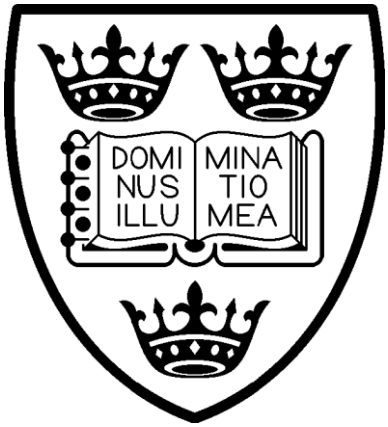

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Railways as Patient Capital

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Abstract

Why are railways mostly in the public sector? Interest rates define a time limit for markets. Projects with longer break-evens cannot be funded by business alone. Corporate 'franchise' arrangements overcome the limit by means of revenue guarantees which transfer risks to government. Innovations originate bottom-up in private enterprise. Positive externalities create demand for universal provision but scaling up cannot be financed commercially. In the British railway manias of the 1830s and 1840s speculative fever overwhelmed prudence. Overinvestment left an excessive infrastructure legacy and wiped out windfall profits. In other countries railways required external support. Expanding access give rise to stand-offs with investors which ended up in government regulation or takeover. The tramway boom of 1870 to 1914 followed this pattern, initially with horse power and then electricity. In the UK railway privatisation of the 1990s, the free market delusion was confounded by the infrastructure requirement for long-term commitment.

Keywords: Railroads, privatisation, project evaluation, public services, scope of government

JEL classifications: G11, G18, H11, H43, L33, L92, N7

Railways as patient capital[1]

Why are railways across the world mostly in the public sector? Railways are an enduring technology: After two centuries new ones are still being laid. The permanent way and rolling stock require costly up-front investment, and take long to pay off. Long-term durability places such projects beyond the time horizons of commercial credit. The positive externalities are difficult to internalise. Hence railways worldwide tend to be run by governments or as regulated monopolies. In British railway history private enterprise took the lead three times, during the railway booms of the 1830s and the 1840s, the urban transit revolution of the late-Victorian period, and railway privatisation in the 1990s. These episodes show why it is difficult to run a private-sector railway.

I

Victorian cities grew piecemeal. Network infrastructure requires rigorous specification, disciplined execution, and central control. Before steam railways two transport networks existed in Britain, namely toll roads (turnpikes) and canals. Cities were being undergirded with paving, waterworks, drainage, sewage, street lighting, and energy supply. Much of that was done by private enterprise, sometimes for profit and sometimes through joint private and collective action (Bogart, 2014; Laski et al., 1935). Horse and man-powered railways began to carry goods over short distances during the eighteenth century. When steam locomotion was applied in the 1830s, it offered a more than tenfold improvement in freight costs and the opportunity was seized by entrepreneurs and investors (Bogart, 2014, table 5, 385). The limited-liability joint-stock corporation emerged to enable railway construction (Chaplin, 2016).

Victorian cities were dark, dirty, and unhealthy(Chadwick, 1942/1965; Williamson, 1994). At the outset, alleviation technologies were untested and demand for them uncertain but novelty held out the promise of high returns. The opportunities of canals, water supply, gas, railroads, tramways, telegraphs, telephones, underground railways, and electricity, have all driven capitalists into ‘manias’ of over-investment. After the dust settled a good deal of the money was gone, but the physical assets remained (Newbery, 1999, 393-4). A reprise occurred in the broadband telecoms boom in the late

[1] Based in part on Offer (2019). Offer (2022), ch.1, draws on the same source, and has some overlap with this publication.

1990s (Malik, 2003). As technologies settled down investors were locked in, competing technologies emerged, and the bargaining advantage shifted to the side of the community.

As a consequence of such enterprise, 'The luxuries of one age become the necessities of the next' (Robson, 1935, 300).[2] A role for government emerged when network technologies had to pass over private and public property (which required compulsion), when their benefits acquired universal appeal, or when there were large economies of scale or spillovers. Universal access came to be seen as a matter of entitlement. An early example was the British penny post of 1840. After 1844 every railway line had to run a cheap 'workmen's train' in both directions every day.

A private concern which provides universal necessities is exposed to political opportunism. If the median voter was less wealthy than the average one, politicians had a motive to support him (Lindert, 1996, 6; Meltzer and Richard, 1981). If politicians restrict profits, they can lower the cost to their voters. If one set of politicians do not do it, their rivals will: 'Marginal seats count for more than marginal costs'(Lawson, 1992, 186). Hence, from the 1840s onwards, there was a prolonged standoff between investors and the community (Hart, 1995, 27-8; Millward, 2000; Newbery, 1998, ch. 2; Ricketts, 1998,151). Governments restricted rates of return, and imposed price caps, service standards, and taxation (Cheape, 1980,14-15, 216-219; Priest, 1993, 301-20; Toninelli, 2000). If owners were pressed too hard they would no longer invest, and regulation or takeover became the default.

In British water supply rates of return, initially limited to ten percent, were forced down to four. This was less than the cost of capital, and the service had largely passed into local government hands by 1914 (Falkus, 1977; Millward, 2000, 329-332; Robson, 1935; Spar and Bebenek, 2009). The Board of Trade regulated railway rates, while towns laid down and regulated tramways, and began to take them over in the 1890s. London Underground railways, built by private capital from the 1860s onwards, passed into public ownership in 1931, the railways, road and air transport in the 1940s. Most electricity supply and distribution was publicly owned by the 1920s, although less than half of the gas supply. Telegraphs were nationalised in 1866, telephones in 1911, electricity transmission in 1926.

[2] The rest of this section draws on Offer (2003).

A similar if more erratic process took place in the United States. Regulated monopolies make no claim on tax money, and have more management discretion (Newbery, 1998, ch. 3). They became the norm in the United States, although by the inter-war years they were increasingly regarded as failures in the UK (Glaeser, 2001; Jacobson and Tarr, 1993; Millward, 2000; Priest, 1986).When the technology was pervasive and stable, as in electricity or railways, such monopolies had the advantage of relative simplicity. Rate-of-return regulation gave no incentive to cut costs, but also not to cut corners (Joskow and Schmalensee, 1986; Bannerjee, 2001). A less benign view is that regulators are easily captured by their clients (Stigler, 1971). This was common in the United States, and occurred in Britain as well (Glaeser, 2001; Millward, 2000, 329; National Civic Federation, 1907,i, 126-7; Offer, 1981, 297-308).

II

Railways are major projects. Their duration is long, their trajectories uncertain, their cost massive. Such long-term open-ended undertakings present a financial challenge: commercial lenders require short maturities and strong safeguards. The problem is generic to major projects (Offer, 2019).

Why do markets have short time horizons? The interest rate provides a benchmark for expected returns, and the same interest rate defines an outer-bound time horizon for cost recovery. We take the prevailing interest rate as exogenous, given to firms by policy or the market, i.e. not a 'natural' variable arising from economic equilibrium (which is a theoretical construct and difficult to identify). This interest rate (adjusted upwards or downwards for the risk of any particular undertaking) defines a time horizon for bank credit to break even. Commercial ventures must recover their initial outlay prior to reaching this horizon. A project which takes longer to break even cannot pay its capital cost and cannot be undertaken for profit. An investor can get more by lending at the prevailing interest rate. If break-even takes longer, it requires some protection from risk by a public body through ownership, subsidy, management, regulation, a concession, or a licence. For European railways in the nineteenth century, 'Private capital to ensure their extension at such a pace as was needed was not available…The Governments were therefore compelled perforce to render a large measure of direct assistance' (quote, Pim, 1912, 134; Millward, 2005, ch. 4). The Croton Aqueduct in

New York was built over a seven-year period starting in 1835, and took thirty years until annual revenues exceeded expenses (Glaeser, 2001, 29).

Many worthwhile activities are embodied in long-lived physical assets, have long product lives, or have indeterminate, distant break-even horizons, or positive externalities which cannot be internalized. To go without them would be self-defeating. A public body can undertake long-term projects even if success is uncertain. It spreads the risk among the whole of society (Arrow and Lind, 1970). In contrast, short-term projects can access commercial credit, they benefit society through market competition, and are typically undertaken by private enterprise. This suggests a division of labour between private and public: market competition for short-term provision; government, not-for-profits, philanthropy and the family for long or uncertain durations. This boundary is both positive and normative. When violated, poor outcomes are likely, inefficiency, corruption or failure (developed in Offer, 2022).

The intuition is simple: the higher the rate, the shorter the wait. The credit time horizon is defined here as the time it takes a lender to break even on a loan out of successive equal payments of interest. For the borrower it defines how long it takes for cash flow to add up to the principal: 'counting the number of years it takes before the cumulative cash flow equals the initial investment,' (Brealey et al. 2011, 133). This is the 'payback period' method of investment appraisal. It is not recommended because it ignores the time value of money (a dollar in ten years is worth less than one today) and any cash flow beyond the break-even point. But it features in investment manuals and is widely used in business, apparently as a measure of exposure to failure (downside risk) (Blatt, 1983, ch. 13; Graham and Harvey, 2001, 196-200; Thiebeierge and Beresford, 2015, 80-81 Treynor and Black, 1976, 314). The venerable measure of 'Years Purchase' is precisely the same: it is the number of years' rent which add up to a property's purchase price (Smith, 1776/1976, 359; Marshall, 1910, 593; Offer, 1981, 268-271; Tarbuck, 1904, 125).

The payback period method is not endorsed here as a practical tool, but as a rough-and-ready diagnostic which defines an outer bound time limit for bank credit to break even. To make a profit, projects have to recover their initial outlays in less time. Business typically sets investment hurdle rates for profits that are considerably higher than prevailing interest rates (Dixit and Pindyck, 1994, 6-

7; Stockfish, 1982, table 7-3, 268). Interest-only credit is a simplification but is not unusual. A machine delivers flow of output and only scrap value at the end. The British government used to borrow against perpetual bonds ('consols') with no maturity. Before World War One most housing was financed with rolled-over interest-only mortgages and the main form of business credit was the interest-only overdraft which was serviced but not repaid. With capital repayment the time to break-even is shorter still.

The canonical method of project appraisal is Net Present Value (NPV) which is all cumulative future cash flows, discounted by the interest rate, less the initial investment (Holmes, 1998, ch. 2; Thibierge and Beresford, 2015, 76-77; Wright, 1990, ch. 2). For investment to go ahead NPV has to be positive. The Internal Rate of Return (IRR) is the rate of return required for break-even, i.e. for the Net Present Value to equal 0. For the same break-even period IRR is always higher than the payback interest rate on the money borrowed or invested so the payback period of the IRR is always shorter (the bank can lend at the payback rate because it pays less for the money than it charges). This is shown in figure 1, in which (for ease of calculation) a loan of £100 at 10% interest has a payback period of 10 years. When the Net Present Value is calibrated to break even (NPV=0) at ten years, the same as the payback period, the Internal Rate of Return is 16%. For the same break-even period IRR is always higher than the payback interest rate on the money borrowed or invested, so the payback period of the Internal Rate of Return is always shorter.

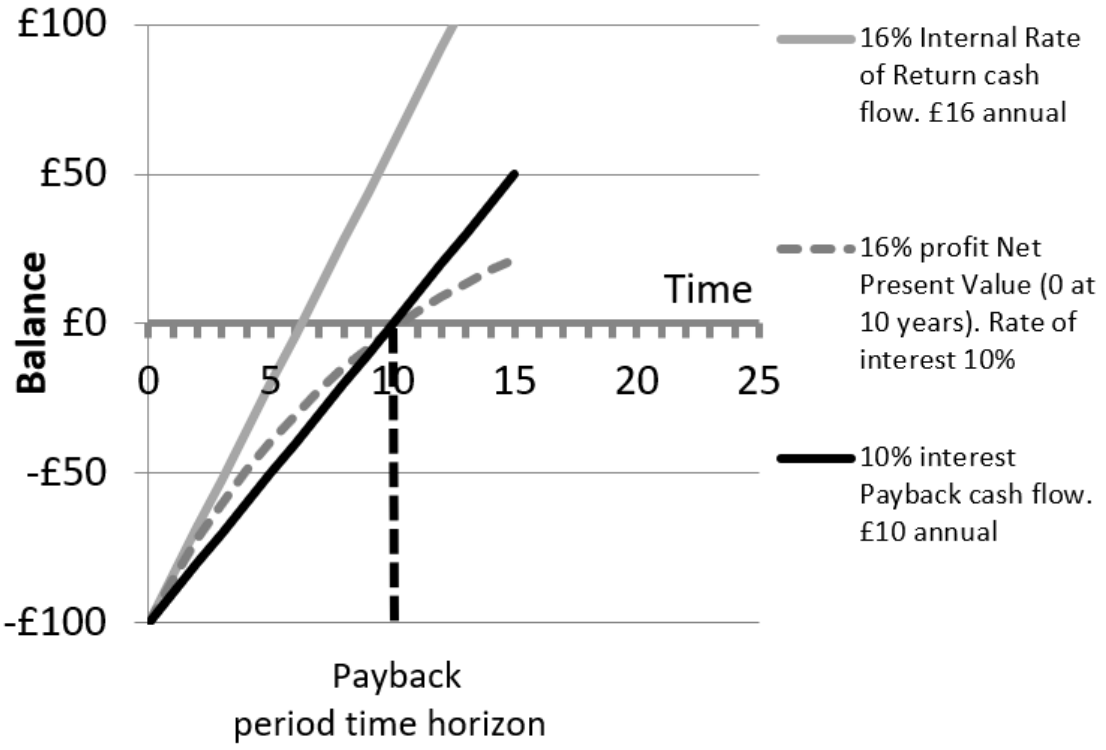

Figure 1. £100 loan, 10% interest: Break-evens of Internal Rate of Return, Net Present Value, and Payback Period.

If an investment is locked in for decades then bond and equity investors require some guarantee. Typically long-term bonds have been backed by governments or issued for projects with an element of market power or natural monopoly. Unpublished research indicates that of the large flows of overseas investment during the first great globalisation, 93% of British, German, and French overseas investment between 1880 and 1913 was either in government securities or in government backed entities (Bent and Esteves, n.d.). In 2014, 61% of the liabilities of the USA financial system were subject to explicit or implicit protection from loss by the federal government (Marshall et al., 2017). The equity premium over bonds implies much shorter time horizons for the former. Project equity must be capable of providing that kind of return.

IV

The payback boundary can be overridden using the device of the ‘franchise’, defined here as a revenue flow with pricing power, long duration and low variance, partly or fully shielded from competition. Such revenue flows are available to natural monopoly network utilities, electricity, gas,

water, and landline telephones, and to strong commercial brands, as well as by privileged access to land and natural resources. Governments support franchises with limited liability, rights-of-way, tax concessions, natural resource grants, patents and copyrights, outright subsidies, guarantees, and bailouts, contract enforcement, and a legal personality for corporations. Hence a great deal of business enterprise has little to do with free markets, and depends on the pleasure of the state (Ciepley, 2013).

Commercial banking, which gives rise to the payback time horizon, is itself a franchise under license, underpinned by central banking, with its clearing, licensing, regulation and lender of last resort functions. Private enterprise relies on public goods: law and order, money, transport infrastructure, the skills and abilities imparted in households and public education, not to mention regulation, administration and national defence.

The franchise operates in a broad range of economic and social activity: finance, network infrastructures, mass housing, defence and war, internal security and the legal system, social insurance, social and cultural infrastructure, and environmental protection, the household and the family (Offer, 2022). Social enterprise seeks for profit in public and social goods (Nicholls et al., 2015). That can be done when interest rates are low. At 2%, the payback boundary is fifty years. The model is vulnerable to rising interest rates. A similar movement of 'five-percent philanthropy' for working-class housing in late-Victorian Britain came to grief on this issue (Morris, 2001).

The sway of franchise runs against the assumption that business is better due to competition. Business needs assurances to invest for the long term. Inside the payback boundary competition is good, beyond it a franchise is needed. The security of franchise makes it possible to issue bonds at lower cost and longer maturities than equity or bank loans. Finance is locked in, while the investor can exit at any point. Business can undertake projects extending for longer than bank or equity finance would allow. When that is not enough, government steps in to carry out the projects itself. Government can borrow for less, and can forgo a financial return entirely.

V

Once in a very long while, some breakthrough, real or imagined, offers investors a prospect of enrichment, of super-profits beyond the humble returns of prevailing interest rates. In Britain in the 1830s and 1840s, newly developed railways promised a vastly superior productivity over roads and

canals. A railway investment stampede in 1835 vindicated early movers. A new investment mania began in 1844 and lasted until 1847 (Odlyzko, 2010). Such opportunities give rise to temporary blindness: cash-flow calculations are suspended and investors become speculators. 'The central dynamic is that the price of the financial asset is separated from any concern with the underlying cash flows' (quote, Janeway, 2018, 2; Odlyzko, 2010; Perez, 2002, pt. 2). Mania is rife with corruption: promoters misled investors, swindled them with high start-up costs, overpaid themselves, and sometimes ended up in prison or dead.

Within a few short years, equity commitments overwhelmed real opportunities and gave rise to over-investment, over-construction, and large losses. Some early movers realized windfalls. For the rest, it was either outright loss or the steady returns of a blue-chip investment. After dust had settled, society was over-equipped with a dense railway system, to the extent that a even a normal profit was difficult to make (Arnold and McCartney, 2005*;* Casson, 2009; Lewin, 1936; Mitchell et al, 2011; Odzylko, 2010). Some 20,000 miles of line were built when 13,000 would have sufficed (Casson, 2009, 2)

Positive legacies of financial manias are less frequent than the episodes themselves. Apart from English railways, two others come to mind: The electric tramway (and underground rapid transit) boom of the 1900s discussed below, and the telecom bubble of the late 1990s with its legacy of fibre-optic lines (McKay, 1976; Malik, 2003).

Piped water, canals and railways were undertaken for profit initially. Eighteenth-century toll roads (turnpikes) were built not-for-profit and the Post Office was a public service. Roads, pavements, street lighting, and sewers were laid out by self-governing towns. In more recent times the highway system has been provided by government. By the end of the nineteenth century much of the private network utilities had shifted into in public hands, while the others made use of a public subsidy, public sanction or were subject to rate of return and service quality regulation (Millward, 2000; Millward, 2005, 22). The railway systems of continental Europe, when they were not built by governments directly, all required subsidies and guarantees. Likewise colonial railways in nineteenth-century Australasia, India, and South Africa, as well as those in the 'informal empire' in Latin America. In railways globally, public ownership was increasingly preferred, and was not inimical to

efficiency (Bignon et al., 2015; Bogart, 2009a, 2009b, 2010; Chaudhary and Bogart, 2010; Bogart and Chaudhary, 2015).

Only Britain, the first mover, ran a privately-owned railway system. This is not inconsistent with the time-horizon model. In this case investor mania overcame uncertainty and made government risk-taking unnecessary. Other countries all required some form of franchise. In effect British experiment may have been the experience which other countries needed to avoid. British railways were not envisaged as a system. They began as a patchwork of local initiatives. In a satirical railway mania short story of 1845, the 'Glenmutchkin Railway' was all of 12 miles long in the Scottish Highlands (reprinted in Odlyzko, 2010). Promotions combined chicanery and inconsistency: traffic projections were based on pre-railway traffic, while promises of growth were out of line with any conceivable potential. Imaginations were fired by direct connections between the main cities, but the actual traffic was mostly local. It was only after a private system had assembled itself bottom-up that it was possible to envisage the railway network as a whole (Odlyzko, 2010). William Gladstone, President of the Board of Trade, attempted in 1844 to centralize and rationalize planning, and parliament reserved the power to nationalize the system, but to no avail (Casson, 2009; Lewin, 1936; Odlyzko, 2016) A rigorous counter-factual study has found 'that while private enterprise may have been important in 'kick-starting' the railway system, it was unnecessary for its subsequent development. Railways could have been nationalized in 1844 (or later) without adverse effects' (Casson 2009, 26). That moment did not return for a century. British railways did not make up a coherent national system. By the 1890s there was serious talk of consolidation and nationalization (Findlay, 1891, ch. 14). In colonial India, the main lines were constructed privately with government guarantees. Lines were later taken over for direct operation due to excessive costs. After independence, the railways were nationalized in 1951. In France private construction was subsidized and failing lines were nationalized. In Germany initially private beginnings were consolidated into a state-owned network. In Belgium the railways were developed top-down by government (Pim, 1912).

The largest railway system emerged in the USA. As in Britain, it started piecemeal in the 1830s, and took the rest of the century to consolidate into eight large systems. Railways were chartered by the states, and received government loans and tax benefits. Federal government

assistance kicked in as they expanded westward. Railways received massive grants of federal land in conjunction with the homestead act which provided land to settlers. Railways were usually granted alternate blocks of land to those of homestead settlers. In all, some 6.8 percent of the United States land surface was handed over to the railways as a subsidy, more than completed homesteads, constituting a much larger proportion of economically useful land (Stover, 1997, 81-86).

Franchise gives rise to agency problems, and American railway development was rife with corruption and abuse. This took two forms, one being outright bribery and lavish distribution of free passes, the other was fiduciary dereliction of investors, by diluting the stock, connivance with suppliers, overpayment of promoters, and manipulation of ownership. Railways imposed their market power, favouring some users and extorting others. Labour was often exploited brutally. These abuses stimulated an agrarian populism which eventually came into alliance with the urban Progressive movement to bring the railroads under regulatory control before the First World War (Stover, 1997, chs. 3-5). In the 20th century American railways settled down as regulated monopolies, and faced competition from road and air transport. Most of the main railway networks failed in the 1960s and early 1970s.

American intercity passenger railways were nationalized in 1971 and continue to be run as a public service, like most suburban railways. For eight years the largest freight system (Conrail) was run successfully by the federal government before it was sold off. Freight currently operates successfully in private ownership. The lines inherited pre-existing permanent way and rolling stock. Much of the business has captive clients, carrying bulk commodities on long-term contracts, as well as containers (Stover, 1997, chs. 9-10) Freight railways have pricing power, and carry very little debt. In Japan, the main railways were nationalized in 1906, and privatized in 1987. Privatization has worked due to high urban densities and levels of passenger rail use, very low interest rates, and (it might be added) a corporate culture of patient capital (Shoji, 2001; Fukui and Oda, 2012).

VI

The mid-Victorian town was a ‘walking city’ (Warner, 1962, 15). In Anthony Trollope’s novels of the 1860s, his well-to-do characters moved everywhere on foot in London between the Thames and Oxford Street, or (rarely) by Hackney Carriage. Most people today would take a bus, a taxi, or the

underground. After the railway mania and global deployment, the next significant application of rail was for urban transport. After sporadic beginnings, urban tramways ('street railways' in the USA) were first deployed at scale with horse-drawn vehicles in the 1860s and 1870s. Steam power was tried, but the critical innovation was electric power in the 1880s. Electric urban transport was a revolution comparable to the first railways and built up even more rapidly. After early beginnings in Europe an effective technology was deployed in the United States in the late 1880s. Steel rails were laid in the street, and passenger cars were driven by electricity from overhead wires or a roadway conduit. It took Europe a decade to catch up and by the First World War most of the larger cities had them, some of the main colonial cities, and in China, Japan, the Ottoman empire and Latin America. A few metropolitan centres developed underground rapid transit systems. Within twenty years the number of trips rose about fourfold, the cost of travelling declined by about one half, while speed and frequency more than doubled (McKay, 1976, ch. 6). Tramways also helped to relieve urban overcrowding. Before they arrived manual labourers lived within walking distance of work in bad and costly inner-city housing. Electrical tramways, underground and elevated railways allowed them to live further out at lower cost (Schapiro, 2003a, 155-157).

Tramways exemplify the effect of contractual time horizons on the deployment of major projects. Horse tramways replaced horse omnibuses. In Britain their onset was rather sudden, and began in 1869. It led to an investment mania with the same windfalls for devious promoters (Ochojna, 1978, 143). The 1870 Tramways Act empowered cities to authorize and even lay down tramway tracks in the streets. With experience of other private urban utilities, and as if to anticipate a stand-off, the act did not allow the cities to run the service themselves, but gave them authority to acquire the lines after 21 years with only limited compensation. No restriction was imposed on dividends, and the assumption may have been that this was long enough to pay back the investment. By the 1880s however,

> Residents demanded tramway communication to their new suburbs, councils demanded overall town coverage, and local opinion demanded efficient service, cheap fares, and a sense of civic purpose. Tramway companies had to survive amongst these forces, and normally had to succumb to them or be branded money grabbing speculations (Ochojna, 1978, 142).

Councils threatened with non-renewal, and in the absence of a secure franchise, the operations were run down by their owners (Knox, 1901). Initial tramway leases began to fall in during the 1890s at which point electrical technology was available for deployment. The 21-year provision discouraged private re-investment. Councils were exasperated by their inability to control the details of tramway deployment, management, quality of service, obstruction, and fare levels. Once the leases began to fall in, the lines were taken over by local authorities, with perpetual tenure and much lower financing costs. British cities were energetic and competent and by the First World War some 80% of the lines had reverted into civic hands. Even the Moderate (i.e. conservative) governing party of the London County Council after 1907, which opposed 'municipal socialism', persisted with municipalisation, cheaper service, and improved labour conditions (McKay, 1976, 69; Schapiro, 2003a, ch. 6; Schapiro, 2003b). Fares were set at a level which returned an operating profit, but did not cover depreciation. Benefits were shared between passengers, taxpayers, and tramway workers (Knoop, 1912, 149-164;Schapiro, 2003a, ch. 6).

Continental Europe was more inclined towards a regulated monopoly, i.e. a 'franchise' in our terms. In Germany and France an oligopoly of equipment suppliers gave priority to their immediate profits. German towns chose either direct management or a concession according to local circumstances. In France concessions typically lasted 40 years and more, which allowed the investment to be recovered privately.

The United States deployed the technology first. The combination of muscular private enterprise and corrupt city government gave rise to powerful local monopolies with concessions unlimited in time. Streetcars had the same benign urban effect in the United States as in Europe, and were taken up at a much faster pace (McKay, 1988). They had the lasting effect of creating an urban layout of concentric zones with a central business district, a 'downtown' easily accessible from increasingly distant suburbs. 'Owning a city-franchised utility or streetcar line could elevate a man to the exalted wealth of the Gilded Age elite' (Menes, 2006, 76). Electric tramways coincided with a period of municipal reform, much of it motivated by popular anger against the tramway magnates. Rapid electric transit, elevated and underground, was undertaken by city governments in New York and Boston, but not initially in Philadelphia and Chicago (Cheape, 1980). The effect of the tramways

was lasting but not the technology itself. No sooner had the systems been built than competition appeared in the form of internal combustion. Buses were less durable, but were not locked into a rigid, costly infrastructure, cost less to purchase, and did not incur long-term debt (Cudhay, 1990, ch. 16, esp. 190-191). In the UK buses squeezed out trams entirely by 1950. In Europe long leases protected the trams. Many cities retained them until they came back into fashion in the 1990s. Several cities in the UK have recently installed new street railways at lower density and greater cost.

Tramways demonstrate the infrastructure opportunity for massive social gains. Benefits were re-distributed in stand-offs between the private enterprise and city governments. In the UK, local government was powerful and competent, and the resolution was increasingly municipal takeover. In the United States by the First Word War trams were regulated, and by the Second, or shortly afterwards, most urban transit was in public ownership (Cheape, 1980; Cudahy, 1990; Glaeser, 2001; Jacobson and Tarr, 1995).

Electric tramways exemplify the risk of premature obsolescence. The tramways themselves made some commuter railways redundant. Their costing and pricing was criticised for inadequate amortisation (Knoop,1912, ch. 5). Mostly this did not matter: long-term projects are often rendered obsolete before they wear out. That was the fate of turnpikes, canals, railways, gaslight, and urban tramways. All of them left large stranded assets. Internal combustion is going to leave even larger ones behind if society moves towards renewable energy.

VII

'British Railways' (BR) was formed by the 1945-50 Labour Government following *de facto* nationalisation during the Second World War. Motor transport was displacing the use of rail. Nevertheless, in more than four decades of existence, BR built up a record of resilience and successful adaptation. A third of the track mileage and half of all stations were closed during the 1960s and electric and diesel traction supplanted steam by1968. Major stations were rebuilt, and the West Coast main line was electrified. The corporation forged a positive brand identity with its double arrows red logo, which persists on tickets and stations.

BR showed a capacity for technical innovation and long-term vision (Gourvish, 2002, ch. 6). In response to falling demand it developed and deployed the 'Intercity 125' diesel train units in the

1970s. These were fast, spacious, comfortable, and robust. British designed and made '225' electric train sets entered service in the early 1990s. BR also developed the 'Advanced Passenger Train'. The patents were sold to Fiat Ferroviaria, and tilting trains which used them were imported after privatisation (Hall, 2012, 40).

In the 1980s management was re-organised by function rather than region. Productivity and financial performance improved, and passenger numbers increased. Unit costs in passenger service fell by about 1.8 percent per annum (McCartney and Stittle, 2017, 9-15) (henceforth, M&S) . By 1993, when it was privatised, BR was the least-subsidized railway in Europe (Lewis, 2015, 26-27). The main passenger services operated free of subsidy. For the rest, operating losses fell substantially.

VIII

The economic crisis of the 1970s discredited the social democratic mixed economy and carried Thatcher and Reagan into power. In its UK version the vision was 'liberationist': the 'full potential of business energies released and stimulated for the social good, through the operation of a free market economy, with a minimum of state control and a maximum of resources in private, not public hands' (quote, Boswell and Peters, 1994, 17; Cockett, 1994). Public ownership was out of keeping with the temper of the times (Letwin, 1988). Conservatives and New Labour both embraced the private corporation as a model for public service provision (Hay, 1999, 127).

Mrs Thatcher drew the line at the National Health Service and the railways (Wolmar 2012, 62). Her government privatized the buses, but not the roads, perhaps with intuitive understanding that what mattered was the length of the product cycle. During the 1980s most of BR's subsidiaries (hotels, catering, shipping) were sold.

The 1993 Railways Act devolved the vertically integrated monopoly into over one hundred separate entities, including one infrastructure owner, three rolling stock firms, and twenty-five train operating companies (TOCs). Nineteen maintenance companies were also created, as well as several regulators. Such drastic disintegration had never been attempted. British Rail already received the lowest level of subsidy in Europe (Shaoul, 2004, 29). The objective was no subsidy at all. Risk would move from the state to the private sector.

But privatisation could not escape the time horizon constraint. The largest and longest-lived element, the track and station network, was partly sold and partly given away to a joint-stock company, Railtrack Plc. The asset had been built up over 170 years and continued to require a long-term horizon. The rolling stock, with a prospective life in decades, was handed over to three leasing companies (ROSCOS). Twenty-five seven-year franchises operated the trains. Lease charges for track and rolling stock came up to 89-94 percent of operating costs, leaving little scope for further efficiencies (M&S, 2017, 5). From a time horizon point of view, privatisation was completely misguided: the bulk of the assets had very long lives. Costs were largely fixed. No risk could be transferred. The consequence was inefficiency, low quality service, and failure to achieve the policy objectives (Haubrich, 2001, 332).

The infrastructure owner, Railtrack plc., concentrated by design on short-term profit extraction. It eliminated engineering staff, outsourced track maintenance, and relied on contractors, focusing instead on opportunities to monetize legacy land holdings (Wolmar, 2012; Nelson, 2019, 123). Maintaining the permanent way requires expertise and vigilance. Under Railtrack, the track was allowed to run down. On 17 October 2000 a rail disintegrated under the 12.10 from London to Leeds, the train derailed near Hatfield, and four passengers died. Millions of passengers had been riding over damaged rails for years. Speed restrictions were imposed at 800 sites, and 300 miles of track needed to be replaced quickly (Jack, 2011, 70). A permanent way engineer explained: 'The days of the line being patrolled by a man every day have gone. But it's worse than that. Not only have the maintenance structures disappeared, but the knowledge of what the structures did has disappeared.' (Bill Amrstrong, quoted by Jack, 2011, 54). Railtrack was discredited and could not raise funds for repairs (Crompton and Jupe, 2002, 627-628; Idem. 2003, 2007). A new 'not-for-profit' company, Network Rail, took over the infrastructure in 2002. Operational deficits and investments were henceforth underwritten by the Treasury. Effectively the railway was re-nationalized, since the permanent way accounted for more than two-thirds of its cost.

Short franchises had no incentive to invest in long-lived rolling stock, which was transferred to leasing companies at a large discount. Government guaranteed investors 80 percent of the lease income (Haubrich, 2001, 320). ROSCOs were left unregulated on the grounds that they were subject

to market forces. But that was wrong. Much of the rolling stock was specific to its lines, and there was no surplus, so the leasing companies had captive customers. If a franchise failed, government would make sure that the service continued, as happened repeatedly (Nelson, 2019, 252-3). The OTCs were subsidised, so leasing charges were not constrained by ability to pay. ROSCOs overcharged grossly for rolling stock (M&S, 2012, 161). Two of the leasing companies more than quadrupled their value over the first decade (ibid, 164-5). They merely transferred public subsidies to the private banks which owned them.

When it came to replacing BR intercity trainsets, the government chose not to rely on the ROSCOs. Instead New Labour reached for its favourite financial device. Public-private partnerships (PPP) were designed to leapfrog the credit time horizon. Introduced in the late 1980s, they deliver public infrastructure by means of private funding, secured by government revenue guarantees (Hodge et al., 2011; Offer, 2019, 2022, ch. 1). Between 2005 and 2010 the Department of Transport formed the Intercity Express Programme, to replace BR trainsets. Detailed specifications were laid down and the winner was a consortium controlled by Hitachi, the Japanese manufacturing firm. Long term finance was provided at commercial rates with government guarantees, the trainsets to be assembled in Britain from Japanese components. Other companies deployed Italian and German trainsets during the same period. The capacity to design and manufacture advanced rolling stock was abandoned. BR's technology had been world-class and it exported trainsets as late as the early 1990s. In the spring of 2021 the Hitachi trainsets had to be taken out of service due to metal fatigue. Private-public partnerships place all the risk on government. The PPP method was inherently deceptive and inefficient, if not corrupt, and has now been formally abandoned by the UK government and more widely (Offer, 2019).

Privatisation envisaged open access to the track to any operator. Once this was abandoned, the initial operating franchises were shortened to expose them to periodic competition. Such durations implicitly acknowledged the need for private enterprise to break even within a short time horizon, with a product, passenger train journeys, that was a perishable short-life commodity. Patronage of the railways rose with the economy, but as a percentage of all transport miles remained constant between 1965 and 2010 (Lewis, 2016, 15). Nevertheless, the operators required continued

heavy subsidies, which at 29% of revenue in 2013 were double the final BR subsidy (M&S, 2012, 153; Idem., 2017, 4; Fig. 2) .

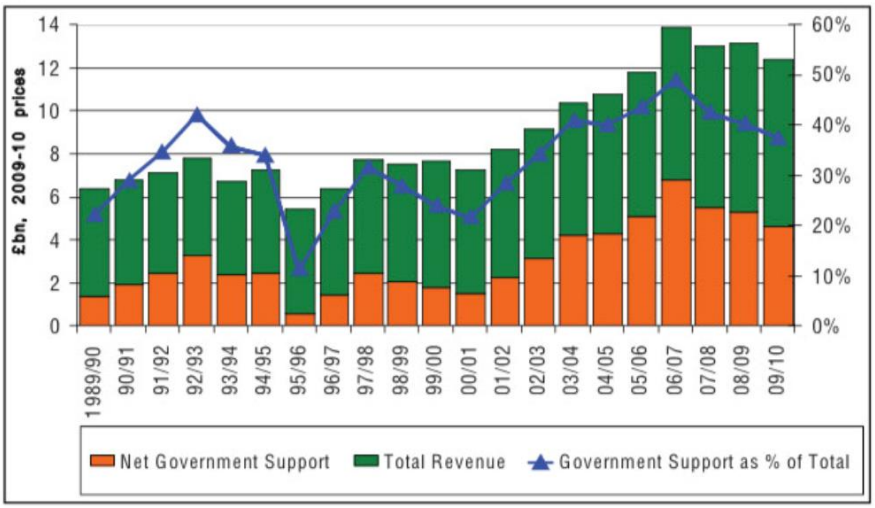

Figure 2. Railway revenues and subsidy, 1989/90 to 2009/10.

Source: McNulty, 2011.

Franchises were repeatedly terminated due to financial, management or service failure, some of them reverting to government operation (Nelson, 2019, ch. 7). By 2014 some three-quarters were run by European state-backed railway companies (M&S, 2017, 5). The industry failed to match BR's scale of investment. The age of rolling stock hardly declined, and major investment projects were delayed or cancelled. The annual grant from HM Treasury quadrupled from 1994 to 2006, despite rising patronage and mostly fixed costs.

Several applications of the franchise model failed: the Channel Tunnel was taken over by the government, as well as two London underground privatisations, Metronet (to run some of the lines) and Tube Lines (for track and tunnel maintenance) (Wolmar, 2011). Rail privatisation was 'a major policy error' (Haubrich, 2001; quote, M&S, 2017, 1; Parker, 2011; Wolmar, 2012). The private sector has no capacity for long-term investment on the scale that railways require. New major projects after 2000 (the London-Channel fast route, Crossrail, and HS2) were undertaken by government on its own.

IX

The profit motive is not sufficiently patient for railways. There are efficiency and social benefit arguments for privatisation more generally (e.g. Florio, 2005, ch. 2; Letwin, 1988, ch. 2; Megginson, 2005, ch. 2). In practice, experience is mixed. Outcomes have been more successful in manufacturing, commerce and finance, and where the criterion of success is financial (Millward, 2009, review of Roland, 2008). Privatised companies may earn more profit but that is not compelling: the point of public enterprise is to serve the public (Cordelli, 2020). In the case of infrastructures and utilities, there are few positive outcomes (Millward, 2009, 139). This is consistent with our argument that competitive markets are effective only with short-term product cycles (World Bank, 2005, ch. 6).

Historically private railways involved massive corruption and handouts of public assets (e.g. Lewin, 1936, ch. 15; Menes, 2006, 76-77; Stover, 1997, ch. 5). Privatisation and franchise transfer social assets to private hands, with opportunities for rent-seeking, bribery, state capture, cronyism, and fiduciary failure (Offer, 2022, chs. 2-3). The privatisation decade in Britain, the 1980s, was accompanied by a one-off increase in income and wealth inequality. Gini coefficients of disposable income rose by about a third between 1979 and 1992, and the wealthiest (top 10% and upwards) started to increase their share again (Alvaredo et al., 2018; Great Britain, 2021). In the absence of clear public benefits this may well be seen as the real objective of privatisation, which was also aligned with Conservative party ideology.

As a public service the privatised railway has been a disaster. It may nevertheless be seen as a success. Privatisation can be seen as an attempt by the private sector to capture the public services and extract a rent, in the tradition of 19th century robber barons, but more discreetly behind the mantra of efficient markets. When BR assets were handed over to Railtrack, the company was made a gift of BR's tax losses, was relieved of the upkeep of 1000 bridges, and £1bn of debt was written off (M&S, 2017, 9). The ROSCOs charged exorbitant leasing fees. The private entities (including not-for-profit Network Rail) borrowed at a premium over government rates, despite an implicit guarantee. Out of their public subsidies, these private entities siphoned cash into dividends, finance charges, and capital gains. The shares of the delinquent and short-lived Railtrack rose almost sixfold with generous dividends and bonuses for directors (M&S 2017, 6). In the first seven years dividend and interest

payments (‘leakages’) were about half the public subsidy. In real terms Network Rail paid more than seven times more interest a year than BR in its final year (M&S, 2017, 15). ROSCOs were seriously underpriced, enriching BR managers who formed most of the buy-out groups (Nelson, 201, 119; M&S, 2008, 95-8). Privatisation shifted managers from public sector pay to corporate salaries and capital gains (Haubrich, 2001, 321, 324, 326). The privatised railway raised its passenger fares by 80% in real terms between 2004 and 2014, with some of the highest fares in Europe, especially for peak inter-urban travel (Steer Davies Gleave, 2016).

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To conclude, railways are mostly in the public sector, for most of the time, and for good reasons. The privatized British railway incurred heavy ‘interface costs’ incurred in endless negotiations and contracting. Integrated railways solve agency problems internally by means of command and control. A nationalised railway can invest at low government interest rates, and has the long perspective that the technology requires. Government alone can take on the long-term uncertainties entailed by long-lived assets. It spreads the risk among the whole community. Public ownership provides patient capital, either through the borrowing power of government itself, or by providing a guarantee for franchise borrowing, especially bond finance. Instead of opportunistic self-seeking deal makers, public ownership manages inherent agency problems by means of permanent bureaucracies of impartial and qualified experts, with well-defined responsibilities and chains of command.

Entrepreneurial flair created the railways but tends to undermine their routine operation, as in our three episodes, the mania of the 1840s, the tramways of the 1890s and privatization since 1993. Reversing privatisation, begun within five years with Network Rail, continues. British railways are being placed under a single authority, Great British Railways. Only operations will be outsourced to private companies, for an operating fee of 2 percent of revenue (Williams-Shapps, 2021). Is this the last gasp of privatization dogma, or an honest attempt to re-integrate the railways? A public agency will control strategic and operational decisions, network and service density, long-term finance, rolling stock and stations. The livery will be uniform. Only retail journeys will be sold by concessions, for benefits which remain to be seen.

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