Conclusion

INNOVATION AND SHARED PROSPERITY

How can countries translate innovation into high living standards? For many policymakers, this is a second-order concern. For them, innovation is an end in itself, rather than a means to an end. But, as I have argued, there is little point in a highly innovative economy unless it benefits workers. To bring about this outcome, we need to extend our understanding of innovation policy, learn from examples beyond Silicon Valley, Oxbridge, and Shenzhen, and think harder about the distributional consequences of what are often major investments of public money. We should be learning from places where innovation translates to higher living standards.

We can learn a lot from the experience of countries such as Switzerland, Austria, Taiwan, and Sweden, which achieve high levels of innovation and have, at times, managed to share the benefits. These countries have plenty of problems. Austria, Sweden, and Switzerland have faced problems with populism and intolerance; Swedish income equality is rising, and social mobility is counterposed by higher wealth inequality; Taiwan's inequality statistics are

massaged by incomes from China, the share of national income going to the top 1 percent is growing rapidly, and house prices are squeezing young workers. All these countries still suffer from major disparities based on gender, race, and migration status. And they all face the challenges of sustaining their models in the face of global competition. There are, unfortunately, no utopias.

But examples do not have to be perfect to be helpful. These countries provide causes for optimism and examples of ways in which innovation can be used to achieve a broadly shared prosperity.

HOW TO SHARE THE BENEFITS OF INNOVATION

At this point critical readers may be worried about the extent to which we can learn lessons from countries with distinct histories and institutional architectures. First, critics might object that because these are small states, we cannot learn much from them. These countries are certainly small, but the idea that other countries can learn nothing from them is wrong. After all, policymakers in mid-sized countries such as my own, the United Kingdom, try and learn from much larger countries, such as the United States. Small size carries both advantages and costs. Small countries may find it easier to adapt their systems and experiment. As Peter Katzenstein argued in the mid-1980s, the "low-voltage politics" of small states allows coordination and institutional reform.[1] And small countries are forced to adopt a strategy based on openness to international markets.

The second argument is a trick of distraction. Some people may point to Austria's problems with corruption, Switzerland's shady bankers, or the problems of a Taiwanese model in which wealth inequality has been increasing. These criticisms are often valid, but they do not make other features of the models irrelevant. If we search for perfect examples of places that are highly innovative and share the benefits, we will be searching for a very long time. Instead, we should

take what we can from these models, warts and all, but avoid portraying them as clichés or misguided ideas of paradise.

A third criticism is fairer: these countries are rich, but—with the exception of Taiwan—they have been slow growing; they are innovative, but not leaders in the latest waves of technology. These countries have also seen their growth stall. For example, although Austrians enjoy high average wages, their earnings have increased by less than the European average. But slow growth does not equal failure, and growth inevitably slows when countries reach the technological frontier. Most people would rather live a country that is rich and slow growing than one that is poor but experiencing rapid growth.

A fourth criticism is that policies that work in specific institutional contexts may not work elsewhere. This point is important and correct: naive and context-blind replication of policy in very different places leads to failed policies, wasted resources, and cynicism. Policymakers are pressed for time and for resources, so the temptation to make fast policy by following ready-made examples elsewhere is always going to be a problem.

But the danger of naive policy transfer is a cause for caution, not grounds for an outright rejection of the practice. Misguided policy transfer from countries such as Switzerland is no worse than simply uncritically adopting the US model. Here I aim to provide general lessons for adapting policy to specific local economic, social, and institutional conditions. The critical audience in the United Kingdom, for example, could learn much from Swiss efforts at vocational education—about its quality, prestige, and links with advanced industries. But they should not attempt to replicate the Swiss model exactly in the United Kingdom. Trying to transplant something that worked in one system into another without modifications would be foolhardy.

These four criticisms all hint at one of the foundational principles of public policy research: we need to think hard about the external

validity of our models and consider carefully the contexts in which we apply them. No policy, let alone an innovation policy, works consistently across time and space—as faddish innovation policymakers have too often failed to realize.[2] Instead we should separate the unique circumstances of each individual country from the specific policies and development strategies it has followed.[3]

THE STATE, INNOVATION, AND SHARED PROSPERITY

My four cases show the role of the state in linking innovation with shared prosperity. First, the state does more than promote innovation; it also sets the framework to ensure the benefits are broadly shared. A narrow focus on innovation for its own sake risks missing the overall point of policy. Innovation policy needs to take account of skills, housing, welfare, and other social and economic concerns. Wage-setting and labor-market regulatory structures in Sweden and Austria help distribute the benefits of those countries' success in innovation. Taiwanese education policy has supported innovation and at times helped share the benefits (although the state's role in housing markets and the limited welfare state have not benefited workers).

Second, sharing the benefits of innovation requires the development of institutions that enable its diffusion. Such institutions include skill systems that help workers use and adapt new technologies, applied research institutions that tailor innovations to the needs of small firms, and dense networks through which knowledge diffuses. Scholars of innovation policy have tended to focus on systems and the structures that achieve innovation; less attention has been paid to the institutions that help innovation and new technologies diffuse through the wider economy, or to linking success in innovation-intensive industries with redistributional structures.

Finally, policies for innovation and shared prosperity are mutually reinforcing. This is clear in the cases I've considered. The high

Swiss quality of life attracts skilled international workers who contribute to the country's economic success. Competent government in Sweden increases equity and also, by raising skill levels, innovation. These economies don't succeed despite their social models; they succeed because of them. Moreover, equity in the innovation process can create a virtuous circle. For example, better vocational training allows workers to benefit from innovation and also allows the diffusion of innovation; including disadvantaged groups in the STEM workforce benefits those workers and also creates more innovation; countries whose innovation ecosystems are geographically distributed are more innovative than those with a few dominant hubs. Inequality of access to innovation reduces innovation overall.

These three arguments provide a rationale for government intervention. But they don't tell us how these countries do it. Many books would, at this point, offer a new model of innovation policy. They might offer a concept that "disrupts" innovation policy and a recipe for success. But there is no generalized formula. While it is tempting to portray national innovation systems as homogeneous, no serious analysis would support this conclusion. Moreover, differences between innovation systems are even starker at the local or regional level, as comparisons of superstar cities in different regions demonstrate. A firm in Switzerland deals with a very different context from one in the United States, let alone one in China. But a firm in Basel also faces a different context from one in Geneva. Policy is best when it is informed by global evidence but tailored to local circumstances. This means striking a balance between analytical simplicity, which helps clarify ideas, and local nuance. There are no easy, formulaic approaches to successful innovation policy.

Instead of offering a new model for innovation policy, I consider the types of institutions that seem to matter. Each of these countries I examine here has, or has had, a specific institutional structure focused on the generation of innovation but also has strong institutions focused on diffusion and redistribution.

INSTITUTIONS: GENERATIVE, DIFFUSIVE, AND REDISTRIBUTIVE

Political economists use the concept of growth regimes, each of which, as Peter Hall notes, is "distinguished by the distinctive ways in which it generates economic growth and distributes its fruits."[4] Scholars in innovation talk instead about innovation systems that exist at the national and regional levels. The basic insight here is that firms do not operate in isolation but produce new innovations in tandem with a set of relationships, demand conditions, and supply constraints—for skills, intermediate goods, and so on—that are created, in part, by the state. This pattern is clear in all four of my case studies. The role of the state is either highly directed, as in Taiwan and Austria, or more laissez-faire, as in Switzerland. But in all cases, the institutional structure in each country shapes outcomes in important ways.

David Soskice has argued that the US dominance in radical innovation comes from a set of "generative institutional structures." These institutions, concerned with research, finance, labor markets, market size, and legal structures, have given rise to the particular form of US innovation, with radical tech firms able to scale up and defend their dominance through continual upgrading, defensive purchases of other companies, and legal capture. One key implication of this outcome is the importance of the structure of institutions and their interrelationships: venture capital is useless without investable firms, and money invested on R&D is wasted unless there are routes to commercialization and diffusion.

Clearly, some institutional structures are useful because they are generative, allowing radical innovation to develop: world-leading universities that produce technologies unseen elsewhere; venture capitalist firms that fund high-risk, high-return activities; agencies, such as DARPA in the United States, that fund blue-sky research on topics of scientific significance; angel investors reinvesting profits

made from early innovations in new start-ups; PhD skill systems that provide the most imaginative researchers with the time, guidance, and resources to make major leaps. Weak antitrust legislation may belong in this category, in the sense that it allows firms to scale up, although it has many negative effects. Other important institutions include those in leading-edge research, high-impact entrepreneurship, and other forms of commercialization. Strong institutions need to generate innovation, not just invention.

The US has a specific generative institutional structure, but each of the countries I have studied has its own variety. In Taiwan, research labs feed chip-manufacturing success, and finance was steered toward good job creation. Swedish venture capital helps steer firms toward radical innovation, while Nordic markets provide Swedish companies with opportunities to scale; leading Swiss universities such as ETH produce applied innovation for leading-edge sectors. Some institutions focus on radical innovation, but others concentrate on the upgrading of local sectors. Austrian R&D focused on the low-tech industries of the past, and the result was productivity growth and occupational upgrading.

But the institutions that matter for increasing living standards are not just generative. Diffusive institutional structures ensure that innovations and new technologies are distributed through the economy. They include networks of small firms that apply existing technologies to specific institutional niches; vocational skills systems that train workers to adapt existing technologies to specific commercial needs; skills systems that train workers for the second-stage work of commercializing innovations; business networks that help diffuse technologies; financial markets that provide capital for firms likely to achieve only limited growth; and powerful local government, which can help firms grow and bring the benefits of advanced sectors into different regions.

These institutions provide mechanisms through which the benefits of innovation can reach workers. Diffusive institutional structures help distribute rents from innovation across a wider group of

Table 6 Institutions key to promoting innovation, by country

	Switzerland	*Austria*	*Taiwan*	*Sweden*
Generative institutions	World-leading research universities Openness to skilled foreign workers Deep pools of capital Competitive taxation	Universities focused on local strengths Large firms with long-term experience in local economies Focused national government policy	Multinational firms Science parks Government finance focused on leading sectors	Radical tech companies Venture-capital funding Angel investors recycling finance and expertise World-leading universities
Diffusive institutions	Universities of applied science Vocational education system Competitive, nonfrontier SMEs Cantonal governance structures	Local business networks Competitive, nonfrontier SMEs	STEM focused education system Highly competitive small firms	Vocational education system National technology-focused policy Decentralized regional government
Redistributive institutions	Corporatist labor-market institutions	Corporatist labor-market institutions Strong welfare state		Fiscal transfers to less advantaged regions Wage coordination policies Strong welfare state

people. They ensure that workers have the capabilities to benefit from innovation and thereby ensure that new technologies are diffused through the wider economy. The higher levels of the Swiss vocational education system offer one example, facilitating innovation and the diffusion of technology from elsewhere, and ensuring that workers benefit. All four countries offer forms of vocational education and have some focus on STEM. Another example is applied or translational research infrastructure, in particular infrastructure that serves local needs, such as *Fachhochschulen*. Swedish tax credits that subsidized the purchase of personal computers helped people adopt new technology, thereby increasing diffusion, sparking new ideas, and allowing people to develop the skills they needed to benefit from further productivity increases. The wider support infrastructure of economic development that allows firms across different regions to develop in innovation-intensive niches is also important.

Diffusive or distributional institutions solve a core problem with innovation and new technology: that access is unequal and focused on the wrong goals. It is crucial to give people the opportunity to be part of the innovation workforce—to participate in the delivery of innovation. Scare stories about technological change and the labor market tend to identify innovation and new technology as a problem for society. Of course, this is sometimes true. But the central problem is more often inequality of access to innovation, resulting in unequal distribution of benefits. We need to provide greater access to innovation and new technology, not less.

Institutions that shape the distribution of the benefits of innovation are also important. Inevitably, some innovations concentrate economic value, but things can be done to mitigate this trend. Some of these institutions operate in the labor market. For example, centralized wage bargaining, works councils that negotiate wages, and minimum wages convey some of the benefits of innovation to workers, even if those workers are not necessarily at the cutting edge. Other institutions in this category include redistributive institutions

such as an appropriately designed tax system, a welfare state that brings people into economic activity, and strong, high-quality public services. Good schools, strong public services, health-care systems that work, and sensible immigration policies all help share the benefits of innovation while also sustaining it.

One key feature of the institutions most successful at generating, diffusing, and redistributing the benefits of innovation is that they achieve some sort of geographic equity. For innovation to reach people, it has to happen close to where they are. Urban economics models assume that people are willing and able to relocate— and migration should be celebrated for the economic and social role it can play. But mobility is not for everyone: people are kept in place by dense webs of family ties, networks, and so on. The costs of migration make it most appealing to those with the weakest ties and the most to gain—the young and the talented. In advanced economies, a slim majority of people move.[5] One common feature of Sweden, Switzerland, and Austria is that highly innovative firms operate even in relatively peripheral areas. Local economies compensate for the lack of agglomeration in various ways, including the development of localized clusters of skilled workers, research institutes focused on local economies, strong public services, and access to natural resources.

IS INNOVATION WITH EQUITY POSSIBLE?

I started this book with the concern that high levels of innovation are simply incompatible with broadly shared prosperity. The United States is the global leader in radical innovation and home to most of the world's leading firms. Partly as a result, it is rich but riven with inequality. China is following this lead. China is not yet rich, although some regions of it are, and inequality is relatively high.[6] These countries are leading, but they are also unequal. Focusing on them leads to the conclusion that inequality is the price of successful innovation.

But there are three arguments against this view. One is that the relationship is circumstantial: the US lead does not necessarily come solely from the processes that make it unequal. The institutions, financial markets, leading universities, scalable companies, and competitive labor market that seem to drive US innovation are not all linked to inequality. So it might be that inequality is circumstantial, caused by specific characteristics of the US tax system and financial markets, and the lack of diffusive institutions. Yet the scalability of US tech is a reason both for its success and for the inequality that results. Market size can concentrate income, as it allows digital tech firms to scale. The case of Sweden—which has achieved success in rapid-growth industries—offers only an imperfect counterexample here, because although inequality remains low there, it has been rising rapidly.

A second argument is more persuasive. We need to distinguish between the rapidly scaling firms of the tech economy and the very different forms of innovation that occur in other sectors of the economy. This argument, which draws on Breznitz, Meisenzahl, Mokyr, and others, contrasts the rapidly scaling stars of the tech economy, which make radical innovations (although plenty of tweaking takes place afterwards), with the incremental innovation that takes place in, for example, automobile firms.[7] Austria has achieved growth in traditional industries through innovation. Ownership may matter here. Firms in slow-growing sectors may have more diffuse ownership than rapidly scaling tech firms, which are more likely to concentrate wealth and income. This means that the rewards of innovation in tech firms are more unequal.

A third argument is related to the nature of inequality. Switzerland and Sweden have achieved high-growth, radical innovation while sustaining high incomes for middle-class earners. But they are both highly unequal at the top of the income distribution. No country, as far as I am aware, has managed to sustain growth in highly innovative firms without this sort of inequality developing. One form of inequality is "good'—as far as inequality can be said to be good—

provided it does not lock in advantage. Swedish industrial dynasties go back centuries, but it isn't clear that they have caused major problems for the country. They have often supported industrial upgrading, bringing others up with them.

So if we ask whether it is possible to lead in innovation without creating high levels of inequality, the answer is that it depends. The rapid growth of new tech firms is accompanied by growing inequality, and this can—in a narrow sense—be seen as a reward for growth. Some countries develop institutions that combine rapid growth in tech firms with rising incomes for mid- and low-skill workers; others don't. The problem isn't the nature of innovation but the institutions that share the benefits.

ANTI-INNOVATION POLITICS

The focus on generating innovation, and the consequent lack of attention to the distribution of the gains, is a problem for policy. Many of the most important works on innovation policy emphasize the role of the state in creating innovation. Mariana Mazzucato argues in *Entrepreneurial State* that because the state supports the research that underpins advanced products, governments should be more assertive in their taxation of innovative firms. It is an indictment of much governance in advanced countries that this call was seen as so controversial. The state's role in innovation has been the subject of debate for some time: a case in which the public returns on R&D exceed those of the private sector is commonly regarded as market failure. But I don't think this argument goes far enough. We should be thinking more, and more clearly, about the type of jobs and the distribution of the gains that come from major investments of public money.

Governments invest vast resources in innovation, and they have a moral duty and a practical imperative to make sure that the benefits are widely distributed. But there is also a pragmatic reason for doing

so: if we don't share the benefits of innovation, we risk nurturing the backlash against it. The last decade has been marked by a rise in antisystem politics. Most advanced economies, including those I have studied, have suffered from challenges of populism and discontent. Populist politicians, and others, rail against the key institutions of the knowledge economy. For example, universities—a core institution for innovation—have been criticized rather than supported; the immigrants needed to work in innovative industries have been attacked rather than encouraged; unions lobby against the use of new technologies that might, in the long run, benefit their members; and housing markets in the most successful tech hubs have been restricted so that the benefits of high-tech growth go to landowners, not workers.

It is hardly surprising that many people feel they have no stake in the innovation economy. They are often right. If you live in a tech hub such as Oxford or San Francisco, how have you benefited from the city's growth? You might have a job created by the tech economy, but many other cities have high employment without it. Your wages may be slightly higher, but so are your rents; and your chances of owning your own home are probably lower. Many workers end up squeezed out of successful cities, commuting long distances to work and to see their friends and family. So if an opportunistic politician tells you that universities exist only to benefit other people, you might find yourself agreeing. It would hardly be surprising if you voted for a candidate who is antigrowth and anti-innovation.

Innovation is crucial for economic growth and rising living standards. But if the innovation economy remains exclusive and its rewards concentrated, it will sow the seeds of its own failure. A backlash against pro-innovation policies has been under way across many countries, with some justification. The exclusion of some groups from the innovation economy—because of who they are, the skills they have, or where they live—is a waste of talent and resources. In some places, too few people benefit. Making sure the high-tech economy is inclusive is the best way to share the benefits, but also the best way to sustain innovation overall.