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REVIEW ARTICLE

WAR, CAPITAL, AND WAGES: A NEW ECONOMIC THEORY OF "THE GREAT DIVERGENCE"

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Before and Beyond Divergence: The Politics of Economic Change in China and Europe. By Jean-Laurent Rosenthal and R. Bin Wong. Cambridge, Mass.: Harvard University Press, 2011. Pp. xi + 276. ISBN 10: 0674057910; 13: 9780674057913.

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Jean-Laurent Rosenthal, a distinguished economic historian, and R. Bin Wong, an eminent world historian and specialist on imperial China, have collaborated in this effort to shed light on the causes of the eighteenth-century economic divergence of China and Europe. This book has many of the virtues one would expect from such a collaboration – keen insights into comparative history, explicit models of economic relationships, and novel ideas regarding causation. Yet it also has some defects that reflect this combination: at some points in their argument, the logic of models seems to outweigh historical facts. At other points, details of history that don't fit the models, such as the history of productivity gains in agriculture in imperial China, are neglected. I shall start with the virtues of their arguments, and then discuss some particulars that lead me to question their view.

THE ARGUMENT FROM POLITICS AND CONFLICT TO CAPITAL AND LABOR COSTS

Rosenthal and Wong (hereafter RW) present a wholly original argument as to why Europe, formerly the economic laggard, pulled ahead of China after 1600. They argue that from this date, if not earlier, Europe was more inclined to invest capital to mechanize production processes than China, and that the reason for this difference was a relatively higher price for labor and lower price for capital in Europe. So far, the argument simply generalizes from the recent work of Robert Allen who argued that Britain was the home of the industrial revolution because it had the highest real wages and lowest real capital costs

in Europe.[1] The originality lies in RW's explanation of why Europe had higher labor prices and lower capital costs. They claim that Europe's division into many sovereign nations with recurrent wars created rural insecurity that forced manufacturers and manufacturing into walled cities. In such cities, labor was more expensive (because of the need to pay a higher real wage to cover purchased foods and pay urban rents) while capital was cheaper because of the concentration of capital and capitalists.

Many scholars, of course, have argued that Europe's multiplicity of states produced a healthy competition, leading states to invest in advancing military technology and preventing any despotic authority from stifling innovation.[2] RW turn this argument around, noting that wars were rather costly in economic terms and that China's government invested enormous sums to promote economic well-being through public granaries and water control. Indeed, they argue that China's long period of peaceful and unified administration through the Ming and Qing dynasties did more to promote economic advance in Smithian terms – through extensive and diversified markets and protection of private property and public works – than Europe's high-taxing, military-obsessed and war-entangled regimes. However, a wholly inadvertent result of the greater insecurity in Europe is that manufacturing was driven inside city walls, creating a different relative cost of labor and capital in the two regions. European manufacturers responded by investing more in labor-saving machinery, putting Europe on a trajectory that led to steam power and factories while China remained a rural-manufacturing low-labor-cost society.

In order to strengthen their argument that it was the urban labor/capital cost differential that produced the divergence, RW take pains to knock down other explanations. In response to Ken Pomeranz, whose has written the most famous account of the great divergence, and attributed it to Europe's greater access to coal and virgin land in overseas colonies, RW argue that Europe's trajectory to greater mechanization was already under way before the eighteenth century when coal production and colonial agriculture began to make major contributions to Europe's economy.

RW also spend considerable effort on negating four other types of explanations. The first is the demographic argument that China's extended household structure and Confucian culture encouraged higher fertility and more rapid population growth than Europe's nuclear family households, which depleted capital and impoverished Chinese families. RW thoroughly demolish this argument, which had already been substantially undercut by the work of James Lee and Wang Feng.[3] RW not only note that Europe and China had essentially the same population growth rate from 1400 to 1700. They also point out that Chinese merchants accumulated large amounts of capital and that China as a whole deployed extensive capital in water-control projects and urban construction, and moreover that there is no evidence for mass impoverishment of Chinese peasants through most of the imperial period. Indeed, while they note the problems with comparative real wage data, they show that a contextually sensitive analysis of incomes suggests

1 Allen 2009.

2 Jones 2003.

3 Lee and Wang 1999.

that Chinese living standards likely did not deteriorate until after 1800, when internal disorders and foreign incursions and demands undermined China's economy.

RW next overturn the argument that Europe's formal institutions of justice, property, and business operations were superior to those elsewhere.[4] RW draw on recent archival research that shows that China had extensive formal contracting governing private property holdings, with contracts enforced in state courts. They also point to research on privately owned salt producing and food processing firms in imperial China that shows they sold shares and maintained continuous operations beyond the lifetime of founding individuals. The idea that China lacked such formal property and business institutions is thus a myth, due to lack of attention to existing records. RW grant that much long-distance trade in China was managed through informal institutions, particularly regional merchant associations and lineage groups. However, they point out that this was also true in Europe up to the twentieth century, for interactions in which trade was over such long distances that local jurisdictions and courts were likely to be unclear, unreliable, or biased in favor of local parties. The Fuggers and Rothschilds were only the most notable among family and informal networks that were operating banking, merchandising, and trading enterprises across borders and long distances. RW thus claim that China only appears to have had more informal institutions for property and trade because Western observers have looked at European transactions through the lens of local transactions which were well-regulated in local courts, while Western observers have looked at Chinese transactions through a focus on long-distance trade networks that relied more on informal mechanisms. RW argue that if we compare like with like – that is, local transactions in China and Europe, and long-distance transactions in both – we would find that formal institutions dominate the former and informal institutions dominate the latter in both areas, and that formal and informal institutions are both capable of facilitating trade and protecting the exchange and accumulation of private property.

A third argument that RW counter is that Europe had lower capital costs because its credit markets were superior in marshalling credit where needed. As befits an expert on capital markets (Rosenthal), RW note that there are many different credit markets and interest rates are sensitive to the conditions of the borrower and the expectations of the lender. Thus loans to sovereign borrowers, to short-term unsecured borrowers, to borrowers offering land as long-term non-perishable security (mortgages), and to those making long-term investments in uncertain manufacturing enterprises have very different risks, and would be expected to have different interest rates. RW complain that other commentators have compared Chinese interest rates from pawnshops with European mortgage debt, not recognizing that one would find that these different types of loans have very different interest rates even *within* Europe. RW argue that China in fact had well-developed capital markets, as shown by the fact that Chinese peasants readily borrowed to acquire additional land if their family fortunes allowed. They further argue that the transfer of funds within lineage groups and regional associations provided capital to those who needed it at reasonable costs; only the poorest and least trustworthy borrowers who were outside of such networks would have recourse to more formal loans from pawnbrokers and thus would pay a

4 North and Thomas 1976.

higher than "normal" rate. If Europe had better formal credit institutions by the late nineteenth century, RW argue, it was because such institutions followed, not caused, Europe's mechanization of production. It was the greater capital needs of Europe's urban-concentrated manufacturers, who were seeking to substitute capital for more expensive labor, which led them to seek more extensive and formalized credit institutions to serve their needs. As Europeans further invested in mechanization, they drove the creation of more widespread and formalized credit institutions. By contrast, China's more dispersed and rural manufacturing centers, with plentiful low-cost labor, generated much less demand for formal credit.

The last alternative explanation that RW debunk is the argument that European monarchs, because they competed for loyalty and capital to fuel their war needs, had to treat their populations better, and be less despotic in extracting taxes and seizing property, than the autocratic rulers of large empires. RW invert this argument, showing that China's rulers in fact protected their populations and promoted trade, taxed lightly, and in general followed Adam Smith's prescription for pre-industrial prosperity – "peace, easy taxes, and the tolerable administration of justice" – far better than most European rulers.

Running through all of RW's arguments is the strong claim that differences between European and Chinese culture cannot be pivotal in the divergence of their economies, since both regions had long-established and persistent cultures rooted in ancient classical models, while their economic prosperity and dynamism shifted markedly, with China having the advantage from the thirteenth century to the seventeenth century, but Europe taking the lead thereafter. RW thus base their explanation firmly on political and material grounds, with the higher labor costs that arise from Europe's chronic warfare, due to its political fragmentation, driving Europe's greater mechanization of production.

SOME PROBLEMS WITH ROSENTHAL AND WONG'S THEORY

On the whole, RW provide far more effective evidence to knock down competing explanations than they do to support their own. The book is surprisingly devoid of data – there are few numbers to indicate comparative costs of labor and capital in different regions. For a book on economic history, *Before and Beyond Divergence* is remarkable for not providing a single table or graph! Indeed, RW argue that wage data is often untrustworthy because of index problems and differences in household structure that affect supply and demand in formal labor markets. They thus rely on numerous boxes presenting formal models that underpin the logic of their argument. They apparently believe that such models and logic can carry all before them – *if* war forces populations into town walls, and *if* urban workers require higher wages, then higher labor costs will drive manufacturers to seek more mechanized production.

Facts thus get rather little respect. To cite what is to me the most egregious instance of this, RW's key claim is that European manufacturing was primarily urban due to war-driven insecurity, and this urban location drove factor costs that led European manufacturers to invest in mechanization. Yet, as RW note, England stands as a striking exception. With virtually no wars within England after the Battle of Bosworth that ended the War of

the Roses in 1485, excepting only the decade of the Civil War in 1642–1651, textile manufacturing in England remained overwhelming rural throughout the early modern period. When textile manufacturing was mechanized the first phase – use of the spinning jenny – was adopted throughout the countryside in England but as Robert Allen documents,[5] *not* in the Low Countries, nor France, nor Northern Italy where Europe's historic urban manufacturing centers were found. The second phase of British mechanization, investment in factories, also was not in urban centers but in rural areas where water power and cheap rural labor could be found. It was Lancaster and Manchester that were the site of early cotton factories, Birmingham and Sheffield that were the site of burgeoning factory metal goods production, and the tiny rural town of Burslem in Staffordshire that was the first home of Josiah Wedgwood's pottery works. In 1662, *none* of these towns was even among the thirty largest towns in England as listed in the hearth tax. Meanwhile, most of the larger cities of England in the 1660s – York, Norwich, Exeter, Ipswich, not to mention London – were largely irrelevant to English mechanization of manufacturing.

To most scholars of the Industrial Revolution, the rise of manufacturing in Lancaster, Manchester, Birmingham, Sheffield and Burslem was at the heart of what needs to be explained, not a minor exception to be dismissed. Yet that is precisely what RW do. In a statement that shows remarkable bravado, they claim that "Only those who are terminally Anglophile would suppose that the forces behind improved waterwheels, the printing press, the pistol, or the knitting frame are somehow different from those that led to the spinning jenny or the steam engine" (p. 123). In other words, the fact that the spinning jenny was mainly adopted in rural manufacturing, and that the steam engine and other British manufacturing enterprises also were developed mainly in rural locations, is irrelevant, because we can presume that the forces behind their development were the same forces that led to "improved waterwheels, the printing press, the pistol" and "the knitting frame." This is itself an odd list, as the printing press was developed and used commercially in China long before its use in Europe, and as Andrade relates, current evidence shows that China's development and use of gunpowder firearms including drill and volley preceded that in Europe.[6] So this is hardly a list that shows Europe's greater tendency to mechanization! Even so, to treat the steam engine as a direct and unproblematic outcome of the same forces that brought printing and knitting frames to Europe is a breathtaking leap that most experts on steam technology would not follow. But it allows the fact that Europe's industrialization, and the development of steam power, was led by a country with centuries of internal peace and rural manufacturing to be treated as not an issue for the RW thesis that internal war and urban manufacturing were the key to Europe's economic leap ahead of China.

In general, RW elevate models and logic over facts throughout the book, showing an almost careless approach to facts and data. Although I believe their argument regarding the non-role played by demographic factors is correct, they are simply wrong when they say on p. 39 that "the growth rate of China's population was slower than Europe's over the long run (1400–1900) [a]s detailed in Table 2.1." In fact, Table 2.1 shows that China's

5 Allen 2009.

6 Andrade 2011.

population grew much faster over these five centuries, by six-fold compared to growth of four and two-thirds times in Europe. Moreover, there is no period of over 100 years between 1400 and 1900 in which it is true that China's growth rate was slower than Europe's. It is particularly striking that Table 2.1 shows that for the critical century from 1700 to 1800, when Europe began its major investments in capital-intensive manufacturing, Europe's population grew by only 50 per cent, while China's population grew more than twice as fast, increasing by over 100 per cent. Is this relevant to RW's argument? If so, they don't bother to mention it.

RW's lack of concern about detailed data may stem from their belief that the data we have is either misleading or inaccurate. In a startling claim that would invalidate several decades of detailed research on comparative wages and prices, they say that "any statement more precise than 'sometime between 1450 and 1800 per capita income came to be higher in Europe than in China' is unlikely to be very meaningful (p. 230)." If that is so, how can we hope to empirically test or even distinguish among models explaining European and Chinese trajectories of economic change?

Their answer is that we must rely first on clear and explicit models to create falsifiable arguments. Thus they present Leontief and Cobb-Douglas production models (on pp. 108–09) that show how the costs of war will force manufacturers to choose urban locations and more capital-intensive manufacturing processes. These models start by assuming that rural wages are lower than urban wages, while rural capital costs are higher, and that war aggravates these differences. It is then a simple matter to use the models to show that as war costs grow, the critical level of capital intensity to drive manufacturing to urban locations declines. (There is some carelessness here too, at least in proofreading: Box 4.1 sets up the model with the subscripts reversed, as the equations specify wages that are higher in the countryside and capital costs are lower, the reverse of the assumptions given in the text.)

But we should surely ask – is this the *right* model governing the adoption of a given technology? In fact, looking at the price of "capital" is a misleading approach to answering this question.

Take one classic example from agriculture. In the ninth and tenth centuries, northern Europeans adopted a far more capital-intensive mode of agriculture than the scratch plow mode that characterized Mediterranean agriculture. To till the forested and clay valleys of northern Europe, they invested in heavy, iron-tipped plows driven by large teams of oxen. This required investment in felling forests, maintaining herds of draft animals, and building and maintaining heavy plows. At the time, "capital" was scarce and expensive – so why embark on a capital-intensive agricultural technology? The answer is that "capital" varied. Capital that was liquid and easily exchanged in small amounts – bullion coin or stored grain – was indeed very scarce and expensive. Coin was rare and food storage was costly and often ineffective in the face of spores and rodents, so interest rates on these forms of capital were very high. But other forms of capital – draft animals and heavy plows – were more readily available and maintained over time. The return on these latter forms of capital more than repaid the cost of their production and maintenance – so the technology of oxen and heavy-plow based agriculture spread through northern Europe.

In other words, the cost of borrowing in capital markets to acquire a given piece of machinery was only one part of whether the costs and returns of technology adoption

were favorable. Much depended on the cost of a particular technology and the rate of return of that technology; indeed these costs were often far more important than the cost of "capital" in terms of borrowing for investment.

RW say their reasoning is based on that of Robert Allen, who argued that England led the industrial revolution because its labor costs were relatively high and its capital costs low compared to other regions in Europe.[7] Yet Allen's argument about "capital" costs is not mainly about costs of borrowing in credit markets; he focuses on the costs of specific technologies. Thus in his examination of Hargreave's spinning jenny, one of the first breakthrough capital-intensive technologies to contribute to mass manufacture, what matters according to Allen was the cost of the jennies relative to the cost of labor it saved; this was what determined whether it was adopted.[8]

Allen shows from local documents that in England, the purchase cost of a 24-spindle spinning jenny was 70 shillings, about 70 times the cost of a simple spinning wheel. Was this investment worth the increased productivity, which Allen estimates was triple that of the simple wheel? With wages of 6.5 pence per day, Allen estimates the return on investment on such a spinning jenny, allowing for rate of use, was likely around 30 to 50 per cent. By contrast, in France Allen puts the purchase cost of a spinning jenny much higher, at 140 *livres tournois*, equivalent to nearly 120 shillings – thus purchase costs were 70 per cent higher for the machine. Daily wages were lower, at 9 sous, equivalent to 4.5 pence, per day. Higher initial costs and lower wages to be saved meant that in France the return on investment was much less, probably 7–10 per cent at best and negative at worst, again depending on the exact increase in productivity and the time spent at the machine.

Under these conditions, it simply was not worthwhile for French home spinners to invest in a jenny, nor for their masters to buy it for them. Indeed, with a 70 per cent higher purchase price, this differential in the cost of a jenny was so large that French manufacturers declined to purchase them, even though the technology was available and the French government even offered subsidies for their purchase! Even if French manufacturers had been able to borrow the cost of a jenny for no interest at all (zero capital costs, in RW's model) they would not have done so, because the costs of the particular technology, relative to the rate of return on that technology given prevailing labor costs, was too low. Indeed, Allen does not even use an imputed interest rate on capital (the RW cost of capital) to assess the return on using the spinning jenny; he makes his case simply on the cost of the technology, and comparing the estimated return to other investments.

Allen argues more generally that the ratio of capital costs to labor was higher across the board in France than in England; thus it made sense for England to invest in the search for and deployment of labor-saving technologies. But this is an argument about the cost of capital goods (including purchase price, interest rates and depreciation) and specifically the cost of labor-saving machinery compared to the cost of labor, not simply about the cost of borrowing. Thus the costs of capital for sovereign borrowers or for landowners seeking mortgages tells us nothing about the true costs of investment in any particular machine technology relative to the returns on such investments.

7 Allen 2009.

8 Allen 2007.

The difference in impelling Britain to seek and adopt labor-saving technology was mainly in the purchase cost of the capital goods. Labor costs were 44 per cent higher in Britain than in France, by Allen's reckoning, but the cost of the technology, the jenny, varied even more, being 70 per cent higher in France. If the costs of the jenny had been the same in both France and Britain, a spinner's return would still have been higher in Britain due to higher wages; but the return in France would have been sufficient for France to adopt the technology.

Why would a given technology cost so much more in one region than in others? If the spinning jenny were a simple piece of equipment, like a spinning wheel, that any local wood carver could make, there would be no reason for such a difference. Indeed, since a building craftsman's labor was more expensive in Britain, constructing a jenny should have been more expensive as well. But if the spinning jenny were a complex piece of machinery requiring a mating of wood and metal parts, precise gears, and coordinated moving parts, then in a society where skilled craftsmen concentrated mainly in production of luxury goods for courts and aristocrats, and metal parts were expensive (as in France), the cost of building a jenny would be very high. In contrast, in a society that led the world in the production of scientific instruments and where clock-makers and other gear and machine craftsmen were widespread and worked for consumer markets, and metal goods were increasingly mass produced for market (as in England), then the cost of building a jenny would be much lower. It was this difference that meant jennies could be widely adopted in England but not elsewhere, until other societies caught up in their machine-producing infrastructure.

Allen himself notes that England's advantage in adopting mechanization lay not merely in lower costs of borrowing for investment in machines, which as we have seen were not really critical, but in a much deeper and more broadly dispersed culture of mechanical engineering.[9]

Let us examine two other technical achievements of the eighteenth century that were crucial for industrialization and fueling the "great divergence." Metal goods became cheaper in England in part because of the success of Abraham Darby in using coke instead of charcoal to fuel smelting of iron, and using the resulting pig iron to create cheap metal castings in place of the forging previously required for most iron goods. Darby was in fact interested mainly in casting iron goods – a process used in brass but previously not available for iron, where the resulting thin-walled products were too brittle for use (it was the process of casting, not using coke for smelting, that Darby patented). Darby's process worked because coke smelting produced higher temperatures, which turned silica in the ore into silicon in the iron in the smelting process, and produced a more ductile iron that worked to create lightweight but strong metal castings. The use of coke instead of more expensive charcoal and the use of castings rather than forgings greatly reduced the costs of small metal goods in England. But nothing in this process was driven by investment in capital to reduce labor costs. In fact, as Allen shows,[10] the detailed records of Darby's factories show that adopting the coke and casting process did not reduce labor

9 Allen 2009, pp. 204–05.

10 Allen 2009, p. 219.

inputs per unit of output at all – from 1709 to 1737 labor input per ton of pig iron was constant. But the new process greatly reduced the cost of capital inputs for fuel and raw materials – capital costs fell by two-thirds and coal costs by half in this period – and greatly increased the value of the final products (in fact there was no equivalent to the lightweight and strong iron castings that Darby produced, hence his patentable invention). Thus this technological innovation was adopted because it was *capital* saving and value-increasing, not because it was labor-saving, as RW's model implied drove innovation in Europe in this period.

For the second innovation, let us consider the history of the steam engine. Non-technologists often consider the invention of the steam engine as a particular invention, occurring at a particular time, and driven by England's easy access to coal that made its use as a fuel attractive. Nothing, however, could be further from the truth. The steam engine was in fact a series of distinct inventions, each of which greatly transformed the utility and potential of the machine.[11] The initial steam pump of Thomas Savery, developed in 1698, had limited pumping capacity, depending on the pressure of the steam. It had no moving parts and worked solely through vacuum and steam pressure. Although introduced as "the miner's friend," in practice it could raise water no higher than 70 feet, insufficient for pumping deep mines. Thomas Newcomen then worked for another decade to develop a far more powerful piston pump, using atmospheric pressure to drive the piston into a vacuum created in a cylinder by condensation of steam. This far more powerful pump could raise water hundreds of feet. The Newcomen engine did not replace human labor but horse-driven chain pumps. Its value was in saving capital (horses) and concentrating greater power than chain-pumps achieved. Without the Newcomen engine, England would not have enjoyed cheap coal – the mines in the north were rapidly filling up with water by the late 1600s and Parliament was warned that coal supplies were threatened. The new pumping machines made it possible to continue and extend sub-surface mining, and orders poured in from wet coal mines all across England for Newcomen's engines.

However, the Newcomen pump had two major drawbacks. First, it was extremely inefficient, using huge quantities of coal to generate power. Second, its motion was uneven, as the power stroke was only in one direction. This made it impractical to use in powering machinery or rotary equipment, so the Newcomen pump could not replace water wheels for power. Rather it was used in conjunction with them, pumping water upwards to supplement water flows in driving a waterwheel for rotary power. Nonetheless, the Newcomen pump was used widely in England for water pumping from the 1720s to the 1780s.

The next phase in the development of steam power came only a half-century later. James Watt provided two key innovations – a separate condenser that improved the fuel efficiency of the Newcomen engine by about a factor of four, and the development of a double-action drive motion and sun-and-planet gearing that provided a smooth output of rotary power. The result of these two innovations was a great saving in the cost of fuel and the ability to deploy steam engines in place of waterwheels to directly drive machinery. But this huge innovation had no relation to labor-saving at this time; it was

11 Nuvolari 2004.

undertaken, patented, and marketed to save fuel costs and replace the cumbersome process of using steam engines to pump water to drive waterwheels with direct steam-driven machinery. The Watt engine was used mainly to replace the high fuel-consuming Newcomen pumps in mines, but also to replace some waterwheels in mill operations and blast furnaces – but not for many years to save labor.

The steam engine was not in fact widely deployed to drive labor-saving machinery in textile production (the classic locus of labor-saving mechanization) until the 1800s. Thus, it was a century of development and deployment driven by a desire to replace horses and save fuel (that is, save non-labor costs) and to achieve higher power concentrations for pumping that laid the foundation for a nineteenth century of "cheap coal" and the deployment of steam-driven machinery that increased the productivity of labor. To describe this 100 years of steam-power development from 1712 to 1800 as "induced" by relative factor prices that motivated manufacturers to seek labor-saving methods of production is ludicrous. Certainly, the relative factor prices of capital and labor may have played a role in the decision to adopt steam engines for textile production once they became suitable for that purpose; but the process by which such engines came into existence was driven by totally different considerations.

Moreover, the fact that "capital was cheap" in Europe in the sense that labor-reducing *machinery* was cheaper to build and operate was almost entirely due to the learning-by-doing processes that began with coke-smelting in rural Coalbrookshire and steam-engine use in rural coal and tin mines in far northern and western England. These innovations led to cheap metal parts and cheap coal to power the machinery, and moreover to the creation of a cadre of experienced gear-cutters, machine builders, boiler-makers, pump-fitters and mechanical engineers whose numerous microinventions and adaptations continually lowered the price of machinery while increasing its capabilities.[12] That these innovations from rural Britain were more important in setting the price of the capital that mattered to the great divergence – labor-saving and fuel-saving machinery – than were the general costs of borrowing in the urban centers of the Low Countries or Northern Italy, seems an insuperable problem for RW's explanation.

I have great respect for the use of formal economic models in economic history; I have used them myself in my study of inflation (Goldstone 1984) and have been a fan of the cliometric revolution from its early days. Yet the role of formal models has been mainly to clarify ideas and set up theories for precise testing against quantitative data. In this book, models are cut loose from their moorings in hard data, and set adrift on a sea of pure logic. The result is that while the models are sound, they lead us away from explanations that stand up to the facts of history. There may be a world in which the cost of borrowing relative to the level of wages is the main driver of the rate of technological advance, and where towns and urban labor are the loci for the adoption of labor-saving machinery. For much of the middle ages, this may have been true. However, eighteenth-century Britain was not part of such a world, and leaving it out does too much violence to the story of the divergence of Europe and China to let the RW model ring true.

12 Allen 2009, p. 205; Mokyr 1990.

Still, there is much to value in this book. In particular, RW's criticisms of alternative explanations of the divergence strike me as largely correct. It is particularly welcome to see the costs of war – the dislocation, destruction, and suffering – given their due, and the economic value of the long peace and light governance of China's rulers brought to light. The California School argument, that China achieved a high level of Smithian pre-industrial economic prosperity by 1800 through extensive specialization and trade, gains substantial support through this evidence.

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