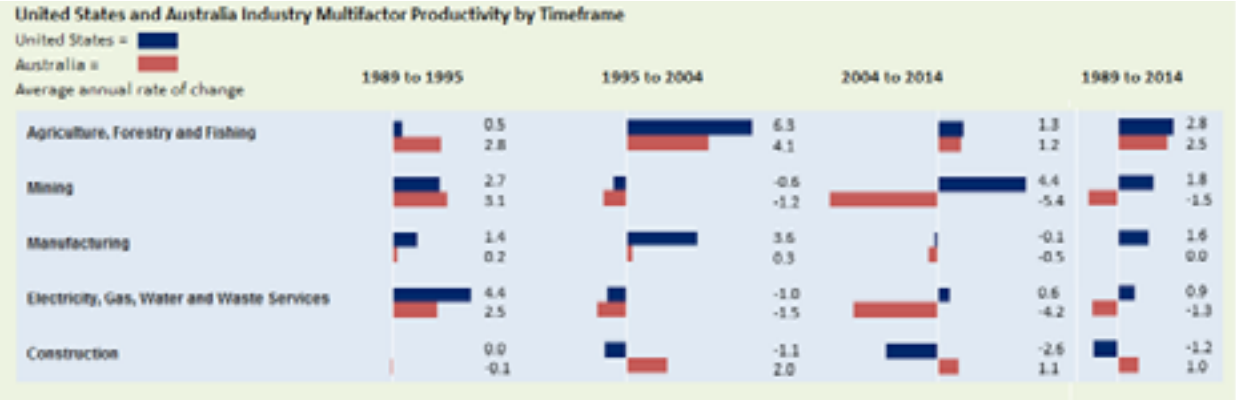
The comparison of manufacturing industries shows a substantial productivity growth advantage for the U.S. industry. MFP growth over the full period was 1.6 percent in the U.S. sector and zero in the Australian sector. It is the high-tech sector in the U.S. that accounts for this difference; the rest of U.S. manufacturing looks similar to that in Australia. Productivity in the production of semiconductors and electronics in the United States benefitted from Moore's law and related advances whereas the Australian manufacturing sector had very little production in this segment. These data for manufacturing point to an important need for Australia to determine where it can compete effectively. The United States faces the same challenge as electronics manufacturing moves offshore.

The performance of the utilities sector in Australia is problematic. MFP declined at a -1.3 percent a year rate over the entire period 1989-2014 and the rate of decline was much faster at -4.2 percent a year from 2004-14. Water and sewage are largely publicly owned and face rising real

costs due to declines in natural resource inputs per unit of production. Electricity is partly privatized, but heavily regulated and had a funding model that encouraged excess capacity to avoid brownouts or blackouts at times of peak demand. Unwinding this will take time. Utilities are a sector of the economy where changes need to be made in order to avoid a substantial drag on overall economic growth.

For construction, the roles are reversed. As noted above, the Australian industry was judged to be close to best practice in 1995 and its rate of MFP growth has exceeded that in the U.S. industry by at least two percent a year since then. There are question-marks around the validity of the U.S. construction productivity data but, regardless, the Australian industry looks very good indeed by comparison.

Figure IV.4 Industry Multifactor Productivity Growth, Australia and the United States. Agriculture, mining, manufacturing, utilities and construction



Source: Calculations based on Bureau of Labor Statistics Multifactor Productivity tables and Australian Bureau of Statistics (Estimates of Industry Multifactor Productivity, 2014-15, Cat. No. 5260.0.55.002)

Figure IV.5 below adds six additional industry comparisons. Strong productivity growth in wholesale and retail trade was an important driver of the surge of productivity in the United States in the 1990s and Australia shared in that strong performance. This period in the U.S. market is often described as the "Wal-Mart effect" because this big-box retailer expanded its operations nationwide in the 90s and drove a relentless competition that forced other retailers to step up their own performance or else exit the industry. For the entire period the growth rate in Australia was very close to the U.S. rate for the retail portion, which is the larger part of the two. For wholesale trade the growth in Australia was modestly slower but was catching up in the last decade. In comments on this paper, the Australian Productivity Commission has pointed to several studies they have done that suggest zoning restrictions have been an impediment to improved retail and wholesale productivity. That suggests that while this large sector fares well in growth comparisons with the United States, it still has the potential to do even better. Going forward, traditional retailing in both countries will be under competitive pressure from online stores. Accommodation and food services are also land intensive, and growth in Australia 1989-2014 was almost an exact match of the U.S. performance.

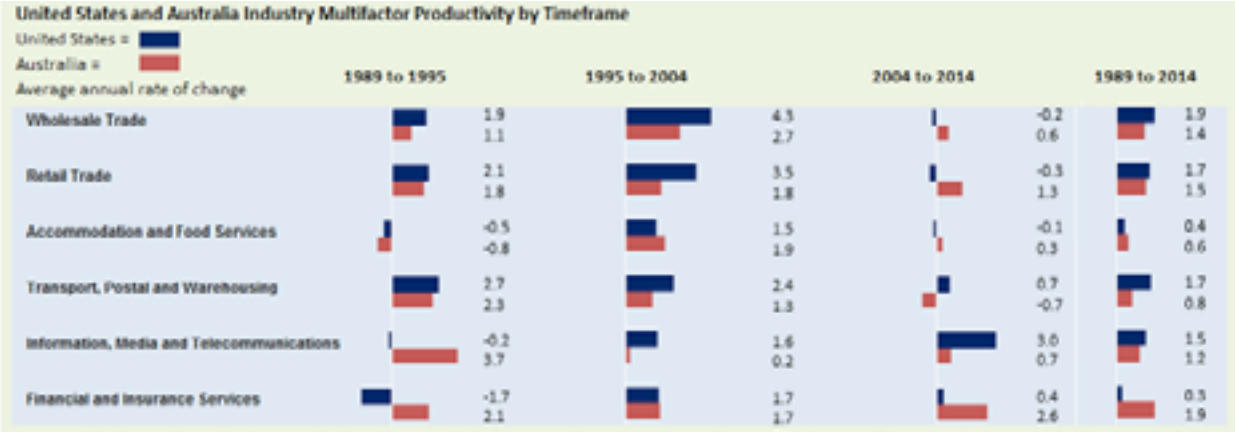
The information, media and telecom industries in Australia looks to be a potential area of concern. Growth was very strong 1989-95 but since then it has largely disappeared. The introduction of competition to the telecom sector likely contributed to the strong growth but the productivity boosts from privatization seem to have faded. This sector is a mix of different activities but all of them should have faced strong productivity opportunities because they are users of information and communications technology. This sector is one where there may be problems worth pursuing.

The finance and insurance industries in the two countries saw roughly parallel performances 1995-04 but have recently diverged with Australia showing strong growth. In addition, the Australian sector did not go through the period of negative growth 1989-95. That period of weakness in the U.S. industry occurred at a time of consolidation following the easing of restrictions in interstate banking. It is impressive that Australia's financial services industry has done so well along the productivity growth dimension while also avoiding the financial crisis.[38]

In studies that this author participated in before the financial crisis as part of the work of the McKinsey Global Institute, we found that banking industries where there was a strong competitive pressure as banks struggled for market share were more efficient in their operations. However, it was usually the case that the practices of central banks and bank regulators made a big difference. Holland was much quicker than the United States in adopting electronic funds transfers and reducing the number of checks written and processed. And of course the aggressive competition among the U.S. banks contributed to the financial crisis and the global recession, while the less competitive banking industries such as Canada and Australia avoided these problems. Given the balance of risks and rewards it may make sense to preserve the Australian status quo, even if competitive pressure is not the highest. The next challenge for this industry is coming in the form of fintech, or financial technology, that threatens to undermine traditional bank business models the same way Uber has undermined the taxi industry.

38 Finance has actually had quite low MFP growth (and declined 98-99 to 2007-08). The rest of finance and insurance, including superannuation, appears to have fluctuated with very high growth then very large growth decline so overall the aggregate stats look fairly stable. See a discussion in http://www.pc.gov.au/research/supporting/productivity-financial-insurance-services

Figure IV.5 Industry Multifactor Productivity Growth, Australia and the United States. Wholesale and retail trade, accommodation and food services, transport, postal and warehousing, information media and telecom, and financial and insurance services



Source: Calculations based on Bureau of Labor Statistics Multifactor Productivity tables and Australian Bureau of Statistics (Estimates of Industry Multifactor Productivity, 2014-15, Cat. No. 5260.0.55.002)

The third in this series is Figure IV.5, covering rental and real estate, professional services, administrative services, arts and recreation and other services. These are all important parts of the economy but measurement problems make them difficult to assess. There are also definitional differences that undermine any comparisons. The "other services" category in the United States includes private education and health whereas these are excluded from the productivity data in Australia. For completeness sake we have included these "hard to measure" industries in the figure, but it is likely not worth pursuing the comparisons any further at this point.

Figure IV.6 Industry Multifactor Productivity Growth, Australia and the United States. Rental, hiring and real estate, professional services, administrative services, arts and recreation services, and other services

Source: Calculations based on Bureau of Labor Statistics Multifactor Productivity tables and Australian Bureau of Statistics (Estimates of Industry Multifactor Productivity, 2014-15, Cat. No. 5260.0.55.002)

Note: Due to data availability, some industries are not reported for the duration of the timeframe.

Conclusions from the Productivity Data

Sustainable growth in a country's standard of living depends upon growth in productivity. At the aggregate level, Australia has achieved good growth in labor productivity thanks to a substantial contribution from high levels of investment. Multifactor productivity growth captures the contribution of technological change and other improvement in business processes. In the aggregate, MFP growth in Australia has been zero since 2003.

In an important study of economic performance and productivity in manufacturing firms in Australia published in 2009, Roy Green, Dean of the Faculty of Business at the University of Technology in Sydney, found that management matters and the quality of management in Australia was mixed.[39] Larger firms scored well in management performance but smaller firms not as well. Multinationals outperformed domestic firms in management performance and publicly listed firms performed better than private and family firms. Some of the productivity weaknesses observed in the comparisons shown above likely reflect management weaknesses. This work suggests that improving the quality of managers with professional training and the diffusion of best practices could be helpful in improving productivity performance.

Strengthening productivity growth at the aggregate level depends primarily on improvements at the industry level. Changes in the mix of industries also have some impact. With an eye on policy decisions, there is an important question as to whether to focus on the industries with strong growth in the past, or to focus on problem areas, industries that have fallen behind global best practice where there could be opportunities to grow quickly by moving towards the frontier. The answer in both cases, of course, is that growth potential is the key factor. The answer may also depend upon the extent to which an industry produces tradeable goods and services. The best outcome for domestic service industries and construction, that are not traded, is use policies that encourage best practices in the home market. For tradeable goods and services, where there is little chance of achieving best practices domestically, then it is better to rely on imports.

Among the domestic industries, the data shown here suggest construction, wholesale and retail trade, financial services, and accommodation and food services are all demonstrating solid MFP growth. Utilities, transport, media and telecom, and rental and real estate are areas with performance problems. Among tradable industries, agriculture looks very strong. Mining is clearly globally competitive despite the recorded weakness in MFP. This is a "problem" industry from the perspective of its MFP performance, but one where the potential future growth of productivity is high as the industry moves from its development and investment stage to the production stage. Professional services are hard to measure[40] and so the apparent MFP weakness may or may not

39 Roy Green, *Management Matters in Australia: Just how productive are we?* Findings from the Australian Management Practices and Productivity global benchmarking study, November 2009.

40 No good methods have been developed so far to measure the diverse nature of the professional services sector, at least no methods that can be implemented at reasonable cost.

be a concern. The manufacturing sector has not experienced MFP growth and this is a matter of concern. This sector is a smaller part of the economy but can account for a surprisingly large portion of productivity growth for the whole economy, based on results from the United States.[41] At the same time, the earlier evidence from the trade and competitiveness discussion indicates this sector should have the potential to expand exports under a more favorable exchange rate valuation. Manufacturing is diverse and we would expect to see subindustries where Australia cannot be competitive globally because they are labor intensive. And there may be other examples where scale economies are significant, making it difficult for Australia to be competitive against established market leaders. We should not rule out the possibility that an Australian company might in the future establish first-mover advantages in a completely new product and then use exports to achieve scale economies, while production stays in Australia. Advanced manufacturing industries, carefully chosen, should represent the best prospects for future growth in this sector. The Industry Growth Centres initiative is designed to help companies find the right areas to develop.

Because data are organized by industry that is the lens we usually use to examine economic performance. Increasingly, however, it is more revealing to look at steps in the value chain of production. What happens within a factory is only a part of the total story and is often a part that receives a small fraction of the overall value created. Policy decisions will have to be made going well below the industry level data shown here, moving not only to subindustries but below that to segments of the value chain. This issue is re-visited in the next section.

41 See the discussion in "Why is Productivity Growth so Slow?" by Martin Neil Baily, Brookings, 2016.

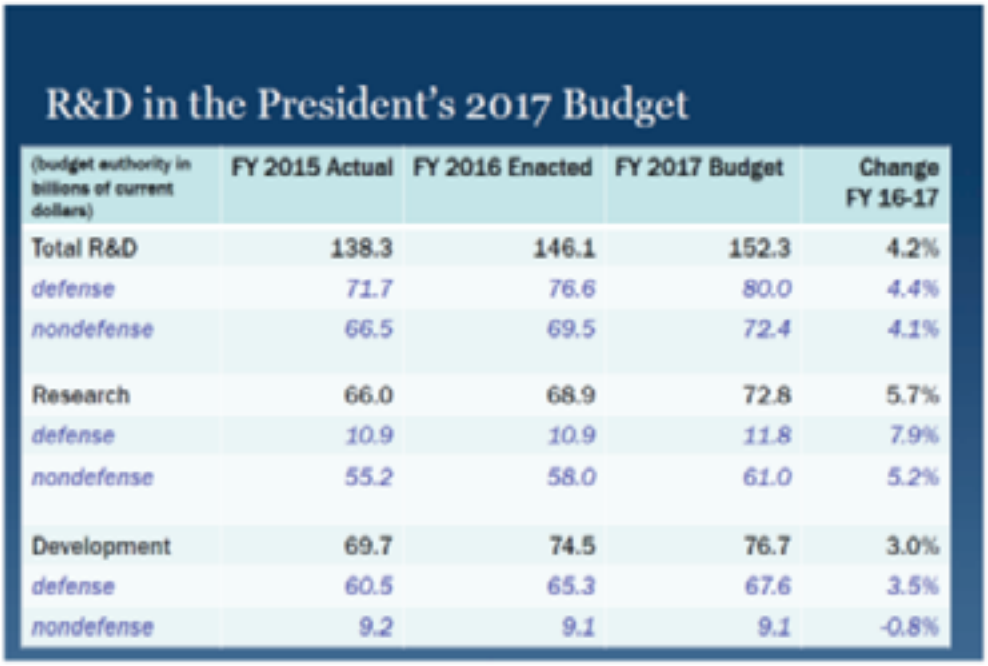
V. An Introduction to Innovation Policy in the United States

This section provides a short introduction to an important topic that will be examined in greater depth in the next paper to be written by this author for the DIIS. In this section I will look at the approach to innovation policy taken in the United States. Of course, there are limits to how far the lessons from the United States will be applicable. In Section VI, I will take a first cut at a review of the lessons for Australia based on sections III, IV and V.

The United States is still a leader in innovation and in the presentation he gave on April 6th-7th 2016 Rob Atkinson, the President of the Information Technology and Innovation Foundation, looked to understand why this was the case, given that by several indicators the United States was falling behind. Other countries invest a larger fraction of their GDP in university research than does the United States and it provides a smaller tax break for R&D than do many other countries. Atkinson cited some cultural factors he judged were important, such as willingness to take risks, but probably the most important advantage the U.S. economy has is the size of its economy and the first-mover advantages it achieved in the years after World War II. Atkinson pointed out that scale is very important in innovation-based industries where there are high fixed costs and low marginal costs. These conditions characterize the industries where the U.S. has been a consistent leader, such as information technology hardware and software. The pharmaceuticals industry is another example. Although the size of the U.S. economy remains an important advantage, it is not clear that this will be enough to ensure continued leadership in technology. The European Union economy is now significantly larger than is the U.S. economy.

Atkinson also stressed the importance of government funding, either funding R&D or alternatively the role of government as a customer for the products being developed. The United States also has an R&D tax credit that helps support business R&D, although it is not especially generous relative to other countries. In terms of funding R&D, Figure V.1 U.S. R&D Current Spending below gives a breakdown of direct U.S. Federal government support.

Figure V.1 U.S. R&D Current Spending



R&D in the President's 2017 Budget

(budget authority in billions of current dollars)	FY 2015 Actual	FY 2016 Enacted	FY 2017 Budget	Change FY 16-17
Total R&D	138.3	146.1	152.3	4.2%
defense	*71.7*	*76.6*	*80.0*	*4.4%*
nondefense	*66.5*	*69.5*	*72.4*	*4.1%*
Research	66.0	68.9	72.8	5.7%
defense	*10.9*	*10.9*	*11.8*	*7.9%*
nondefense	*55.2*	*58.0*	*61.0*	*5.2%*
Development	69.7	74.5	76.7	3.0%
defense	*60.5*	*65.3*	*67.6*	*3.5%*
nondefense	*9.2*	*9.1*	*9.1*	*-0.8%*

Source: "The 2017 Budget: Investing in American Innovation" by John P. Holdren, White House Presentation

The total amount allocated for fiscal year 2016 is large at $146.1 billion split roughly 50-50 between defense and non-defense. The defense part is very heavily geared towards development, going into weapons development. The Defense Advanced Research Projects Agency (DARPA) is the research arm of the Department of Defense and it has been famous for the innovations it has helped develop, including the Internet. Its budget is relatively small at $2.9 billion in fiscal year 2015, rising to $3.0 billion in 2016. The non-defense R&D budget is heavily skewed towards research with fiscal year 2016 spending of $58.0 billion.

Figure V.2 R&D Spending by Government Agency

Government Agency	Funding (in $billions)
National Science Foundation (NSF)	8.0
Department of Energy (DOE Office of Science	5.7
National Institute of Standards and Technology (NIST) Laboratories	.826
NASA	19
NIH	33.1
USDA Agriculture and Food Research Initiative	.700
NOAA	6

Source: "The 2017 Budget: Investing in American Innovation" by John P. Holdren, White House Presentation.

Figure V.2 gives the breakdown of the non-defense R&D spending by agency/type of R&D. By

far the largest portion of the spending is allocated to the National Institutes of Health (NIH) and opinions differ as to the effectiveness of this spending. It is popular among legislators. $8.0 billion is allocated to the National Science Foundation for pure research, much of it performed in universities, and the Department of Energy Office of Science is allocated $5.7 billion.[42] As well as direct R&D funding, government can play an important role through its procurement. Historically, the Department of Defense was the most important driver of new technologies, particularly in the early days of the computer and semiconductor industry. Fairchild Semiconductor was a pioneer in integrated circuits the majority of which were sold to the defense industry. Whether or not defense procurement is still important for developments in the high tech industry is a matter of debate. Today, the primary market for the equipment is coming from business and consumers and defense contractors are often buying off the shelf products. The U.S. government is still playing a role in the development of frontier technologies such as artificial intelligence, nanotechnology, the internet of things and biotechnology, but the private sector is stepping into these areas and leading the effort.

The Small Business Innovation Research (SBIR) Program

In the SBIR program, U.S. government agencies are required to allocate 2.8 percent of their R&D budget to small businesses and eleven federal agencies participate in the program. Each agency takes an active role in calling for R&D in areas of concern to them. Any small business (one to 500 employees) can then bid to undertake projects against those solicitations. The U.S. Department of Agriculture, for example, issues solicitations once a year, receives about 500 applications for "Phase 1" projects (those up to US$100,000 over up to eight months) and funds about 15 to 20 percent of them. If a project is a success at Phase 1, they can apply for a Phase II award, which can be up to US$500,000 over two years. Some departments have further, larger Phase III stages, although the USDA does not. For the Department of Defense 2.8 percent of its externally-funded R&D budget is a large sum and will be hard for the agency to fulfill especially given the extreme complexity of military procurement procedures. The Department is looking at ways to joint venture with small companies. Some SBIR projects are longer term and involve significant scientific challenges. The U.S. Navy uses about 1.4 billion tons of fuel annually and they contract for fuel through 2040, so they are having to budget for climate change.

The SBIR program is designed to take advantage of the role of the federal government as a large customer, one that is looking for new technologies. This is the "demand pull" effect on innovation. There is also "technology push", where small companies offer new technologies that agencies can use. The SBIR program has also worked to bring companies together to pool their respective skills. For example, innovative new pharmaceuticals are often developed by small companies but these lack the scale and resources to carry out clinical trials or bring new drugs to market and so they partner with the large pharma companies.

42 The largest project ever funded by the National Science Foundation is the Laser Interferometer Gravitational-Wave Observatory (LIGO), a large-scale physics experiment and observatory to detect cosmic gravitational waves and to develop gravitational-wave observations as an astronomical tool. The project started in 2002 but no waves had been detected by 2010. The Advanced LIGO project started in 2015 in collaboration with facilities in the UK, Germany, and Australia and waves were detected in 2016. The project illustrates the value of cooperation among countries for large-scale projects of this kind.

Although Australia's procurement policies are on a much different scale than those of U.S. agencies, the same ideas could be used in Australia. Having a customer that is interested in buying the new product or service once it has been developed is one of the best incentives for R&D.

University Industry Collaboration

The successful technology clusters in the United States have been built in part through connections with university research. Silicon Valley famously draws on Stanford and the University of California at Berkeley. The Route 128 complex of companies includes many that were founded by professors from MIT and Harvard. Research Triangle is proximate to Duke, the University of North Carolina, Chapel Hill and North Carolina State. What factors have resulted in these successful collaborations?

Robert Litan argues that the formalization of university-industry collaboration has in many cases actually impeded the process of technology transfer. The key legislation in the United States was the Bayh-Dole Act of 1980 that made it clear that universities could commercialize ideas that grew out of research that had been funded by the federal government. By that time, however, the most successful technology clusters were already going strong, having been developed informally by professors looking to develop the commercial implications of their work and also by companies seeking out research findings to enhance their technologies and hiring graduating students in with expertise they were looking for. The culture of American universities had been more oriented towards making money and the professors and graduating students have taken advantage of the availability of Angel Investors and Venture Capital to start and expand companies.

Litan argues that the Bayh-Dole Act encouraged university administrations to formalize the process and set up technology transfer offices or TTOs as part of the central administration of the university. In practice most TTOs actually impede technology development because professors are required to submit applications to the TTO and are then held up waiting for approval from an organization that does not understand the technology. There are exceptions to this pattern, University of Wisconsin system, MIT and Stanford, but they are the minority. The University of North Carolina has created a standard license where the university gets a fixed percentage of the revenue from the innovation and this has worked well.

Litan's work provides a clear warning that well-meaning efforts to encourage technology transfer between universities and businesses can backfire if the result is to create new red tape and new bureaucracies. A technology transfer office can see its mission as controlling the process even though the staffs have no understanding of the technologies in question. Simple rules and simple licensing arrangements are needed.

Litan's presentation is valuable and points to real concerns, but it is too critical of university TTOs in U.S. universities.. They have for some time aggressively sought out commercial opportunities and partnered with business to exploit their research. There is an important pointer from his work for

Australia. The risks of bureaucratizing research and its commercialization would seem applicable to universities with more modest endowments and research profiles, including Australian universities. See also the discussion in the next section that looks at the findings of the Watt review in Australia.

University Industry Collaboration: Success Examples. A new take on industry university collaboration has been researched by Antoine van Agtmael and Fred Bakker.[43] Both were born in Holland, but van Agtmael moved to the United States and founded an investment company while Bakker was a leading business journalist in Holland. They argue there is a new model of collaboration that has been driven by the decline of traditional industries. Akron was the center of the tire industry in America for generations but the companies closed their manufacturing facilities, leaving the city economically depressed. Eindhoven in Holland was the site of Philips production of light bulbs but the factory was closed down leaving that city depressed. In both of these examples, and in others like them, universities played a vital role as *connectors*, linking companies with university research and encouraging research collaborations. The President of the University of Akron was able to attract so many new companies in the area of polymers that their employment is now higher than the employment in the tire factories that departed. Eindhoven has become a center for chip research and development while Albany New York has become a center for nanotechnology.

The authors identify key success factors for the revived economic growth of these formerly depressed cities.

- There is a strong leader with the vision to build the collaborations needed for the technology center.
- Companies are able to collaborate within the framework of a university research environment and avoid problems arising from anti-trust restrictions.
- Research professors work side by side with industry personnel which allows the academics to see the market needs and possibilities and allows the companies to see how the research can benefit them.
- The leader is able to identify a core competency for both the university and the companies. The research effort is not spread too thin.
- An open style of research fosters both collaboration and competition.

The study by Agtmael and Bakker suffers from the difficulty that we do not see the attempts that have been made to achieve this kind of success that have not succeeded. There is no control group in their research. And it is always tricky to extrapolate from specific examples to a plan for a whole country. Nevertheless, it is powerful to see the examples they find and they are building off prior research by Michael Porter and others who have highlighted the importance of clusters. The argument that such clusters need a connector makes intrinsic sense.

43 Antoine van Agtmael and Fred Bakker, The Smartest Places on Earth: Why Rustbelts are the Emerging Hotspots of Global Innovation, Public Affairs, Perseus Brook Group, New York, 2016

One of the key questions raised by this research it whether or not it can be influenced by government policy. I think the potential is there for this to happen. In the case of Akron, it was the President of the University that was the facilitator of the process, but there is no reason that one of the industry centres in Australia could not take on this role. And perhaps the government funding can be used to provide basic startup infrastructure, such as internet links, office and lab space. It is also important to success in such ventures that city planning play a role to make movement of people easy and the area an attractive place to work and live (not characteristics of Akron or Eindhoven when they started their transformations).

VI. Competitiveness, Productivity and Innovation: Matching Up with Policy

This paper has provided some evidence and discussion on the issues of competitiveness, productivity and innovation. These represent primarily lessons drawn from this author's experience working on these issues in the United States, although comparison data has been introduced for Australia for the first two elements and some policy implications drawn out. In this section, I will try to push forward the policy implications for Australia, working at a more disaggregated or industry level. This section will draw on the work done by Australian experts.

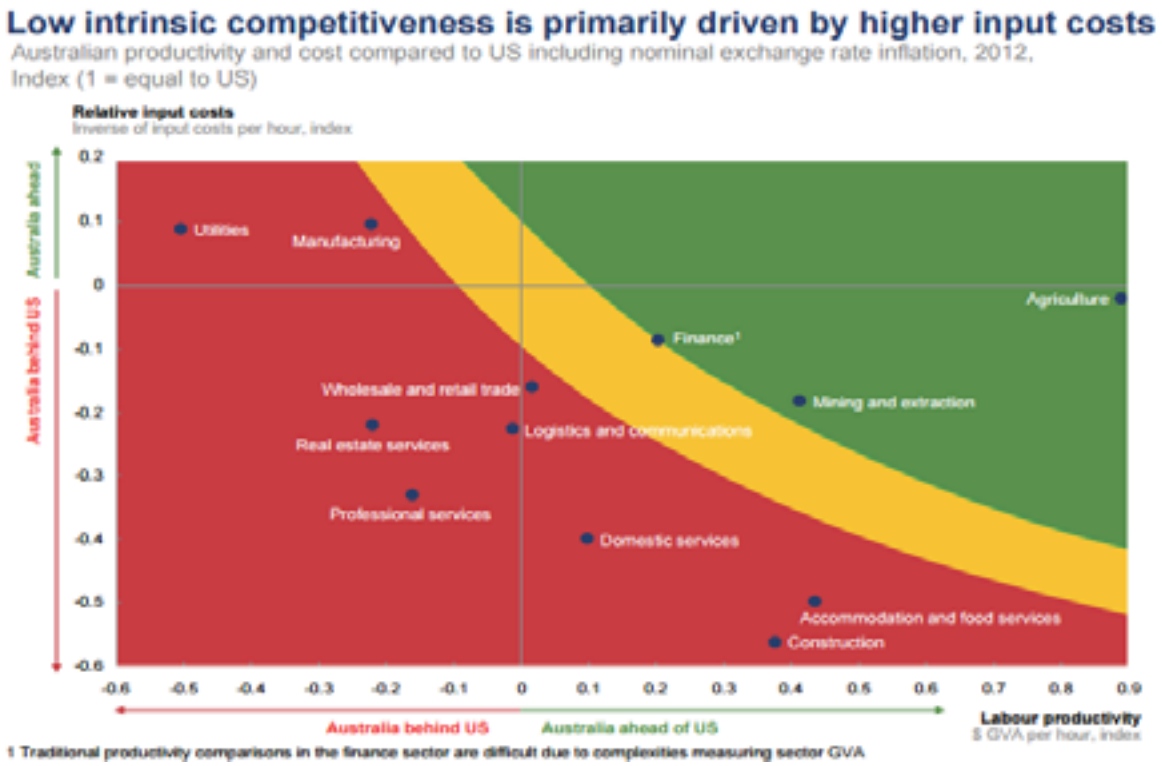
Criteria for Industry Classification

Figure VI.1 below shows a mapping of 12 private sectors of the Australian economy along the dimensions of productivity and trade competitiveness, based on data from 2012, including the exchange rate prevailing in that year. The figure mapped each sector's productivity (output per hour) relative to the United States along the horizontal axis and its input costs (evaluated at the exchange rate) on the horizontal axis. The higher is the relative productivity of a sector the more competitive it is. The lower are its input costs, the more competitive it is. A sector that is very high along the productivity dimension can still be competitive even if its input costs are high. The three sectors in the green segment; mining, agriculture and finance all had trade surpluses. The remainder had trade deficits or were not traded (domestic services, for example). The chart indicates that six sector had higher labor productivity in Australia than in the United States; two were about the same; and four sectors had lower labor productivity.[44]

This figure was prepared by McKinsey Australia and their report argued that only the three sectors in the green had what they called intrinsic competitiveness. Others were domestic industries such as construction, utilities, real estate services, accommodation, real estate and domestic services that are not tradeable. Manufacturing is the largest tradeable sector where productivity is below the U.S. level, but logistics may also be tradeable.

44 This study used the exchange rate to compare output by industry in the two countries which can give rise to volatility in the relative productivity calculations if the exchange rate moves up or down.

Figure VI.1 A Mapping of the Productivity and Competitiveness of Australian Sectors



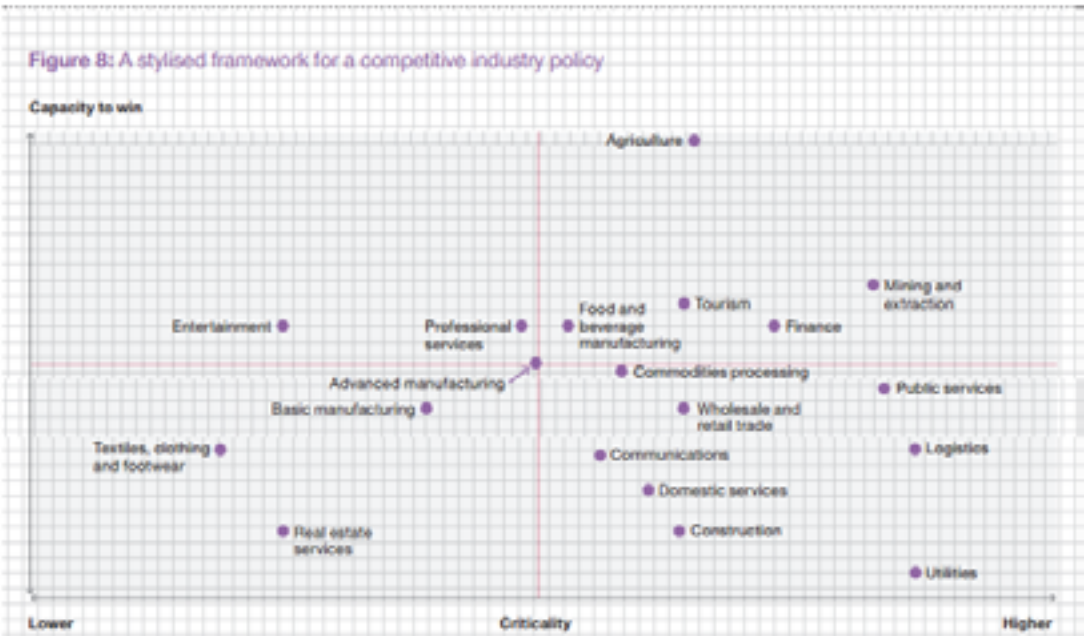
Source: "Compete to Prosper: Improving Australia's Global Competitiveness," by John Lydon, David Dyer, and Chris Bradley, Mckinsey Australia, July 2014, pg. 14. http://www.mckinsey.com/global-locations/pacific/australia/en/latest-thinking/compete-to-prosper

McKinsey also looked at additional characteristics of industries to try and assess where they fell in terms of potential for growth and competitiveness and on this basis they divided the economy into five groupings: Advantaged performers (agriculture, mining, tourism, and education); Latent potentials (food manufacture, and niche markets in manufacturing); transitional industries (commodities processing, advanced manufacturing, basic manufacturing); enabling industries (finance, utilities, professional services, construction, logistics, and real estate services); and domestic core industries (wholesale and retail trade, communications, domestic services, and public services). For each of these groupings of industries, they then set out a diagnosis of what should be done. For advantaged performers, nurture ongoing competitiveness. For latent potentials, convert this potential to actual advantage. For transitional industries, adapt by transforming their business models. For enabling industries, improve performance to support competitiveness. For the domestic core industries, strive for global benchmark performance.

The Business Council of Australia collaborated with McKinsey on its study of Australian competitiveness but developed a perspective that is a bit different. They developed a mapping of industries along two dimensions: "capacity to win" and "criticality". Capacity to win measures whether "A sector has a high capacity to win if it is competitive or could be competitive, or will be exposed to

strong demand growth, and will be in a good position to meet this demand (i.e. it will not be undercut by more responsive suppliers in other countries)." Criticality measures whether "A sector is highly critical if it is too important to lose, usually because it is a major employer, or exporter, or provides a critical input into other sectors, and it encompasses risk to jobs, the economy and standards of living should it be severely disrupted in an unanticipated way." [45]

Figure VI.2 Business Council Framework for a Competitive Industrial Policy



Source: Business Council of Australia, Building Australia's Comparative Advantages, 2014.

Agriculture is already highly competitive and is also high on the ranging of criticality, being an important part of the economy and of exports. Textiles, clothing and footwear score low on capacity to win, since it would be hard and expensive to try and create a globally competitive industry based in Australia. Moreover, this is an industry that most advanced economies have delegated to developing economies. It is hard to think of situations where Australia would be unable to procure these products from the global economy on good terms.

This framework for industrial policy is extremely helpful, although it is described cautiously as stylized. If operationalized, it would allow the reader to position industries that can be considered for industrial policy assistance. Agriculture and mining are both very critical but are performing well without assistance from the government. They do not appear to need industrial policy. Real estate services are performing poorly according to this figure, but this industry is not critical, so that perhaps what is needed is a dose of deregulation or an effort to bring more competitive pressure into the industry. Professional services, food and beverages, commodities processing, and advanced manufacturing are all in the category of being on or above the line in terms of capacity to win and on

45 Business Council of Australia, Building Australia's Comparative Advantages, 2014, file accessed October 2016.

right of the line or close to it in terms of criticality. Clearly, to be made really useful, the figure would need to drill down to a deeper level of disaggregation in many of the industry categories. The next two sections report relevant research from Australia that helps inform how a more disaggregated picture may be created.

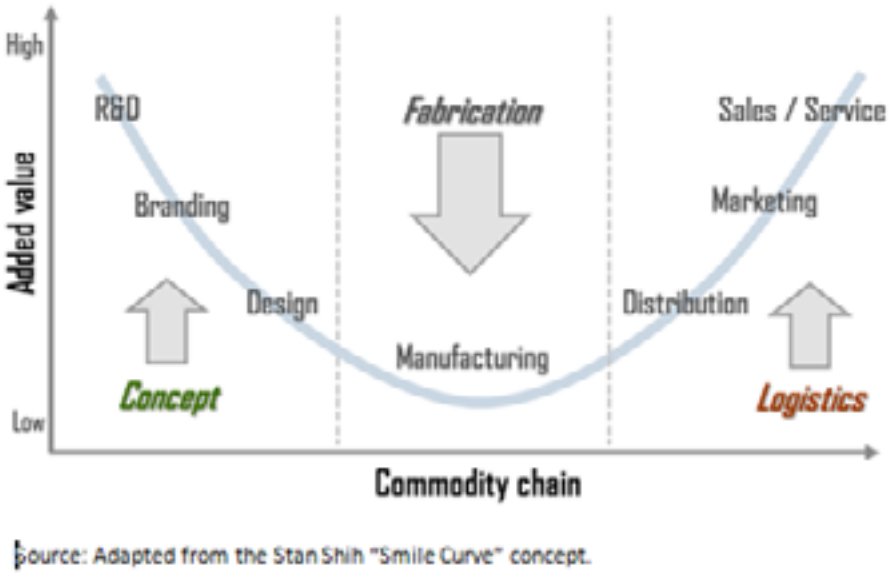
Breaking Up the Value Chain

In this section I have looked at efforts to classify industries in a way that can be helpful to constructive industry policy and this was followed by a very micro analysis that emphasized individual products and product groupings where technology played an important role and where policy was important, particularly for medical technologies.

An important dimension to industry policy is to understand the role that an industry or a product or service line is playing in the overall value chain. A good starting place to think about this issue is the so-called "smile" chart first proposed by Sam Shih, the former CEO of Acer industries, a computer maker based in Taiwan. Figure VI.3 shows the figure that illustrates the idea that some parts of the value chain have higher value added than others. In the example shown in the figure, the parts associated with the product concept (R&D, branding and design), have higher value than the manufacture. The logistics (distribution, marketing and sales and service) also have higher value added.

Shih's figure is prescient in that many companies decided to eliminate their role in the manufacture of their products, relying on contract manufacturers and assembly that is usually done in Asia. Apple became the most valuable company in the world by following this strategy, outsourcing components to many producers and assembly to Foxconn in China. Apple does product selection, design and R&D, mostly in Cupertino California and it retains control over the distribution and marketing of its products.

Figure VI.3 The Smile Chart, which links the different parts of the value chain to their contributions to value added.



Source: Adapted from the Stan Shih "Smile Curve" concept.

Shih recognized that his figure was illustrative and did not apply literally to all products. In some cases, the distribution and marketing margins are very small and generate little value added. If the product manufacture is complex, and requires unique technology and skills, then this part of the value chain can be highly profitable.

How does the disaggregation impact Australian trade? Given the relatively small size of the Australian market and the specialized skills that have been developed in technology markets, it makes sense that participation in global production networks will be an important part of Australia's comparative advantage. This is the argument made in the paper by Prema-chandra Athukorala, Tala Talgaswatta and Omer Majeed, who see such networks as Australia's competitive edge and a way to enhance manufacturing exports.[46] As they note, "Engaging in global production sharing is an effective way of linking domestic manufacturing to dynamic global industries of electronics, electrical goods, medical devices and transport equipment, which are the incubators of new technology and managerial skills" (op. cit. page 6). Participation in global production networks allows Australia to escape the "tyranny of distance" and specialize in products that have a high value to weight ratio.

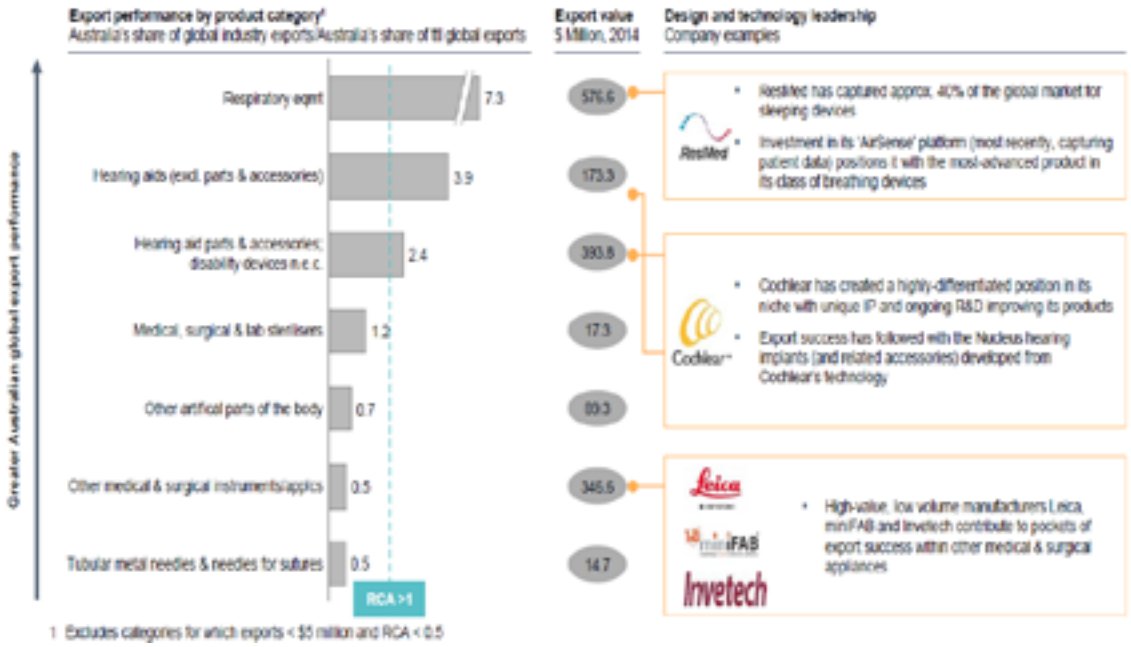
In a careful empirical analysis they examine the determinants of Australia's export trade and find that Australia has a competitive edge in parts and components for aircraft, earth moving equipment, mineral processing machines and specialized auto parts. For final production they find a competitive edge in medical equipment, light aircraft, measuring and scientific equipment and instruments for chemical analysis.

46 See Prema-chandra Athukorala, Tala Talgaswatta and Omer Majeed Global production sharing: exploring Australia's competitive edge, available at http://econpapers.repec.org/paper/paspapers/2016-05.htm

The Importance of Technology

Another potential way to categorize industries in order to determine how to allocate industry policies is to look at the technology dimension, which is complementary to the analysis just described above. Figure VI.4, taken from the presentation by Alpha-Beta Strategy and Economics, shows that having a technology advantage can be a key success factor in exporting from Australia. The figure shows seven product lines in the medical device area where Australia is an exporter. Starting at the bottom, Australia's share of global exports is fairly low and the technology is relatively simple, needles for medical use. Moving up the figure shows products where Australian export performance is stronger and where the technology dimension is greater, with hearing aids, such as cochlear implants and respiratory equipment at the top.

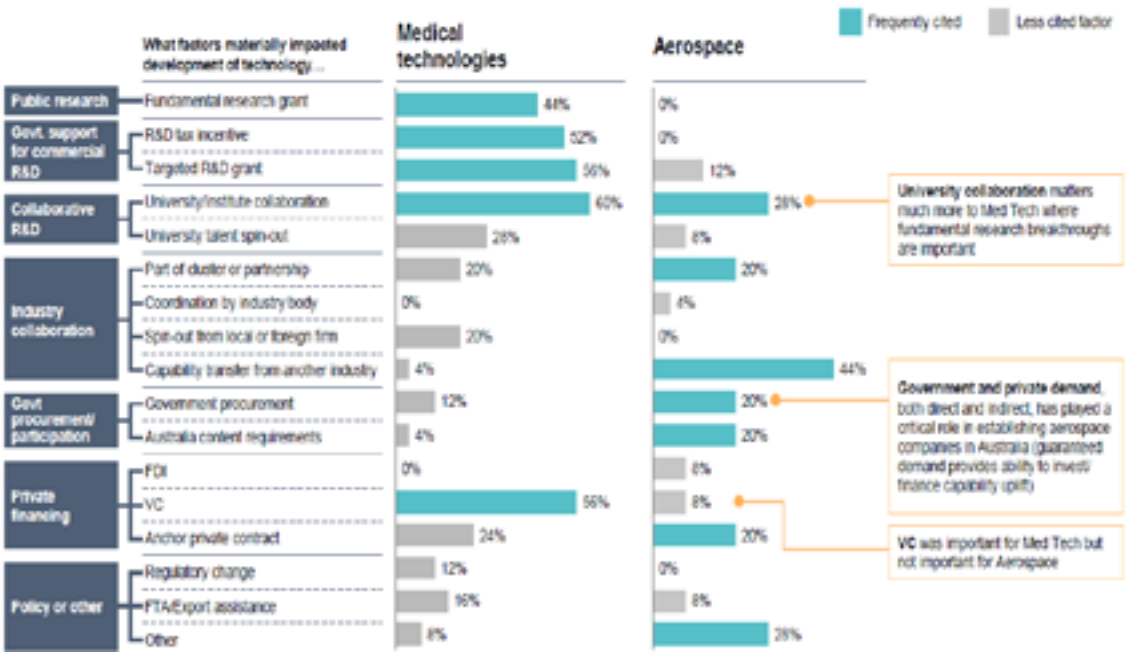
Figure VI.4 Having a Technology Edge Provides a Competitiveness Edge



Source: Alpha Beta Strategy and Economics, Presentation, 2016, UN Comtrade data 2014
Alpha Beta also looked at what factors determined whether a company had been able to develop a significant technology that allowed it to compete globally.

Figure VI.5 documents their assessment of what factors mattered in medical and aerospace technologies.

Figure VI.5 What Factors Matter for Technology Breakthroughs



Source: Alpha Beta and McKinsey, expert interviews, company websites and press search.

For medical technologies, research grants, R&D tax credits, and targeted R&D grants, were all very important. For aerospace, much less so, with only targeted R&D grants contributing. University industry collaborations were important for both sectors but much more so for medical technologies. For aerospace, being part of a cluster or partnership was important and also the transfer of capabilities from another industry, with this last being the most important factor listed for this technology. Government procurement and Australia content requirements were also important to aerospace technologies. In terms of funding, venture capital was very important to medical technologies while having an anchor private contract was more important in aerospace.

VII. Key Lessons from this Study and Directions for Future Research

Key Lessons

- Australian economic growth performance over the past ten years has been strong, far stronger than either the U.S. economy or that of the European Union, which are worried about the possibility of secular stagnation. Australia's growth since 2005 has exceeded that of the United States or Germany by a full percentage point.

- Investment in mining provided a major boost to growth and the resulting shift in Australia's terms of trade boosted incomes. As Australia seeks out new drivers of economic growth, these will come from two sources. First, from boosting productivity in domestic industries. Second, from seeking out the product segments or parts of the value chain where Australia can expand or create areas of sustained comparative advantage.

Good Industry Policy

- The case for industry policy in theory is based on overcoming externalities and information or coordination failures.

- Good industry policy in practice encourages and supports innovation and can help develop the companies of the future. Good industry policy avoids limits on competition.

- It may be desirable to help industries and communities transition away from the products where Australia has lost comparative advantage. Communities that have lost a plant that provided the lifeblood of the local economy can experience severe losses. Support for such communities should be directed primarily at helping the people of the community. Time limited assistance may be justified if allows the kind of restructuring that can re-establish a viable economic hub for the community. Endless government support for a firm or industry that never becomes profitable is not justified.

- In short, good industry policy helps markets work better and helps firms and workers achieve their economic potential.

Competitiveness

- Australia and the United States share a common issue - they have run large current account deficits for a number of years. It is not necessary to run a current account balance or surplus all the time. Net foreign borrowing can provide funding for profitable investments that enhance economic growth. Australia relied on foreign capital to fund the very large investments made

in mining and this made economic sense and contributed to the well-being of Australians. At the same time, persistent current account deficits mean that an economy is increasing its net indebtedness to the rest of the world. Financing government fiscal deficits and financing current consumption with foreign borrowing over extended periods is problematic. In addition, chronic current account and trade deficits undermine the employment and investment in the manufacturing sector of the economy.

- The Australian current account deficit is made up of a large manufacturing trade deficit, a very small services trade deficit, negative net income flows and a large trade surplus in non-manufactured goods, particularly commodities.

- While competitiveness is very hard to define and measure, this paper draws on work with Robert Lawrence and looks at structural competitiveness, based on trade performance after adjusting for exchange rates effects. It was found that Australia's rising trade deficit in non-commodity trade was exchange rate driven and was not the result of a loss of structural competitiveness. This result, perhaps surprising, is a positive sign that Australian manufacturing should be able to regain lost ground.

- Australia has seen its share of manufacturing jobs in total employment decline over time at about the same rate as the other advanced economies. Still, that employment share in 2010 was only 8.9 percent, the lowest share among developed countries. That compares with 21.2 percent for Germany, the highest share among developed countries.

- Despite data that, at times, point in different directions, it seems fair to conclude that Australia's manufacturing sector could benefit from good industry policy to help generate the firms and industries for the future. There may also be a need for additional efforts to train and educate the workforce needed for these future jobs, although this is outside the range of this paper.

Productivity

- Productivity is an economic measure that flies under the radar and is rarely featured in debates about economic policy, but it is of central importance. Productivity growth generates growth in wages and household incomes.

- Labor productivity is the simplest measure, output per hour worked. Most economists preferred productivity measure is multifactor productivity (MFP), which reflects improvements in technology, better business operations and higher value goods and services. MFP growth plus the contribution from capital deepening generate the growth in labor productivity.

- At the aggregate level, labor productivity growth has been strong, powering the strong GDP growth described earlier. This is turn has come from largely from the largescale investments in mining. MFP growth has been weak from 2003 through 2015 (with signs of improvement since 2011.

- At the industry level, MFP growth shows a mixed picture. Agriculture, construction, wholesale and retail trade and financial services all show favorable performance relative to the United States. Reported MFP growth in mining in Australia has been low reflecting the fact that huge rates of investment are taking time to mature. MFP growth in mining should strengthen going forward, although the industry over capitalized and this will take some time to work through. MFP growth in manufacturing in Australia has been slow, as is true for the U.S. industry except for high tech. Productivity in utilities in Australia has been problematic. To a degree this is because the decision was made to build in spare capacity, but there have also been reported management and policy problems. Other industry comparisons were reported in the paper but measurement problems make it hard to draw clear conclusions from these findings. On balance, *the two industry sectors that stand out in the productivity analysis as needing attention are manufacturing and utilities*. Improving manufacturing performance is needed to support efforts to increase competitiveness, while productivity in utilities is important both for consumers and for other businesses.

Innovation Policy in the United States

- The United States economy dominated in size in the years after World War II and its universities had attracted a galaxy of talented scientists fleeing wartime Europe. These advantages allowed the U.S. to take a lead in many emerging technologies, including those that offered first-mover advantages. Over time, the U.S. lead in technology has shrunk and there are many areas where advantage has been lost.

- One way the U.S. economy has maintained its advantages is through the large sums it spends on R&D, with military R&D being very large, as is the research funded through the National Institutes of Health. The Defense Advanced Research Projects Administration (DARPA) has been successful in developing technologies that have wide civilian application.

- The Small Business Innovation Research Program (SBIR) is a recent effort to allow small companies to benefit from government R&D budgets and to compete for procurement dollars. Agencies must allocate 2.8 percent of their R&D budgets to small companies and this has proven to be a vibrant program.

- University-industry collaboration has been hugely successful in some cases, notably in the development of Silicon Valley, the Route 128 complex in Boston, and the tech companies around Austin Texas and Research Triangle in North Carolina. In the first two of these cases the synergies grew up spontaneously as professors started companies, got their students involved and then created critical mass. Defense funding was very important also in the early days in both cases and still remains fairly important. Austin Texas and North Carolina benefitted from favorable policies, including making land and infrastructure available.

- Intriguing recent examples of university-industry collaborations have been documented in industrial cities that lost their primary employer but were able to develop new technology

hubs. Among the examples cited are Akron Ohio that lost the tire industry but created a hub for polymers, and Eindhoven in Holland that lost a large Phillips factory but created a hub for chip design. Among the key success factors identified were local leaders that were determined to revive their cities and sought out areas of competence based on the prior economic base of each city.

Applying the Lessons to Australia

- Work by McKinsey's Australia office and by the Business Council helped push forward the conceptual framework for thinking about industry policy. McKinsey divided the economy into five groupings: Advantaged Performers (agriculture, mining, tourism, and education; Latent potentials (food manufacture, and niche markets in manufacturing); transitional industries (commodities processing, advanced manufacturing, basic manufacturing); enabling industries (finance, utilities, professional services, construction, logistics and real estate services); and domestic core industries (wholesale and retail trade, communications, domestic services, and public services). They argue that, historically, industry policy has not focused enough on the industries with clear advantages or latent potential. The Business Council worked with McKinsey but also came up with their own industry perspective providing a framework for prioritizing policies based on an estimate of the criticality of the industry, along one dimension, and capacity to win, along a second dimension. Clearly these are subjective estimates, but based on the detailed industry analysis that McKinsey had carried out. Their framework seems particularly helpful as a way of thinking about industry policy and it would be worthwhile, in my judgment, to see if the DIIS is able to refine and disaggregate this analysis (including disaggregating the value chain as discussed in the next bullet point.

- One of the developments that has been important to global trade and that is percolating into the international trade literature is the idea of global production networks. International trade in components has been important for a number of years, but it is now being realized just how important is this trend. The Taiwanese businessman Sam Shih proposed the so–called smile chart where he suggested that in many industries the manufacturing process had become the low value-added part of the value chain, with higher value accruing to those carrying out the R&D and product design and those doing the marketing and distribution. Apple is an obvious example of this phenomenon, where Apple does the R&D and design and controls the distribution and marketing but outsources component manufacture and assembly to others. This production revolution is particularly important for Australia where its small size and geographic distance from many large markets makes it a natural candidate to look for segments of the value chain where it can achieve a competitive edge.

- Drawing on the recent presentation made by Alpha-Beta Economics, together with the work of economists from ANU, as well as Omer Majeed and Tala Talgaswatta of DIIS, we can see the areas of competitive advantage for Australia. Majeed and his colleagues identify parts and components for aircraft, earth moving equipment, mineral processing machines and

specialized auto parts. And for final production they identify medical equipment, light aircraft, measuring and scientific equipment and instruments for chemical analysis. Alpha-Beta stress the importance of technology to the determination of segments of the value chain where Australia can expand its exports and improve its trade position. They identify specialized medical devices and aerospace. They also identify the places where government policy has been important both as a funder of technology and in the procurement space.

Potential Directions for Future Research

- The analysis of innovation policy given here described some elements of how such policy is made in the United States but additional research is needed to explore how innovation policy is being applied in the Australia, and what is working and what is not.
- It would be helpful to develop further the frameworks to identify which industry segments are best suited for industry policy.
- In terms of tradable goods industries, it could be helpful to apply the trade proximity analysis that has been developed by Ricardo Haussmann at Harvard and that has been used by Brookings Fellow Dany Bahar.
- It would be worth exploring further the global production networks analysis to see if there are segments of the market that have not yet become clear focal points for Australian companies but that may have potential.
- This paper has not looked into the funding of R&D, the barriers to startups and the importance of venture capital and angel investors.
- What are the main barriers faced by small and medium sized companies that wish to expand?
- How well is the program for industry-university collaboration working?
- The work on innovation should be extended and should include additional material on diffusion of innovation and how Australia can best tap into global innovations.
- The work on innovation should take advantage of the recent studies that identify key advances in information technology and communications. How do companies bring digital technologies into their operations successfully? There is a conventional wisdom that managers in Australia are not innovative. Is this correct and what could be done to improve the situation.
- There are disruptive innovations like Airbnb and Uber that seem to be reducing investment levels by traditional industries but are not creating new investment and employment opportunities on the same scale, even though they clearly create value for customers.