

1. Introduction: Why innovation matters

The economics of innovation, growth and welfare are complicated. Academics like to make it even more so, by adding layers of complexity and nuance. Some portray innovation as a linear process, others as a chaotic one. Some recommend policy which is transformative, mission-oriented, or finely tuned for specific local ecosystems. But others think the state should avoid these fads and simply fund basic research. There is little agreement on how best to create innovation. But most do agree on one thing: innovation matters for people's living standards.

To see this, strip back the layers of complexity and consider a basic categorisation: there are, fundamentally, three types of rich country. The first group are rich because of extractives. Norway, Kuwait, Saudi Arabia, and similar countries have high incomes because they sell the hydrocarbons found around them. It is easy to waste such a windfall, of course, and many countries have done. But most countries don't have a windfall to squander in the first place. Having oil or natural gas reserves is a matter of luck, not judgment. Extractives are only a viable route to prosperity for a lucky few.

A second set of countries - think Luxembourg, Ireland, Singapore - have grown rich through what can be euphemistically called 'openness'. These countries tend to be small, have skilled populations, fortunate locations next to large markets, and, often, very low taxes for international firms. A charitable interpretation of this strategy is that they are dynamic, open economies which attract global capital. A less charitable one is that they are tax havens. There is probably some truth behind both portrayals but competing on very low corporate taxes is only an option for a few countries. Tax competition is often a zero-sum game, a strategy which moves wealth around rather than making more of it. If all countries did it, there would be a race to the bottom, with states competing on low welfare standards and poor-quality public services.

This leaves a third route to prosperity: innovation, or the development and application of new products and processes. Extractives are rare and tax havens are small, so most rich countries have

innovation at the heart of their economic model. To see this, if you plot GDP per capita, a measure of national income, against Research and Development (R&D) intensity, a measure of the share of national income devoted to innovation, you find a strong relationship. Strip out the ‘extractors’ and the ‘free traders’, and all other countries sit near the trend line - their GDP per capita is closely related to the innovation which occurs there.¹

Let me be clear about what I’m arguing here. I’m not arguing that R&D is the only measure of innovation, nor that it is the best. It will prioritise some sectors over others and miss some important innovations. Neither am I arguing that increasing R&D spending, or spending on any type of innovation, will inevitably lead to economic growth.² It is easy to waste money subsidising pointless R&D. And I’m not saying that countries fit perfectly into my three categories: some, such as Singapore, combine both innovation and ‘free trading’ models. But most countries lie somewhere near the line, and there is a huge body of academic work which supports the basic claim that innovation matters. Unless you have oil or suspiciously low taxes, innovation is the best route to prosperity.

[Insert figure 1 around here]

Most of the success stories of economic development - from the old world of the UK and France to later developers such as Taiwan or South Korea - have involved the identification, production, and commercialisation of new technologies. Policymakers know this and invest vast resources in innovation policy. They use tax credits to subsidise R&D, fund expensive labs for blue sky and applied research, and set out ‘missions’ around which policy is supposed to focus. Innovation has become a central goal of most advanced economies who hope to benefit from innovation-led growth.

¹ You might think that I’m missing out finance or high value business services, but I’m not: these are industries which tend to do a lot of R&D. In the UK, HSBC and Lloyds both spend over a billion pounds annually on R&D.

² In fact, in one paper I worked on we make this exact argument: Arman, H., Iammarino, S., Ibarra-Olivo, J. E., & Lee, N. (2022). Systems of innovation, diversification, and the R&D trap: A case study of Kuwait. *Science and Public Policy*, 49(2), 179-190.

Except there is a problem with this strategy. Innovation is vital for prosperity, but too often the benefits are shared by small groups. High-tech innovation has revolutionised the world, but it has concentrated income and wealth in the hands of a few, polarised labour markets, and led to divides between a small number of superstar cities and the rest. Inequality in advanced economies has been rising since the 1980s: the ratio of the top 10% to bottom 10% of income earners across the OECD, a group of advanced economies, increased from seven times their income in 1980 years ago to nine times in 2013.³ Between 1980-2017, the share of US national income going to the bottom 50% fell from 20% to 12.5%.⁴ The one percent have been the biggest winners, and their incomes have been increasing since the 1980s across the English-speaking world. With a few hold outs, such as France, there has been long-term growth in income inequality across most of the advanced world.

If the richest are gaining an increasing share of output, someone else must be losing theirs. Most of the evidence says that it is the middle-classes (or, at least, middle income earners) whose relative position has declined. The OECD investigated what happened to middle-income households, defined as those earning between 75% and 200% of median national income. The share of households in this class had been declining between the mid-1980s and mid-2010s, from 64% to 61% of households.⁵

These macro-level problems hide a host of intersecting inequalities. Ethnic or racial inequalities have been prominent in public debate, for good reason. Racial inequalities in the US are stark and rooted in problems of violence, policing and educational attainment. In the UK, they are different but little better, with Black Britons suffering most in the criminal justice system and people of Bangladeshi or Pakistani ethnicity having the lowest median household incomes of any ethnic groups. These inequalities are intersectional with the other great lines of distinction and discrimination. Most notably, gender wage gaps are pervasive across the 'advanced' world and have changed depressingly little. Women earn less than men, even when performing the same jobs.⁶ Even where you live matters,

³ OECD (2015), *In It Together: Why Less Inequality Benefits All*, OECD Publishing, Paris.

⁴ Chancel, L. (2019). Ten facts about inequality in advanced economies. *WID. World Working Paper*, 15, 2019.

⁵ OECD (2019), *Under Pressure: The Squeezed Middle Class*, OECD Publishing, Paris, <https://doi.org/10.1787/689afed1-en>.

⁶ OECD (2022), "Gender wage gap" (indicator), <https://doi.org/10.1787/7cee77aa-en> (accessed on 18 July 2022).

and evidence shows that growing up in a deprived neighbourhood or town can have a long-term impact on your living standards, even if you move elsewhere.⁷

These inequalities – and the many others which are often less visible, less well reported, but equally severe – are a major fault line with significant social, economic, and political consequences.

Inequality solidifies social structures, reducing social mobility. If people feel their outcomes are predetermined by parental income, class, gender, ethnicity, or where they live it is hardly surprising that they are more likely to vote for populist parties which offer simple solutions for these entrenched social problems. They are less likely to trust national governments, vote, and participate in civic life. And they are more likely to become rent seekers, increasing their own income at the expense of others, rather than collaborating and building the social structures which are necessary for a functioning economy. As a result, inequality can eventually threaten the social foundations of economic success.

Yet it is the most innovative places which are often most unequal. San Jose, home of Silicon Valley, is one of the most unequal metros in the United States and there is a clear link between employment in high-tech sectors and localised inequality.⁸ Oxford and Cambridge are two of the most unequal places in the UK, despite their innovative success. Many of the world's most important hubs of innovation, from Shenzhen to Seoul, are characterised by high levels of inequality. The new products and processes which are created in these cities are producing real gains for some of those working in these cities. But these gains are not widely shared.

⁷ McNeil, A., Luca, D. & Lee, N., (2022). The long shadow of local decline: birthplace economic conditions, political attitudes, and long-term individual economic outcomes in the UK. International Inequalities Institute Working Paper (76), London School of Economics and Political Science.

⁸ See: Aghion, P., Akcigit, U., Bergeaud, A., Blundell, R., & Hémous, D. (2019). Innovation and top income inequality. *The Review of Economic Studies*, 86(1), 1-45. Florida, R., & Mellander, C. (2016). The geography of inequality: Difference and determinants of wage and income inequality across US metros. *Regional Studies*, 50(1), 79-92. Lee, N., Sissons, P., & Jones, K. (2016). The geography of wage inequality in British cities. *Regional Studies*, 50(10), 1714-1727.

This problem - innovation is vital for economic success, but often linked to gross inequality - is a challenge for policy and society. But there is an important caveat to this problem: growing inequality is a general trend not a universal law. There are significant national and regional differences in both the magnitude of increases in inequality and their patterns. For example, while the top 1% income share has increased in the English-speaking countries since the 1980s, it has remained flat in much of continental Europe. Growth since 1980 hasn't benefited those below median income in the US, but in Western Europe the poorest 50% saw their incomes rise by 40%; the bottom half of US incomes increased by only 3%. The Western European bottom 50% overtook the Americans in this period, seeing their pre-tax incomes rise from slightly below those of their US equivalents in 1980 to 25% higher by 2017.⁹

Divergent trends such as these are difficult to reconcile with the conventional explanations for inequality, which centre on the impact of technology on different workers and the pervasive impact of trade with less advanced economies. While there are universal pressures caused by technology and globalisation, these do not play out the same way in all countries. National institutions and policy choices matter in moderating the effects of these changes. There are plenty of prosperous economies which have managed to grow without succumbing to the high levels of inequality of the English-speaking world.

Beyond the Valley

When policymakers aim for innovation, they search for models from most innovative places - and they tend to draw on one, Silicon Valley, in particular. Countries from Saudi Arabia to Vietnam have built business parks in deserts, set up state backed venture capital funds to support disruptive innovators, and invested in high-risk innovation agencies. A cliché of Silicon Valley has inspired countries across all six inhabited continents to develop their own Silicon-somethings, from Kenya's

⁹ Blanchet, Thomas, Lucas Chancel, and Amory Gethin. 2022. "Why Is Europe More Equal than the United States?" *American Economic Journal: Applied Economics*, 14 (4): 480-518.

“Silicon Savannah” to the UK’s “Silicon Canal” (Wikipedia lists 81 of these). Innovations from the Bay Area have shaped the world, from Google search to social media such as twitter. The Silicon Valley model of innovation policy is itself one of these, and it has gone viral.

Yet, for all its success, the Silicon Valley model of innovation is highly problematic. The Bay Area is home to many important tech start-ups, but there are homeless encampments on its streets. The US may be the home of more tech unicorns than any other country, but life expectancy has been falling. GDP has grown, but the middle classes have declined. The most successful start-up founders have made billions, but real wages for the least well-off Americans have not increased since 1979.¹⁰ Some scholars have argued that Silicon Valley has concentrated investment in super-star cities, locking in regional inequalities.¹¹ The Silicon Valley model, and the US-centric view of innovation policy which it represents, is not as perfect as it looks.

Other examples are similarly troubling. South Korea has become one of the world’s most important economies for advanced technologies such as smartphones but struggles with stagnant wages and gross inequality (if you doubt this, watch some of its most famous media exports: Parasite, Squid Game, or even Gangnam Style). The capital city, Seoul, dominates the economy so much that the government is pushing for balanced national growth to ensure all in the country can share opportunity. The UK model - less innovative, but still important for policymakers internationally - has strengths in higher-education, but spinouts from Oxford and Cambridge concentrate the benefits in the already affluent parts of the country, while high house prices squeeze the real wages of those who live there.

It is now clear that the Silicon Valley model of radical innovation, start-ups, and elite, exclusive universities does not lead to broadly shared prosperity. This problem has been noted in the classic texts of Silicon Valley. In one of these, Berkeley’s Annalee Saxenian highlights the problems of ‘low-

¹⁰ Donovan, S. A., & Bradley, D. H. (2019). Real wage trends, 1979 to 2018. *Washington DC: Congressional Research Service*.

¹¹ Feldman, M. P., Guy, F., Iammarino, S., & Ioramashvili, C. (2021). Gathering round Big Tech: how the market for acquisitions reinforces regional inequalities in the US. *Kenan Institute of Private Enterprise Research Paper*, (21-01).

income' workers in factories who were already at that stage being priced out of affluent areas. Bennett Harrison argued that “boosterist narratives” of the place ignores problems of inequality and disadvantage. Yet researchers and policymakers have too often assumed that this inequality is inevitable. Focusing on Silicon Valley alone has led us to one conclusion – it is hard to create a truly innovative economy without paying the price of high inequality.

About this book

Innovation policy is fixated on the basic question of how to increase innovation. There have been many, many high-profile books and academic articles providing different, partial answers to this question. The answers matter, of course, and should provide a foundation for policy. Yet focusing on this question treats innovation as an end in itself rather than a means to an end. There is no point being “one of the most innovative countries on earth”, “a leader in the 4th industrial revolution”, “winning the global race for innovation” – or whatever hyperbole is currently in fashion – unless this translates into broadly shared prosperity. The US model, for its great strengths, is problematic: the true purpose of technological leadership is not to win Nobel prizes or have the most disruptive technology, but to increase living standards. Policy for innovation should aim to improve living standards, create good jobs, and ensure prosperity is widely shared. Innovation is vital, but only half the answer.

But while there are many studies on innovation and inequality, most of these are attempts to look at where one leads to the other, be it by considering the impact of technological change on labour markets or studies of the divided labour markets of high-tech hubs. So in this book, I'm going to ask a different question. Rather than look at cases where innovation drives inequality, my focus is on where it is a more positive force: when does innovation lead to widely shared prosperity?

In doing so, I'm going to challenge the conclusion of US studies which show that innovation inevitably results in high levels of inequality. My core argument is that, too often, innovation policymakers ask the wrong question and then look for answers in the wrong places. Because researchers too often focus on the first question - how to increase innovation? - they focus on models

from places such as Silicon Valley, drawing up shopping lists of policies which are then transplanted to other parts of the world in haphazard fashion. It is hardly surprising that these policies fail so often to increase the welfare of people in the national and local economies in which they are applied.

Good inequality, bad inequality

Let me be clear at this point about the problem I am going to focus on. There are good reasons to see inequality as a bad thing. Basic ethics suggests that inequality is undesirable, and a simple utilitarian principle is that the least well off will gain more value from the marginal pound than someone whose needs have already been met. But it might be the case that innovation leads to inequality but is still societally beneficial. A new technology – for example, a lifesaving vaccine – might make someone rich, but others gain as well. Moreover, in the long-term many people would be able to build off this initial innovation, and the wider benefits would be seen. In this case, inequality is the consequence of innovation, but it is not clear that inequality is necessarily a problem. We can see the industrial revolution in this light: it led to a major increase in inequality, as some parts of Britain grew rich, but this was just the first step and other places followed in time. Where it provides the incentive for behaviour which increases living standards for others, inequality can be justifiable. With tongue in cheek, I'm going to call this sort of reward for risk taking 'good inequality'.

The problem is that 'good inequality' too often leads to 'bad inequality'. We know that income inequality is associated with to inequality of opportunity, as those who have higher incomes draw up the ladder from those who have less, and social structures start to solidify. The rich start to bring their children into private schooling and start to demand credentials which cost money, preventing others from participating. But we can see similar processes at work in the wider economy if the unequal rewards of innovation create barriers to competition and the gains from others. Some digital tech industries, for instance, see firms gain a first mover advantage and then build strategic moats – barriers to others gaining market share – which stop others from competing with them. Even worse is the case when these firms maintain their market share through anti-competitive practices or the

strategic use of the law. The unequal rewards of innovation can, in this case, lead to less innovation in the long-term.

A second challenge to this view is that the gains from innovation rarely derive from one firm or worker alone. An innovation tends to be the result of effort from a range of actors, in the public and private sector, who provide the supporting infrastructure and existing knowledge on which innovative firms build. While some inequality might be the result of just reward for the risk and talent required to commercialise these activities, the gains need to be shared widely.

Because of this, it is helpful to think clearly about when inequality is, and isn't acceptable and what should be the goal of public policy. There is a clear rationale for ensuring the benefits of innovation are shared within the firm, industry, or city in which it takes place. There is also a strong justification for incentives to those who introduce new innovations, provided these do not become distortions.

In this book, I'm going to think about the innovation-inequality link in several different ways. Firstly, I will consider aggregate measures of inequality, such as the Gini coefficient which summarises the income distribution between 0 (perfectly equal) and 1 (perfectly unequal). This is useful, but partial as it doesn't tell us much about what is happening within the distribution. Another measure is related – the share of incomes going to the bottom 40%, or even an overall measure median income. It is probably better to be well off but surrounded by the rich than in uniform poverty (although it is better to be rich and equal). There's a question about the extent to which you would tolerate the development of elites if it came with higher living standards for the rest of the population, a question which can only be answered on a case by case basis. I will try and draw out the distinction between 'good inequality' – temporary rewards for genius, risk taking, or hard work – from the bad inequality which can result. I'll also focus on wages and job creation, with a focus particularly on incomes for the middle classes (although this is quite problematic to define). The extent to which inequality is tolerable if everyone's incomes are increasing is a more challenging question.

Innovation and equity: Four clubs

Which countries manage to combine innovation with broadly shared prosperity? It is hard to answer this question. Innovation is hard to define statistically. Common measures, such as R&D spending or patents, give only a partial reflection of innovation. Both are commonly available but limited - they give no indication of the significance of innovation, and many innovative parts of the economy are missing from them.

Shared prosperity (or, its inverse, inequality) is equally hard to define. The standard way of measuring inequality is a Gini coefficient, essentially a measure of how far any distribution is away from being perfectly fair. A higher Gini, normally ranged between 0 and 1, indicates greater inequality. Yet underlying a simple measure are a host of problems – should income be measured pre- or post-tax? Should it be considered as individual or household incomes (and how should children be treated?). How to treat inequality between different groups? A single aggregate measure can hide significant variation within the income distribution.

I will consider these complications in more detail in chapters 2 and 3, but will make a general point here to motivate my approach. The clearest test of the innovation – equality trade-off is given in figure 1 which shows two simple scatter plots of inequality, on the horizontal axis, and the two most common measures of innovation, R&D spending per capita and patenting, on the vertical. The result is a scatter plot which gives four clubs, working clockwise from top left on the left-hand panel: high innovation / low inequality, high innovation / high inequality, low innovation/high inequality, and low innovation / low inequality in the bottom left. The second panel gives a sort of inverse relationships: the bottom 40% share of pre-tax income is ‘more equal’ on the right-hand side. So the club of equal and innovative countries is in the top right corner.

[Insert figure 2 around here]

The first point is obvious: there is no clear relationship between innovation and equity. Innovation does not come at the cost of inequality; nor does high inequality necessarily spur innovation. The East Asian economies are mostly in the high innovation, high-inequality group. These economies are highly innovative, at least when measured by R&D or patenting, but are also unequal. The US, while less R&D intensive, is in the same category. Canada and the United Kingdom are closer to average.

But there is a club of countries which combine innovation with equity. These include the non-oil rich Nordics of Finland, Sweden, Denmark, but also the Central European or alpine giants of Switzerland, Austria and Germany. Even Belgium, traditionally overlooked, has relatively low inequality and relatively high innovation, at least by this measure.

Many of these economies have, in the long-term, been converging with the technological leader of the United States. GDP per capita in PPP terms in the Netherlands was 19,139 USD in 1990, 80% of the US total. By 2019 it was 59,554, 91% of the US total. Denmark went from 76% to 92%. The figures for Austria – which went from 81% of US GDP per capita to 90% - are only slightly worse. Sweden lagged, relatively – staying roughly at 85% of US national income, and Switzerland (whose figures are more volatile because of an independent exchange rate) fell from 115% to 108%. These are strong economies.

It's hard to give a definitive set of countries in each category, but we can roughly say that the Anglo-Saxon economies of the US and the UK (just), plus the most successful of the rich East Asian economies, Japan and Korea, tend to be highly innovative and unequal. Israel, an innovation success but one with an obviously problematic social model, also falls into this category. These countries are those which are often used as the most important models of innovation.

But in this book I will focus on those in other club: highly innovative, but where the benefits are shared. How do these countries translate an innovation-intensive economy into benefits which are widely spread? This is a difficult question to answer, in part because innovation policy tends not to be

directly focused on improving living standards, but also because the policy areas which lead to innovation and those which ensure it is broadly shared are often conducted in parallel with little coordination.

My argument

In this book I make three arguments – each of which I support with theory, empirical literature, data analysis, and case studies of countries which achieve this balance in very different ways. My three arguments are:

First, the dominance of Silicon Valley and, increasingly, China, obscures models which are better at linking innovation with shared prosperity. Europe is too often either dismissed because of the poor performance of Southern Europe in the early 2010s or, alternatively, the focus is on Germany or clichés about the Nordics. Yet other European countries have been highly successful at innovation. Switzerland is regularly ranked the most innovative country on earth, but inequality is below the OECD average. Austria has seen the fastest growth in R&D of any OECD economy, bar South Korea, and has a strong record at creating skilled, middle-class jobs. And Sweden has long been an economic poster-child, combining entrepreneurship and high median wages with a strong welfare state. These countries present important lessons for policymakers in other countries, yet they have too-often been ignored in favour of other models.

Second, the state plays a vital role in ensuring the benefits of innovation-led growth trickle-down. Despite rhetoric about a global playing field, national and local context still matters hugely for the development of innovation systems and how those systems translate into living standards. The success of these states has been in maintaining and developing their own local ‘models’. Innovation policy should not be considered on its own, but with consideration to the wider policy frameworks which ensure workers benefit – this includes skills, housing, and welfare policy. Considering innovation policy without integrating it into a wider policy framework means missing the overall point of innovation. The state plays a role in creating innovation, but also in ensuring that the benefits are

shared. It manages educational and training, providing a cushion which allows entrepreneurs to fail, providing a policy framework which can help ensure the innovation economy is inclusive and so on. The state funds basic R&D, but my argument is that its role is much more important and dynamic than that. However, while a strong welfare state can be important, the role of the state is much broader. In many of the countries I studied state actors had, intentionally or not, aligned policy in a way which ensured that workers had the ability to gain, adapt, and shape the nature of innovation.

Third, policies for innovation and broadly shared prosperity are mutually reinforcing. My final argument is that policies which enable a broader participation in the innovation economy provide an important comparative advantage. High quality public services in Switzerland or Sweden attract skilled international STEM employees who contribute to the economy. The Austrian skill system creates highly productive mid-skill workers, with Austrian firms restructuring production processes to create jobs for these workers. Taiwan balances skill development with innovation led growth strategies. Each of these is an example of co-evolution of state and economy.

Building on these arguments, I will argue that three sets of institutions can be seen in each of these cases. The first set are institutions which generate innovation, particularly where that is at the leading edge. Much of the focus of the academic and policy literature has been on the development of these institutions with good reason, as they are crucial to success in advanced economies. Yet a second set of institutions – those which allow diffusion, adaptation, and spread access to innovation – are more important in ensuring that the benefits are broadly shared. These include applied research organisations, networks of small firms, and skill structures focused on diffusion of new technologies. The focus here is predominantly on incremental innovation and adaptation, rather than radical new technologies. A final set of institutions are focused on redistribution and basic public service delivery. Given the tendency of innovation in many leading-edge sectors to concentrate wealth, these institutions remain important in many countries.

The immediate challenge to these arguments is likely to be that we should be careful about policy transfer – the idea that policies which are successful (or otherwise) in one place can be packaged up and re-used in a very different context. This idea, sometimes called “Fast Policy”, is a real concern for anyone doing comparative work.¹² Where policymakers, desperate for success in a difficult world rely on superficial learning from other countries, with “prefabricated solutions” provided which are decontextualized, in that they are not necessarily appropriate in new geographies, and depoliticised, in that they imply there are no hard choices and trade-offs required. Yet such problems of fast policy are exactly what this book is trying to address. The problem of Silicon Valleyism I outline above is fast policy, and instead we need a deeper understanding of the systems in which certain policy measures succeed or fail. This book is about providing that.

A second challenge is that these outcomes are simply about the state. One variation of this argument is that the only solution to inequality is redistribution and a larger state. Yet while redistribution and the state matters hugely, they can only ever provide a partial explanation. General government spending is just under half of GDP in Sweden and Austria, but in Switzerland it is only 33%, less than the United States (39%).¹³ Figures for Taiwan are missing. While clearly redistribution matters, increasing taxation is not the only way to deal with inequality. According to estimates by Lucas Chancel, the lion’s share of the difference in post-tax inequality levels - fully 90% - between the US and Europe can be explained by the pre-tax distribution. To put it another way, while redistribution matters much of the income distribution is already set by institutional frameworks, the skill distribution of the population, and other factors. Redistribution is vital but is also partly a symptom of something going wrong elsewhere. If the right institutions are put in place, redistribution becomes less necessary. Innovation allows growth, which allows redistribution and so reduces inequality. This is partly true – Sweden and Austria have high levels of redistribution. But not in Switzerland, which has the third *lowest* difference between pre and post-tax inequality in the OECD.

¹² Peck, J., & Theodore, N. (2015). *Fast policy: Experimental statecraft at the thresholds of neoliberalism*. U of Minnesota Press.

¹³ Figures given for 2019, to avoid the pandemic. OECD (2023), General government spending (indicator). doi: 10.1787/a31cbf4d-en (Accessed on 08 January 2023)

A third and final caveat is important: this book is about realism. It is not about clichés of Nordic perfection nor breathless hype about digital technology. Austria's persistent gender gaps are shameful, Swedish populism is embarrassing, and the neutrality of the Swiss model had a dark side. These are countries, not football teams, and I'm not going to pretend that they are perfect. But if we were looking for a perfect country, a perfect model, or a perfect policy idea we would be looking for a long time - instead, we need to learn from the real world.

Plan of the book

My arguments will be advanced in two parts. The first part provides a framework for analysis. I will define innovation, look at how it improves living standards, and consider what conditions need to be in place for this living relationship to hold. I argue that the rents from innovation are an important part of modern economic performance, but that we should be thinking more about sharing the benefits. Many studies consider the risks of innovation, that it will displace workers, but my argument is that it is far better to ensure that workers are in a position to benefit from it. Next, I develop this analytical framework building on data on the link between innovation, inequality, and living standards I will show that countries which combine innovation with equity are not the exception. There are basically four groups of countries in this category: the Nordics (Denmark, Finland, and Sweden), two low countries (Netherlands, Belgium), the Alps (Switzerland, Austria, and – stretching it a little – Germany), and two island nations of East Asia (Taiwan and, by some measures, Japan – although as I will argue Taiwan is not a clear-cut case for inclusion in my category).

Each of the subsequent chapters develops a theme drawing, primarily, on an in-depth example. First, I consider Switzerland – a country which combines strengths in radical innovation in digital tech with incremental innovation in manufacturing industries. The Swiss model is one of historical development focused in long-cycle industries such as pharmaceuticals where historic advantages can be sustained over a long time. The origin story of high-tech growth in Silicon Valley normally dates to the 1950s;

in Switzerland, many pharmaceutical firms date a hundred years before that. This has led to some Swiss cities being highly innovative, although this fact rarely forms part of the popular narrative. Yet while the US middle class has been in decline, in Switzerland there has been robust growth in high-wage jobs for the middle-classes. My argument is that the Swiss model is unusually good at both radical digital tech and diffusion of new technologies through the skills system, regional balance, and applied research.

Next, I consider Austria – a very different model of innovation. By many of the conventional Silicon Valley metrics, the country should barely be competing. There is little venture capital, broadband penetration is low, and the country has one of the lowest shares of graduates in the labour force of almost any OECD country. Yet the Austrian model works: the median Austrian wage is the fourth highest in Europe. The Austrian story has been one of innovation in traditionally low-tech industries such as steel or timber, supported by a strong social partnership model. The result has been that industrial decline has been less stark than in other countries. This case study considers how innovation in traditionally low-tech industries has been crucial to the resurgence of Austria.

My third case is very different. Taiwan is unique amongst the Asian Tigers in having achieved rapid economic growth alongside equity. It has balanced growth in skills with a greater focus on SMEs rather than large firms, and educational development has been accompanied with growth in the welfare state. Taiwan is no Nordic nirvana: inequality has been rising fast, real wage growth for younger workers has been slow, and there are pronounced inequalities. But the island tells something important about the need to balance economic development and skill strategies to ensure that workers can gain from new, high-tech development.

Finally, I consider what is probably Europe's most successful economy in digital tech. Sweden is the archetypal part of the Nordic model which apparently combines inequality with economic competitiveness. The strong welfare state is supposed to be a barrier to competitiveness, but in the Swedish case it works: per capita, the country has more rapidly scaling unicorn firms or tech

billionaires than the United States. I argue that the strong state is an important part of Swedish competitiveness in innovation-intensive industries. But the growth of digital tech is causing problems, even in Sweden.

In each of these cases, I start with history – the economic and institutional conditions in each of these countries can only be understood with reference to its development over time. My work is based on data analysis, interviews with policymakers, firms, and academics, and a review of the literature. I'll present evidence on parts of the economy which are particularly important for my argument, and data on living standards which comes – where possible – from standardised sources.

Moreover, as I argue in chapter 3, many of the benefits (and costs) of innovation are felt in the local economies in which it takes place. Because of this, in each chapter I have finished by narrowing down to a specific region or area which is particularly interesting. I've built on literature, interviewed policymakers, firms, and academics, and conducted some new data analysis. But I can only ever present an overview of the detailed, changing, complexity of the economics and politics of these countries and their innovation systems.

My focus is, deliberately, on the extent to which the benefits of innovation are widely shared. I've tried to take a big picture overview of this – but as a result I am making some inevitable simplifications. One of these is relatively easier to justify, as I am trying to draw simple, tractable, messages from a messy reality. In doing so, I will miss out detail which some will feel is important. Sadly, there is no alternative to doing so. A second simplification is more concerning: I can only give a broad overview of individual living standards in each place I study. Yet inequality is complex, intersectional, and hard to measure. This book is not about the unpleasant ethnic, racial, and gender inequality which exists in these countries. I have tried to acknowledge this but cannot do justice to it in a book which is primarily about linking innovation to living standards in aggregate. These pernicious topics are worthy of fuller research. Moreover, I have focused on one form of inequality, income inequality, rather than wealth inequality which is often closely related to the role of the state

in provision of public goods. For example, where home ownership is less common, wealth inequality is often more pronounced, as individuals do not need to save and so have lower wealth. To abstract away from this, my focus has been on income.

Much of my argument will move beyond innovation. While innovation needs to be placed at the heart of our understanding of different economic models, other features – trade, institutions – are also important. I don't think it is possible to separate these out, and so have chosen not to. But I need to acknowledge that not all the economic outcomes in these places is a result of innovation.

Innovation matters. But it isn't enough for policymakers to think about innovation without also considering how that innovation can improve living standards. No model is perfect, but some countries provide clues about what the benefits of innovation are and how these benefits can be shared. In the rest of this book I will try and draw out some lessons from these places.