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### Chapter 3

#### TOWARD A THIRD INDUSTRIAL DIVIDE?

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#### Introduction: The Second Divide Revisited

*The Second Industrial Divide: Possibilities for Prosperity* was written in another time of great despair about the future of the American economy. Michael Piore and Charles Sabel described the mid-eighties in terms that seem to fit our own predicament:

“ The times are troubled indeed when the good news is almost indistinguishable from the bad. Economic downturns no longer seem mere interruptions in the march to greater prosperity; rather they threaten to destroy the world markets on which economic success has depended since the end of World War II. Meanwhile, upturns avert disaster without solving the problems of unemployment and slow growth, which have become chronic in almost all the advanced countries. No theory seems able to explain recent events, let alone predict what will happen next.” (Piore and Sabel 1984, p. 3).

The book went on to lay out a theory of the disaster and ways out of it. In an economy that feels as bad as the mid eighties, it is worth returning to this analysis to discover what we might learn from it about recovering from a crisis and building an economy with higher levels of sustainable growth and a more just distribution of returns. Of course, as in any bold effort to suggest worlds that

have not yet come into being, there's much in the book (hereafter: *Second Divide*) that today looks unrealistic. And there were critical changes in the organization of capitalism in the eighties that *Second Divide* failed to identify. But the book remains as important today as it was then because it raised new questions about advanced capitalist countries that are as relevant today as they were twenty-five years ago.

First, *Second Divide* asked whether there was a future for manufacturing, and production more generally, in advanced economies. Secondly, it questioned whether there were organizations that could combine radical and continuous innovation with large-scale efficient manufacturing. Third, starting from the insights of the *régulation* school, it demonstrated how economic growth and stability depend on fit between the domestic micro-institutions of the labor market and of the workplace, and macroeconomic policy. It analyzed fit as a matter of historic legacies and political contestation—and not as a product of the superior intelligence or deliberate choices of economic policymakers. Finally, at a time when the conceptual divide between the major bodies of research on domestic societies and economies and the major bodies of research on the international economy was very wide and deep, Piore and Sabel tried to integrate their vision of a desirable and possible domestic economy into an international framework. They anticipated the challenges of trying to sustain growth and prosperity in advanced economies as large new developing countries entered the arena. The book argued that international institutional coordination would be required to regulate a world economy. It laid out an architecture for accommodating interests of the rising and the established powers.

The starting points of *Second Divide* in this analysis were those of much of the literature of the time. Its vision of the ground level of a modern economy was a production system based on manufacturing. Services do not figure in this model in any major way nor does finance. Piore and Sabel, like others, saw mass manufacturing as the dominant form of production in all advanced countries. But from this point forward, their analysis departed sharply from the standard views. In the sixties and seventies, the dominant social science understandings of industrial societies built on a technological determinism that specified a common trajectory of development for all advancing economies. Most scholars of industrial societies agreed implicitly with Marx that “the country that is more developed industrially only shows, to the less developed, the image of its own future.” Study England, Marx urged: “de te fabula narratur.” In the post-World War II world, the American economy was the most advanced example of capitalism, and its structures and practices were held to be ones that would eventually emerge everywhere—through imitation, competition, and diffusion.

In contrast to this theory, Piore and Sabel argued that the major industrial countries had evolved along different trajectories and retained diverse legacies from their histories. At the first industrial divide in the nineteenth century—when mass production technologies emerged—some countries like Italy and Germany retained more of their traditional craft industries, alongside mass production companies, while in countries like the United States, skilled craft workers and firms were mostly wiped out by some combination of competition and repression. According to *Second Divide*, where industrial districts survived with vibrant craft sectors and skilled artisans, their capabilities and legacies provided potential resources for different paths of development.

As in the varieties of capitalism literature that would appear a decade later, *Second Divide* suggested that societies with the same mass production technologies and capitalist forms of ownership might vary greatly in their coordination and governance mechanisms in ways that would produce different productive capabilities and different kinds of economic citizenship. In *Varieties of Capitalism*, Peter Hall and David Soskice (and in the many research contributions in this vein that would follow them) societies based on mass production technologies were seen as varying according to their different regulatory institutions (Hall and Soskice 2001). In liberal market Anglo-American capitalism, the varieties of capitalism literature argues, the market regulates provision of skills, relations between producers and suppliers, the flow of capital from savers to investors, and the processes of innovation. In the coordinated market economies of Germany and Japan, these realms are regulated by relationships negotiated among labor, capital, and government. The varieties of capitalism literature emphasizes the tight integration of each of these economic systems (Liberal Market Economies, Coordinated Market Economies) through the interaction of complementary institutions, each supported by and at the same time reinforcing the dominant patterns of regulation within the system and the efficiency of the performance of each of the subsystems.

In sharp contrast, the *Second Divide* sees societies as incorporating fundamentally heterogeneous elements. Economies differ in so far as they incorporate more or less important craft organizations and skilled workers with capabilities distinct from those of mass production technologies. If there is any complementarity suggested in *Second Divide*, it's in the notion that traditional craft sectors may compensate for the weaknesses and rigidities of the dominant

mass production form. This understanding of how societies gain resilience by maintaining and reproducing heterogeneous social and economic structures had already been developed in Michael Piore's earlier writings on labor market dualism (Doeringer and Piore 1971; Berger and Piore 1980). The availability of these different economic structures within some societies gives them a flexibility in responding to changes in preferences, to fragmentation of demand, and to technological shifts that other societies do not have (but perhaps could regain with major political and social redesign and re-engineering).

Piore and Sabel laid out a rather eclectic view of the origins of the crisis of the eighties. After exploring a variety of standard explanations for why the trajectory of postwar expansion had derailed, they concluded: "Too many answers, too many questions" (Piore and Sabel 1984, p. 192) and proclaimed there was no way to decide among them. But the outcome post-crisis, as *Second Divide* presented it, was a world economy with saturation of mass consumer-good markets and developing -country rivals piling into the very same lines of production. In such a world, they argued, there are two fundamentally different strategies for breaking out and building a new prosperity. One family of solutions would be a global Keynesianism, to relaunch, expand, and stabilize world demand and to divide it around between developed and developing economies (Piore and Sabel 1984, p. 254). The other policy approach would involve choosing among alternative technological trajectories. The basic idea would be to nourish and strengthen flexible specialization and craft production wherever these forms of economic organization had survived the onslaught of mass production (as in the Italian and French industrial districts and the German and Japanese middle-firm sectors) and/or seek to recreate them wherever possible---and Piore and Sabel's

account reads as if this would be plausible just about everywhere. Near the end of the book, Piore and Sabel arrived at the hopeful possibility that these two families of strategies might be combined in a “unified international economy” (Piore and Sabel 1984, p. 279).

In this system the old mass-production industries might migrate to the underdeveloped world, leaving behind in the industrialized world the high-tech industries and the traditional dispersed conglomerations in machine tools, garments, footwear, textiles, and the like—all revitalized through the fusion of traditional skills and high technology. Such a system would have to be created in much the same way as a multinational Keynesian order: and it would require many Keynesian institutional features to maintain economic prosperity and ensure macroeconomic stability (Piore and Sabel 1984, p. 279).

### **Modularity, Core Competences, and the Transformation of Production**

When we look back over the past twenty-five years at the evolution of production in the advanced and developing economies, this vision of global Keynesianism and flexible specialization appears to have been realized in large swathes of the economy—although in ways from very different from those that *Second Divide* envisaged, and under the aegis of states and social actors that could not even have been imagined in the mid-nineteen-eighties. The permissive policies of central bank authorities have supported strong consumer demand in both more mature and emerging economies over the past fifteen years. The international division of labor has indeed evolved in a way that moved old mass-production industries to the developing countries and left powerful and extremely dynamic high tech industries in the more advanced societies— even if not in the old craft districts. The new structures of production around the world

enabled forms of flexible specialization that went beyond anything that Piore and Sabel in the mid-eighties could ever have conceived.

The transformation of industry by new information and communications technologies destroyed many of the advantages of the rigid hierarchical structures of large vertically-integrated Chandlerian corporations. To achieve the degrees of conformance, quality, and performance required in producing complex goods and services, it was no longer necessary to carry out all the operations from research and development to product development to detailed engineering, manufacturing, distribution, and after-service within the walls of the same enterprise. In many industries, digitization made it possible to break out functions like manufacturing or detailed engineering. These activities had once been executed in-house, but now could be handed over to suppliers and subcontractors along with a complete or near-complete set of instructions in a digital file transmitted over the internet. The reconstruction of world-wide industry with enterprises stripped down to their “core capabilities” and linked through supply chains or “value networks” to designers, contract manufacturers, original-design manufacturers, original-equipment manufacturers, brands, and service providers created a productive system with firms far more specialized and also far more flexible than in the past. So something *like* the scenarios laid out in *Second Divide* did indeed come in being.

The prosperity to which these scenarios were supposed to lead did not, however, turn out as promised. Though there has been great wealth creation over the past twenty years, this prosperity raised as many problems as it created rewards for some. Why were the returns so skewed to the wellbeing of those at the very top of the income distribution? Why in the United States were the

highest gains captured almost entirely by finance? Why did prosperity prove to be so fragile? Now that the financial sector--- whose excesses and dysfunctions were responsible for the crisis--- has returned to its previous trajectory and profitability, why does industrial production in advanced economies continue to sag and sink? These are more questions than any short reflection on the legacy of Michael Piore's on capitalism could possibly address, but here I consider one of them. What are the prospects today for relaunching production and employment with the forms of flexible specialization that became dominant in the corporate organizations of the advanced industrial countries in the twenty-five years after *Second Divide*?

First, anticipating the protests of my friends and colleagues Piore and Sabel, who may well deny that there is any similarity at all between the scenarios they conceived as international Keynesianism and flexible specialization and the actual course of the economic transformations of the past quarter century, I will try to justify my claim that the world that they imagined did—in broad outline at least—come into being, and then explain how basic features of the design, rather than deviations from it, relate to our current dilemmas.

With respect to global Keynesianism, the solutions that *Second Divide* laid out required international regulatory institutions that could expand and stabilize world demand. The book considered the roles that the International Monetary Fund and a less-volatile exchange-rate regime could play in building such an international order. In retrospect, we see that the hopes attached to these particular institutions failed to materialize. Even the rosier reading of the record of the World Trade Organization would not support the conclusion that formal international arrangements as such played the major role in expanding and



stabilizing world demand for the goods and services of mass-production economies. But over this period there did come into being forms of international cooperation that sustained high consumer demand in the advanced economies and fed rapidly rising demand in the emerging world. The institutions that achieved these results—even if not through formal coordination-- were the U.S. Federal Reserve Bank, the European Central Bank, the Bank of Japan, and the Chinese government. And new financial instruments that had been first developed on a large scale in the seventies to hedge exchange-rate risks took off along with other derivatives in the nineties and undoubtedly played a role in reducing exchange-rate volatility and in expanding credit.

The crucial period is the decade between the Asian financial crisis (1997) and the second half of 2007, when the first tremors of the current financial and economic crisis began to shake the system. During the decade of global expansion of the nineties, on the side of the Japanese and the Chinese, there was an apparently inexhaustible willingness to invest their surpluses in US Treasury bonds; on the side of the Fed, there was an unshakeable determination to maintain US consumer spending with low interest rates. These policies allowed the US trade deficit to balloon while trade surpluses grew in Asia. These global imbalances continued to swell through a decade of unprecedented growth in the developing world and one of sustained prosperity in advanced economies; then bubble, and bust.

The critical actors in this period were ones that nowhere figure in *Second Divide*: financial institutions. Yet it was the banks and shadow banks and non-financial businesses like mortgage lenders and insurance companies that would provide new instruments of securitization to stoke enormous increases in

lending that fueled growth through the decade. In 1980, global financial assets (including equity securities, private debt securities, government debt securities, and bank deposits) were roughly equal to world GDP. By 2006, world financial assets were 3.5 times greater than GDP. In the United States, financial assets relative to GDP grew from just under 200% in 1980 to 424% in 2006 (Farrell, Lund et al. 2008, pp. 9-10). The gains of those employed in finance rose astronomically, while incomes stagnated and sagged across the rest of the working population over the past two decades. Over the same period, the new instruments churned out in the financial sector along with relaxed monitoring of the creditworthiness of borrowers, made for an unprecedented expansion of consumer borrowing and spending. So even absent the specific institutional framework that *Second Divide* imagined, there did emerge institutions and policies that enabled an enormous increase in consumer credit and demand across the world economy.

The flaws of the 1990s that were to prove fatal were not so much those of international macroeconomic coordination (though international coordination certainly did fail to rectify global imbalances) but weak and ineffective domestic regulation and flat-out deregulation. On this terrain, the Keynesian tradition does not have much to offer. Keynes was not sanguine about the future of laissez-faire, but he did not have much to suggest systematically about how to organize and regulate particular markets. Even set aside as implausible *Second Divide's* notion that international institutions could conceivably orchestrate a division of labor and "apportion the expansion of productive capacity among the advanced industrial countries and between them as a group and the newly industrializing countries" (Piore and Sabel 1984, p. 254), it still is asking more than Keynes can provide to expect that macroeconomic prescriptions could

provide sufficient guidance on regulating financial markets. Even if central banks were able to detect and deflate asset bubbles in the making, this would not substitute for more developed and constraining domestic regulatory regimes. Now that financial markets represent an unprecedented proportion of the global economy, it is impossible to imagine the coordination of the emerging economies of China and India with those of the developed world without building on a scaffolding of domestic regulations. The relatively meager results of efforts at international coordination in the establishment of new banking regulations (G20, Basel III ) and the strong return of national states in the bank rescues and bail outs and in the elaboration of new codes make it very unlikely that international organizations will play a major role in the near future in regulating international capital markets. The dynamic of demand creation has shifted toward the developing world, and the governments of India and China—to consider just the largest of these economies—seem disinclined to bend their ambitions to the norms, rules, and constraints of international institutions. Both for macroeconomic policy and for the regulation of particular markets, including financial, the lion's share of the action remains with national governments.

It may seem odd to claim that the *Second Divide's* vision of flexible specialization as a strategy out of crisis for mass-production economies has largely been realized, for at least on the terms defined in the book, craft production has massively declined even in its strongholds in Europe and Japan.<sup>1</sup> The most successful industrial districts in advanced economies were in northern Italy. Today most of those districts are in deep trouble. In Prato—the exemplary

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<sup>1</sup> On the current plight of the Italian districts, see Foresti (2009).

case that nourished the analyses of everyone who wrote about the role of districts in contemporary capitalism—today's new enterprises are overwhelmingly those of Chinese immigrants, legal and illegal. From 2001, the number of Italian-owned garment and textile firms in Prato fell by half, and there are fewer of them than Chinese-owned firms in the sector (Donadio 2010). Much of the production takes place under sweatshop conditions that have nothing in common with labor-capital collaboration in the districts in the eighties and nineties, and suggest, rather, the exploitative labor relations of the immediate postwar years. Craft traditions and industrial districts nowhere appear as a significant option in developing economies.

But the *Second Divide's* conception of flexible specialization went well beyond craft production in more or less traditional industrial districts like Prato and Biella in Italy or Oyonnax in France. Technologically, the core of this alternative was the combination of general-purpose equipment and highly-qualified and experienced workers to enable investments in capital and human resources that could be utilized and redeployed in producing a wide range of varied products and services as contrasted with dedicated equipment and narrow skills that can only be used in producing a specific and rigidly defined set of goods and services. At the outset of their discussion of the possible technological dynamism of a flexible specialization trajectory, Piore and Sabel briefly lay out the ways in which computer-aided manufacturing (programmable assembly) might make it efficient and profitable to adjust equipment for new purposes without massive investments in new plant and machinery. They claim the introduction of these technologies reflects the changed character of markets—more segmented, specialized, shorter-lived demand—and the availability of new technology. This

enables a new flexibility that previously was attainable only with craft techniques.

In the early 1980s when the *Second Divide* was being written, the technological possibilities for using digitization to break apart dedicated production systems were still over the horizon. It was only a decade later that modularity in production became a major option.<sup>2</sup> This would make it possible to disassemble large vertically-integrated companies into networks of autonomous firms, each supplying and producing components that would be combined by yet other firms into a vast and rapidly-changing array of final products. The *Second Divide's* glimpse of new technological possibilities that might enable flexible specialization was thus truly prescient. Once designers could send a full set of digitized instructions for a chip to semiconductor fabrication plants located anywhere in the world, it was no longer necessary for Texas Instruments, Motorola, or IBM or their likes to invest in their own dedicated fabs to produce chips. They could use contractors like Taiwan Semiconductor Manufacturing Company (TSMC) whose fabs worked with multiple customers. Internet-enabled links could connect sites of conception and production distributed across the globe. Once it was possible to codify the interface between different stages of the path between conception and final product and to break apart design from production, major new industries could arise around new enterprises like Broadcom, Qualcomm, and Cisco—without any manufacturing capabilities at

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<sup>2</sup> On the history of modularity, see Baldwin and Clark (2000); Langlois (2002) and Sturgeon (2002).

all.<sup>3</sup> Looked at in retrospect, the dramatic transformations of the past quarter century in the structures of production in the advanced industrial and the developing countries are marked off from the past by a technological and organizational divide which separates us irreversibly, so it seems, from the world of Fordist mass-production.

The iconic products of this era of flexible specialization are ones like the iPod and the iPhone whose value derives from manufactured hardware tightly bundled together with services. The components, services, and assembly combined in an iPod and an iPhone are furnished by hundreds of different suppliers located in distant sites—from Germany to Silicon Valley to Japan and China. Craft production this is not. But like production in the industrial districts, it requires and stimulates new forms of cooperation, collaboration and exchange among economic actors located along different points in the networks that link product definition to design, detailed engineering, manufacturing and assembly, distribution, creating services attached to the product and end-users. It is production that allows for rapid readjustment to innovation and to changes in markets, demand, and tastes.

The strengths of the global production system that has emerged over the past two decades derive not only from flexibility, but from lowering costs. The possibilities of shifting manufacturing and service work to low-wage labor markets reduced prices across the board and contributed to keeping inflationary pressures at bay. On the other side of the globe, this made possible rapid increases and upgrading in production in manufacturing and services in

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<sup>3</sup> These are questions I have discussed at greater length in Berger (2005).

countries like India and China with large reserves both of low-wage low-skill workers and growing supplies of better-educated technicians. With the shifts of manufacturing and low-end services work into low-cost countries, the prices of consumer durables remained stable or fell, thus allowing workers in the West to maintain high levels of consumption even as their wages stagnated. High levels of consumption supported high levels of employment.

The new fragmented production networks also lowered capital costs, since contract manufacturers could now spread the costs of capital across a wider and more diversified customer base. A new semiconductor fab today involves an investment close to \$5 billion, so building one within a vertically-integrated enterprise solely to supply the needs of that company looks like a very risky bet (especially wherever government is not providing massive subsidies in the form of cheap loans, or land, or tax relief to encourage such investments). The rise of independent fabs like TSMC with a broad customer base has made it possible to share production capacity and thus to spread around the risks associated with any single brand's product or family of products.

Spreading around the risk did not, of course, mean that risk was spread evenly. The first "test" of the resilience of the new fragmented system of production was the crisis that followed the bursting of the dot.com bubble. Because demand had been expanding so rapidly, lead brand firms had been placing very large orders with their component suppliers---who found themselves stuck with huge volumes of excess inventory when the bubble broke. The plight of the contract manufacturers was so desperate that in a number of important cases, lead firms stepped in to pick up some of the costs of inventory still held by the supplier to prevent bankruptcy and the disappearance of a

supplier whom the lead firm could not easily replace.<sup>4</sup> But in many cases, the distressed suppliers shrank or closed down. The current economic crisis, too, has exposed the relatively greater or lesser vulnerability of firms located at various points along the chain from conception to final customers.

Along with greater responsiveness to change and lower costs, the new world of flexible specialization has also had the virtue of facilitating the entrance of new firms into the economy. By outsourcing those parts of production that contract manufacturers can provide, firms like Intel, Apple, Broadcom, Dell do well without mastering the full-range of capabilities that an IBM in the 1960s had in-house or that a Sony or Samsung still keep within their own four walls today. This opens new opportunities for entrepreneurship both in the advanced and the developing economies. These are opportunities not only for firms specialized in design and innovative technologies like a Cisco or Qualcomm or Apple, but also for specialist firms in manufacturing and detailed design, like Flextronics, a large contract manufacturer, or Quanta, which makes a large share of the world's laptops, or TSMC, or Foxconn (Honhai), the largest Chinese exporter, best known for making iPhones and iPads, or Pouchen, the world's largest shoe contract manufacturer, known for making Nikes, among other brands. The collaboration of these enterprises linked through markets and value chains has greatly accelerated the speed with which innovations move into the market. The reverse of the coin, however, is that even in their areas of greatest strength, firms face competition far more rapidly than they ever did before and the rents of technological superiority are far more quickly under attack.

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<sup>4</sup> See two cases in Berger (2005): Jabil and Cisco (pp. 195-6) and MSL (pp. 143-4).



The basic unit of analysis of the new networked global production system is the “supply chain” or “value chain.” The metaphor of a chain, however, suggests far more similarity and equality of power among the individual links in a chain than actually exist in the economy. Just as the dot.com crisis revealed the very different levels of risk and vulnerability of producers located at different points in the system, so to, analysis of the distribution of profits in these networks shows that some participants in the system extract far more of its gains than other. In one of the few systematic attempts to analyze the gains of producers carrying out different functions in the creation of goods and services, Dedrick, Kraemer, and Linden show patterns that vary both by industry and by the architecture of the product. In their breakdown of the distribution of profits among the various producers of the components that go into iPods as contrasted with notebook computers, they found some of the products of the new fragmented international economy have more integral architectures than others. On these, the system architects (like Apple) reap higher profits than they do in the more modular “Lego-like” products with standard interfaces and standard components (Dedrick, Kraemer et al. 2008).<sup>5</sup> On the more standardized modular products, like laptops, component suppliers like Intel who hold capabilities and intellectual property that are essentially irreplaceable, at least in the medium term, capture the lion’s share of rewards.

These micro-analyses of the distribution of gains across global production systems are very valuable. But looked at in the aggregate, they do not help much in drawing up a scorecard of winners and losers in the new global economy. As a

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<sup>5</sup> On the breakdown of costs and profits for the iPhone, see Barboza (2010).

moral issue, there are no scales we could agree on to weigh the gains for low-end service workers in call centers in India as against the job losses and declining incomes of Americans once employed in the same sectors. Even as a matter of economic analysis, there is no agreement on whether widening inequalities and slow employment creation in the advanced industrial countries are the result of this new system of global production or whether they reflect *something else*. What something else might be varies from explanation to explanation and includes financialization of the economy, transition from a manufacturing to a services economy, new technologies (without direct relation to production structure) or national policy choices on taxes and welfare regimes or the demography of aging societies.

Were it not for the current crisis, these questions might well have remained the object of mainly academic debates, spilling over only from time to time into political attacks on China and India for “unfair” practices along the lines of some of the attacks on Japan in the nineteen-eighties. But today with at least 10% of the workforce in the United States unemployed, amidst the wreckage of foreclosed home mortgages, massive job losses, distressed small and medium-sized businesses and rising populism and political paranoia, the question of whether there are fundamental defects in our economic model has become inescapable.

The direct causes of the current economic crisis were the near meltdown of the financial system in the wake of the collapse of the markets for asset-based securities and credit debt swaps, the fall of Bear Stearns and Lehman Brothers, and the paralysis of lending across all segments of the capital markets that followed. Historically, as Reinhart and Rogoff show in ironically-titled *This Time*

*is Different*, it should be no surprise that serious banking crises are followed by deep economic crises that take a long time to resolve. This was the recurrent pattern in all eighteen of the major postwar financial crises and subsequent economic recessions in the developed countries that they studied (Reinhart and Rogoff 2009, see especially Chapter 14). In all of their cases, however, the economy after recovery eventually returns to something like the status quo ante. As Reinhart and Rogoff point out, though, the cases they analyzed were crises taking place in particular countries or regions and did not pull in the entire world economy. They argue: “The global nature of the recent crisis has made it far more difficult, and contentious for individual countries to grow their way out through higher exports or to smooth the consumption effects through foreign borrowing” (Reinhart and Rogoff 2009, p. 239).

We need to consider, though, whether return to status quo ante—in whatever time frame—will be made more difficult, or even impossible, by the structures of the production system that has been set into place over the past 25 years. Might we be worse off, not only as a result of the effects of the crisis, but also as a result of the ways in which the fragmented global production system constrains recovery? Both the *Second Divide's* vision of an economy based on flexible specialization and the fragmented global production system that has actually emerged since the 1980s have in common a focus on the strengths to be gained from organizing production in firms producing specific components or carrying out distinct functions required for transforming an idea into a product or service delivered to an ultimate end-user, rather than organizing within vertically-integrated enterprises that carry out all or most activities within their own four walls. The economic crisis has revealed the fragility of many of these

assumptions about the values that can be created at any particular node in such an economy, the kinds of jobs that are likely to be created, and about long-term dynamism.

### **Towards a Third Industrial Divide?**

One of the great virtues of the Piore-Sabel contribution to debates on contemporary capitalism was to make explicit a set of assumptions about the direction of technological change, about the factors driving change, and about the relative position of different societies along the technological trajectory. The world of flexible specialization as Piore and Sabel envisaged it never came into existence, but what did emerge had strikingly similar underlying drivers. Fragmented, networked production, modularity, and firms focused on specialized core competences did come to dominate the landscape in many of the leading-edge sectors, especially those strongly linked to information technology. The boundary conditions of the *Second Divide* defined reasonably well the foundations of the most dynamic sectors of the economy. As the advanced industrial countries struggle today to recover from the economic crisis, there are abundant signs of exhaustion of this economic model; there is also much evidence that our assumptions about the directions, drivers, and gains and losses from technological change need radical revision.

Over the past twenty-five years the IT industry came to provide the basic paradigm for thinking about industrial change. Given the spectacular success of the leading new companies in the economy—ones like Apple, Dell, and Broadcom—it was understandable that they would appear enviable models for all the rest. The “IT paradigm” rests on assumptions about modularization and the location of the highest-value activities, and it has shaped our conceptions about organizing an entire economy. The technological and organizational possibilities for separating product definition, research, development, and design

on one side, from manufacturing and production in a broad sense, on the other, seemed to represent the future for producing goods and services across many sectors. In this prospect, one could imagine more advanced industrial countries with better educated populations continuing to concentrate their efforts on the former set of activities (R & D, design, distribution) while less-developed economies would focus on exploiting their comparative advantage in low-wage labor by carrying out manufacturing. As the research previously cited by Dedrick, Kraemer, and Linden on decomposition of value and jobs created at different points along the supply chain suggested, such a division of labor has allowed the lion's share of profits and of high-paying jobs to continue to accrue to enterprises and workers in advanced industrial countries.<sup>6</sup> Manufacturing in this view has become a commodity, that is, a standardized, repetitive activity requiring relatively low levels of skill and experience and with low barriers to entry. Manufacturing firms will, therefore, be subject to intense competitive pressures, generate low margins, and often fall easy prey to newcomers who exploit new reserves of cheap labor.

This view assumes a basic stability in the division of labor between high-end, high-value activities like R & D, which would continue to be carried out in high-wage advanced industrial countries and production, which would be carried in developing economies with vast populations of poor, unskilled, or semi-skilled workers. Our experience with other developing economies like Japan, Singapore, Taiwan, and South Korea over the post-World War Two half-century had conditioned us to expect that the newcomers' progress along the trajectory that

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<sup>6</sup> For an early example of work in this vein, see Gourevitch, Bohn, et al (2000).

leads from mastering mass production of commodities to innovation in high tech products and services might be steady, but it would be slow. It would leave us-- the leading platoon on the trajectory of technological advance-- plenty of time to stay ahead of the latecomers. This assumption had been severely shaken in the 1980s by Japanese successes in the very sectors that had seemed the preserve of advanced innovative capabilities in the United States, but the anxieties about our lead faded when the Japanese economy fell into a long-term slump.

The predictions generated by the "IT paradigm" about the course of technological change across the economy and about the division of value between advanced industrial countries and the developing economies were for long-term continuity and stability. These expectations now look like false optimism. Even before the financial and economic crises of 2007-2010, there were clear signs of stress and rupture. There will be no return to an international division of labor in which developing economies compete only on cheap labor nor any revival (at least in any foreseeable time) of a dynamic in which American consumer debt fuels global economic expansion. We are at a major divide--although it may still be beyond our grasp to discern which new forms of integration and organization, which new winners and losers in domestic economies or internationally, and which new boundaries between public and private realms will emerge over the next decade.

#### Integrating innovation and production

The major discontinuities with the recent industrial past cluster around three points. First, will modularity play as large a role in emerging sectors as it has over the past three decades in IT industries? There has always been contention

over how much of the economy has or could have a modular structure that would allow the separation of ownership and control over distinct phases of the production system. (Ernst 2005; Herrigel 2010). In the case of products and processes that had integral architectures and that were resistant to fragmentation along the value chain, it was understood that ownership of key assets across the whole chain remained critical. But such sectors were seen as residual and not likely to be located on the cutting edge of technology. Today, however, across a broad swathe of emerging technologies—for example, in clean energy, new materials, biotech, batteries, biofabrication—possibilities for new enterprises seem to depend on tighter integration of the innovation and production functions than is required in IT companies. We are only beginning to understand the conditions under which promising and powerful discoveries in the laboratory in these new areas can be translated into promising and powerful new companies, jobs, and profits.<sup>7</sup> But the emerging picture is one with relations between upfront innovative phases and sequentially later production phases that are far stickier, more porous, and less codifiable than the interfaces between phases in the value chain of the IT industry. In order to get full value out of intellectual property, innovators in these new sectors may need to establish large measures of control and ownership over the production processes through which their ideas are transformed into goods and services for sale in the market.

Why might innovation and production be more tightly connected in these new technologies and industries than in the IT sector? Several common factors seem to be at work across diverse new sectors. The difficulties of modularity in

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<sup>7</sup> A major research project on these questions is underway at MIT. See MIT Production in the Innovation Economy at <http://web.mit.edu/PIE/>.



these areas lie not only in moving from a new idea to a prototype, but in moving the prototype into full-scale production. Stabilizing the production process is a challenge for all new activities. In the early years of software development and the creation of “pure-play” semi-conductor fabrication plants, too, there was a long period in which the transfer of knowledge required much tacit and face-to-face human interaction, and not simply the exchange of digital files. It could be, then, that what seems today to be a fundamental difference between the degrees of integration needed in the IT sector and that required for these new industries is rather a matter of phases in a product development cycle and stages of maturity.<sup>8</sup> But managers in firms in these new technology sectors emphasize how much more difficult breaking apart innovation and production will be whenever biological and mechanical processes need to be controlled, stabilized, and replicated on a large scale. Many projects hit the rocks at that point exactly because problems that were not apparent in fabricating the prototype (and could not have been anticipated) emerge only as the project moves to large-scale production. Dealing with these issues requires bringing the firm’s best science and engineering talent to play important roles not only in the first R & D and prototyping phases of the process but all the way through into manufacturing. As one German firm that specializes in producing systems and components for automation explained, the only way they have found to ensure that their designs can be manufactured is to assign each of the design engineers full responsibility

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<sup>8</sup> This idea owes much to discussion with my colleague Charles Sodini, who has reflected on his experience as an engineer in the semi-conductor industry in the seventies

for the “manufacturability” and performance of his creation.<sup>9</sup> The hand-off takes place not with the fabrication of the prototype but with the stabilization of the manufacturing of the component in significant volumes. This requires keeping all of these steps from innovation through production within the same corporate structure. Alternative solutions, like sending the engineers to “live with” the contract manufacturers while they try together to solve the problems of scale up, are more costly and work less well than they did in the IT industry.

A second and related reason why getting the value out of innovation in these new technologies may require a tighter integration with production has to do with the advanced manufacturing technologies that may be required to bring these new products into the market. It would be a gross simplification to imagine that assembly in consumer electronics required no more than tweaking of old assembly-line procedures and skills. But the organization of the operation and the skills were in many respects not so very different from traditional manufacturing. When managers from Pou Chen, the world’s largest shoe contract manufacturer announced that they were adding electronics assembly to their portfolio of businesses, they explained to an astonished researcher wondering how people in the shoe business could do electronics: “No problem! Only the commodity is different. The business and procurement practices for shoe contract manufacturing and for electronics contract manufacturing are the same. There are many good Taiwanese and mainland engineers who can be hired to do either job.” (Berger 2005, p. 148). Such is not the case in the production phases of many of the new technologies. They may require altogether

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<sup>9</sup> Interview with Production in the Innovation Economy team, May 2011.

novel production solutions or customization for end-users or some degree of collaboration between makers and customers, or skill sets that go far beyond those of ordinary assembly workers. This means there is need, opportunity, and potentially high returns for innovation in the actual technologies of manufacturing. Where the world's greatest contract manufacturers today, like Foxconn (Hon Hai), excel by their mastery of a fairly standard set of assembly skills across a diverse set of products and by highly disciplined execution of these requirements in new industrial territories, the new manufacturing may itself be the site of significant innovation. This provides yet another reason why the innovative enterprises at the front end of new product creation may seek to maintain the manufacturing of their new wares within their own four walls rather than selling off licenses or handing the product off to be made by outsource contractors.

#### The International division of labor

The second point of rupture with the trajectory of the past twenty-five years is the relationship between advanced industrial countries and the developing world. Even before the current crisis, the rise of China and India were beginning to look like a different story than that of any of the previous late industrializers. Even setting aside the implausible claims of the past decade about "a flat world," evidence has begun to pile up that countries like China, Brazil, and India are developing innovative capabilities that will allow them to compete not just in low-wage manufacturing, but in hi-tech sectors, too. Many of the claims about the capabilities of emerging economies are very exaggerated, and the same small set of company names are repeated every time that examples are provided to

substantiate the case for the dangers of competition on the frontiers of technology.<sup>10</sup> But the extraordinary pace of Chinese, Brazilian, and Indian advance suggests there is no permanent and stable division of labor between advanced economies with innovative design and research activities and those societies that once seemed destined only to be the terrain for low-end manufacturing activities. Though still today the examples of technological leaders in the developing world may be exceptional, they are becoming more important and numerous very rapidly, with major implications for competition across the board in Western economies.

There is also another and less obvious shift at work in the character of competition between companies from advanced economies and those from the developing economies. As long as we thought we were operating in a world where new products would be like iPods and iPads --- designed, developed, and distributed by American firms that reaped the lion's share of the profits---the fact that production of these devices took place somewhere else did not matter much. When Apple makes \$360 profit (before factoring in the costs of sales and marketing) on a \$600 iPhone, paying \$6.54 for assembly in China does not suggest a rationale for bringing production under the Apple roof either at home or abroad (Barboza 2010). Collaboration between firms specializing in R & D and design in advanced industrial countries and those specializing in manufacturing in low-wage countries may have generated benefits for both sides over the past thirty years—but still, it was clear which end of the deal was the better one.

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<sup>10</sup> See Breznitz and Murphee, 2011.

The question in the new emerging technology sectors is whether this deal can be replicated, and there are many reasons to doubt it. Research that Edward Steinfeld and his Production in the Innovation Economy group are conducting on “partnerships” between U.S. and Chinese firms in new energy sectors like wind, solar, nuclear, and gas suggest that the willingness and ability of the Chinese government and of Chinese private firms to invest and deploy in ever-earlier stages of testing, demonstration, and scale-up in these sectors may be pulling these activities and the returns on these activities into the hands of those who in the recent past were only the assemblers of the products of others’ design. It is too soon to calculate the material gains and the gains in learning that may result from these new and dynamic relationships and the ways in which these gains will be distributed among the various partners. But if there is substance to the claim laid out above about tighter integration between production and innovation in the emerging technologies, then we should expect an upheaval in the relationships between the partners in different territories, as those in territories that master complex production and deployment begin to work their way back towards the early stages of innovation in the value chain.

#### The role of government

The third great break point with the world of modularity and the “IT paradigm” –or the Piore-Sabel world of flexible specialization—has to do with government. As Fred Block and his collaborators have shown in a set of studies of the role of government across a broad set of industrial sectors since World War, the hand of the American state in promoting innovative companies was visible and important even in the high water phases of neo-liberal market

fundamentalism (Block and Keller 2011). As we look across the third industrial divide and try to discern emerging forms of state involvement in the industrial economy, it is not activism as such that looks new, but activism that substitutes for what private enterprise used to do even fairly recently-- and no longer does. With the break-up of the old vertically-integrated corporations in the 1990s and the emergence of new slimmed-down companies focused on core competences, the great corporate research centers like AT&T's Bell Laboratories, Xerox's Palo Alto Research Center (PARC) and similar organizations at IBM and DuPont were closed or drastically scaled-down. It was in corporate R & D centers like these that the critical technologies for information technology had been pioneered: transistors, Ethernet, Unix software, cellular technology. These projects had been pursued over decades, with much of the initial efforts focused on open-ended basic research. They resulted in a wave of new products and services that transformed society—but these results were long in coming, and the gains did not always accrue only or even mainly to those who had made the investments over the years. With the new focus on core capabilities and the restructuring of these vertically-integrated giants, research and development labs were attached to the “profit centers” of smaller business units. The possibilities for “cross-subsidization” of research disappeared.

With the downsizing of the large corporation came a downsizing and a narrowing of corporate R & D investments. Increasingly, research and development take place in small firms—without deep pockets and without the financial capacity to pursue projects with long time horizons. Block and Keller document the relative decline in the innovation and patenting efforts of large Fortune 500 companies from the 1970s to today and the concomitant rise of the

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number of significant innovations and patents developed in smaller-size firms. (Block and Keller, 162-5) Over the same period, the proportion of R & D scientists and engineers working in large companies declined, and the proportion of technologists employed in small firms rose. These shifts in innovative activities into much smaller-size enterprises undoubtedly reflect multiple factors: changes in technology, opportunities for open sourcing and licensing of innovation, the role of venture capital as well as the downsizing and restructuring of the vertically-integrated corporation. But in retrospect the retreat of the large corporations funding broad spectrum R & D may have had the most significant impact by creating a gap in funding for innovation, for early-stage development, and for the scale-up from start-ups to full-fledged production. In fields like software and biotech, venture capital and private equity have stepped in and provide funding for product development and enterprise creation that might in earlier decades have taken place within the four walls of the large corporation. Aside from these few sectors, however, across the range of innovative activities in the economy as a whole, it is government finance through programs like the Small Business Innovation Research or through support of basic research in university laboratories that has come to play a more critical role.

Can government can substitute for the large corporation in its old role of nurturing innovative activities and bringing them to market? If government were to provide funding for those innovative activities which venture capital and private equity find too costly, too risky, and too long to take public in equity markets, would there still be a problem? Writing in August 2011, it is difficult to assume even on the funding side that the gap left by the transformation of the structures of production and finance by the restructuring of private companies

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could be filled by government. But the even more difficult issue has to do with a legitimacy gap. If there is a broad consensus in American politics on government support for basic research and defense-related research, there is none at all on “industrial policy.” In the pejorative sense, this means government “picking winners and losers.” The opponents of industrial policy deny that government is capable of doing this and also (with some contradiction) argue that even if government could, this would be a bad thing for a government in a free-market economy to do. It would produce both waste and corruption. Aside from this dire interpretation and more generally, industrial policy has an inherently ambiguous and expandable set of meanings. There is no sharp boundary between support for innovation and support for some industries, technologies, or firms or others. Whatever the definitional disagreements, however, when the issue is one of assisting firms to scale-up their activities and not simply to initiate activities, most would agree that the line in the sand has been crossed and government is doing industrial policy. Industrial policy that dares not speak its name in America may work, as Block and Keller argue, for advancing innovation; it does not work for building companies capable of exploiting that innovation and bringing it to life in new production, new firms, and new jobs. Where private capital markets cannot or will not fund such activities, government cannot yet fill the gap.



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