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The US as Exemplar and Paradigm

For much of the twentieth century, the US was a standard of the good life, for perfectly explicable reasons. In a war-torn, class-ridden, poverty-stricken and undemocratic world, America was distinctive for peace, class mobility, wealth and the absence of mass terror. This transcendent position reached its height in the period immediately after the Second World War. The vibrant role of the US in the interwar period in the forms of culture characteristic of the twentieth century – cinema, popular music and jazz – was now supplemented by overwhelming military, political and economic predominance.

The most important source of its international prestige in economic affairs, however, has remained its singular superiority in levels of per capita income, which was double that of the nations of Western Europe in 1950. In the postwar period up until the early 1970s, the US experienced lower growth rates in national income and higher levels of unemployment than Western Europe and Japan. Even with this erosion, the US continued to maintain its leading place in the calculation of national income per capita. In 2014, it was richer than any state in the European Union (excluding Luxembourg) – by 16 per cent in comparison with the Netherlands, by 20 and 21 per cent compared with Germany and Sweden, respectively, and by 40 and 41 per cent compared with the UK and France, respectively.¹ As we shall see in the next chapter, much of this apparent predominance disappears for typical workers when these figures are modified to reflect the highly unequal distribution of income in the US and the exceptionally high number of hours worked per year.

The US is an old nation and invariably embodies idiosyncratic and peculiar aspects. It is, for instance, the centre of world science and simultaneously the location of a vast creationist movement. These are fascinating and troubling aspects of the culture, but will be dealt with only in passing. The focus here will, rather, be upon the persistence in the US of a distorted view of its own development that, in retrospect, made the revival of pre-New Deal pieties in the 1980s a plausible event. Thus, even in the late nineteenth century, as we have seen, the American view of Thomas Edison as the lone

curmudgeonly genius contrasted with the more realistic perspective held abroad (see Chapter 2) that he and those like him in the US were grand systems builders.

By the end of the twentieth century, this gap in perception had become a chasm. It is epitomised by attitudes towards the postwar electronics revolution, a key aspect of US hegemony and, even more so, the gateway worldwide to the technology of the twenty-first century: the Edison myth has been re-created in the popular lionisation of the heroic entrepreneurs Steve Jobs and Bill Gates. The creations of these individuals, however, so visible to the consuming public, only emerged in the context of an electronics sector in the US that had its origins in important elements of state enterprise and planning; of no less fundamental significance was the pioneering role played by the state in the US in creating the educational infrastructure that made the electronics revolution possible.

The mythic history of the electronics sector as solely the triumph of entrepreneurial individualism has served as a totem for the renewed political economy of unfettered capitalism in the US from around 1980, reinforced by the disintegration of European centrally planned economies in the period from 1989 to 1991. The decades since 1980 have been characterised by such rapid rises in the levels of inequality and wealth in the US as to make it once again exceptional among major capitalist economies, but not in an altogether positive manner. While growing inequality is to be observed in other economies, its rapid ascent in the US (and the UK) is linked, at least in part, to explicit political decisions that have generated inequality and a willingness to accede to the judgement of the market.

In one sense, American hegemony has remained in place. At a cultural level, the mass marketing of films and television programmes in the US has been successfully transferred abroad and has often smothered local output. In a broad range of academic fields, the American accent has become, figuratively and literally, pervasive. In economics, the US brand offers a view of rationality linked to individual decision making that has only a distant connection with the decisive role played by collective and state action in the nation's rise to world dominance. Like Ancient Rome even after its demise, the US continues to structure worldwide the terms in which intellectual discourse can take place about the future of society.

US history – the peculiar and the explicable

The US emerged in the late eighteenth century with a singular history among large countries. It conducted its political affairs on the basis of a republican constitution emerging from Enlightenment discourse, abjuring an established church and approaching a separation of citizenship from nationality for white Europeans. The rhetoric of its politics moved decisively

in a democratic direction in the first half of the nineteenth century. Yet the functioning of this democratic republic continued undisturbed, even in the midst of civil war, at a time when democracy was considered a volatile and subversive political form by the great sages of the era. Its population ranked in per capita terms among the richest in the world, and, as we have seen, was already notable for its exceptional levels of literacy.

Europe's past was tied to the collective institutions of the medieval manor, guild and church. Much of the tumult of the history of the early modern period was engendered by aspirations to extricate social affairs and personal life from the strictures of these institutions. The US, by contrast, had a primordial myth of the independent farmer: the free, unsupported and unconstrained individual was taken to be not so much an aspiration as a primary, natural state of existence. The state was not to be seen, in European, Hegelian terms, alongside a civil society, but as an encumbrance, perhaps a 'necessary evil'² upon a free and unfettered individual. This view merged with democratic politics and rhetoric in the election for president of Andrew Jackson in 1828, defeating the incumbent John Quincy Adams who had plans for federal expenditure on domestic improvements, including the building of a national astronomical observatory, dubbed by its enemies 'lighthouses of the skies'.³ A history of anti-state and philistine rhetoric has somehow continued to co-exist in the US into the twenty-first century alongside periods of enormous expansion in state power and planning, as well as intellectual dynamism and educational development. And since 1828, all arguments on social and political affairs have been couched in the language of democracy.

Various aspects of the traditional story were dubious.⁴ The myth of the independent farmer is to be seen in the context of the use of state power to subdue aboriginals and to add substantially to the territories of settlement through a war of aggression with Mexico; the prosperity of this independent farmer was also linked to coordinated state and quasi-state action for the financing of the railroads and, as we have seen in Chapter 1, the setting up of grain markets. For the conurbations already in place, from New York to Chicago, internal improvements, city planning and urban hygiene were central concerns.

The notion that social existence in the US distinguished itself from that in Europe by its unfettered and individualistic character may be further contrasted with a range of instances of collective action. In a positive direction, we observe a deeply rooted movement for public education; more negatively, we see an intolerance of non-conformity that drove religious minorities such as Catholics and Mormons to live in tightly clustered communities. The latter exceptions to what we would now consider to be the normal exercise of civil rights pale in comparison to the existence of slavery as the basis for the leading export of the US *ante bellum* economy – cotton. If a conceptualisation of citizenship and national identity that is not

linked to ethnicity, race and religion remains the most significant contribution by the US to juridical procedure in republics, it was deeply compromised by the legacy of slavery: not until the passage of the Civil Rights Act of 1964 do we see the general revocation or striking down of a host of laws and ordinances at the state level that violate the principle of equality before the law with regard to ethnicity, race and religion, such as the anti-miscegenation statutes.

Already by the early twentieth century, the US was perceived by a range of observers to have engendered a new form of capitalism, a coherent system of planned production and continuous innovation. In this period, Europeans remained predominant in technical innovations in areas such as chemistry that were closely linked to the latest developments in high science. But it was the American Edison who fully implemented the practical implications of the great achievements of Faraday and Maxwell in the theory of electromagnetism with the electrification of a great city. In the implementation of the assembly line, attributed to Henry Ford, the US was seen to make a managerial innovation in manufacture comparable to any technological discovery.

By the beginning of the twentieth century, the US was not only notable for the exceptional characteristics of its industrial development, but was emerging as a focus of interest worldwide and a symbol, for good or ill, of modernity. Both its supporters and its detractors agreed that it displayed immense dynamism, with rapid rises in per capita income even in the context of massive immigration. The political system was unique among the great powers, with its century-long uninterrupted tenure of republican-democratic forms and practices (outside of the South), in the context of a political stability rivalling that found even in Great Britain. No society was more successful in inventing and exploiting new mechanisms of mass production and distribution for the transmission of traditional European culture, such as with the sale of the opera recordings of Enrico Caruso. But what made this the American Century as much in culture as in economics and politics – much to the dismay of many on both the left and the right of the political spectrum – was the capacity of this vast and diverse society to find indigenous aspects of its culture, such as the music of ragtime, that had a capacity for mass appeal. As the century wore on, Hollywood and rock 'n' roll played as great a role in the perception of American hegemony as did mass production and space exploration.

Why, Werner Sombart asked at the beginning of the twentieth century, was there no socialism in the US, with its enormous working class ranged against the most advanced form of capitalism in the world? There are proximate answers to this question: the Socialist Party in the US suffered repression due to its opposition to participation in the First World War;⁵ labour union development in the US, as in Britain until 1906, was inhibited by judicial decisions ruling union actions as restraints of trade. These rulings,

coupled with aggressive action, including violence, on the part of employers, constrained working-class organisation until the New Deal. But not even then was Franklin Roosevelt's Democratic Party transformed into a British-style labour party, much less into something more radical on continental European lines.⁶

The absence of a socialist movement in the US was partially linked to the presence of ethnic and racial tensions within the working class in the US. The potential for such conflict was undoubtedly high, with immigration from diverse national and religious backgrounds in Europe, as well as from Asia and Latin America, interacting and competing with the large population of former slaves and their descendants. These divisions were often successfully exploited and exacerbated by employers and by right-wing politicians, and not just in the former Confederacy. Unlike Europe, where socialism was linked to a secularist agenda, populist agitation, much as in seventeenth-century England, was diffused using the language of religious renewal, as in the presidential campaign of 1896 of William Jennings Bryan, a figure who later supported the creation story of Genesis in the Scopes trial of 1925.

Sombart's answer to his own question makes the original query sound almost rhetorical – there was no socialism in America because the living standards of the working class had been raised to a level of comfort that precluded the need for militant action or organisation. For Sombart, the primary impetus for these high living standards – the presence of free land and the possibility of becoming an independent farmer as an alternative to being a worker – was now disappearing. With the 'closing of the frontier' (famously decreed by the American historian Frederick Jackson Turner to have taken place in 1890), Sombart suggested that socialism was likely to experience 'the greatest possible expansion of its appeal' in the future in the US.⁷

And despite the failure of the Sombart thesis as a predictive model, the high wage story retains some explanatory power: there is little doubt that growing living standards in postwar Western Europe were an aspect of the gradual dissipation of working-class militancy and socialist political organisation in this period. But if we thus move to account for the absence of working-class, socialist politics on the basis of growth, rather than levels of income, it becomes difficult to explain the conservatism of politics and labour in the Great Britain of Sombart's day, since Britain was in this period (with the exception of the Netherlands) the slowest-growing country in Western Europe. Sombart's story also doesn't work too well if we take it literally – that a high absolute standard of living dampens militancy – since US workers in his time were poor in comparison to the standards achieved in postwar Western Europe, where militancy and socialist politics persisted for many decades. The notion that US workers in Sombart's day were well-off relative to foreigners – a variant hypothesis – would have presumably struck

them as irrelevant; in any case, workers of recent immigrant stock – those capable of making such a comparison directly – were often more militant than other workers.

The high wage explanation is not sufficient to account for the absence of socialism in the US, as Sombart recognises at various points in his text. What was peculiar to America was the presence of a high and rising standard of living combined with its success in instilling a sense of legitimacy in the population towards the government and its associated institutions. The Civil War of 1861 to 1865, with its demand for a massive sacrifice of blood without external threat, was a successful test of this legitimacy matched in no other country.⁸ For newcomers of European stock, the separation of citizenship from nationality inherent in the US constitution was key to instilling in them a sense of their rights as citizens, as opposed to a presumption that their presence in the country was due to the sufferance of the majority.

The Lincolnesque basis of legitimacy in the US ('of the people, by the people, for the people') was reinforced in the late nineteenth century by the presence of institutions as advanced in every particular as any in the capitalist world – electoral democracy (outside of the former Confederacy), a meritocratic civil service, an independent, often elected judiciary, a sophisticated legal and institutional framework for the setting up and operation of business, and the absence of de facto medieval residuals in rural areas (with the exception of analogous social structures in the former Confederacy).⁹ In the context of the regulation of industry, the US government's antitrust framework was without parallel. In other respects, the US was unrivalled in the progressive nature of its institutions, fulfilling demands that in other countries would fall under the rubric of socialism. We observe the efflorescence of state-funded, secular school education and even universities, offering the prospect of income and class mobility, if not equality, and thus dampening the frustrations of those upwardly mobile groups that were an important aspect of radical political and intellectual life in Europe, and a separation of church and state that gave no basis for a radical politics rooted in militant secularism, as was to be found in France and Italy.

In addition, the US became in this period the epicentre of the myth of upward mobility from independent ambition and entrepreneurial activity, disseminated through the British writer Samuel Smiles (1812–1904) and later the American Horatio Alger (1832–99). Legitimacy in an economic context was thus reinforced in the US not with any claim to economic equality per se, but to an equality of opportunity, a notion long implicit in British liberal ideology, but having far greater pungency in the context of American republican institutions, practices and habits, as even a grumbling Sombart was willing to concede: 'One must accept that there is a grain of truth in all the nonsense spoken by the Carnegies and those parroting them who want to lull the "boorish rabble" to sleep by telling them miraculous

stories about themselves or others who began as newsboys and finished as multimillionaires.¹⁰

Indeed, there has long persisted in the US an image of the UK as a society more equal than the US in terms of claims on resources (as evidenced by the presence of the socialist National Health Service), but less mobile because of the residual effects of a class system, epitomised by the presence of a royal family. The role of class, blatantly and overtly present in the UK two generations ago, interacted subtly with the issue of mobility in terms of the differential access to economic and political power offered to an elite, as well as the limited aspirations embodied in 'knowing your place' for the lower end. Propagandists for American uniqueness highlighted these aspects of stratification in Europe, as if they were absent in the US, and coupled them with claims that the US was uniquely receptive to the emergence of the next Thomas Alva Edison: the US as the land of opportunity, most especially for entrepreneurial endeavour.

To the extent that this notion of the US as *der goldene Medina* (the Golden Medina) possessed a modicum of validity, it was a product of the sheer absolute superiority of the US in levels of per capita income and the provision of broad access to education of all kinds compared with Western Europe from the nineteenth and over much of the twentieth century, as we shall see below. Social mobility was due less to the US being a unique bastion of entrepreneurial freedom than to the more substantive presence of an elaborately funded state educational system that provided the possibility of individuals rising through the professions as employees, and only occasionally as independent business entrepreneurs.

In broader terms, America's dominance, far from being a manifestation solely of spontaneous action by lone entrepreneurs, was underwritten by its success, most especially compared with Britain, in the creation of industrial giants whose characteristic planned and coordinated nature was a key inspiration for the technocratic paradigm of technocrats and socialists. But the American myth remained that of the independent creative genius – Edison and the young Henry Ford – despite their reliance at every stage on a rich infrastructure of skills and intellect at least partially created by collective action, without whose presence their schemes would never have come to fruition.

The economy, culture and politics of the US had been a subject of intense study and curiosity by others in the first part of the twentieth century, but the period after the Second World War was one in which the commanding dominance of the US was underwritten by its moral prestige. The US emerged after the war associated with its role in the creation of the United Nations, the associated declarations on human rights, the Marshall Plan aid programmes for Europe, and an anti-colonial rhetoric. In material terms, the US was without rival for the first decades after the war, setting a standard that other nations felt to be dispiritingly distant. The lead in

school education pioneered earlier in the century by the US was now reproduced in an expansion of higher education from both the state and private sectors that was unmatched anywhere in the world.

If in the first part of the century the US had already established a predominance in the practical implementation of technologies, from the electrification of cities to the invention of the safety razor, after the Second World War these accomplishments were now matched by supremacy in theoretical pursuits, such as pure mathematics and physics. The illustrious individuals who had fled totalitarian interwar Europe were instrumental in the maturation of scientific and technological activity in the US after the Second World War. But the human and institutional infrastructure already in place meant that the dispersion of mathematics and high science was unprecedented in breadth and depth, a fact reflected in subsequent decades both in the theoretical productions emanating from academic institutions and in the application of high science in nuclear power and electronics.

The presence of notable exiles from Europe was perhaps of even greater significance in high culture than in technology; the US became a centre for European classical music, with residency by composers Arnold Schoenberg and Igor Stravinsky and a host of eminent conductors and instrumentalists. But even here, the domestic soil was already rich, and the ferocious Schoenberg had to concede that he had never heard a better performance of his *Verklärte Nacht* of 1899 than that produced by the augmented Hollywood String Quartet. As if it were not sufficient that it had achieved parity with Europe in the replication of classical music, the period after the Second World War also saw the worldwide realisation that the US, most especially through its African-American citizens, had created in jazz a new and distinctive branch of the Western musical tradition that in its postwar manifestation as be-bop was self-consciously high art. An even more pervasive influence was the emergence of rock 'n' roll in the mid-1950s – a popularised synthesis of African-American electrified blues with a largely white country and western tradition. Thus, the US became emblematic of modernity worldwide, not merely because of the vision of a high material standard that it represented, but because of its striking influence on both high and popular culture: debates on modernity – almost wholly identified with the 'Americanisation' of life – already in progress since earlier in the century, continued at a new level of intensity.

The impact of this Americanisation worldwide, but especially in Western Europe, was profound: as postwar prosperity unfolded, this region found itself confronting American-style mass consumption, youth culture and the other consequences of affluence in its daily life. In a range of instances, European nations failed, as in access to higher education, and in others succeeded, as in the provision of universal health insurance, in finding solutions to the problems of affluence superior to those in the US.

But the US precedence in modernity was present not only in economic and social life, but also in political affairs. In the case of former fascist countries, there were issues surrounding the construction, or reconstruction, of liberal political democracy. More pervasively, mass immigration has forced Europeans to confront the quintessential American issue of the relationship between citizenship and national or ethnic identity: for example, Germany was reluctant until recent times to offer citizenship to long-standing guest workers from Turkey or their children, but gave a right of return and citizenship to foreigners claiming German ethnicity. Even European countries with long republican traditions, such as France, have often dealt with this question in an obtuse, unthinking manner (such as the infamous phrase found in French textbooks offered to francophone Africa – ‘Nos ancêtres les Gaulois’), with others resorting to genocidal approaches, as in the former Yugoslavia. And few European nations besides France have embraced the relatively rigorous separation of church and state embodied in the US constitution, thus prohibiting the privileging by the state of any particular religious practice or institution.¹¹ If in daily life the US has not always dealt with issues concerning race, ethnicity, religion, gender and immigration with any greater justice or efficacy than other nations, its constitution, especially as amended after the Civil War, had set a standard for the juridical and political equality of all those living within its borders long before other rich nations.

Postwar Western Europe had to deal with unburdening itself of its past history, which it did sometimes eagerly and at other times with regret. The changes in daily life were palpable, with the transition from a predominantly rural to an urban economy and society having barely begun in many countries, and the necessity for the recasting of political procedures and institutions in formerly fascist and authoritarian states. In the US, the situation was very different. Postwar prosperity and full employment merely permitted a return to the dreams of material affluence put on hold by the interwar depression – cars and household appliances were not new in postwar US, just more freely available: only television was newly visible in the ordinary life of upper-middle-class families.

Politically, the eighteenth-century constitution continued its uninterrupted functioning, US citizens noting with amazement the movement in France from a third to a fourth, and eventually to a fifth republic, with not even McCarthyism and Cold War paranoia impinging seriously upon the stolid self-confidence with which the US viewed the world. In important ways, the US had become the oldest country in the world – an American child’s breakfast of the mass-produced product of a great corporation, Kellogg’s Corn Flakes, might well have been the same as that of her great-great-grandfather: in Europe, the introduction of such delectations for breakfast represented a profound disjunction with the past. Americans in this period were not forced to think about change to the same degree,

because it took place with less discontinuity and did not have its origins in any other nation's culture.

In the present day, American culture may well prove less adaptable to changing relations with other nations, precisely because of its ownership of the twentieth – the 'American' – century. Past successes and the illusions attendant on them may generate an obduracy that makes it impossible to respond to present-day challenges. Already in the interwar period, Hollywood movies absurdly depicted foreigners, from Parisian policemen to Czech shopkeepers, speaking fluent if pleasantly accented English, a practice that continued well into the postwar period of US hegemony. But, like sleepwalkers, Americans have woken up in the twenty-first century, and this fantasy is an approximation of reality: hoteliers in Paris, as well as corporate executives and academics in Europe, will function in English. For many Americans, this relatively recent development is taken as a verification of continued hegemonic power and cultural superiority, and an excuse not to learn languages, or anything else, from foreigners. When coupled with a history that is perceived as defeating all challengers – the Axis powers in the Second World War, the Soviet Union in the Cold War, and even the later economic rivalry with Japan – there is, at worst, in the collective psychology of the US a notion of divine protection, one that makes it unnecessary to deal seriously with substantive realities such as climate change.

And the grand myth of the heroic entrepreneur continues to be of great assistance to right-wing political movements in the US seeking a return to former glories by pursuing a path of individual self-reliance and low taxes. The realities of American history are something quite different. Much of the earlier achievement of the US is located in collective action in various forms, most importantly in the commitment to education, as well as in acts of planning in the economic sphere, as will be seen below.

Economic development and government enterprise

A few years ago, I was asked to review a few chapters of a book proposal by American academics. The prospective book was well-constructed and distinctive: for a nation notorious for marinating in its own history and institutions, this book was a rare foray into comparative economic history, in which a European model of government involvement in industry was contrasted with the hands-off US approach. The analysis was admirably even-handed in weighing the merits of each system, but ultimately left me, in a proverbial sense, speechless. A key premise of the whole book – that US industrial affairs can be described from a fundamentally laissez-faire perspective – was based on an innocent blindness to the substantive and rich instances of state involvement in the US economy that have proved critical to its development.

The mythology of independent enterprise is compromised at its epicentre – the US agricultural sector. By 1890, ‘the development of large-scale, government-financed agricultural research appears to have been primarily an American phenomenon not copied abroad’.¹² As a result of the passage since 1862 of acts of Congress creating the US Department of Agriculture (USDA), the land grant colleges and agricultural experiment stations, practically all agricultural scientists throughout the early twentieth century were full-time government employees.¹³ Though the resulting agricultural research made little direct contribution to productivity for many decades,¹⁴ the disproportionate electoral weight of the agricultural sector in US national politics continued to underwrite the development of these institutions and their expansion in the 1930s and subsequently.

There is a purely economic rationale for the exceptional level of government intervention in this sector, one perhaps implicit in the minds of the participants but not formalised until a century after the original acts of Congress:¹⁵ even when the individual, atomised farmer has the intellectual capacity to pursue agricultural research and is not constrained financially from so doing, such research will rarely be undertaken, as any resulting benefits will quickly be dissipated to others. US farmers, realising these limitations, had formed thousands of voluntary associations by the early twentieth century, which were conduits, along with county agents, for the diffusion of research from the USDA, experiment stations and land grant colleges; attending meetings offered by the public extension service in order to become acquainted with the latest research and techniques became a regular and important activity.¹⁶

Starting in the 1920s, more dramatically in the 1930s, and continuing during and after the Second World War, the agricultural sector evidenced substantial rises in productivity that were sustained for many decades, reflecting the successful assimilation of the products of free enterprise, such as tractors and other machines powered by the internal combustion engine, as well as foreign innovations, such as the invention of chemical fertiliser. These developments were complemented by the activities of government and government-financed institutions in the creation of a broad range of scientific innovations and procedures, as well as the offering of assistance and guidance in the introduction and implementation of these transformative changes: the government played a central role in the creation and dispersion of a scientific-technological revolution in US agriculture.¹⁷ From the perspective of dynamic efficiency, the American agricultural sector emerges as an exemplar not of disinhibited free enterprise, but of successful governmental–private sector collaboration.

The by-products of this revolution in the agricultural sector have been manifold. On the one hand, this scientific productivity revolution was of disproportionate benefit to well-off farmers and owners, with resulting pressures driving smallholders, sharecroppers and others off the land that

were only partially mitigated by the New Deal interventions described in Chapter 8.¹⁸ But the depletion of rural areas and escape to urban centres are a commonplace of capitalist development. What is striking is the extent to which the vast subcontinent embodying the US did not follow this cultural pattern of an educationally backward rural sector, as we shall see below: the origins of the high school movement are to be found in the Midwest, with respectable rates of college attendance engendered by the land grant colleges, largely, in the early decades, for non-agricultural pursuits.¹⁹ The role of federal government in the creation of these institutions of higher education interacted with unprecedented action at the state level for public school enrolment, giving the US a uniformity and depth of education across its great expanse (outside the former Confederacy) that was to have profound consequences for its economic development during the twentieth century.

In industrial development, the US had a world presence even in the *ante bellum* period, with the 'American system of manufactures' notable for its distinctively high volumes, uniformity of output and use of interchangeable parts. These early triumphs of the system of free enterprise in the US had their origins in 'armory practice' – the demands from the early nineteenth century by the US Ordnance Department that weapons be produced using interchangeable parts. In what would now appear as a slow process of dispersion, the know-how embodied in armouries was diffused via the machine tool industry through a range of consumer products. This culture of interchangeable parts, especially new techniques in pressing and stamping steel introduced by bicycle manufacturers, was later to be central to the emergence of the mass manufacture of Henry Ford.²⁰

Several elements of the development of mass manufacture in the nineteenth and early twentieth centuries thus parallel those to be found in the following discussion of the postwar electronics industry: the US government's role as a source of market demand and in directing development in the primary stages of the new technology; the reliance of the new sectors on the *in situ* skills embedded in the older, displaced ones (bicycles in the context of car manufacture, and vacuum tubes or valves in the case of electronics); the necessity for innovation in the context of a high-wage economy. An important difference in the case of electronics, as we shall see below, is the central role played by science and science-based education in the evolution and dispersion of technology in the postwar context. Both of these American success stories cause difficulties for primitive narratives built around *laissez-faire* and creative destruction.

But this myth of free enterprise and the heroic entrepreneur has proved persistent, partly because it contains important elements of truth. The US economy from the late nineteenth century until the Second World War had evidenced forms of government intervention in its development: distinctively high tariffs, a deep engagement in the technology and the dissemination of knowledge in agriculture, the financing of the railroads, government

activity concerned with the setting of uniform standards in the electrical industry and other sectors, and, as we shall see below, First World War involvement in the reorganisation of the infant electronics industry with the creation of the Radio Corporation of America (RCA). All this is true, but overall, the Second Industrial Revolution of the late nineteenth and early twentieth centuries – the emergence of giant firms, mass production and the innovation of new technologies – took place under the aegis of private enterprise uncoordinated by any state agency, and was often directed and sometimes founded by an entrepreneur. This history may thus be summarised as follows:

1. Technological and institutional innovation in the US (and other countries) largely took place within firms, with leakages from these technological achievements to other firms sufficiently small to make investments in new technology profitable, largely as depicted in the literature of endogenous growth theory.
2. The direction of the development of these new technologies was almost exclusively initiated and directed by firms for the purpose of making a profit in the private sector.
3. Investment in new technologies was undertaken by firms using funds from internal sources and externally from financial institutions and private individuals.

By contrast, the high-technology industries emerging after the Second World War – electronics (semiconductors, computers, telecommunications), aircraft manufacture, atomic power and space exploration – took a very different path. Of these, the electronics sector has had perhaps the most powerful and permanent impact worldwide. In contrast to the Second Industrial Revolution, the innovations of the postwar period emerge in a very different way:

1. Technological innovation in the high-tech sector emanated from a complex web of firms, universities and governmental institutions.
2. High-tech research and development, especially in the crucial first two postwar decades, was largely, though not exclusively, initiated and guided by an interaction between private enterprises and governmental agencies, most especially the US Department of Defense (DOD).
3. As in earlier times, investment in new technologies was undertaken by firms using internal sources and a range of financial institutions and private individuals, with an important role for investment banks and equity-based entrepreneurial finance. But in the postwar period, the government (largely the US DOD) played a key, and in the early decades an overwhelming, role in the financing of research and development of new technologies, whether undertaken by companies, universities or a

governmental agency. Government financing of companies' innovation often took the indirect form of generous 'cost-plus' contracts and/or a guaranteed market for the purchase of the products of firms.

The role of defence expenditure in the postwar US was a subject of great controversy. To President Eisenhower (or his speechwriter) in 1961 we owe the phrase 'military-industrial complex', with its implication that much of this expenditure was unnecessary and due to a corrupting influence on political processes; Baran and Sweezy, as we have seen in Chapter 5, thought that defence expenditure was, like advertising (though even more sinister), part of the economic surplus – useless expenditure maintained to prop up a capitalist economy that would otherwise collapse.²¹ Some economists were concerned with possible inefficiencies in weapons acquisition, with cost-plus agreements permitting cost overruns and possibly excessively high profits for contractors.²² Others noted the high cost to society in terms of the drain on civilian resources.²³

And yet, with all these negative characterisations of defence expenditure, a profound paradox emerges. In the early postwar years, US hegemony appeared to be linked to the great Second Industrial Revolution sectors such as cars and steel, which were engendered and sustained (albeit with some government contracts) by private enterprise. But the performance of these sectors, once so emblematic of US power, was ultimately undistinguished in comparison with that of their international rivals, and began a long contraction. What eventually emerged as the industrial basis of American economic and military power in the postwar world were sectors in which the financing and coordinating role of government was crucial. If earlier the list of sectors with a high level of government involvement included only agriculture, in the postwar world it embraced a whole new set of activities in which the state played a key role, not only in the financing of these sectors, but in the planning and the development of new technologies; in the case of the internet, the US government was central to its creation.²⁴

The US that thus emerged in the twenty-first century was one that had suffered precipitous decline in a range of traditional free enterprise industries, in many of which, such as textiles, this was an inevitable product of the increasing competition from lower-wage countries. In other cases, however, such as the car industry, rapid decline was linked to the failure of this free enterprise sector to maintain its enormous historical advantages when faced with superior management, production techniques and products from others, most notably the Japanese. By contrast, many of the distinctive advantages that the US has retained are embodied in a series of high-technology sectors that are the product of state financing, planning and coordination²⁵ combined with intense competition between enterprises and entrepreneurial financial activity.

Most importantly, all of these sectors were underwritten by several generations of state investment in public and university education, complementing a rich *in situ* base of practical skills with the intellectual infrastructure to make these developments possible. Other elements of US advantage in the tertiary sector, such as the sophistication of its financial institutions, were also made possible by this exceptional commitment to education. An distinctively practical and business focus in American universities may have facilitated this extraordinary outburst of new technologies, but the key characteristic that differentiated the postwar US from any other contemporary society, and any other society in history, was the sheer size of its intellectual establishment, either on a per capita basis or in absolute terms.

And yet, the myth of the entrepreneur has been the impetus in recent decades for a neoliberal reconstruction of society in the US in order to recapture past glories linked to this mythology. Its most recent ideological incarnation in business school circles in the US has been an updated version of the Schumpeterian doctrine of creative destruction – the notion of innovation as invariably disruptive, but inexorable and inevitable in the contemporary world: we can do little but fatalistically accede to its power.²⁶

The postwar electronics revolution in the US fits poorly with these notions of innovation being acts of creative destruction and disruption. The semiconductor was central to the early history of this revolution, with its invention and development prerequisites for progress in almost all other aspects of electronics: the Japanese later dubbed the semiconductor the ‘rice’ of the industry. The semiconductor also plays a special role in capitalist mythology. In its genesis, it appears as the quintessence of Schumpeter’s thunderbolt from a great monopoly: the overturning of the well-established vacuum tube (valve) industry appears to be a prime example of creative destruction of an older sector, with the newer one rising from the ashes.²⁷ And, far more than the mainframe computer with its identification with the Goliath IBM, many of the subsequent semiconductor and microchip developments were the products of firms beginning as entrepreneurial Davids, leading us to a giddy ‘overthrow of matter’²⁸ with the aid of heroic, risk-taking venture capitalists.²⁹ All of these entrepreneurial elements are relevant to the overall story, but must be seen in the context of a sector that emerges from a complex web of relationships between firms, government contractors and universities, whose different aspects are not easily disentangled.

Bell Labs announced the invention of the transistor in 1947, but this discovery had not been made serendipitously. The notion of solid state amplification had emerged as early as 1936, with the research arm of the great private US telephone monopoly AT&T, Bell Labs, seeking a replacement for mechanical relays by electronic connection.³⁰ Bell’s development of the transistor proceeded independently of government funding, though Second World War research and expenditure on radar gave it an important impetus.³¹ An exceptional aspect of the emergence and development of

this sector was the crucial role played by the absorption and integration of the latest achievements in solid state physics,³² a fact that underlines the importance of the existence in the US of a sophisticated intellectual infrastructure from the universities in the genesis of the electronics revolution. The centrality of pure science also plays, as we shall see below, a key role in explaining why the role of government in the innovation process, so peripheral at the beginning of the twentieth century, emerged so prominently here and in subsequent developments.

An important contribution to early research efforts was also made at a less abstract level in materials research by chemists and metallurgists, some of it linked to wartime work: ‘the “linear model” of technological development – wherein scientific research precedes technological development, from which useful products emerge – does not encompass very well what happened in the case of the transistor’.³³ In addition, the new industry was dependent upon the prior existence of skills and the institutional infrastructure from sectors it was later to replace. The emergence of the famous Silicon Valley area of California is linked to the presence, from the early years of the twentieth century, of an extensive electronics sector to serve the needs of the US Navy, shipping companies and then ham (amateur) radio enthusiasts;³⁴ Charles Litton and other tube manufacturers from the interwar era built up a sector whose familiarity with a range of materials and vacuum techniques, cleanliness and precise protocols in manufacturing made them competitive in quality control with the great East Coast manufacturers. Many of these *in situ* skills and institutions were important for the postwar semiconductor sector, as was the entrepreneurial model of a new firm emerging with little capital on the basis of contracts with the US DOD; some of the older manufacturers became suppliers of equipment to the newer industry.³⁵

Even in this apparently most striking example of Schumpeter’s creative destruction, the notion appears to be deeply inadequate. It is vague enough to permit various readings, but the language he uses – comparing this process to a gale, or even a bombardment³⁶ – seems to suggest a sanguine attitude towards the destruction of now obsolescent sectors for the sake of creating anew. But this Wagnerian linkage between destruction and new creation comes up against the historical reality that new developments, be they the cotton industry of the Industrial Revolution, the car industry, or the revolution in miniature of the semiconductor, rely upon the existence of embedded activities, whose associated skills and ways of life can then be transferred to the new activity. In addition, as noted in Chapter 6, older technologies tend to remain in place longer than is generally recognised because of the persistence of bugs and difficulties in implementation of the new techniques and machines.³⁷ Thus, creative displacement, rather than creative destruction, is the norm for socially beneficial developments: the notion that laying waste to a region or sector is a prerequisite for progress is false.

The invention of the transistor by Bell Labs generated enormous interest and excitement in the scientific and engineering community. But for Bell, the device was largely conceived merely as a replacement for the vacuum tube; diffusion in the civilian sector was slow, with some applications in telecommunications and hearing aids. In consumer products more broadly, there was little more than the furtive (and premature) issuance of a transistor radio by Texas Instruments in 1954. Broadly speaking, 'The *ad hoc* manufacturing technology of the early fifties, while sufficient to sustain at least with military help – a minor industry, would have been unable to support the sort of growth the industry was experiencing by the early sixties.'³⁸

A decisive factor engendering the rapid transformation of this sector was the role of the US government, largely through the US DOD. The state played a central role in the funding and directing of research and development by firms and universities, and, more importantly and unambiguously, the DOD created a large and lucrative market for these untested products that permitted firms to undertake long-term development by shifting much of the risk of failure to the tax-paying public through the use, in the 1950s especially, of cost-plus contracts.³⁹ It not only provided an open cheque-book for the provision and engendering of unprecedented new products and their replication in massive numbers, but was constantly prodding and monitoring companies to meet the demands of military technology.⁴⁰

The role of the DOD in providing a market for these new technologies was decisive. One key enterprise, the Silicon Valley startup Fairchild Semiconductor (in fact, the subdivision of a more conventional firm), played a central role in the emergence of reliable and cheap transistor production with the planar process (based on research at Bell Labs). This development was critical to the economic viability of the integrated circuit,⁴¹ and was perhaps the most important innovation since the invention of the transistor itself. Fairchild, along with Texas Instruments, also produced the first integrated circuits about the same time, around 1960. Yet even Fairchild, which generally avoided military financing of R&D in order to prevent the DOD from controlling its research and product development, agreed that 'only the military and the large weapon system contractors... would have the necessary financial resources to buy the complex and expensive products'.⁴² US government purchases of integrated circuits as a percentage of total production were 100 per cent in 1962, 94 per cent in 1963 and 85 per cent in 1965;⁴³ as late as 1959, 85 per cent of total electronics research and development was financed by the federal government.⁴⁴

With the invention of the integrated circuit, a technological revolution beginning in 1947 that might have lasted for the rest of the century if governed by the demands of the free market was consummated in less than a decade and a half with government financing. The increased reliability, and the doubling of the number of transistors on a microchip every 18 to 24 months that followed the emergence of the integrated circuit ('Moore's

Law'), made the semiconductor a viable, and then a necessary, commercial product, symbolised by the creation by Intel in 1971 of the microprocessor – a so-called computer on a chip.

The decisive role of the government as a market for these devices in the early phases of its development is indisputable; its other functions were also of significance, if more contentious. Efforts to spread knowledge by Bell Labs were complemented by government sponsorship of conferences and symposia starting in the early 1950s.⁴⁵ In the wake of the invention of the transistor, the US government's aggressive antitrust stance thwarted any temptation on the part of AT&T to preserve control over its development, with a consent decree of 1956 forbidding it to sell semiconductors or computers commercially and demanding that it give royalty-free licences on all transistor patents up to the year 1956, and at 'reasonable royalties' thereafter.⁴⁶ As noted above, the invention of the planar process, a key element in the development of the integrated circuit, took place at Fairchild in 1959 without explicit government support. But the shaping of silicon technology, and later the development of the planar process and the integrated circuit, 'were closely coupled with military procurement and the establishment of reliability and performance standards by the Department of Defense',⁴⁷ with a more rapid dispersion of these new technologies than would otherwise have taken place because of governmental demands for multiple sourcing of products.⁴⁸ Overall, it is hard to avoid the conclusion that 'By creating, supporting, and disseminating diverse approaches to technical innovation in semiconductor microelectronics, government agencies were extremely important in the overall development of micro electronic technology and thus also in the development of the microelectronics industry.'⁴⁹

Early innovations emerged from the AT&T monopoly and from the established receiving tube firms, such as General Electric and RCA, with their extensive research facilities and rich experience in the production of electronic devices. But with older firms hesitant to abandon the lucrative tube market, by the mid- to late 1950s the impetus was shifting to firms that were either new (Fairchild Semiconductor) or new to the sector (Texas Instruments),⁵⁰ generating intense competition among the contracting firms, as they often span off into new enterprises. There was a broad, fluid range of supplementary finance available from other companies (as in the creation of Fairchild Semiconductor by Fairchild) and from established investment banks; by the late 1960s, managers and engineers were leaving Fairchild to start new ventures, facilitated by the emergence of a range of venture capital enterprises and an independent semiconductor equipment industry.⁵¹

The firestorm of energy leading to the introduction of the microprocessor in 1971 and beyond is thus seen to be the product of a complex interaction of forces. In its genesis and early development, the sector was characterised by planning with a long-term time horizon from AT&T and the US government;

further impetus then emerged from intense competition engendered by the fluid entry of new firms, often financed by equity-based venture capital with a much shorter, typically five-year, time horizon. Venture capital here – in sharp contradistinction to some later forms of financial innovation (such as the bundling of subprime mortgages; see Chapter 12) – was characterised by a hands-on, intimate knowledge of the sector, with investors often being engineers and/or entrepreneurs themselves.⁵² The resultant intense competition engendered rapid imitation of Fairchild's silicon transistor planar process and manufacturing techniques for integrated circuits in the 1960s.⁵³ As will be discussed below, this shift to shorter time horizons in the semiconductor industry may reflect the gradual predominance of engineering over fundamental scientific achievements as the product matured.⁵⁴

Other important participants in these developments were universities such as MIT and Stanford, key players in the 'military-industrial-academic complex',⁵⁵ whose intensity of integration with these practical high-technology projects – mostly state-financed and with a military connection – was perhaps without precedent in the history of capitalist development.⁵⁶ These tendencies were enhanced in the Cold War context: as late as 1968, 73 per cent of university and college research and development was funded by federal government, with 58 per cent of the total going for defence and space-related research.⁵⁷

Educational establishments in the US thus played an important role in the formal development of these technologies, a practical orientation to which they had been directed since the late nineteenth century, generating Veblen's deep sarcasm about the nature of these university–business links. US higher education has aspects that still distinguish it from universities in other countries in the context of research and development and patents, including the possible compromises to its integrity from business, the military and (among private universities) rich alumni. In these aspects, as well as the presence of athletic scholarships, sororities and fraternities, the US university system remains singular, most especially when compared with its European counterparts.

But in the period after the Second World War, the most important characteristic of the US educational system that permitted it to contribute to this monumental, world-transformative technology was not so much a business orientation that lent itself to involvement in projects for the practical development of these technologies, but, rather, the sheer size and coherence of the university sector in the US, in both its state and private incarnations. The offerings of US universities dwarfed what existed, and ever had existed, in any country, with scientific and technical subjects ranging from pure mathematics and theoretical physics to the full spectrum of engineering disciplines, as well as provision of specific programmes relevant to semiconductor research.⁵⁸ The richness of the university infrastructure undoubtedly promoted mastery of a range of other skills – administrative,

entrepreneurial and even legal – that were significant in, for instance, Silicon Valley development.⁵⁹

This high level of human infrastructure, the product of an incomparably rich and elaborate university system emanating from state and private sources, had been underwritten by the development of its predominantly state school system. In the pre-Civil War period, US school participation was surpassed only by Prussia; by the early twentieth century, the US was a world leader in participation rates in secondary school with, strikingly, many of the highest rates for the smallest towns.⁶⁰ The notion of the US as a uniquely mobile society was significantly reinforced by these developments.⁶¹

It was the existence of these educational prerequisites that provided both a human infrastructure for the engendering of the entrepreneurs and the personnel for the extraordinary, and extraordinarily rapid, emergence of the electronics sector. When coupled with the *in situ* advantages embodied in individuals inheriting the already advanced development of this sector (such as the key role of amateur ham radio operators in the post-First World War electronics industry), the superiority possessed by the US must have seemed insurmountable. Yet, within a few decades, the US was to be challenged at the very highest levels in electronics, not exclusively, or even particularly, by its European peers, but by nations such as Japan and, later, other Asian nations that, in the immediate postwar context, had appeared to be among the poorest nations in the world. The very sophistication of this sector, with its high component of pure science and its constant desire to put in place strict protocols of manufacture to replace black art,⁶² meant that the rapid emergence of the new technology in its early phases could only take place with extensive state subsidy. But somewhat later, this high scientific component helped promote a rapid diffusion of this revolutionary technology to potential international competitors with the appropriate educational prerequisites.

The period of development in the electronics sector up to 1971 (with direct control of the internet by the US military stretching into the 1980s)⁶³ is thus to be characterised by an admixture of elements with long-term considerations, such as the development of *in situ* skills and institutions, government and big firm (such as AT&T) planning, and advances in formal education, combined with shorter-term, entrepreneurial behaviour in a fiercely competitive environment. But since that time, the seemingly inexorable unfolding of Moore's law has lowered the price of computing power so far as to push the public's focus almost wholly onto applications of this power and its use with the internet – this being the weightless world of entrepreneurial startups and competition, with the Lourdes of this new faith being the garage in Los Altos, California where the electronics hobbyists Steve Wozniak and Steve Jobs started the Apple Computer Company in 1976. Apple's success, however, presupposes not only the range of long-term elements that made cheap computing power and the internet available, but