Economic Dynamism and the Global Economy

A White Paper by Prof. Edmund Phelps

2006 Nobel Laureate in Economics

Director, Center for Capitalism and Society,
Columbia University

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Introduction: Dynamism and Innovation

Dynamism is a nation's capability and desire to innovate. During the rise of the modern spirit in the 19th century, indigenous innovations in Britain and America soon were adopted by other Western countries, notably Germany and France, and their innovations in turn were adopted by Britain and America. The same phenomenon was seen during the half century between 1920 and 1970. Close analysis of the data allows us to estimate the degree to which indigenous innovations and imported innovations contribute to total factor productivity in each of the major Western economies.

The more economies rely on innovation, the greater the interdependence of the countries that participate in the world economy. We can measure the impact of innovation on the output of goods and services. But innovation in a society also fulfills the aspirations of the people that comprise the world economy for discovery, purpose, adventure, and satisfaction beyond their function as consumers.

Tensions and policy disagreements between the United States and China have increased considerably during the past several years, and they are likely to persist for some time. This White Paper does not propose to discuss all, or even most, of the issues outstanding between the world's two largest economies. It will focus, rather, on one decisive issue that bears on these tensions, namely innovation and its expression in economic development.

Standard Western economic theory does not provide an adequate framework for evaluating China's problems, or the interaction of China with the rest of the world. Part of the source of misunderstanding between the United States and China stems from deficiencies in economic theory. A better theory – a theory of economic dynamism – can contribute to improved policy deliberation on US-Chinese economic relations.

We might think we have all heard enough about innovation, but it is an essential subject that all of us need to understand better. It has long been understood that sustained growth and development requires sustained innovation. Without that, capital investment will run into diminishing returns and both growth and development will slow and vanish. What though do economists mean by this term?

An innovation is not a discovery or invention. The term refers to a new product or method that is adopted for use in production by the developer or marketed to others who adopt it for use in their production or consumption.

And innovation requires "innovators," both ordinary people employed in commercial enterprises who, in the course of their work, hit upon a better way to produce something or to make a better product, as well as extraordinary people who conceive and evaluate a new enterprise for producing something new and very different.

In the present age, we speak of the innovation that is indigenous to a nation and the innovation that is imported, or "copied," from other nations — although an increasing amount of innovating is international or global, involving collaboration of contributors in two or more nations. In the vast majority of countries, imported innovation contributes more to productivity than indigenous innovation, according to studies that my collaborators and I published in the 2020 book *Dynamism*. That is as true of Sweden or France as it is of China, and it should be no surprise. Richard Nelson and I argued in 1966 that the diffusion of technical advances is hastened by investment in human capital (such as education) and the process of technological diffusion. [i] Since educational levels vary widely among countries, an improvement in education levels, that is, a deepening of human capital, allows the more developing countries to quickly import innovations created elsewhere – to catch up. The prospect of foreign competition, moreover, provokes businesses to innovate faster.

The economic literature on productivity growth focuses on "research" and "technology." Yet these concepts are less narrow than they might be supposed. The technology includes the original screenplays that pile up at MGM, from which future movies can be made, and the inventions of Wagner and Stravinsky, which subsequent composers draw on. Yet there are limitations of the focus on "research." One, which I was well aware of in the

1960s, was that new technologies are not costlessly absorbed into the market economy, so the link from invention to innovation is not prompt or reliable. It takes a creative entrepreneur to solve the problems in developing and marketing an innovation; it takes Nelson-Phelps managers to solve the problem of evaluating the innovation's likely gains, if any; it takes the of type of consumers described by Amar Bhidé to solve the problem of evaluating the gains, if any, of bringing an innovation home; and it takes financiers who can do better than choosing randomly in deciding which entrepreneurs to back. [ii] In sum, it takes a whole village for an innovation to be developed, launched and adopted.

My 1966 paper with Nelson also brings in uncertainty. The manager of a vineyard confronting a new insecticide might have no idea what the "expected value" of the benefit and the cost of using a new insecticide would be – or what the probability of successful adoption would be – if he lacked an education in basic science and humanities. A modicum of knowledge of engineering, chemistry and other fields improves a manager's ability to evaluate a new product or technique and thus bolsters the manager's confidence enough to encourage him to evaluate innovations that he would otherwise ignore.

China's Contribution to Global Innovation[iii]

After the launch of reform and opening-up, China's innovation was predominantly imported, although at some point in the present decade indigenous innovation became significant. But, as China runs out of foreign innovations it can import at acceptable cost, its focus is now on indigenous innovation.

The shift in focus in recent years from "made in China" to "created in China" is essential. And, unquestionably, outstanding innovations by such pioneers as Jack Ma have shone a bright light on the path for China to take. Alibaba, Baidu, Huawei and Tencent are stellar examples of China's tech innovation. Such technological progress is required for raising productivity and thus raising wages as well. No one can foresee the magnitude of their contribution to the world's economy, but I feel sure they will make a significant contribution to the global economy.

To continue this progress and transformation, China will require leaders in government that continue to recognize the importance of both indigenous innovation and entrepreneurship, and in turn this will require a people with imagination and creativity.

In his speech at the Boao Forum in 2018, President Xi Jinping talked of China's entering a new era of openness. [iv] Under his leadership, initiatives have been taken to boost innovation through entrepreneurship. Premier Li Keqiang has spearheaded a movement to encourage massive formation of new companies, thus to provide vehicles for business people possessing innovative ideas, and Vice-Premier Liu He has got behind a policy to refrain from rescuing moribund enterprises, of which there are more than a few in the State sector.

The process for forming a new company has been shortened, leading to an increase in the number of enterprises. I would also note the huge increase in the participation of foreign experts in the Chinese economy.

All of this is fine, but there are still several more reforms China should make to continue economic development. Notably, development of a financial sector oriented toward business investment by private enterprises will be necessary.

There are other areas in which China, as well as parts of the West, can continue to make reforms, such as coming up with ways to boost inclusion. Women, for example, are underutilized. They have an intuition that men do not have and they have a different perspective on the nation and the world. Women can add their intelligence and pragmatism to the pool of innovators. Adding them to the economy adds new ideas and new productivity gains.

In addition to further reforms, thoughtful people have questions and worries about cooperation within the global economy. While the admission of China to the World Trade Organization was an important development, there has been much talk about tariffs.

The recent trade dispute is about the high tariffs and other hurdles that US companies feel they are faced with as they contemplate attempting to enter Chinese markets. China can reply that the European Union also has some pretty high tariffs, but it may be that the non-tariff obstacles are not as daunting in Europe as they are in China. Furthermore, former US President Donald Trump was wrong – as he was in so many economic matters -- to believe that the US and China ought to have balance in their trade accounts.

The real underlying problem is that some sectors of a national economy are hurt more than they are helped by free trade. So, all countries engage in protectionism. And China's protectionism hurts the interests of the US, just as US protectionism hurts Chinese interests. In the US, it is low-skill labor that is hurt.

If the US-China trade conflicts continue, I do not see a large impact on aggregate production, or GDP, in the United States, the eurozone and China. The Chinese economy is not nearly as open as we are accustomed to supposing it is. US exports, and to some extent EU exports are mostly foodstuffs, wine and the rest; and these goods will go on being produced even if the suppliers are hit by higher tariffs. But prices will be depressed, of course.

Yet another concern is that the innovation achieved in the economy may very well steer the economy in the direction that is not what is wanted by society. President Xi has spoken of "quality growth."[v] Others speak of addressing inequality. Still others talk about the quality of life. I have argued in China for more attention to the experience of work.

People in their working lives badly want to have the experience of succeeding at something. People take satisfaction in having a sense of "acting on the world" and, with luck, "making a mark."[vi]

My position is that, for a good life, people need a degree of agency in their work. They want to be able to take the initiative and do work that is engaging. They value attainment through their own efforts.

What sort of economy — more precisely, what kind of society — offers this? History suggests that it would be fueled by the original ideas of creative people and developed by entrepreneurial people alert to new opportunities and keen to start new businesses and developing new concepts into commercial products and methods, and marketing them to potential users.

This is the China that I hope will emerge. It would also help the rest of the world. The fact is that there is much less innovation coming out of the US than there once was — and hardly any coming out of Europe. So China could become a major source of innovation for the global economy. This is an invaluable opportunity for China to be an innovation leader.

From the early nineteenth century to the early twentieth century, Western nations attributed their economic growth to the discoveries of scientists and navigators. A country needed only the zeal to develop obvious commercial applications, and build the facilities to meet demand for new products.

Until recently, the Chinese believed the same thing. But now, Chinese businesspeople and entrepreneurs are increasingly showing not only the entrepreneurial drive to adapt to new opportunities, but also the desire and capacity to innovate for themselves, rather than simply copying what's already out there.

Indeed, more and more Chinese companies are realizing that they must innovate in order to get – and stay – ahead in the global economy. Several companies made breakthroughs by offering digital-age infrastructure that facilitates innovative activity. And industrial firms have recently moved into robots and artificial intelligence. Huawei is the first Chinese company to become a world leader in a key sector of technology infrastructure, namely telecommunications equipment, with a 30 percent global market share. This achievement has occasioned alarm and suspicion in the United States.

Huawei was the first Chinese company to dominate its market segment, but it surely will not be the last. For its part, China's government is evidently supportive of

Chinese businesses developing a capacity to produce indigenous innovations. It no doubt recognizes that such innovations are all the more valuable when innovation remains weak in the West, where growth in total factor productivity (TFP) has continued its long slowdown.

China's Reforms Point in the Right Direction but Have Far to Go[vii]

In recent years, China's government has introduced initiatives aimed at increasing both entrepreneurship and innovation. It has encouraged the creation of a new stock exchange for high-technology starts, the Shanghai Stock Exchange Science and Technology Innovation Board, or STAR. It has shortened dramatically the process for forming a new company. It has built a vast number of schools, where Chinese children learn more about the world they will face. It has built a university system many of whose constituents are ranked among the world's top fifty engineering schools, and it now graduates six times as many engineers and computer scientists as the United States.

The authorities have also recognized the importance of allowing more competition in the economy. By co-founding the Regional Comprehensive Economic Partnership, a trade association of sixteen Asian countries, it has committed China to drastic reductions in tariffs for manufactured goods from Japan, South Korea and other countries that will compete with Chinese manufacturers. Individuals should be freed up to start new companies, and existing companies should be freed up to enter new industries. Competition solves a lot of problems – a point that is increasingly lost on the West.

The key insight is that when existing enterprises are protected from new market entrants bearing new ideas, the result will be less innovation and also less "adaptation" to a changing world, to use Friedrich Hayek's term.[viii]

Another argument can be made. In any modern economy, virtually every industry operates in the face of a largely unknowable future. The more companies an industry has thinking about a problem, the more likely a solution is to be found. A company that has been kept out of an industry might know something that all the companies in the industry do not. Or some unique experience may have furnished an individual with "personal knowledge" that is impossible to transmit to others who have not had the same experience.[ix] Whatever the case, society benefits – through lower prices, more jobs, better products and services, and so forth – when outsiders with something to add are free to do so.

All of this was known to the great theorists of the 1920s and 1930s: Frank Knight, John Maynard Keynes and Friedrich Hayek. And now it is known to the Chinese, who understand that a country benefits when companies – each with its own thinking and knowledge – are free to compete.

The West seems to have forgotten this. Since the 1930s, many Western governments have seen it as their duty to protect established enterprises from competition, even when it comes to new firms offering new adaptations of innovations from abroad or indigenous innovations. These protections, which come in myriad forms, have almost certainly discouraged many entrepreneurs from coming forward with new and better ideas.

History is rife with evidence of the value of competition. In post-war Britain, into the 1970s, industries were controlled by exclusive clubs within the Confederation of British Industry, which barred new entrants. By the time Margaret Thatcher became prime minister in 1979, TFP had stagnated. But Thatcher put a stop to the Confederation's anti-competitive practices, and Britain's TFP was growing again – albeit slowly – by the mid-1980s.

We are now seeing something similar in China. By 2016, China's TFP growth rate had been slowing for a number of years. But since the reforms that year, it has been increasing again.

The West must address its terrible TFP slowdown, which has lasted since the early 70s –interrupted briefly by the IT Revolution from 1994 to 2004. Ending protection of incumbents from new entrants possessing ideas for new adaptions and innovations is a good place to start.

Quality Growth in China[x]

There is much talk about China's capabilities to innovate, its innovation policy and the growth that can be expected to result: What kind of growth and how much of it?

People have an innate desire to create, which can be traced as far back as prehistoric Homo sapiens and the Neanderthals before them.[1] *Innovation, however, means adoption alongside creation. And adoption takes place only when the new thing is seen to be profitable to use — more profitable than choosing any other new thing. So innovating is hard and success may be infrequent, to say the least.*

Yet careers that invite efforts at innovating are highly valued. During the United States' glorious years from the 1820s to the 1960s, innovation was pursued by ordinary people as well as geniuses. This innovating was an engaging and often exhilarating experience: people were involved in their work and had a sense of taking action and of achieving things. Now, statistical analyses show that a low rate of innovation in a country is a reliable predictor of low life satisfaction.

It is clear that the US has lost that and it looks to tiny Silicon Valley for whatever innovation the economy is going to have. Is it also clear that China can take the place of the US as the world's greatest innovator?

The Chinese have always been a vital people and that helps. They have also shown the acumen —the business savvy —that is necessary if attempts at innovation are to materialize in actual innovations. It may be important that those aspiring to innovate have the ability to step back from the group in order to identify and think through any hazard.

Now, published data suggest that an astoundingly large number of new companies — about 14,000—are registered every week.

Innovative efforts in supply side reform

Speaking at the World Economic Forum in Davos, Switzerland, in January 2018, Chinese Vice Premier Liu He said that, under the new policy introduced two years ago, excess capacity in an industry is a signal that "supply" should be allowed to contract and prompt the less able companies to leave the industry.[xi] Liu, a member of the Political Bureau of the Communist Party of China Central Committee, said that similarly, excess demand is a signal to new companies to enter the industry. With this policy, he said, the government hoped "to make the supply side more adaptable and more innovative," adding that this reform appears to have worked. The growth rate of "total factor productivity," which had slowed for a while, picked up after implementation of the new policy.

But, thoughtful people have questions and worries. In China as well as the US, a great deal of innovation is in industries making capital goods, infrastructure or mining, there is little innovation in industries such as clothing, housing and healthcare. It is natural to ask whether such narrowly focused innovation can go on very long. In fact, data in the US show that an index of prices of capital goods has been steadily falling for several decades. This suggests that companies aiming to innovate — in China, too — will ultimately run out of possibilities for innovation in that direction. In short, economies have to achieve broad innovation or die.

A worry in the West is that the new technologies being created by this focused innovation, in expanding capacity in the capital-goods sector, also drives down wages in those industries. This phenomenon has brought high unemployment to several regions in the US, the United Kingdom and France. If innovation in China becomes similarly focused, it will be a worry in China too.

China's Economy is Capable of Correcting Imbalances

The economy may be capable of correcting some of the wage inequalities. The fall of wage rates in some industries has the effect of slowing down the growth of wage rates in other industries — until wage rates have regained their former balance. And this phenomenon will be a force gradually pushing up the rate of return to investment in the latter industries. The result will be a gathering boom in investment and ultimately a revival of wage growth and employment. Other healing mechanisms may also be at work. But this is possibly a very long adjustment process.

Similar concerns about innovation were aired with the rise of corporatism in Europe in the 1890s. (Prussian sociologist Ferdinand Tönnies was an important voice especially in 1920s Germany). One concern is that innovation was a headless horseman going in a direction that is largely unknown. The corporatists of that time, as now, regarded this as a profound failing of capitalism. The reply of mine is that the direction of the economy is not necessarily of great importance as long as participants — employees and bosses, investors and lenders — are finding that engagement in the processes of innovation are a rewarding experience and that the resulting growth of productivity is also valuable in meeting needs.

Another concern is that the innovation achieved in the economy may very well steer the economy in the direction that is not what is wanted by society. It may take some time to get to the bottom of this issue.

That brings us to the concept of "quality growth" put forward by Xi. I would suggest that

China is big enough to be able to have both: a highly innovative business sector and a public sector that fills in the deficiencies and omissions of the business sector. Thus, China, with its two sectors, will be able to create a brighter future for its people.

Risks to China from America

Imported innovation from America has had a net positive impact on China during the past four decades, and the prospect that America might import innovation from China is a prospective benefit to the United States economy. This section will discuss risks to China from the United States. These take two forms: The first is the slowdown in American productivity growth, and the second is the increase in US public indebtedness.

Economists commonly think about the benefits and costs of economic cooperation between two large countries, such as China and America, or the East and the West, in terms of the gains from trade: Each country steps up output of the good in which it has a "comparative advantage" and exports some of this output to the other country. The gains from such trade are clear: China gains from the increased price it obtains for the product it exports to America and America gains from an increased price it obtains for the product it exports. As a result, national income increases in both countries.

Yet, a country's products are predominantly produced by a combination of two or more "factors of production" – labor and capital, for example. If a country's production of the imported good is labor-intensive, the imports may cause wage rates to fall; if capital-intensive, the return on capital may fall. (There can be a reduced return on labor or on capital though not on both.)

It is worth saying, however, that after China achieved what Walt Rostow dubbed "take-off into sustained growth" its economy soon became large relative to the countries with which it traded as measured by gross national product. As a consequence, China's gains from trade with America have generally lessened. And after America lost its high rapid growth, China was able to become still larger relative to America and thus gaining.

Now, though, there have been –most importantly in America – some forces operating through channels other than trade that have had important impacts on China. Three such forces in America will be discussed: First: the severe loss of productivity growth (i.e., the growth rate of

Total Factor Productivity) and resulting fall in the rate of return to investment; second: the broad decline of the "spirit" to invest; last: the huge increases in the size of the U.S. public debt.

Impact of Big U.S. Shocks on China 1980-2019

The sharp slowdown of America's productivity growth in the early 1970s lasting for more than two decades and then resuming (after the internet boom) in the early 2000s, has had the effect in America of slowing the "augmentation" of labor, thus leading to a gradual rise of the capital-augmented labor ratio.

In turn, this "capital deepening" in America, in reducing profit rates there, drove down long real rates of interest in America (and may have pushed share prices up in the process). That is a force operating to reduce real interest rates (and possibly raise share prices) in China as well and thus to increase China's investment-output ratio. Thus America's slowdown – in this respect at any rate –has boosted China's development.

The logic – the "theory" – behind this slowdown thesis is perhaps clear enough. In any case, the econometric analysis undertaken here– a statistical analysis of time series – estimated that America's TFP growth rate does indeed have a negative coefficient in the equation explaining China's investment-output ratio. That finding supports the slowdown thesis – whether or not the totality of forces drove up China's investment ratio.

Another hypothesis is that a significant loss in America of the spirit that investing typically requires – a weakening of what John Maynard Keynes referred to as companies' "animal spirits" – can be expected to have a positive impact on Chinese investment because the pullback of investment in America widens the market share available to the Chinese. Overseas capital markets will be especially less crowded than they would otherwise have been. The logic, or "theory," of this thesis is quite simple.

The econometric analysis here estimates that an increase of "animal spirits" in America – an increase of the constant term in the equation – would have a negative effect on Chinese investment, as implied by the thesis. Hence a loss of that spirit would indeed be positive for Chinese investment.

The theory here implies that an increase of America's public debt resulting from fiscal deficits, in adding to its total wealth, operates to contract its supply of labor, thus lowering its real wage rates. But in the long run, the increase of America's public debt, in driving a wedge (or widening the wedge if one is already there) between wealth and capital, has the effect of driving world interest rates up and thus causing the capital stock to take a flatter (less steep) path in China and in the world than it would otherwise have been taken.

Evidence from the econometric model of the Chinese economy studied here finds that such a creation of wealth in America does indeed have a negative effect on investment in China.

Last, there may be positive effects from the surge of American firms into China in order to take the opportunity to operate factories where wage rates are far lower than in America – thus pulling up wage rates in China and causing wage rates in America to slow, if not fall.

Surprisingly there has been little or no research that would support or call into question the above three hypotheses. Thanks to the collaboration of my long-time colleague in the area of econometric analysis, Prof. Gylfi Zoega, it has proved possible to find some econometric support for the above hypotheses.[xii]

Slowdown of Productivity Growth

Figure 1 shows (in the blue line) the growth rate of total factor productivity growth taken from a Bank of France database and an exponential smoothing of that series.[xiii] The smoothing serves to capture the gradual realization, or awakening, among the actors in the economy of changes in the rate of productivity growth – thus to capture learning about developments in the growth of productivity. Note the fall in productivity growth at the end of the 1950s, the increase in the late 1960s and the decline that started around 1970s and reached a trough

in the mid-1980s. There is also the recovery of productivity growth in the late 1990s and the subsequent decline. Thus, the rate of productivity growth rose in the late 1960s and the late 1990s and fell from the late 1960s to the mid-1980s and then again in the 2000s.

Figure 1. Total factor productivity growth in the United States

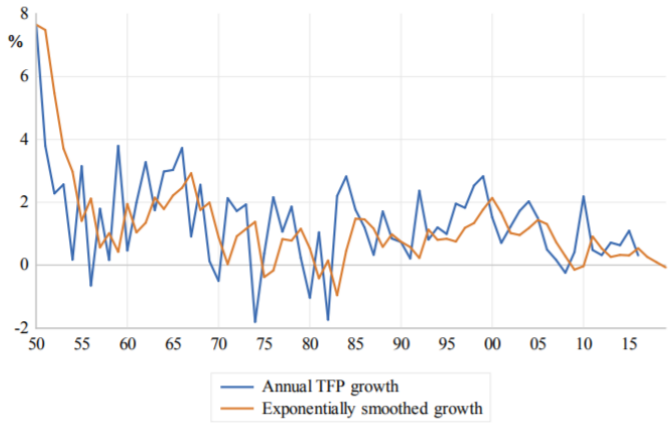


Figure 2 has the rate of growth of productivity in each decade starting with the 1950s (1950-1959). The average rate of growth of TFP is high in the 1950s, falls somewhat in the 1960s and then more in the 1970s and 1980s, rises in the 1990s and then falls back in the 2000s.

Figure 2. Average TFP Growth in the United States

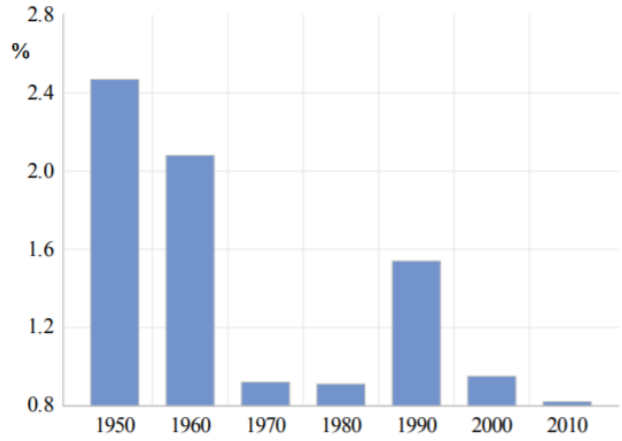
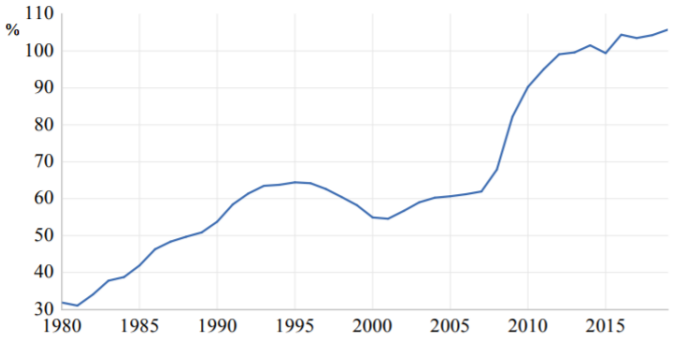


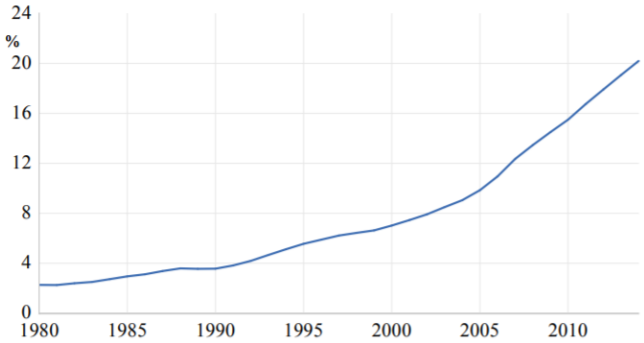
Figure 3 shows that there was a steady increase in public debt in the U.S. from 1981 to the mid-1990s, then a fall until 2001. The fall in the late 1990s coincided with the higher productivity growth shown in the figure above and the Bush tax increase in 1991. Between 2001 and 2007, the Bush tax cuts and the war in Iraq led the debt to increase from 55% of GDP in 2001 to 62% in 2007. Then the global financial crisis of 2008 caused debt to increase rapidly from 2008 to 2014, reaching 102% of GDP. Before Covid-19 hit the economy, the debt level had reached 106% of GDP. Now it is widely thought it could reach as high as 140% of a reduced GDP.

Figure 3. Central government debt in the U.S.



The rapid rise in debt after 2008 coincided with the growth of investment in China stalling in 2010. There is of course the problem of distinguishing between the direct effect of the financial crisis on investment in China and elsewhere and the indirect effect going through debt in the United States. Last, we consider the effects of an increase of American firms operating in China. American firms operating in China have the effect of transferring technology, which is one of many routes through which China is gradually closing the technology gap with the United States. Figure 4 shows the ratio of output per employed worker in China to that in the United States, which is increasing over time.

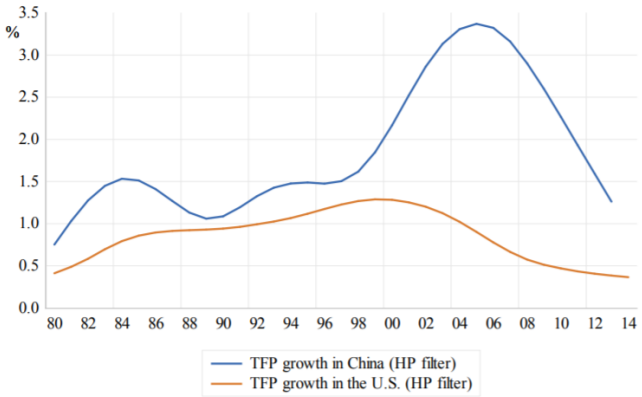
Figure 4. Ratio of Chinese to U.S. output per employed worker



Source: Penn World Tables.

The rising output per employed worker in China stems from both high investment as well as rapid productivity growth. Figure 5 shows the Hodrick-Prescott smoothing of the time series of the rate of TFP growth in China and the U.S. since 1980.

Figure 5. TFP growth in China and the U.S (HP smoothed)



Source: Penn World Tables

The fact that TFP growth in China is faster than in the U.S. means that the technology gap with the U.S. is shrinking over time. It is noteworthy that TFP growth in China accelerated in the early 2000s when the gap was much smaller than in the 1990s. This could be explained by China's increased ability to learn from the rest of the world due to the many Chinese students returning from studies in the West, a surge of American and other Western countries' operation of factories in China or increased rate of indigenous innovations.

Multiple Regressions

In Table 1 we report the results of a multiple linear regression where the dependent variable is the investment ratio for China (ratio of gross capital formation to Chinese GDP taken from the Penn World Table) in percentages. The objective is to assess to what extent the U.S. economy impacts China through the channels described above.

Table 1. Investment equation for China
(Investment and public debt relative to U.S. GDP)

Dependent variable: Investment-output ratio in China		
Period: 1980-2014		
	Coefficient	t-ratio
Constant term	38.52	1.62
TFP growth in U.S. (%)	-2.05*	2.15
Investment-output ratio U.S. (%)	-1.68	1.57
Public debt/GDP in U.S. (%)	0.27*	2.51
Standard & Poor 500 (real)	2.62*	2.82
R-squared	0.84	
F-statistic	40.6	

* Indicates significance at the 5% level.

The first explanatory variable is the rate of TFP growth in the U.S., measured in percentages.[xiv] We apply adaptive smoothing techniques that make our TFP growth series respond gradually to actual TFP developments.[xv] The estimated coefficient is statistically significant with a value equal to -2.05, which implies that a 1% slowdown in productivity growth in the U.S. (as from 2% to 1% per annum) goes together with an increase in the ratio of gross capital formation in China to GDP in China of 2%.

Table 2. Investment equation for China
(Investment and public debt relative to Chinese GDP)

Dependent variable: Investment-output ratio in China
Period: 1980-2014

	(1)	(2)	(3)	(4)
Constant term	55.39*	57.72*	59.91*	54.34*
	(43.12)	(44.63)	(33.17)	(20.69)
Investment in U.S./output in China (%)	-0.51*	-0.52*	-0.49*	-0.44*
	(22.30)	(26.03)	(17.70)	(14.92)
TFP growth in U.S. (%)		-1.55*	-1.12*	-1.70*
		(3.50)	(2.24)	(3.39)
Public debt in U.S./GDP in China (%)			-0.03*	-0.03
			(1.69)	(1.39)
Standard & Poor 500 (real)				0.67*
				(2.72)
R-squared	0.94	0.96	0.96	0.97
F-statistic	497.33	339.60	240.53	219.52

* Indicates significance at the 5% level.

There is then the effect of changes in the U.S. investment to GDP ratio discussed above. A significant loss in America of the spirit that investing typically requires can be expected to have a positive impact on Chinese investment because the pullback of investment in America widens the market share available to the Chinese. The estimated coefficient is less significant. Its value implies that a 1% fall in the U.S. investment to GDP ratio goes together with an increase in the investment ratio in China of 1.7%.

We then add public debt (central government debt) in the US as a ratio to GDP measured in percentages. The coefficient has a value of 0.27, which implies that an increase in the U.S. debt ratio of 10% will increase investment in China by 2.7%. The sign of the coefficient goes counter to the hypothesis proposed in the earlier section of this note. But see the paragraph below for a further discussion.

Finally, the real S&P 500 index (deflated by the CPI) has a robust and statistically significant coefficient. The index has a value of 6.2 in 2005 and 8.2 in 2014 so that the implied effect on the investment ratio in China is 5.2%.

A better way of measuring the effect of U.S. investment and public debt on China is to measure them relative to China's GDP. The results are in Table 2.

We first include the investment-output ratio in column (1) of the table, then add TFP growth in column (2), then public debt in column (3) and finally the S&P 500 in column (4). The estimated coefficient of the investment variable implies that a 1% fall in U.S. investment as a ratio to Chinese GDP makes the investment-output ratio in China rise by 0.5%; a fall in TFP growth in the U.S. by 1% makes the investment-output ratio in China rise by 1.7%; a rise of public debt of 10% in the U.S. makes the investment-output ratio fall by 0.3%; and the observed rise in the S&P 500 from 2005 to 2014 makes the investment-output ratio in China go up by 1.3%.

The impact of rising US indebtedness on China's economy has been measurable, but small. This may change if America's public debt continues to increase rapidly, and America eventually is forced to pay higher interest rates on government debt.

Critical Shortcomings of the Standard Theory[xvi]

Standard Western economic theory does not provide an adequate framework for evaluating China's problems, or the interaction of China with the rest of the world. Part of the source of misunderstanding between the United States and China stems from deficiencies in economic theory. A better theory of economic dynamism would contribute to improved policy deliberation on US-Chinese economic relations.

In standard economics, true economic growth—defined as growth of total factor productivity, a weighted average of labor productivity and capital productivity—comes out of a machinelike economy driven by "technical progress" (to use Robert Solow's term) that is solely or predominantly exogenous to the economy.[xvii] This "progress" is the driving force: although some nations may maintain a higher level of productivity than some others, no nation can maintain a growth rate of productivity faster than the "rate of technical progress." Technical advances with commercial applications prompt businesspeople with acumen and zeal to start new enterprises or reorganize existing ones in the expectation of profiting from the new step.

Schumpeter and others in the German Historical School thought that this "technical progress" arose from the discoveries made by the world's "scientists and navigators," which may have been true enough of Schumpeter's Austria. Such discoveries were viewed as the prime mover while entrepreneurs undertook the commercial applications that a discovery made possible. This became the standard theory's explanation of innovations. In Schumpeter's thinking, there were no people inside a nation's economy who might be conceiving new things and thus potentially contributing to a nation's innovation and growth—no indigenous innovation.[xviii]

But it is doubtful that these elements of the standard theory fit at all well the highly modern societies emerging in the past 200 years: largely the societies that developed in the 19th century—mainly in Britain and America, later Germany and France. Nor do these elements fit well with China's economic experience of the past forty years. Some points are suggested by the humanities, anthropology, and other social studies.

First, ***people in general—not just scientists and navigators—are capable of having original ideas, and many of these ideas might have commercial applications—just as scientific ideas might. Indeed, virtually every industry has had workers, managers, or others that hit upon new ideas at one time or another.***

Second, there is far more to a nation's economy than growth. It is fair to say, painting with a broad brush, that the standard theory depicts people's wants as entirely material: no more than their consumption and leisure. Such a theory may have described life in a mercantile economy, like that in 18th-century England, but it omits the experiential dimension central to a modern economy—conceiving and trying out new ways and new things. In the standard theory, a person's life is reduced to simply getting the best terms—finding where revenues are highest or the cost lowest.

Furthermore, the standard theory views the participant as atomistic, hence having no sense of impacting on the quantity or quality of any product supplied. Thus working life lacks any exercise of free will and hence any pursuit of the good life. The theory sees us as being robots from nine to five. That feeling is not the norm in a modern economy, however. There, the experience of acting on an idea of one's own gives people a sense of agency—a feeling that they are making a difference in some small part.

Because the standard theory does not recognize these dimensions, it can explain neither the intercountry differences in a nations' economic performance, material and nonmaterial, nor the rise and fall of this performance. Regarding intercountry differences in material performance, the standard theory implies that

productivity tends to be equalized, as capital and technologies flow to countries where they are scarcer. The data, though, show that, among G7 countries, productivity is far below what the theory would suggest in Britain and Germany while far above it in America.[xix]

As for nonmaterial performance, the standard theory says nothing about any systematic intercountry differences, since it does not see differences in the nature of countries' economic experience. The data show that a measure of nonmaterial performance, mean job satisfaction, is high in Switzerland, Denmark, and Austria while low in Spain, Germany, and Italy. Regarding intertemporal differences in economic performance, it is clear that the standard theory, having no predictive model of what it terms "technical progress," does not explain them either. It is not capable of explaining such developments, material or nonmaterial. With a world of change to explain, this is a serious failing of the standard theory.

How then to explain how a nation may gain—or lose—some of its economic performance, material and nonmaterial, relative to other nations and, for that matter, relative to its own past? A few theorists sought to show how a nation's economy might play a wider role than Schumpeter conceived in the development of innovations—some going so far as to speak of endogenous growth in contrast to Schumpeter's exogenous growth. For example, Kenneth Arrow built a model of productivity gains through "learning by doing."[xx] Paul Romer built a model in which successive variants of an original product line are introduced and Philippe Aghion and Peter Howitt analyzed a model in which "research activities"—with probabilistic results—generate random sequences of quality-improving innovations. [xxi]

We have to go beyond this—and in more than one way. We need to find forces that will produce sustained growth. Certainly, learning models do not if there are not new things to be learned. Industrial research teams seeking a commercial application of some scientific discovery appear to be creatures of Schumpeterian advances. (As Nelson said, industrial research would wind down if scientists closed shop.)[xxii] Successive product lines do not constitute sustained growth either.

"Research activities" and "new ideas" are a black box. The spark and the fuel are not described. While, in modern economies and somewhat less-than-modern ones, organized corporate R&D—activities such as researching for new applications, learning by doing, and solving problems—may yield an occasional productivity gain or new product, no evidence has been presented to suggest that sustained innovation, growth, and job satisfaction are to some degree explained (in the statistical sense) by these activities. It is safe to say that these activities cannot have been the source of the productivity explosion of the past 200 years.

We also need to take into account the new ideas of ordinary people and the wellspring of those ideas. Even if some statistical correlations should be found, to view the organized research activities of technicians in companies and government offices as fundamental to innovation, thus job satisfaction and growth, does not get to the bottom of things: it is a blinkered view of what individuals, inside or outside companies, are capable of conceiving and doing—with or without advancing scientific knowledge—and what things they want to do for their satisfaction. Thus, the existing "endogenous growth theory" is inherently missing key dimensions in human possibilities: the same ones missing in the standard theory.

The thesis expounded and tested in Dynamism takes a different view. Its fundamental premise is that people from all walks of life, not just scientists and lab technicians, possess inborn powers to conceive "new things," whether or not scientists have opened up new possibilities. And a modern society allows and even encourages people to act on newly conceived things—to create them and try them.

The implication is that, whatever Schumpeterian innovation may be occurring, in highly innovative nations, much of that innovating is indigenous: it springs from the powers of originality and creativity among large numbers of people working in the nation's economy. In this

thinking, a nation may possess the dynamism needed to create innovations and a willingness as a society to accept their introduction into the economy.

The sources and rewards of dynamism are tied up with the personal values that came to the fore in those times: the willingness to attempt innovation may be tied to developing conceptions of the "good life." This theory has grown out of work beginning soon after the founding of the Center on Capitalism and Society at Columbia University in 2001 and culminating in *Mass Flourishing*, published in 2013.

Mass Flourishing is a Global Phenomenon

There were forerunners of *Mass Flourishing*, of course. In his first book, *The Process of Economic Growth,* the economic historian Walt Rostow, looking at centuries past, noticed that economic growth had always been episodic, and the rare outbreaks were typically reversed until, in the 19th century, there were—in his inspired term—"take-offs into sustained growth:" Britain and America around 1815, Germany and France around 1870.[xxiii] Countries busy copying the new methods and products passing the market test in a "lead economy"—the Netherlands and Italy, for example—saw their own growth rates pulled up. (The further they were outstripped by the leaders, the faster they grew.)

In any nation where it took hold, this growth was immensely powerful. It transformed the nation from agricultural to industrial, from rural to urban, and from trading to producing. New cities sprouted up and new ways of life arose. In a vivid portrait, *The Birth of the Modern: World Society 1815–1830,* the eminent historian Paul Johnson introduces us to many of the vast number of ordinary people whose originality and daring were characteristic features of the modern life that arose in Britain and to a lesser extent in America and continental Europe. [xxiv]

Johnson was on to something quite important. A new outlook on life—the new attitudes—permeated Britain and America: going one's own way, seizing one's opportunities, and, as Dickens conveyed, taking control of one's life. The English spoke of "getting on," meaning they were getting somewhere—perhaps getting ahead.[xxv] It was this new spirit that gave rise to an unprecedented dynamism. Businessmen might seize unnoticed or neglected opportunities to have better ways to produce existing products or have better-selling products to make. There were some adventurers in Renaissance Venice too, but that was nothing like the spread of entrepreneurial pursuits witnessed in the 19th century. Firms of a more entrepreneurial bent were springing up all over the economies of Britain and America. The agglomeration of such firms led to the emergence of more cities (but they were not a driver).

Workers too brought this enterprising attitude to the workplace. The supply of labor—in the working class and middle class—shifted more and more from work that was routine or dull toward work that was challenging, hence engaging, in offices, yards, and shops. Employees might be keeping an eye out for better ways to do their job or organize their work. This new workplace was important. Marshall, observing in 19th-century England, thought so: "The business by which a person earns his livelihood generally fills his thoughts during by far the greater part of those hours in which his mind is at its best; during them his character is being formed by … his work … and by his relations to his associates in work."[xxvi] Thus, both demand and supply brought people to the new kind of workplace. It was a subject of discussion for decades, from Alexis de Tocqueville to the young Karl Marx.[xxvii]

But, far more important, the new outlook brought a spirit of imaginativeness to people in the economy. Some people might be dreaming up a new product, other people might be conceiving a new way to produce, and still others might be thinking up a new market for an existing product. Everyone was looking for a new way to do something, a new thing to do, or a new thing to use.

It was not a "trading economy" led by enterprising merchants and entrepreneurs that had arrived. It was an "innovation economy"—an economy built by a modern society. At its core was a "vast imaginarium"—a space for conceiving, creating, marketing, and perhaps adopting the new. The philosopher David Hume, decades ahead of

his time, was its first philosopher: he saw the necessity of imagination for new knowledge, the role of the "passions" in human decisions, and the mistake of counting on past patterns to hold up in the future.[xxviii]

The emergence of this phenomenon must have been breathtaking. While the adaptation achieved by "entrepreneurs" could pull an economy to its frontier, or "possibility locus," innovation kept on pulling up the frontier itself, and people had no idea when it would come to rest—or if it would come to rest. The results were spectacular. But what was it about this new kind of economy—this new way of work—that made it desired? And why was the necessary fuel present in some nations and not in others?

Fruits of the Dynamic Economies

The takeoffs gradually brought rising material rewards. Wages were pulled up by rising productivity. Profits gained kept on exceeding profits lost. More and better food and clothing led to improved health and longevity. In Britain, which kept records, wage rates, which had been up and down since 1500 and depressed from 1750 to 1800 (the years of the First Industrial Revolution), finally "took off"—ultimately growing at the same rate as output per worker. Moreover, workers found a growing number of ways in which to spend their time and money—from theater to sports to pubs. (While it is suggested that pollution and crime in British cities offset much of the wage gains there, a study estimates that, taking account of amenities as well as the disamenities, "city size, on net, is an amenity.")[xxix] Ultimately, there were invaluable public benefits as well. As revenues rose, governments could take measures to combat disease and boost public health.

Yet for increasing numbers of participants, the material reward—though historic—was not the extraordinary feature of this unprecedented period. Some rewards from the dynamic economy were unprecedented—spread over the breadth of the country from the grassroots on up: there was an explosion of choices, which brought with it a thirst for more choices. Different sorts of jobs kept opening up, different firms kept on entering, and different kinds of goods for use by households kept on turning up. People found this exciting, needless to say. Lincoln, back from his tour of the country in 1858, exclaimed that "young America has a great passion—a perfect rage—for the new." What may explain that "passion" that Lincoln noticed? [xxx]

The dynamic economy brought with it invaluable *nonmaterial* rewards as well. Even in economies that were not dynamic, there were the rewards of learning things, having interchanges of information with others, and simply keeping busy—all of which arise from the experience of work. Those working in the dynamic economy, however, were in a different world. It was rich in experiences offering nonmaterial rewards that provided a sense of agency: people working in a modern economy—most of them at any rate—were taking responsibility, using their judgment, and exercising initiative. There was also the allure of setting out into the unknown. (We may never know whether Lincoln saw these experiential benefits.)

In the modern societies arising in the 19th century, most people evidently felt a gain from being able to participate in this kind of economy—the excess of benefits over the cost deriving from the inevitable crises and slumps. A great many Americans, for example, did not appear ready at any time to trade away careers offering the prospect of those extraordinary rewards, however uncertain they were thought to be, for a life of security.

Modern Values: The Roots of Dynamism

Much research has ensued on the effects of this unprecedented development—less on the causes. Why were people in some nations happy to have such an economy in which to pursue their careers—and this in spite of the uncertainty of success—while people in other nations were not? And why do we find today some nations less drawn to such an economy than they once were? In short, what was it in some nations that led to a society willing and able to provide an economy with the dynamism to innovate?

We might think at first that the spectacular rewards offered by that economy explain its rise. But that would not answer the question of why such a miraculous economy arose over the 19th century in Britain, America, France, and Germany and hardly anywhere else. The explanation hypothesized here is that a relatively innovative economy tended to be found in nations having (relatively) modern people. People are not the same. Even if all countries would have the same nonmaterial rewards had they acquired a modern economy, the people in some countries might have drawn more satisfaction from those rewards—and hence be more drawn to a modern economy—than the people in other countries: their appreciation of some or all of the nonmaterial rewards might have been more pronounced.

Testing the Thesis of Dynamism and Its Roots

Before proceeding to test statistical support for this break with the standard theory, it should be acknowledged that although what has been sketched so far is a new thesis outside the standard theory, it is not a theory in the academic sense, usually a mathematical model.

To test the thesis in *Mass Flourishing* has been a three-stage process. First, there having been no existing time series on indigenous innovation, we have created an econometric model of the types of innovation in a multicountry world with which to estimate time series of indigenous innovation (in addition to exogenous innovation and imported innovation) in each of the countries under study. These estimated time series provide estimates of both intercountry differences in rates of indigenous innovation in the past and, for each country, intertemporal shifts in the rate of indigenous innovation.

Second, we have drawn on attitudinal data from household surveys of the countries under study to test whether intercountry differences in attitudes expressing the modern values of individualism, vitalism, and self-expression largely explain—better than intercountry differences in more familiar dimensions such as institutions do the intercountry differences in economic performance, as measured by a potpourri of variables ranging from the standard (such as fertility and labor force participation) to the modern (such as indigenous innovation and job satisfaction).

Last, this investigation can be seen as a test of the very existence of dynamism. And that is a radical venture, since the literature aiming to explain differences in economic performance does not admit into its framework the existence of dynamism. The prevailing explanation of differences across countries in economic performance is focused instead on the role of institutions—thus paying little or no attention to values.[xxxi] This is hugely important. Where there is great dynamism, there is also an abundance of its characteristic fruit: achieving, succeeding, prospering, and flourishing. And where it is lacking, there is a joyless society.

Values are subject to change, however. The Renaissance values—referred to here as the "modern values"—that finally attained a critical mass in the 19th century, though initially articulated in much earlier epochs, were not strong enough at first to overcome other values. We must look, then, for evidence that some of the values that fueled the historic dynamism in the West have weakened—and watch for evidence that some competing values have strengthened.

Losses of Dynamism? Losses of Innovation?

Data collected by the Penn World Tables and, recently, by Banque de France show that total factor productivity growth, which had been fast by historical standards over the years 1950–1970 in America and extraordinarily fast in France and Italy, fell to very slow rates in all four countries over the years 1970–1990, then partially recovered to the earlier rates in America and Britain while slowing further in France and especially Italy. (Germany is a special case.)[xxxii] A longer history offers another perspective: among the large countries that were in the economic lead over much or all of the 20th century—Britain, America, Germany, and France—growth of total factor productivity was markedly slower over the span 1990–2013, and still slower in the span 1970–1990, than it had been in the interwar decades, 1919–1939, and the span 1950–1970, according to the Banque de France estimates.[xxxiii]

Innovation: Trends and Global Transmission[xxxiv]

The discussion of some substantive findings contained in the book *Dynamism* by Phelps, Bojilov, Zoega, and Hoon starts with a review of the countries that have generated most indigenous innovation in the world since WWII and then traces how indigenous innovation evolved over time for each specific country. Then it maps out how indigenous innovation shocks have been propagating across the world and compares pre-WWII and post-WWII trends in indigenous innovation.

Data over the period 1950–1972 show the average indigenous innovation for each country and the part of TFP growth, called imported innovation, that can be traced to transmissible shocks from abroad. The main result is that the US, the UK, and the Scandinavian countries have higher indigenous innovation than the continental European countries and Japan. These differences in indigenous innovation, however, do not necessarily translate into observably high TFP growth, as some of the countries in continental Europe turn out to be very good at adopting indigenous innovation from abroad. Indeed, the results for continental Europe support the hypothesis that, in the 30 years after the end of WWII, war-torn Europe caught up very successfully and quickly with the technological leader at the time, the US. Our key contribution in this context is the qualification that the observed rapid TFP growth in continental Europe in the period 1945–1972 is primarily due to catching up to the world technological frontier rather than indigenous innovation.

Data over the period 1972–2012 give evidence of a slowdown in TFP growth globally by almost 2 percent in the period 1972–2012 relative to the preceding period, 1950–1972. In addition, the transmission of indigenous innovation shocks has become more persistent relative to the preceding period. While the relative position of the US as a leader in indigenous innovation remains unchallenged, the magnitude of the associated indigenous innovation shocks has dropped dramatically. The ability of countries to take advantage of the best practices across countries varies: the differences are statistically significant and of approximately the same magnitude as the differences in the indigenous innovation residuals.

Propagation of US Indigenous Innovation[xxxv]

Further research investigates in some detail how transmissible indigenous innovation in the US propagates across the world and transforms into imported innovation. It reports the cumulative effect of a transmissible US indigenous innovation shock of one standard deviation on TFP growth in other countries, and it contrasts the results for the periods 1950–1972 and 1972–2012. The most important difference between the two periods is the decline in the magnitude of the transmitted shocks. In most cases, this decline is greater than the decline in indigenous innovation in the US itself. Thus, the estimates suggest that the adoptable innovation from abroad has declined in many countries since the early 1970s.

Thus, the estimates suggest that the ability to adopt innovation from abroad has declined in many countries since the early 1970s. Comparing the raw numbers, we find that the annual TFP growth rate between 1990 and 2012 is not higher than but very similar to the annual TFP growth rate for the first two post-WWII decades. Furthermore, accounting for short-term fluctuations and factors actually implies that the TFP growth rate in the earlier period was higher than the growth rate during the IT revolution. We explore these issues further by comparing indigenous and imported innovation during the IT revolution to their counterparts for the preceding decades.

The average annual indigenous innovation in the US between 1990 and 2012 has been about three times higher than the average annual indigenous innovation between 1970 and 1990. At the same time, it is only about 60 percent of the average annual indigenous innovation for the period 1950–1970. We also find that the average annual imported innovation in the US for the period 1990–2012 is very similar to its counterpart for the period 1970–1990. Thus, imported innovation contributes about a third to the average annual growth in TFP during the IT revolution compared with about one-half for the preceding two decades.

The results for the UK are very similar. Comparing the average annual rates of TFP growth, we find that TFP growth in the immediate postwar decades is still a bit higher than in the years of the IT revolution. In more detail, we find that the average annual indigenous innovation in the UK increased more than two times after 1990 compared with the 1970s and even compared with the 1980s. Nevertheless, the British rate of about 0.36 percent, in the 1990s and the 2000s, is still less than half of what it was in the first decades after WWII. We find that, similar to the US, the average annual imported innovation in the UK since 1990 is lower than what it used to be for the period 1970–1990. As a result, indigenous innovation now accounts for about half of TFP growth in the UK. The only consolation for the UK is that the slowdown in its innovation after 1970s is relatively smaller than the slowdown in other European nations.

Indeed, a comparison between the UK and France is quite revealing. In the three decades after WWII, France experienced a spectacular TFP growth rate of more than 2.5 percent. Most of it, however, seems to have been associated with a rapid catching up to the best practices in the world, as witnessed by the high rate of imported innovation. In fact, the French annual rate of indigenous innovation between 1950 and 1970 was lower than those in the US and the UK. Our estimates show that both indigenous and imported innovation in France failed to recover in the 1990s and the 2000s from the slowdown of the 1970s. In fact, all sorts of innovation appear to have stagnated at rates that are indistinguishable from zero.

The situation is very similar in Italy and Japan, which also experienced rapid productivity expansions in the first post-WWII decades. The case of Germany also appears very similar, but we are somewhat cautious in our interpretation because of the changing borders of the country and the associated adjustments in the growth accounting that were required to control for the effect of former East Germany.

The only other countries that have experienced a recovery in their indigenous innovation relative to the 1970s and the 1980s are the Scandinavian countries. In particular, Sweden and Finland have achieved very high

rates of average annual TFP growth of around 1 percent since 1990. This performance compared favorably to the growth rates for the 1970s and the 1980s. In the case of Sweden, we record an increase in the average annual indigenous innovation from 0.46 percent for 1950–1970 to 0.69 percent during the years of the IT revolution. Both of these averages are much higher than the corresponding rate for 1970–1990. Interestingly, Sweden also improved in its ability to adopt innovations from abroad relative to the period 1970–1990. The evolution of innovation and productivity in Finland followed a similar path.

On the basis of these findings, several conclusions can be drawn. Under the existing methodology for the estimation of TFP, there is no dramatic increase in productivity during the IT revolution despite all the anecdotal evidence that comes from industry- and microlevel studies. If anything, the average annual rates of indigenous innovation after 1990 are for the most part still lower than what they used to be during the first post-WWII decades, even for the US. While the US rate of indigenous innovation in the last two decades is higher than in the 1970s and the 1980s, it is still lower than its counterpart for the period before 1970. Similarly, the UK and the Scandinavian countries experienced a partial recovery in their rate of indigenous innovation. Our estimates also reveal that, in relative terms, the US is still the country with the highest rate of indigenous innovation, along with the Scandinavian countries and the UK.

The IT Revolution Contributed Surprisingly Little to Productivity[xxxvi]

One of the big surprises of our results is that during the so-called IT revolution, we do not detect any peaks either in the raw data of productivity or in our decomposed series of indigenous innovation.

In fact, it seems that the higher average rate of indigenous innovation in the 1990s and the early 2000s for the US is driven by higher realized minima rather than by some unprecedented positive innovation shocks. Furthermore, both the raw series themselves and our results show that the volatility in the innovation and productivity series declined over time until the onset of the Great Recession. Notably, these changes have been accompanied by an increase in the persistence of the effect of innovation shocks on US productivity.

Consequently, the decline in the magnitude of the innovation shocks is somewhat offset by the duration of their positive impact on TFP growth. During the last years for which we have data, 2005–2013, we witness a dramatic slowdown in TFP growth to a range that has not been witnessed since the early 1980s. These findings run against the popular narrative that the US is in the midst of an unprecedented flowering of innovation.

In comparison, the UK experienced consistently lower rates of indigenous innovation in the 1950s and the 1960s. Interestingly, in the following decades, the differences between the indigenous innovation in the two countries decrease significantly, largely as a result of the slowdown in US indigenous innovation. In other words, the relative standing of the UK improved after the 1980s and the country retained a small but positive rate of indigenous innovation throughout the postwar era. Still, the UK also witnessed a dramatic slowdown in productivity just before the onset of the Great Recession. The extent of this decline seems to be even more severe than the one in the US.

A cursory review of cumulative productivity growth rates across major industries in the US since the mid-1980s reveals that productivity gains have been very unequally distributed across industries (see Figure 6 and Figure 7). The IT industry has been the undisputed innovation leader in the US since the mid-1980s, and that is reflected in its high productivity growth. Figure 6 shows clearly that the productivity in the IT sector during the IT revolution has increased more than twelvefold. Such gains dwarf the productivity growth in any other US industry.

Thus, it may seem at first sight that Figure 6 conforms to the accepted wisdom about the economic impact of the IT revolution. This is not the case. If innovations and the resulting productivity gains in the IT industry had such a profound and transformative effect on the economy, then one would expect to see the productivity gains in the IT industry spill over to the other industries of the economy. Yet Figure 6 casts a shadow on the story about the revolutionary and transformative nature of IT innovations: neither manufacturing nor services experienced productivity gains of nearly the same magnitude as the IT industry. Moreover, Figure 7 shows that productivity in the US manufacturing industries has been growing faster than productivity in service industries, in particular retail trade.

Somewhat surprisingly, we do not witness, even with a lag, a major pickup in the productivity growth in other industries that are directly and indirectly connected to the IT industry. One would expect that if the IT industry were the engine of the US economy that generates the products, technologies, and techniques of the future, then the other industries would eventually experience a jump in productivity rates to levels comparable to those of the IT industry. Thus, one may wonder why aggregate productivity in the US has not grown much more.

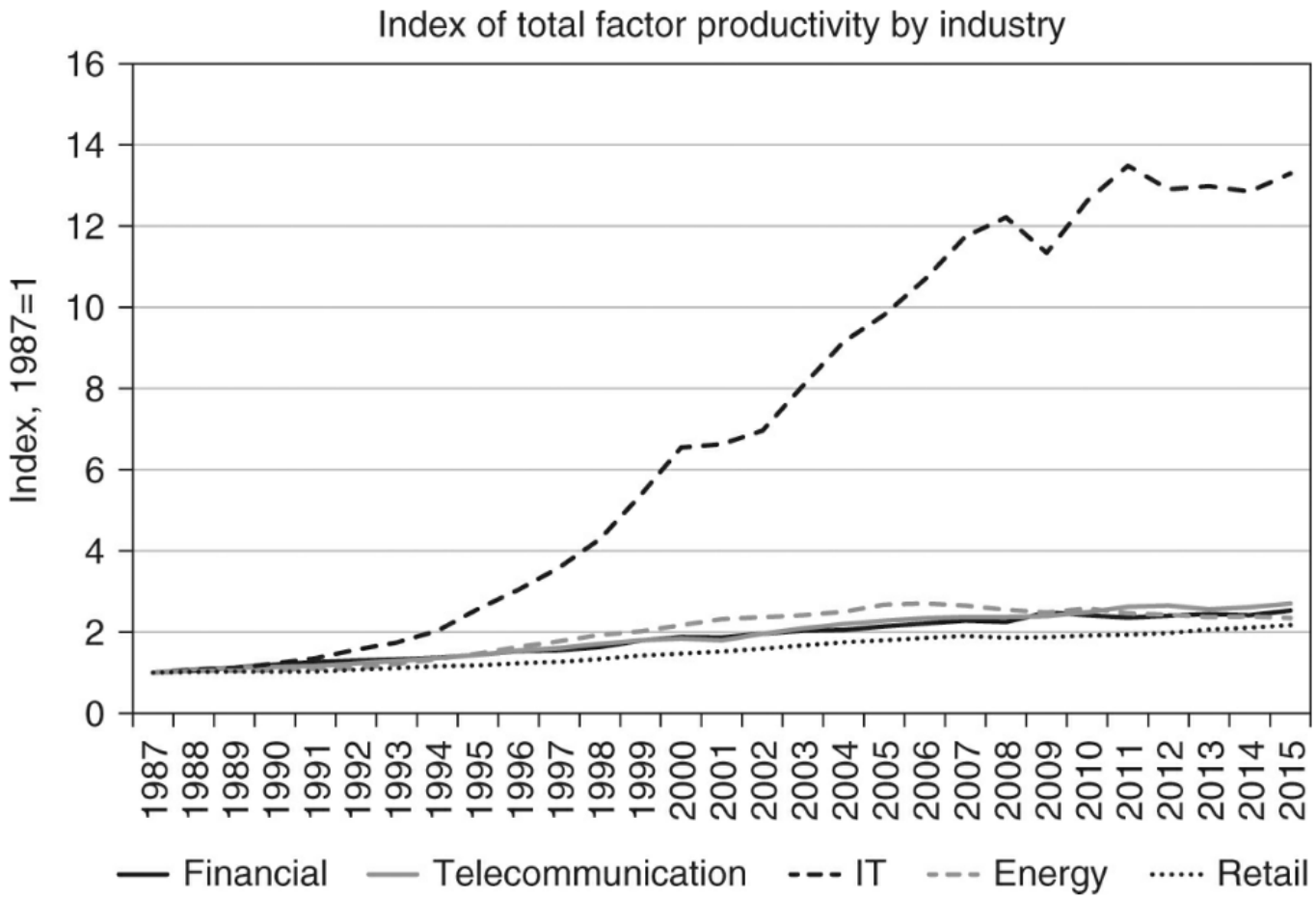


Figure 3.9. Divergence of productivity growth rates across industries in the US since the mid-1980s. *Data source:* Bureau of Labor Statistics.

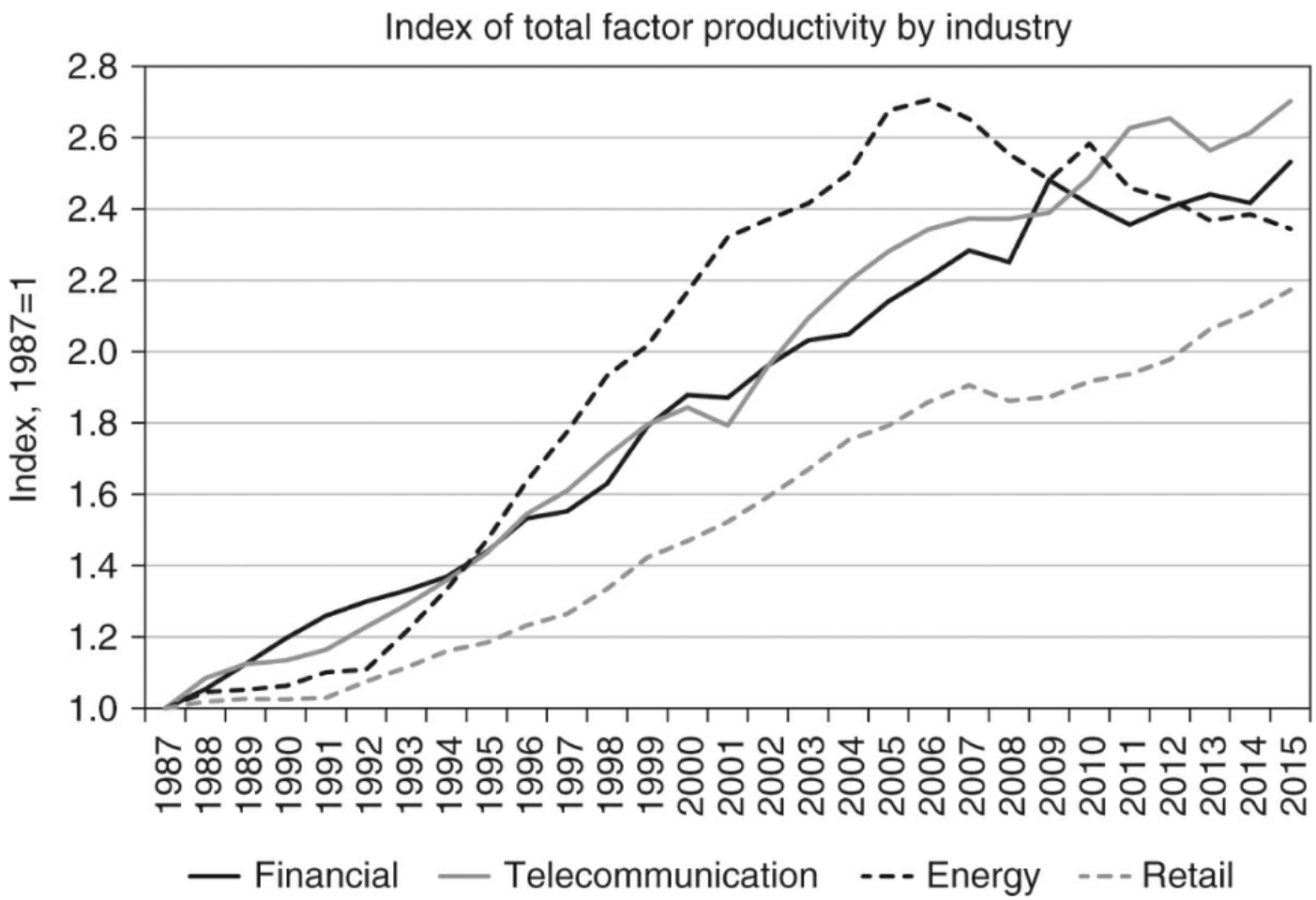


Figure 3.10. Heterogeneity in productivity growth rates across major industries, excluding the IT industry. *Data source:* Banque de France.

Understanding the Slowdown: Dynamism and Modern Values

Popular explanations of the slowdown, in presuming that all or most innovation is Schumpeterian, attribute the slowdowns of total factor productivity to a drying up of commercially usable scientific discoveries—a fall in the exogenous "rate of technological progress" driving economic growth in the standard theory.[xxxvii] Yet that inference looks questionable: if the slowdowns of total factor productivity—nearly all of which began around 1970, by which time all the countries had recovered from the war, so there were no slowdowns on this account—were the result of a decline of scientific discovery, and thus a slowing of Schumpeterian innovation, slowdowns of total factor productivity would have arrived more nearly at the same time and been more nearly of the same magnitude. But perhaps someone will someday show the presence of forces that prevented the slowdowns from being synchronous and equal. So, for the time being, contentions that Schumpeterian innovation played a major role cannot be excluded. Yet there is no evidence for belief in the primacy of Schumpeterian innovation.

The desire to understand the slowdowns of TFP and thus innovation motivates much of the book *Dynamism.* Not all of the statistical findings have direct implications for

the slowdowns, of course, and nothing like a "general-equilibrium" time-series model of indigenous innovation is estimated. Yet we can draw from the pieces some plausible, perhaps persuasive, inferences. There are four layers of questions to probe.

If the nations of the West have been suffering from generally slower growth of total factor productivity in recent decades, are the slowdowns attributable to a structural slowing of innovation, not merely a run of adverse disturbances?

If the nations of the West are indeed in the grip of systematic slowdowns of innovation, are they results of indigenous innovation in some or all of the most innovative economies rather than Schumpeterian innovation?

If there have been major losses of indigenous innovation, whether or not there has been some loss of Schumpeterian innovation as well, are these losses of indigenous innovation to a large extent a result of losses in dynamism—not merely a run of bad luck by plucky, ever-dynamic would-be innovators?

If there have been serious losses of dynamism, is there evidence of losses in the modern values—or gains in the opposing values—that *Mass Flourishing* argued were the fundamental determinants of the level of dynamism?[xxxviii] (It will be an advance in understanding if, instead of attributing the slowdowns to a decline of dynamism by default, we can point to deadly sources of a decline of dynamism.)

A few preliminary inferences may be ventured in spite of the complexity of our thesis. It is plausible to think that the nations engaged in high levels of indigenous innovation on top of the rather equal levels of their Schumpeterian innovation, to which all countries had relatively easy access, would have high productivity growth and have reduced productivity growth when indigenous innovation is low.

It is paradoxical, then, that America, Britain, and France, normally the most highly innovative nations in the world, have seen large regions "ravaged by deindustrialization" since the 1970s, to use President Emmanuel Macron's phrase: America's Rust Belt stretching from Appalachia to the Midwest, Britain's West Midlands, and France's Lorraine region. In the old industries of these regions, there appears to have been deep losses of innovation—so deep that aggregate innovation slowed in spite of the astonishing innovation in the new, high-tech industries. But the structure of an advanced economy is apt to be complex. One could imagine that the fall of investment and employment in these regions was caused by a change in the structure of innovation rather than a drop of innovation.

To the extent that the thesis here—the good life through innovation and innovation through dynamism—finds empirical support, it may cast light on the intense dissatisfaction of many participants in the economies of the West. Certainly, the falloff of dynamism offers an explanation of the severe slowdown of wages. In the view of some commentators, the slowdown of wages in America was deeply disturbing to workers, for they had grown up believing that rising wages would eventually provide them with a standard of living significantly higher than that of their parents.

The thesis may also shed some light on symptoms of discontent with the workplace. Perhaps there has been a significant falloff of the nonmaterial rewards of work in those economies—rewards that may have been more gratifying than the material rewards were. It is significant that household survey data have shown over recent decades appreciable losses of reported job satisfaction in most, if not all, of the nations that were once big stars in the innovation firmament.

Conclusion: The Three Revolutions that Economics Needs[xxxix]

The silence of most economists on the underlying causes of the political ructions erupting throughout the West – and on what, if anything, can be done to restore economic vigor – has been deafening. And it provides further evidence of the profession's refusal to acknowledge the need for change.

The West is in crisis – and so is economics. Rates of return on investment are meager. Wages – and incomes generally – are stagnating for most people. Job satisfaction is down, especially among the young, and more working-age people are unwilling or unable to participate in the labor force. Many in France decided to give President Emmanuel Macron a try and now are protesting his policies. Many Americans decided to give Donald Trump a try, and have been similarly disappointed. And many in Britain looked to Brexit to improve their lives.

Yet economists have been largely mute on the underlying causes of this crisis and what, if anything, can be done to restore economic vigor. It is safe to say that the causes are not well understood. And they will not be understood until economists finally engage in the task of reshaping how economics is taught and practiced. In particular, the profession needs three revolutions that it still resists.

The first concerns the continuing neglect of imperfect knowledge. In the interwar years, Frank Knight and John Maynard Keynes launched a radical addition to economic theory. Knight's book *Risk, Uncertainty, and Profit* (1921), and Keynes's thinking behind his *General Theory of Employment, Interest, and Money* (1936) argue that there is no basis – and could be no basis – for models that treat decision-makers as having correct models with which to make decisions.[xl] Knight injected an uncertain future, Keynes added the absence of coordination. But subsequent generations of economic theorists generally disregarded this breakthrough. To this day, despite some important work on formalizing Knight's and Keynes's insights (most notably by Roman Frydman and his colleagues), uncertainty – real uncertainty, not known variances – is not normally incorporated into our economic models.[xli] (An influential calculation by Robert J. Barro and Jason Furman, for example, made predictions of business investment resulting from Trump's corporate profits tax cut without bringing in Knightian uncertainty.)[xlii] The "Uncertainty Revolution" still has not succeeded.

Second, there is still a neglect of imperfect information. In what has come to be known as the "Phelps volume," *Microeconomic Foundations of Employment and Inflation Theory*, we brought to light a phenomenon overlooked by economists.[xliii] Overestimation by workers of wage rates outside their towns brings inflated wages and thus abnormally high unemployment; underestimation brings bargain pay levels and thus abnormally low unemployment. When workers lose their jobs in, say, Appalachia they have little idea – no well-based estimate – of what their wage would be outside their world and how long it might take to find a job; so they might remain unemployed for months or even years. There is a deficiency of information, not "asymmetric information."

More than that, the volume sees every actor in the economy as being thrown back on whatever sense he or she can make of it, as Pinter depicted, and to do the best they can, as Voltaire urged. But theorists at the University of Chicago created a mechanical location model in which unemployment is merely frictional and thus transitory – the so-called island model.[xliv] As a result, the "Information Revolution" has not yet been absorbed.

The last great challenge is the utter omission from economic theory of economic dynamism. While economists have come to recognize that the West has suffered a massive slowdown, most of them offer no explanation for it. Others, wedded to Schumpeter's early thesis on innovation in his classic 1911 book The Theory of Economic Development, infer that the torrent of discoveries by scientists and explorers has shrunk to a trickle in recent times. Schumpeter's theory operated on the explicit premise that the mass of people in the economy lack inventiveness. (He famously remarked that he never met a businessman with any originality.)

This was an extraordinary premise. One can argue that the West as we know it – the modern world, we might say – began with the great scholar Pico della Mirandola, who argued that all mankind possesses creativity. And the concerns of many other thinkers – the ambitiousness of Cellini, the individualism of Luther, the vitalism of Cervantes, and the personal growth of Montaigne – stirred people to use their creativity. Later, Hume stressed the need for imagination, and Kierkegaard emphasized acceptance of the unknown. Nineteenth-century philosophers such as William James, Friedrich Nietzsche, and Henri Bergson embraced uncertainty and relished the new. As they reached a critical mass, these values produced indigenous innovation throughout the labor force.

So it was by no means clear that the Schumpeterian thesis would be incorporated into economic theory. But when MIT's Robert Solow introduced his growth model, it became standard to suppose that the "rate of technical progress," as he called it, was exogenous to the economy.[xlv] So the idea that people – even ordinary people working in all industries – possess the imagination to conceive of new goods and new methods was not considered. And it would have been dismissed had it been mooted. The "Dynamism Revolution" in economic theory was put on hold.

With the great slowdown and a decline of job satisfaction, however, there now appears to be a chance to introduce dynamism into economic modeling. And doing so is imperative. The importance of understanding the newly stagnant economies has sparked an effort to incorporate imagination and creativity into macroeconomic models. I have been arguing for a decade or more that we cannot understand the symptoms observed in the Western nations until we have formulated and tested explicit hypotheses about the sources, or origins, of dynamism.

That theoretical advance will give us hope of explaining not only the slow growth of total factor productivity, but also the decline of job satisfaction. America cannot be America again, France cannot be France again, and Britain cannot be Britain again until their peoples are once again engaged in thinking of better ways to do things and excited at embarking on their voyages into the unknown.

Notes

[i] Richard R. Nelson and Edmund S. Phelps. "Investment in Humans, Technological Diffusion, and Economic Growth." *The American Economic Review* 56, no. 1/2 (March 1966): 69–75.
[ii] Amar Bhidé, *The Venturesome Economy* (Princeton: Princeton University Press, 2008). See Chapter 11, "Venturesome Consumers."
[iii] See Edmund Phelps, "Opportunity to be Innovation Leader," *China Daily*, January 2, 2019.
[iv] President Xi Jinping, "Openness for Greater Prosperity, Innovation for a Better Future "(speech, Boao Forum, Hainan, April 10, 2018).
[v] President Xi Jinping, "Harnessing Opportunities of Our Times To Jointly Pursue Prosperity in the Asia-Pacific" (speech, 26th Asia-Pacific Economic Cooperation (APEC) Economic Leaders' Meeting, Port Moresby, November 18, 2018).
[vi] Edmund Phelps, Raicho Bojilov, Hian Teck Hoon, and Gylfi Zoega, *Dynamism: The Values That Drive Innovation, Job Satisfaction, and Economic Growth* (Cambridge: Harvard University Press, 2020), 12-13.
[vii] See Phelps, "Will China Out-Innovate the West?," *Project Syndicate*, March 5, 2018.
[viii] Friedrich A. Hayek, *Individualism and Economic Order* (Chicago: University of Chicago Press, 1948).
[ix] Michael Polanyi, *Personal Knowledge: Toward a Post-Critical Philosophy* (Chicago: University of Chicago Press, 1958).
[x] See Phelps, "Innovation in Times of Quality Growth," *China Daily*, March 23, 2018.
[xi] Vice-Premier Liu He, "3 Critical Battles China is Preparing to Fight " (speech, World Economic Forum, Davos, January 24, 2018).
[xii] The econometric research in the sections "Slowdown of Productivity Growth" and "Multiple Regressions" was carried out in collaboration with Gylfi Zoega, professor of economics at the University of Iceland and part-time Professor at Birkbeck College at the University of London. I am also grateful to Professor Hian Teck Hoon, Dean of the School of Economics at Singapore Management University, for discussion.
[xiii] For the Bank of France's database, see http://www.longtermproductivity.com/about.html. The exponential smoothing here uses the Holt-Winters method. In effect, it makes the value of the smoothed series for each year be a weighted average of past values of the original series.
[xiv] Percentages taken from the Bank of France database.
[xv] The smoothing method applied uses adaptive forecasting to capture slow learning about productivity growth developments. Exponential smoothing methods adjust the weights applied to past observations of TFP growth based on forecast errors. See Bruce L. Bowerman and Richard O'Connell, *Forecasting, Time Series, and Regressions*, (Boston: Cengage Learning, 2004). We use the Hold-Winters method that generates forecast with a linear trend.
[xvi] For a fuller exposition see Phelps, Bojilov, Hoon, and Zoega, *Dynamism*, 1-19.
[xvii] Robert M. Solow, "A Contribution to the Theory of Economic Growth," *Quarterly Journal of Economics* 70, no. 1 (February 1956): 65–94.
[xviii] Joseph A. Schumpeter, *Business Cycles: A Theoretical, Historical and Statistical Analysis of the Capitalist Process* (New York: McGraw-Hill, 1939).
[xix] Phelps, *Mass Flourishing: How Grassroots Innovation Created Jobs, Challenge, and Change* (Princeton, NJ: Princeton University Press, 2013), 183–184.
[xx] Kenneth J. Arrow, "The Economic Implications of Learning by Doing," *Review of Economic Studies* 29, no. 3 (June 1962): 155–173
[xxi] Paul Romer, "Increasing Returns and Long-Run Growth," *Journal of Political Economy* 94, no. 5 (October 1986): 1002–1037; and Philippe Aghion and Peter Howitt, "A Model of Growth through Creative Destruction," *Econometrica* 60, no. 2 (1992): 323–351.
[xxii] Richard R. Nelson, Merton J. Peck, and Edward Kalachek, *Technology, Economic Growth and Public Policy* (Washington, DC: Brookings Institution, 1967), 16.
[xxiii] Walt Rostow's wonderful coinage, "take-off into sustained economic growth," or productivity growth, appears in *The Process of Economic Growth* (New York: Norton, 1952).
[xxiv] Paul Johnson, *The Birth of the Modern: World Society, 1815-1830* (New York: Harper Collins, 1991). On the origins of modern life, see also Phelps, *Mass Flourishing,* 77 -107.
[xxv] See Phelps, *Mass Flourishing,* 66. The term *getting on* in 1840s London meant making a success of one's life. See Rick Rylance, *The Cambridge Companion to the Brontës* (Cambridge: Cambridge University Press, 2002), 157–158.
[xxvi] The passage by Marshall is from his early textbook *Elements of Economics* (London: Macmillan, 1892), 5. Marshall knew of what he spoke. Born in 1842, he had been observing business life for five decades when he wrote those lines.
[xxvii] Alexis de Tocqueville, *Democracy in America,* 2 vols. (London: Saunders and Otley, 1835–1840). Marx harshly criticizes Adam Smith for seeing the experience of one's work as a cost to one's tranquility, freedom, and happiness—far from a vehicle to freedom and happiness; see *Grundrisse der Kritik der Politischen Okonomie* (New York: Penguin, 1993), 611, written 1857– 1861, published originally in German (1939–1941) and in English by Penguin in 1973.
[xxviii] See David Hume, *An Enquiry Concerning Human Understanding* (London: Clarendon, 1748), for his discussion of how knowledge is increased.
[xxix] The statistical study and quote referred to here can be found in M. L. Cropper and A. S. Arriaga-Salina, "Inter-city Wage Differentials and the Value of Air Quality," *Journal of Urban Economics* 8, no. 2 (September 1980): 248.
[xxx] Abraham Lincoln, "Second Lecture on Discoveries and Inventions," February 11, 1859. https://teachingamericanhistory.org/document_author/abraham-lincoln/.
[xxxi] Douglass North, *Institutional Change and American Economic Growth* (Cambridge: Cambridge University Press, 1971); and Daron Acemoglu and James A. Robinson, *Why Nations Fail: The Origins of Power, Prosperity and Poverty* (New York: Currency, 2013).

[xxxii] See Assar Lindbeck, "The Recent Slowdown of Productivity Growth," Economic Journal 93, no. 369 (March 1983): 13–34; and Stanley Fischer, "Symposium on the Slowdown in Productivity Growth," Journal of Eco- nomic Perspective 2, no. 4 (Fall 1988): 3–7. See also Robert J. Gordon *The Rise and Fall of American Growth: The U.S. Standard of Living since the Civil War* (Princeton, NJ: Princeton University Press, 2016); and Phelps, *Mass Flourishing,* 220–221.

[xxxiii] Phelps, *Mass Flourishing,* 222–225, reported that the growth rate of total factor productivity in the United States in the span 1972–2012 was *half* the rate in the span 1922–1972, based on earlier annual estimates in Penn World Tables.

[xxxiv] For a fuller exposition see Phelps, Bojilov, Hoon, and Zoega, *Dynamism,* 48 - 67.

[xxxv] See Phelps, Bojilov, Hoon, and Zoega, *Dynamism,* 57 - 84.

[xxxvi] See Phelps, Bojilov, Hoon, and Zoega, *Dynamism,* 68 - 84.

[xxxvii] For prominent accounts, see Tyler Cowen, *The Great Stagnation* (Boston: Dutton, 2011); Phelps, *Mass Flourishing;* and Gordon, *Rise and Fall.*

[xxxviii] See Phelps, *Mass Flourishing*, 135- 169.

[xxxix] See Phelps, "The Three Revolutions Economics Needs," *Project Syndicate*, January 23, 2019.

[xl] Frank H. Knight, *Risk, Uncertainty and Profit* (Boston: Houghton Mifflin, 1921) and John Maynard Keynes, General Theory of Employment, Interest and Money (London: Macmillan, 1936).

[xli] Roman Frydman and Michael D. Goldberg, *Imperfect Knowledge Economics* (Princeton: Princeton University Press, 2007).

[xlii] Robert J. Barro and Jason Furman, "Macroeconomic Effects of the 2017 Tax Reform," Brookings Papers on Economic Activity, March 8, 2018.

[xliii] Phelps et al., *The Microeconomic Foundations of Employment Inflation Theory* (New York: W.W. Norton, 1973).

[xliv] Phelps, "The Emerging Microeconomics in Employment and Inflation Theory," *American Economic Review* 59, (May 1969): 147-160.

[xlv] Robert Solow, "A Contribution to the Theory of Economic Growth," *The Quarterly Journal of Economics* 70, iss. 1 (February 1956): 65-94.