COVER SHEET

Rachel Parker and Louise Tamashke

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Explaining regional departures from national patterns of industry specialisation: regional institutions, policies and state coordination

Rachel Parker and Louise Tamaschke[1]

Abstract

The aim of the paper is to identify the basis of regional competence in industry sectors that are not key performers at the national level. The paper examines the ICT sector in two regions: Dresden (Germany) and Adelaide (Australia). The performance of Australia and Germany in ICT is not high by OECD standards. However, both Dresden and Adelaide have some competence in parts of the ICT sector that departs from national patterns. In Dresden the development of the ICT sector is more advanced than in Adelaide. In both regions, there are distinctive institutional features and policies that explain the development of the ICT sector. Further, in Dresden, the state has coordinated the ICT sector within the regional space, giving focus to institutional strengths in research and training, such that it is possible to describe the institutional environment as thick and coherent. As such, the regional space of Dresden has experienced an agglomeration of ICT and can be regarded as more successful than Adelaide, where institutions and state initiatives are fragmented and incoherent.

Key words: innovation systems, regional transformation, regional policy, state capacity

The national innovation systems (NIS) and varieties of capitalism approaches have explained cross-national patterns of industry specialisation with reference to national institutions and norms. In seeking to explain why some nations succeed in industries in which others fail, the NIS approach has referred to the science base and national research, education and training facilities (Edquist and McKelvey 2000, Nelson 1992, Niosi et al 1993). The varieties of capitalism (VOC) approach has looked at the way in which different national institutions and norms, such as the system of labour or financial relations or tendency towards non-market coordination, affect the innovative behaviour of firms, suggesting that different types of firm behaviour are amenable to success in different types of industries (Hall and Soskice 2001, Whitley 2000: 871-873).

Recent work in this field has sought to explain sectoral departures from national patterns of industry specialisation – or why it is that some nations develop competence in industry sectors that are not supported by national institutional frameworks. Recently, Casper and Kettler (2001) have provided insights into the way in which public policies designed to compensate for deficiencies in the national institutional framework, such as insufficient sources of high risk capital, can interact with stable and core elements of the national institutional framework to result in a

[1] Rachel Parker teaches Governance in the School of Political Science and International Studies, University of Queensland. rachel.parker@uq.edu.au. Louise Tamaschke is a doctoral candidate in the School of Political Science and International Studies, University of Queensland. The Adelaide research was funded by ARC Discovery Project ID: DP0342624 and conducted by Rachel Parker with the research assistance of Chris Diamond in November, 2003. The Dresden interviews and data collection were undertaken by Louise Tamaschke in August 2004 as part of her doctoral research.

hybridisation of business models. As such, public policy intervention may be able to compensate for deficiencies in the national institutional framework, which would otherwise impede the development of particular industries.

While this recent work has explained sectoral departures from national institutional biases, further work is required to explain regional patterns of innovation. As with sectoral departures from national trends, regional pockets of competence in sectors in which the nation is not specialised might depend on institutions, policies and state coordination, albeit at a regional rather than sectoral level. The regional innovation systems (RIS) approach has suggested that localised learning processes based on interactions between spatially proximate institutions are an important foundation for innovation in knowledge sectors and as such a potential domain of policy intervention (Cooke et al 1997, Asheim and Isaksen 2003, Morgan 1997). Further, economic geographers have suggested that state involvement in economic activity has evolved away from hierarchical and control oriented structures towards more flexible, decentralised and informal processes of network governance at a regional/local level (Brenner 2004, Jessop 2002). These approaches are suggestive of the importance of local/regional explanations for regional departures from national patterns of industry specialisation.

The aim of the paper is to explain why some regions develop competence in industry sectors that are not key performers at the national level. The paper examines the development of the ICT sector in two regions – Dresden (Germany) and Adelaide (Australia). Neither Australia nor Germany perform particularly well in the ICT sector at a national level. However, both Dresden and Adelaide have developed some competence in parts of the ICT sector that depart from national patterns. In Dresden the development of the ICT sector is more advanced than in Adelaide. In both regions, it is possible to explain the development of the ICT sector with reference to regionally specific institutions and policies. Further, in Dresden, state led coordination of the ICT sector has provided an ICT focus to regional institutions resulting in institutional thickness within the regional space and an agglomeration of ICT activity. Amongst other things, the state has been able to mobilise the strengths of the German environment in skills development and research to facilitate the growth of ICT. As such Dresden has been comparatively more successful in ICT than has Adelaide, where institutions and state initiatives are fragmented and incoherent.

The paper describes the role of regional institutions and policies in explaining regional patterns of industry performance and the role of the state as a key institution that can structure economic organisation, build on existing institutional strengths and overcome deficiencies in current competences to facilitate the coherent and focused development of particular patterns of industry specialisation at a regional level.

The spatial dimension of an innovation system

An underlying assumption of the varieties of capitalism and national innovation systems approaches is that many of the institutions that are important for innovation are national in origin (Nelson 1992). The emphasis on national institutions and technological trajectories in the VOC and NIS approaches has been criticised because of the dual trends of globalisation and localisation of economic activity. In contrast to the NIS approach, the concept of a Regional Innovation System (RIS) suggests that spatial proximity of diverse regional actors and the presence of regionally embedded

assets facilitate the generation and use of knowledge for innovation (Koschatsky 2003, Cooke et al 1997, Morgan 1997). The close face-to-face interactions arising from spatial proximity within a RIS are thought to be particularly important for the transfer of tacit knowledge, which is not easily translated into an explicit form that can be transferred across distant spaces, rendering the region an important unit for the analysis of innovation. This approach emphasises the 'soft institutional infrastructure' of collective learning involving communication and interpersonal linkages between firms and institutions in a regional context (Asheim and Isaksen 2003: 36-37) or what Storper (1997: 35) has referred to as 'untraded interdependencies'.

The RIS literature acknowledges that RISs might not exist where there is an absence of institutional thickness at a regional level or where there is limited collaboration between regional actors (Asheim and Isaksen 2003: 42). Institutional thickness implies the existence of a plethora of linkages between regionally embedded institutions and organisations such as lead firms, SMEs, universities, research bodies, industry associations, labour unions and municipal governments who have acquired a common agenda for regional economic development (Amin and Thrift 1994). Institutional thickness exists when a variety of organisations and institutions provide a dense network of support for local firms and facilitate collective learning through the exchange of technological and organisational competence within regional spaces. Institutional thickness involves a plethora of organisations that constitute an integrated and supportive web and which have a strategic orientation towards the promotion of innovation, technological support, learning and industrial transformation through the provision of business services, building and infrastructure and promotional activities (Morgan 1997). The Cambridge region is a well-documented example of regional institutional thickness in which SMEs have received supportive local and business services from a broad range of institutions including Cambridge University, the Training and Enterprise Council (a government funded body providing skills training), science parks and incubators and the Chamber of Commerce (Keeble, Lawson, Moore, Wilkinson 1999). A similar conceptualisation of regional economic governance is Cooke and Morgan's (1998) idea of the 'associational economy', which emphasises the importance of inclusiveness and collaboration as the basis of regional economic competitiveness.

In cases where we can talk meaningfully of a RIS, in the sense that regional institutions and patterns of interaction can be regarded as strong, distinctive and coherent, it might well be that industrial specialisation and innovation activities within the region depart from those at the national level. As such, the first objective of the paper is to understand the way in which the regional innovation system and local learning processes are distinctive from national institutional frameworks, mapping out regional patterns of industry specialisation that depart from national patterns.

The state and the spatial dimension of the innovation system

Prior research has indicated that the system of economic governance within a nation associated with state infrastructure or publicly funded institutional arrangements has an impact on technology development and innovative activity. The state has the capacity to direct resources to particular purposes through public research institutions and funding of the science base. The state can also impact on the time-horizon adopted in economic decision making for example, through the provision of public goods such as research or training of sufficient quality to overcome market

deficiencies arising from positive externalities and the risk and uncertainty of returns on investment (Traxler and Unger 1994: 7). Further, the state is an important user of technology and establishes the regulatory environment within which innovation occurs (Lundvall 1992: 14).

The image of the promotional state is of an encompassing organisational complex that can influence the degree of co-operation between individual producers and consolidate disparate interests towards common goals associated with industrial transformation, technological development and innovation (Evans 1995, Weiss 1998). The concept of transformative state capacity draws attention to the interdependence of the state and industry in the development of goals for industrial development and change (Weiss 1998). A key characteristic of state capacity is the existence of policy linkages between the bureaucracy and industry, which are able to coordinate the investment decisions of industry. The state provides an inclusive structural framework that is able to organize industry around long term objectives and socialize the high risk associated with the development and diffusion of new technologies and production processes (Weiss 1998: 6). The coordinating role for the state is thought to facilitate the transfer of knowledge and the socialization of risk and uncertainty, thereby facilitating innovation. According to O'Riain (2000), the notion of the flexible developmental state captures the changed role of the state in relation to the governance of knowledge activities, in which the state attracts FDI to fill gaps in national competences. The flexible developmental state then integrates MNCs with flexible post-fordist production networks amongst local industry, which the state has itself promoted and encouraged to develop.

Given the importance of the state to economic coordination, the spatial dimension of state activity may influence whether regional innovation systems constitute explanations for patterns of industrial specialisation and innovation at a regional level. There have been various predictions that political and economic activities at a local or regional level have or will surpass the national level because they provide the ideal space for a model of decentralised post-fordist economic governance (Scott 1998; Morgan 1997; Storper 1997). Existing understandings of the state and industrial transformation only partially incorporate spatial considerations. Despite the increased emphasis on regional economic governance, there remains an under-theorisation of the role of the state at a local level and in the context of global economic change and the emergence of new technologies. As MacLeod (2001: 806) explains, 'much New Regionalist research has either disregarded the changing role of the state or implied that, amid the current round of globalization-regionalization, it is inevitably in terminal decline'. This is especially the case because the 'soft institutional infrastructure' of regions which is comprised of networks, interactions and interdependencies between a variety of institutions (Amin and Thrift 1994) does not seem to be easily developed or stimulated through political intervention.

Economic geographers have described the decline of national developmentalism which linked state space to the nation and involved centralised control of local institutions and economic development trajectories. Instead, a strategy of urban entrepreneurialism in which local spaces became important sites for local economic development initiatives and competitive local inter-state rivalries, has been favoured (Brenner 2004, p. 463). In this context, we might expect initiatives to develop clusters of competence in a regional context to be important in explaining regional patterns of industry specialisation. There has been much discussion of the various policies that might be used to stimulate the development of knowledge-intensive

industrial agglomerations including investments in education and research, attraction of FDI, provision of grants, facilitation of network formation, establishment of science parks and venture capital support (O'Gorman and Kautonen 2004: 464). There is, however, a great deal of suspicion towards policies that are not context specific and fail to take account of the institutional and path dependent features of successful regional economies. Rather than focusing on individual policy initiatives in isolation from their context, it is necessary to explore the system of state support and the way in which it interacts with the broader institutional framework and spatially specific resources. In particular, the state may play a role in facilitating the development of regional institutions and patterns of interaction that can be regarded as strong, distinctive and coherent such that the RIS provides an explanation for regional patterns of industry development. As McLeod (2001: 815) explains, 'the various properties of the state are fully implicated in the very formation and regulation of regional conventions and in establishing a regional institutional thickness'.

Existing research has indicated that the capacity of the state to coordinate industrial development and transformation varies cross-nationally and is generally regarded as weaker in Anglo-Saxon countries (Weiss 1998). We might also expect variation in the strength and importance of different regional state spaces. As such, the capacity of the state to coordinate and focus the institutional infrastructure of regions might vary across regional spaces. The second objective of the paper is to determine whether regions depart most strongly from national industry patterns in cases where there is a strong capacity for the state to govern and coordinate economic activities and institutions at a regional level such that they can be described as thick and coherent. In so doing, it is necessary to explore the way in which state policies interact with regionally specific resources and institutions to foster the development of a regional innovation system.

The cases

The empirical analysis focuses on the ICT sector in two regions, Adelaide and Dresden. There are several reasons for the case selection. First, each region has developed competence in ICT that exceeds that of the nation as a whole. Neither country can be regarded as a strong performer in ICT. However, the regions of both Adelaide and Dresden have developed strengths in parts of the ICT sector. As such, the case selection facilitates an analysis of regional explanations for departures from national patterns of industry specialisation. Second, although each region is a strong performer within its national context, the extent of development of the ICT sector in Dresden far exceeds that in Adelaide and as such Dresden can be regarded as departing from national patterns of performance in ICT to a greater extent than Adelaide. The choice of these two regions therefore satisfies a further analytical objective of the paper, to explain the *extent* of regions development of specialisation in industry sectors not favoured by the NIS.

National institutional framework and performance in ICT

The industrial dynamics of the ICT sector are such that certain types of institutions are particularly important in explaining competitiveness in ICT. The institutional basis of competitiveness in the various sub-sectors of ICT can be understood with reference to key characteristics of technological regimes. Casper and Whitley (2004:.91-95) explain that appropriability and competence destruction risks are the two major technological and market risks faced by firms in new industry sectors.

Appropriability risks are associated with the potential for competitors to imitate innovations. Competence destruction risks are highest in industry sub-sectors characterised by low technological cumulativeness. They arise from uncertainty regarding the types of skills and technological competences required for knowledge advancement. Elsewhere, cumulativeness and appropriability have been identified as elements of a technological regime, encompassing the fundamental properties of a technology (Malerba and Orsenigo 2000: 301-303).

Firms operating in industry sectors characterised by high appropriability risks utilise strategies such as patenting, secrecy or customisation in order to protect innovations from imitation (Malerba and Orsenigo 2000: 302). Within the ICT sector, enterprise software is an example of a sub-sector with high appropriability risks. The capacity to develop tacit and firm specific knowledge amongst skilled employees is a critical firm strategy in these sub-sectors. Certain institutional characteristics of CMEs, including high levels of management-employee commitment, legal constraints on hiring and firing and traditions of employee participation in decision making, formalised in countries such as Germany through codetermination arrangements, encourage firm strategies which are the basis for competitiveness in ICT sub-sectors characterised by high appropriability (Casper and Whitely 2004).

In contrast, in sub-sectors characterised by high risks of competence destruction, or low technological cumulativeness (Malerba and Orsenigo 2000: 302), firms are required to change direction rapidly in response to changing technological trajectories and therefore require flexibility in their resource base. This might require human resource strategies that offer high rewards as compensation for the high risk of failure and job loss. Within the ICT sector, application-based software, (including CAD/CAM, network software), games software and secure payment systems are examples of ICT sub-sectors of this type (Casper and Whitley 2004, pp. 92). The institutional characteristics of LMEs, with their emphasis on labour flexibility and arms length market relations, allow for the rapid changes in firm strategy which are required in technological regimes with high risks of competence destruction.

Given the nature of the ICT industry, we would not expect the German collaborative business system (Whitley 2000) to be suitable for the development of competence in radically innovative sub-sectors of ICT characterised by high competence destruction risks. While Germany's NIS is not generally supportive of radically innovative industries, the well developed skill base may be helpful to the development of parts of ICT characterised by high appropriability risks, in which technologies are relatively cumulative and therefore depend on a high skilled workforce (Culpepper 1999). This might be the case with semiconductor manufacturing which is the highest value-added component of ICT manufacturing. Semiconductor fabrication is an extremely complex process involving many points of testing and experimentation in which highly skilled engineers plays a central role (Christen et al 2004: 158-159, Leachman and Leachman 2004: 203). While, Germany does not have a specialisation in semiconductors, information technology or telecommunications at a national level (Casper et al 2000: 6), its institutional regime would seem to be more compatible with semiconductor manufacturing than other parts of ICT.

Australia, in contrast, has several institutional characteristics which would be expected to facilitate the development of the more rapidly changing and high risk areas of ICT in that it has a capital market based financial system involving arms-length financial relations and a relatively deregulated labour market with high labour

turnover. Australia might be expected to have strength in radically innovative areas of ICT in the same way as the USA (Casper et al 2000: 7). The weakness of internal ties between management and employees as well as distant external relations with suppliers, contractors and financiers should make it possible for firms to change strategy rapidly and to vary the skills and technological base of the firm.

Although the VOC approach indicates that Australia should have a strength in radically innovative areas of ICT, other aspects of Australia's national innovation system constrain the development of high technology sectors (Gregory 1993, Parker 2001). Weaknesses in Australia's institutional environment include past specialisation in resource based industries, lack of medium technology and heavy engineering industries, focus of scientific research on the agricultural sector, limited number of domestic MNCs, small venture capital market, deficiencies in the skills base in science and engineering and lack of complementary medium-high and high-technology industries. The VOC model indicates that Australia, as a LME, should perform strongly in radically innovative components of ICT. However, a national innovation systems approach, which takes into account the variety of institutions that impact on industry innovation, is suggestive of institutional explanations for Australia's weak performance in ICT.

In neither Australia nor Germany has the institutional environment translated into overall strength in ICT. Empirical evidence indicates that neither Germany nor Australia is particularly successful in the ICT sector. Table 1 shows that the size of the ICT sector and its subcomponents in manufacturing and services are smaller in Australia and Germany than is the case for the OECD countries leading in ICT. However, as the following discussion will show, there is variation in performance in ICT at a regional level which can be understood with reference to the way in which regional institutions, policies and state coordination have interacted with national institutional strengths and weaknesses to map out particular regional patterns of industry specialisation.

Insert Table 1 here

Regional Characteristics and Performance in ICT in Adelaide and Dresden

Adelaide and Dresden share a number of similarities. Both are city-regions and are considered less affluent than their capital city counterparts in their respective countries. Both Adelaide and Dresden are considered semi-peripheral within their national contexts, are metropolitan in nature but small in size relative to their national contexts, have experienced economic crises over the past couple of decades and some reorganisation of their regional economic systems, are dominated by SMEs and are industrialized (Fritsch and Franke 2004, NCLS 2003). Finally, in both regions the ICT sector has been important in the transformation of the region's economy.

In Adelaide, the size of the ICT sector, particularly in manufacturing and telecommunications, exceeds that for the nation as a whole. Adelaide accounts for 12.4 percent of employment in ICT specialist manufacturing businesses in Australia and 6.1 percent of employment in telecommunications. This exceeds its share of national employment, which is around 5.5 percent (ABS 2001). South Australia was the home of 12 winners out of 34 in the Secrets of Australia IT Innovation Competition 2002 and 5 out of 17 in 2003 which rewards the key IT innovations across the country. Adelaide has also performed very well on the Deloitte Technology

Fast 50 list, which is comprised of 'rising star' high technology companies from throughout Australia. Twelve out of the 50 were Adelaide ICT firms in 2004 and 16 made the list in 2003 (Deloitte 2004: 6, Deloitte 2003: 6-7). There is a lack of consensus about areas of specialisation within Adelaide ICT beyond the broad categories of electronics and telecommunications as revealed by statistical data. However, defence electronics and multimedia are typically identified as areas of focus (Garret-Jones 2004: 11).

Dresden has experienced significant success in ICT (particularly semiconductors) in the years after reunification and exceeds the rest of former East Germany's performance in ICT (FDI 2004). There are 20 000 ICT employees in Dresden, which accounts for three percent of total German ICT employment. This far exceeds the 0.6 percent of Germany's population accounted for by Dresden. Dresden was the winner of a federal government competition called *Innoregio* in the late 1990s because of its success in ICT. ICT employment accounts for eight percent of Dresden's entire labour force, which is higher than the 2.3 percent average for the rest of Germany (LD 2002, OECD 2002: 22-4). ICT exports account for 19 percent of Saxony's exports, in comparison to the 9.5 percent average for the rest of Germany (SMWA 2003, Statistisches Bundesamt 2003). Semiconductors are a key area of specialisation within Dresden ICT.

Although both regions' ICT performance departs from national patterns, the extent of Dresden's specialisation in ICT and departure from national patterns far exceeds that in Adelaide. ICT employment makes up eight percent of Dresden's entire labour force, in comparison to 3.9 percent in Adelaide (LD 2002, ABS 2003). Searches of both the US and European Patent Offices show that the number of patents assigned to Dresden is higher than Adelaide (USPTO, EPO: own searches).

There are therefore two important characteristics of the regions' performances in ICT that require explanation. The first is the common departure of the regions from national patterns of industry specialisation. The second is the relatively successful performance of Dresden in ICT compared with Adelaide. The cases involve document analysis and 28 interviews with local units of MNCs, SMEs, government bodies, technology parks, universities, research institutes and industry associations. The first section of the case analysis focuses on the distinctive features of the regional innovation system and policy intervention that help to explain the development of the ICT sector. The subsequent section of the paper focuses on the capacity of the state for regional governance as an explanation for the greater departure from national patterns of specialisation in the case of Dresden.

Regional institutions and policies in support of ICT in Adelaide

As explained above, there are some characteristics of the Australian national innovation system that do not favour the development of ICT. There are also several weaknesses of the Adelaide environment that might be expected to detract from the development of an ICT industry. These include the geographical isolation and small size of the domestic market, the absence of key MNCs which tend to locate national headquarters in the larger and more commercially oriented cities of Sydney and Melbourne, and the very small size of the local venture capital market. As explained below, some of the weaknesses of the national and regional institutional environment have been addressed through policy intervention.

In addition, there are several distinctive characteristics of the Adelaide institutional environment that encourage the development of the ICT sector and help to explain its performance in ICT. First, Adelaide as a region has a stronger orientation towards manufacturing than Australia as a whole. Adelaide accounts for around 5 percent of national employment and around 9 percent of employment in manufacturing. Government expenditure on R&D in Adelaide is above the national average and has a high technology orientation because of its link with defence (Garrett-Jones 2004: 6). These are areas in which the region departs from weaknesses of the NIS as explained above.

Second, key institutions have been established in Adelaide with direct implications for the ICT industry. In 1992 a Multifunction Polis (MFP) was set up in Adelaide alongside the South Australian government technology park. The MFP evolved into Mawson Lakes Technology Park in the mid 1990s. This location became a growing focus for technology industries in Adelaide and has developed into a business, educational and residential site alongside technology based companies. In addition, the presence of the federally funded Defence Science Technology Organization (DSTO) and space activities at Woomera have stimulated the defence orientation of the Adelaide electronics industry, attracting MNCs such as BAE Systems, Tenix and Saab Systems. DSTO is Australia's largest scientific research facility. It employs around 1200 people, of which 900 are scientists and engineers, and there is a flow of researchers from DSTO to industry. The institutional infrastructure of the South Australian Film Corporation and the Arts has also provided a context for the development of a specialisation in multimedia in Adelaide ICT. Two striking examples are the SME Ratbag, which is involved in racing games development including PlayStation 2 and Rising Sun Pictures which has provided visual effects for films such as 'The Lord of the Rings: The Return of the King'. The strong local commitment to the Arts can be traced to the efforts of the former South Australian Premier Don Dunstan during the 1970s in the establishment of the Adelaide Festival, the State Theatre Company and the South Australian Film Corporation.

The University of Adelaide and the University of South Australia have also supported the development of the ICT sector in Adelaide. Both universities play a key role in Cooperative Research Centres (CRCs), which are government, industry and university funded research centres linking industry and researchers. The University of South Australia is a partner in the CRC for Distributed Systems Technology Centre (DSTC) and the CRC for Satellite Systems. The University of Adelaide is a partner in the CRC for Smart Internet Technology and the CRC for Sensor Signal and Information Processing. There are also research institutes in ICT in the two universities such as the Institute for Telecommunications Research. These institutions receive national government funding.

In addition to characteristics of the institutional environment of Adelaide that favour the development of ICT, there has been State government initiatives designed to support the development of ICT in the region. As Adelaide accounts for most of the employment and industry in South Australia, it is the South Australian government whose policies have affected the development of ICT in Adelaide. In Australia, municipal governments tend not to play an economic development role.

First, the State government has sought to attract MNCs to the region and promote local SMEs. As such, the government has used its position as a major ICT user to attract MNCs to Adelaide. In 1995, in an effort to foster the local ICT industry, the

government outsourced its ICT services to the American MNC, EDS, and in 1994, the government awarded Motorola a contract to supply radio equipment, in return for Motorola establishing its Australian software centre in Adelaide. State government initiatives have therefore sought to counteract weakness associated with Adelaide's geographical isolation and its lack of MNCs. Various initiatives have been introduced to support knowledge intensive SMEs. In 1997, the Centre for Innovation Business and Manufacturing (CIBM) was given a mandate to work with ICT SMEs and it has overseen a general support program for SMEs by encouraging forums and seminars and running business training programs. The programs were designed to provide business competence to technical people and to overcome the limited industrial competence of the labour force. This has been especially important because of the lack of key large MNCs which could provide commercial training for technically skilled employees. CIBM has helped companies to access national government funds such as Commercialising Emerging Technologies (COMET) program in an effort to overcome weaknesses associated with the geographical isolation of Adelaide.

There were a few other initiatives from the State government to promote ICT in Adelaide. In an effort to overcome the resource orientation of Australia's research facilities, the State Government and three Universities (Adelaide, South Australia and Flinders) jointly funded five new chairs (professorial positions) in ICT in Adelaide in 1997. In order to address the lack of access to venture capital and high risk finance, the state government provided initial investment in Playford Capital, an institution whose role it is to invest in early stage ICT companies and provide assistance in identifying private equity funds to further develop companies.

In summary, in Adelaide there have been a series of public policies designed to attract MNCs to the region, promote SMEs in ICT and establish a research and education focus on ICT. In addition, there has been some venture capital support for ICT start-ups. The main aim of these policies has been to develop regional competence in ICT and some aspects of these policies have addressed limitations in the NIS as explained above.

Regional institutions and policies in support of ICT in Dresden

Dresden's relative success in ICT and its sub-sectoral strength in semiconductors can be explained in part by specific characteristics of the local institutional environment, some of which build on Germany's wider national institutional environment of high-skilled labour, well funded and collaborative university and research facilities, and its cooperative business model. Other features are distinctive to Dresden.

An important characteristic of the Dresden institutional environment is the strong focus on ICT in education, training and research. To make up for insufficient private R&D activity, universities and other non-university research organizations have been very well funded in the region particularly in technology fields targeted for growth such as ICT. The Technical University of Dresden (TUD) has a teaching and research focus on engineering, computer sciences, and medical and biomedical sciences. The School of Computer Science at TUD houses eight research institutes and 24 professorships, and is extensively engaged with industry. TUD is also an important supplier of skilled labour to the regional ICT industry. The student populations in both microelectronics and computer science are on the rise. The region is also home to a number of technical colleges focused on electrical engineering. The Dresden

technical college, with 4500 students, focuses on various streams of engineering and computer science and has close linkages with industry (Röhl 2000: 8).

Further, many non-university research organisations play a role in the region's ICT cluster. A unique feature of R&D in former East German regions is the existence of R&D companies, which came out of the research divisions of the *kombinate* (large vertically integrated industrial organisations). Dresden has approximately 12 such firms focused on ICT, which have received state subsidies at decreasing levels each year after reunification (SMWA, SMWK). Regional research institutes such as the Max Planck and Fraunhofer societies have made a contribution to research in ICT in Dresden and have collaborated strongly with local firms. These research institutes are a feature of the German system of institutional support for R&D through publicly funded co-operative research institutes.

Thus, the well-recognised German institutional strength in the form of high-skilled labour and strong university-industry relations has an ICT focus in the region of Dresden. In addition, there are distinctive features of the Dresden environment that help to explain its focus on ICT. The industrial history of Dresden is an important factor explaining the regional development of the Dresden ICT sector. Dresden has long been active in ICT activities, which have had positive implications for the contemporary ICT cluster. Dresden's ICT activity can be traced back to the 1930s, when Dresden engineers invented the world's first binary digital computer. Although activities in ICT areas were hindered by WWII: some 70 percent of the region's industrial facilities were destroyed by the 1945 allied bombings (Biedenkopf 1998), Dresden later became the centre for microelectronics and ICT in the former GDR (Röhl 2000a). After reunification products and processes were widely considered inferior to those in the West, and many firms and research organizations were closed. However, the GDR period left behind useful reserves of human capital, university research, and university programs to train appropriately skilled graduates. In particular, the human skill level in the area of ICT related fields was considered to be very advanced (Muller & Etzkowitz 2000).

In addition, there have been specific State government initiatives to fund the development of ICT in the region. Although Dresden's municipal government has played a role in developing the ICT sector, its role has been facilitative in nature (ensuring infrastructure functions smoothly and permits are issued efficiently). While the federal government and the EU have provided some funds to the State government, it has been the State government that has chosen policy directions and the nature of policy implementation in the Dresden ICT sector. In the early years after reunification, the State government's technology policy sought to develop beacons of high technology industry in the region. More specifically, the state sought to support a number of technology fields that were seen as relevant for the future, one of which was ICT (SMWA 1992: 8).

The Saxon State Government's *Leuchtturmpolitik* or 'lighthouse policy' has attracted key MNCs to the region and facilitated the clustering of specialist suppliers and subcontractors around the large firms. In the ICT sector, the policy involved the attraction of AMD, Siemens, and Infineon. State financial aid has attracted MNCs to region. Significant funds for the establishment of local units of MNCs in the region came from government sources. Between 1990 and 2002, total government contributions to the Dresden ICT sector amounted to approximately €1.2 billion, which is significant given that annual turnover of the industry in the region is €2

billion (Weber 2003). A number of the MNCs argued that this funding formed part of their decision to invest in Dresden. When Siemens set up in Dresden in 1993, total set up costs amounted to €1.38 billion, 23 percent of which (or €317 million) was contributed by Federal and State government sources (Weber 2003: 22).

There was consensus among interviewees about the importance of effective and efficient public administration for the development of the Dresden ICT sector. Interviewees considered the State government efficient and highly constructive in administering high technology activity in the Dresden region. There were minimal delays in the issuing of administrative permits and a high degree of constructive cooperation between business and the bureaucracy. Interviewees considered the local council highly receptive to the infrastructure needs of business (Bruner 2001, Weber 2003: 23, Röhl 2000: 13, Edler et al 2002: 58).

Further, the post-reunification propping up of local large microelectronics firms already present in Dresden has been important for the development of the sector. An example of this is the case of ZMD, a former state owned company during socialist times. After reunification, the State government bought the company because of lack of private interest, and ZMD was later sold. ZMD is currently a world leader in producing chips for infrared and hearing aids. The firm has 630 employees, two US sites, and in 2003 the company was profitable with a turnover of €80 million (ZMD 2004). The Dresden city council's director of the economy, Rolf Wollgast (in Boudette 1998) argues that 'without ZMD there would have been no microelectronics here, we went to Berlin and fought for it'.

There has also been a series of policies to support regional ICT SMEs, which have been coordinated by the industry association *Silicon Saxony,* WFS (the state owned economic development corporation for Saxony), and the Dresden chamber of commerce. The policies of these institutions are clearly linked into the overall economic strategy adopted by the State government which is to build beacons of high technology industry in the region. Policy support includes assistance for SMEs to participate in international markets and trade fairs and information gathering functions.

In summary, the focus of policies to support ICT in Dresden has been to build clusters of competence by supporting MNCs, providing financial aid to business, managing business investment in the region to ensure regional economic benefits, providing a supportive infrastructure and administrative environment and assisting new firm start-ups and SMEs.

State coordination in Adelaide and Dresden

The above discussion has shown that there are institutional characteristics of the regions of Adelaide and Dresden as well as policy initiatives in each of the regions which help to explain regional departures from national patterns of industry specialisation in ICT. Regional institutions and policies interact with the national institutional framework to produce particular patterns of regional industrial strength. The following discussion indicates that in Dresden, the state has invested significant funds in the ICT sector and coordinated the development of the industry within the regional space, giving clear direction and focus to the development of the ICT sector, such that it is possible to describe the institutional environment as thick and coherent. As such the regional space of Dresden has been comparatively more

successful in ICT than has Adelaide, where there has been low levels of public investment in industry development and a fragmented and incoherent approach to the industry.

State funding of ICT development in the region

There are differences between the two regions in the level of funding directed to the development of the industry sector. In Australia, direct government expenditure on ICT development has been very small involving, for example, quite low levels of funding for SMEs to attend trade conferences. In 2004, the national government announced AUD $308 million (approximately €225 million) in measures to support ICT across the whole of Australia as part of its *Backing Australia's Ability* initiative. This is a very small level of support when compared with the total of €1.2 billion invested in the Dresden region alone. In Australia, the government has tended to provide indirect support to the ICT industry, for example through contracts to supply government services. There is little State government capacity to fund industry development given the heavy dependence of the State governments on national financial transfers in Australia and the increasingly tied nature of national government payments to the States.

Further to the funding constraints are cultural impediments to government funding of business development in Australia. In Adelaide, it was highly controversial for the State government to provide incentives to MNCs to locate in Adelaide. The media and opposition constructed these initiatives as a form of business welfare rather than an industry development program. The dominant view concerning state-economy relations in Australia is that governments should improve the general business environment rather than provide targeted support programs for industry (Bell 1997, Parker 2001). In the Anglo-Saxon system, government support for ICT was portrayed as support for big business. It lacked legitimacy and was politically unpopular.

In contrast, government investment in the ICT industry in Dresden has been particularly high at €1.2 billion. It has also been direct in the sense that it has involved subsidies to firms. The post-reunification propping up of local large microelectronics firms already present in the region, such as ZMD, is one dimension of state support for ICT in the region. In Dresden, all political parties and the broader population have supported the assistance programs that were offered to MNCs and the ICT sector. Thus within the Germanic system, state support for industry development was regarded as legitimate.

State coordination of the sector at a regional level

A further difference between the two regions relates to the capacity of the state to coordinate and govern activities at the regional level. In Adelaide, government programs focused on ICT have not been well funded and have been administered through competing and conflicting agencies. There has been competition between State and Federal government agencies as well as within the State government. There has also been conflict between different units of State government agencies, each of which has claimed ownership of key government programs in support of ICT innovation. The broader characteristics of the system of economic governance in Australia help us to understand the conflict and competition between State government departments responsible for supporting SMEs as the government was

unable to mobilise and unite different arms of the bureaucracy in support of its goal of promoting ICT development in Adelaide. This is indicative of the weakness of state institutions in an Anglo-Saxon political environment.

In Adelaide the state has demonstrated a limited capacity to coordinate the activities of private industry or to collaborate with industry in the pursuit of common objectives. The IT Council and the Mawson Lakes technology park operate fairly autonomously from government and have sought to create a global brand name for the local market. The IT Council's initiative to create the brand *Solution City* as an identifier for Adelaide is only a few years old and is not coordinated with government marketing of the region as *Silicon Vineyard*. The industry associations are remote from government. Further, MNCs have not been supervised to ensure that they link with local industry and as such there has been only limited benefit to SMEs arising from the investment of MNCs, which have weak connections with local industry and universities. The state has been unable to coordinate the activities of private MNCs even though they were given government incentives to invest in the local market. The state traditionally remains detached from the management of private capital in Australia (Bell 1997).

In Dresden, by contrast, programs for the ICT industry have been both well-funded by state and federal sources and collaboratively implemented by the regional development authority, the industry association, and the chamber of commerce. The Saxon Economic Development Corporation, the industry association *Silicon Saxony* and the Dresden chamber of commerce have collaborated in supporting local ICT, with the Saxon Economic Development Corporation taking a lead role. The state has governed the sector by providing conditional support to the MNCs to ensure their embeddedness in the regional economy. The state's *Leuchtturmpolitik* has involved the clustering of local SMEs around key MNCs as subcontractors and specialist suppliers. The state has given conditional support to MNCs by ensuring, for example, that technologies researched in the region are later commercialised in the region. This has meant that the presence of MNCs has benefited SMEs in Dresden and facilitated a clustering effect involving linkages between MNCs and local institutions and firms. In the Dresden context, the well-established German norm of non-market coordination logically extends to the regulation of MNCs to ensure that networks are forged between local firms and MNCs. In addition, the capacity for inter-firm cooperation amongst local suppliers and subcontractors facilitates the participation of MNCs in local networks.

The Dresden approach has involved a coherent and focused state promotion of ICT through a highly efficient and supportive public infrastructure. A series of policies have promoted key economic actors including lead firms, SMEs, universities and research institutes, and have facilitated an extensive network of linkages between these different institutions, focused on the development of the ICT sector. Institutions normally identified in the literature as important for regional development (universities, non-university research bodies, industry associations, technology parks, local units of MNCs, large firms, SMEs, and government bodies) have all developed a focus on the expansion of the ICT sector. As such, the Dresden approach has resulted in a coherent and thick institutional infrastructure in support of ICT and an agglomeration of ICT activity in the region.

Explaining regional departures from national patterns of industry specialisation in Adelaide and Dresden

This paper has suggested that the nature of regional innovation systems might explain regional departures from national patterns of industry specialisation. Further, it has been proposed that the role of the state at the regional level, particularly in facilitating a coherent and focused approach to regional development and transformation, might explain the *extent* of departure of the region from national patterns of industry specialisation. The two regional case studies have provided some evidence in support of the propositions developed in the first part of the paper.

In Adelaide and Dresden, performance in ICT has exceeded that for the nation as a whole. The two regions have developed some competence in parts of the ICT sector as a consequence of distinctive regional institutions and policies. As explained above, some of these policies were designed to address institutional weaknesses in the national and regional innovation system or to give an ICT focus to particular institutional competences. Therefore both case studies provide support for the idea that regional institutions and policies are important in understanding distinctive regional processes of economic development, change and innovation (Asheim and Isaksen 2003, Cooke et al 1997, Morgan 1997). However, in each of the cases, regional characteristics interact with the NIS such that both national and regional spaces need to be taken into account in exploring regional patterns of industry specialisation.

The paper has also provided some insight into the more extensive development of the ICT sector in Dresden compared with Adelaide. This appears to be explained by the capacity of the state to govern and collaborate with private industry and fund ICT development at a regional level in Dresden. The close and collaborative relationship between the state and industry associations in Dresden has facilitated a coordinated approach to the development of the ICT sector, which fits with the model of transformative state capacity (Evans 1995, Weiss 1998). In addition, the role of the state in attracting MNCs and fostering the development of links between MNCs and flexible networks of SMEs is consistent with a flexible developmental model of state capacity (O'Riain 2000). In Dresden, the state has mobilised national institutional strengths in skills development and research to support the growth of ICT and in particular semiconductors. In the Adelaide region, which is embedded within a broader compartmentalized Anglo-Saxon business system, the state is constrained in its capacity to influence the investment decisions of private industry and MNCs. The state's involvement in industry development has been regarded suspiciously and has involved low levels of funding. The Adelaide system of governance can be described as fragmented and incoherent.

The research reported in this paper has important implications for comparative institutional explanations of patterns of industry specialisation. The cases indicate that institutions and policy interventions at a regional level might provide an explanation for regional departures from national patterns of industry specialisation. There appears to be a complex interaction between a range of regional and national institutions and policies suggesting the need to adopt an open-ended and multi-spatial approach to analysing institutional influences on industry specialisation in unusual cases. As Whitley (2000: 880) explains, although technologies and innovations associated with specific industries have particular properties that are favoured by certain institutional configurations, there is not necessarily only one way in which particular technologies and innovations can be governed. Further, we might expect regional departures from national patterns to be greater in environments in which the state has the capacity to

coordinate and govern the regional economy, to create focus and coherence in the regional institutional and policy environment, facilitating an agglomeration of activity at a regional level. This requires an analysis of the way in which the system of state coordination interacts with regionally specific resources and institutions.

References

ABS. 2001. 'IT Australia 2000-2001'. Cat No. 8126.0: 25.

ABS. 2003. *Measuring Australia's economy.* Canberra: ABS.

Amin, Ash, and Nigel Thift. 1994. 'Living in the global'. In *Globalization, institutions, and regional development in Europe*, eds. A. Amin and N. Thrift. Oxford: OUP.

Asheim, Bjørn. and Arne Isaksen. 2003. 'SMEs and the regional dimension of innovation'. In *Regional Innovation Policy for SMEs*, eds. B. Asheim et al. Cheltenham: Edward Elgar.

Biedenkopf, Kurt. 1998. 'The transition process in Germany and its relevance for Europe'. *World Bank Institute* [www.worldbank.org/wbi/lectures/speech-bieden.html].

Boudette, Neal. 1998. 'Europe's high tech phoenix'. *Industry Week* 11 February. [www.industryweek.com/CurrentArticles/asp/printerfriedly.asp?ArticleId=269].

Brenner, Neil. 2004. 'Urban governance and the production of new state spaces in Western Europe, 1960-2000' *Review of International Political Economy*, 11(3): 447-488.

Bruner, Richard. 2001. 'Dresden's talent for inventiveness serves it well'. Semiconductor Magazine 2 (5). [http://dom.semi.org/web/wmagazine.nsf/0/41aa94cee82a98bb88256a37006217c0?OpenDocument].

Casper, Steven and Richard Whitley. 2004. 'Managing competencies in entrepreneurial technology firms: a comparative institutional analysis of Germany, Sweden and the UK' *Research Policy*, 33: 89-106.

Casper, Steven and Hannah Kettler. 2001. 'National institutional frameworks and the hybridization of entrepreneurial business models: the German and UK biotechnology sectors'. *Industry and Innovation* 8 (1): 5-30.

Casper, Steven, Mark Lehrer and David Soskice. 1999. 'Can high-technology industries prosper in Germany? Institutional frameworks and the evolution of Germany software and biotechnology industries'. *Industry and innovation*, 6(1): 5-23.

Christensen, Clayton, Anthony Scott and Erika Roth. 2004. *Seeing what's next: Using the Theories of Innovation to predict industry change*, Boston: Harvard Business School Press.

Cooke, Philip, Mikel Uranga and Goio Etxebarria. 1997. 'Regional innovation systems: institutional and organisational dimensions'. *Research Policy* 26 (4-5): 475-91.

Cooke, Phillip and Kevin Morgan. 1998. *The associational economy: Firms, regions and innovation*, Oxford: Oxford University Press.

Culpepper, Pepper. 1999. 'Still a Model for the Industrialised Countries'. In Pepper D. Culpepper and David Finegold *The German Skills Machine: Sustaining Comparative Advantage In a Global Economy*, New York: Berghahn Books.

Deloitte. 2003. 'Deloitte technology fast 50: technology leaders sustaining growth'. http://www.deloitte.com/dtt/cda/doc/content/2003%20Deloitte%20Technology%20Fast%2050%20report%282%29.pdf

Deloitte. 2004. 'Deloitte technology fast 50: technology leaders sustaining growth'. http://www.deloitte.com/dtt/cda/doc/content/2004%20Deloitte%20Technology%20Fast%2050%20report%20low%20res%283%29.pdf

Drejer, Ina. 2000. 'Comparing patterns of industrial interdependence in national systems of innovation – A study of Germany, the United Kingdom, Japan and the United States'. *Economic Systems Research*, 12 (3): 377-399.

Edler, Dietmar, Jürgen Blazejczak, Thorsten Böhn, & Martin Gornig. 2002. 'Gesamtwirtschaftliche und regionale Bedeutung der Entwicklung des Halbleiterstandorts Dresden'. *Deutsches Institut für Wirtschaftsforschung* [http://www.diw.de/deutsch/produkte/publikationen/gutachten].

Edquist, Charles, and Maureen McKelvey. 2000. 'Introduction'. In *Systems of innovation: growth, competitiveness and employment, volume 1*, eds. C. Edquist and M. McKelvey. Cheltenham: Edward Elgar.

Evans, Peter. 1995. *Embedded autonomy: states and industrial transformation.* Princeton: Princeton University Press.

FDI. 2004. 'Down but not out'. *Foreign Direct Investment* February 5. [www.fdimagazine.com/news/printpage.php/aid/583/Down_but_not_out.html].

Fritsch, Michael and Grit Franke. 2004. 'Innovation, regional knowledge spillovers and R&D cooperation'. Research Policy 33 (2): 245-255.

Garrett-Jones, Sam. 2004. 'From citadels to clusters: The evolution of regional innovation policies in Australia' *R&D Management*, 31 (1): 3-16.

Gregory, Robert. 1993. 'The Australian innovation system' in R. Nelson, ed., *National innovation systems*, Oxford: Oxford university Press.

Haake, Sven. 2002. 'National business systems and industry specific competitiveness'. *Organization Studies* 23 (5): 711-36.

Hall, Peter and David Soskice, eds. 2001. *Varieties of capitalism: the institutional foundations of comparative advantage*. Oxford: OUP.

Jessop, Bob. 2002. *The Future of the Capitalist State*. Cambridge: Polity Press.

Keeble, David, Clive Lawson, Bary Moore and Frank Wilkinson. 1999. 'Collective Learning Processes, Networking and 'Institutional Thickness' in the Cambridge Region'. *Regional Studies* 33(4): 319-332.

Koschatsky, Knut. 2003. 'Entrepreneurship stimulation in regional innovation systems - public promotion of university-based start-ups in Germany'. In *Cooperation, networks and institutions in regional innovation systems*, eds. D. Fornahl and T. Brenner. Cheltenham: Edward Elgar.

Kristensen, Peter Hull. 1996, 'Variations in the nature of the firm in Europe'. In *The changing European firm: limits to convergence*, eds. R. Whitley and P.H. Kristensen. London: Routledge.

Landeshauptstadt Dresden. 2002. 'Economy and local economic support program 2002'. [http://www.dresden.de/pdf/infoblaetter/wb_2002_engl.pdf].

Leachman, Robert and Chien Leachman. 2004. 'Globalization of semiconductors: Do real men have fabs, or virtual fabs?'. In *Locating global advantage: Industry dynamics in the international economy*, eds. M. Kenny and R. Florida. Stanford: Stanford University Press.

Lundvall. Bengt Åke. 1992. 'Introduction'. In *National systems of innovation: Towards a theory of interactive learning.* London: Pinter.

MacLeod, Gordon. 2001. 'New regionalism reconsidered: globalization and the remaking of economic space'. *International Journal of Urban and Regional Research* 25 (4): 804-29.

Malerba, Franco and Luigi Orsenigo. 2000. 'Knowledge, innovative activities and industrial evolution' *Industrial and Corporate Change,* 9(2), 289-314.

Morgan, Kevin. 1997. 'The learning region: institutions, innovation and regional renewal'. Regional Studies 31 (5): 491-503.

Muller, Karel & Henry Etzkowitz. 2000. 'S & T human resources: the comparative advantage of the post-socialist countries'. *Science & Public Policy* 27 (4): 285-91.

NCLS. 2003. Australian Community Survey. Sydney: Openbook Publishers.

Nelson, Richard. 1992. 'National innovation systems: a retrospective on a study'. *Industrial and Corporate Change* 1 (2): 347-74.

Niosi, Jorge, Paolo Saviotti, Bertrand Bellon, and Michael Crow. 1993. 'National systems of innovation: in search of a workable concept'. *Technology in Society* 15 (2): 207-227.

OECD. 2002. '*Measuring the information economy'.* Paris: OECD.

O'Gorman, Colm and Mika Kautonen. 2004. 'Policies to promote new knowledge-intensive industrial agglomerations'. *Entrepreneurship and Regional Development* 16: 459-479.

Parker, Rachel. 2001. 'Australia's social system of production'. In *Business, work, and community into the new millennium'*, eds. G. Dow and R. Parker. Melbourne: OUP.

O'Riain, Seán. 2000. 'The flexible developmental state: globalization, information technology, and the 'Celtic Tiger''. *Politics and Society* 28 (2) 157-193.

Röhl, Klaus-Heiner. 2000. 'Saxony's capital Dresden – on the way to becoming Eastern Germany's first innovative milieu?' Diskussionsbeiträge aus dem Institut für Wirtschaft und Verkehr [www.tu-dresden.de/vkiwv/VWL/home.htm].

Scott, Alan. 1998. *Regions and the world economy: the coming shape of global production, competition and political order.* Oxford: OUP.

SMWA. 1992. 'Leitlinien zur Technologiepolitik im Freistaat Sachsen'. Dresden: SMWA.

SMWA. 2003. ''Made in Saxony' is a brand in demand'. [www.sachsen.de/en/wu/smwa/download/export_climb.pdf].

Statistisches Bundesamt. 2003. 'Imports and exports by division of the national product classification for production statistics 2003'. [http://www.destatis.de/basis/e/aussh/ausshtab2.htm].

Storper, Michael. 1997. *The Regional World: Territorial Development in a Global Economy* New York: Guilford Press.

Taylor, Mark Zachary. 2004. 'Empirical Evidence Against Varieties of Capitalism' Theory of Technological Innovation' *International Organization* 58: 601-631.

Traxler, Franz. and Brigitte Unger. 1994. 'Governance, economic restructuring and international competitiveness'. *Journal of Economic Issues* 28 (1): 1-23.

Weber, Arnd. 2003. 'Semiconductor developments in the Dresden region'. European Union Tigers Project Final Report. [fiste.jrc.es/download/Tigers_ITAS_Dresden_07%202003.doc].

Weiss, Linda. 1998. *The Myth of the Powerless State: Governing the Economy in a Global Era*. Cambridge: Polity Press.

Whitley, Richard. 2000. 'The institutional structuring of innovation strategies: business systems, firm types and patterns of technical change in different market economies'. Organization Studies 2 (5): 855-886.

Table 1: Size of ICT Sector 2000

	Share of ICT value added in business value added	Share of ICT manufacturing in manufacturing value added	Share of ICT services in business services value added
Australia	8.1	3.31	9.33
Germany	6.2	4.99	6.71
Finland	15.6	21.66	11.94
Ireland	16.5	18.74	14.69
Sweden	10.8	6.96	12.64
UK	10.4	9.65	10.62
USA	11.1	12.75	10.61

Source: OECD estimates, based on national sources; STAN and National Accounts databases, September 2002.