

Network failures and innovation in the New Old Economy*

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Industrial policy has gotten a bad name. Take for instance the 2011 report "on ensuring American leadership in advanced manufacturing" by the President's Council of Advisors on Science and Technology (PCAST). The report argues that "American leadership and competitiveness in manufacturing is at risk" and calls for a new "strategy for supporting innovation in advanced manufacturing." At the same time, however, the authors caution that their call is for *innovation* policy and write that the United States, "should avoid *industrial* policy" -- which they define as "making bets on particular companies and industries" (emphasis added).

Why the worry about the terminology? PCAST's definition of industrial policy differs from those generally proffered by academics writing on the subject, who generally accept Chalmers Johnson's (1982: 19; see also 1984) claim that the term should refer to the "concern with the structure of domestic industry and with promoting the structure that enhances the nation's industrial competitiveness." By that definition, the strategy they outline amounts to a call for a *particular industrial policy focus*, rather than a rejection of industrial policy per se. Still, the distinction is not drawn without reason. PCAST, like others who have of late been calling for explicit state action to support the manufacturing sector, is clearly wary of getting mired in unproductive debates like those that occurred in the United States in the 1980s and 1990s.

This is not illogical. That debate was marked by a curious combination of agreement that American industrial policy was incoherent, but disagreement as to the sources of that incoherence. It is a debate that began by pitting "market fundamentalists" declaring "government failure" to be inevitable in general against "market skeptics" who believed some form of industrial policy to be essential to the maintenance of American living standards, but who despaired of its coherent and effective implementation in a "non-parliamentary system like the U.S., in which power is divided between Congress and the President, and shared with an array of commissions, agencies, boards, and administrations" (Magaziner and Reich 1982: 378-9). That opposition, however, gave way to a unifying "neo-institutionalist" position that: (1) recognized the utility of industrial policy in "coordination-oriented" economies like Japan and Germany; (2) argued that the United States was blessed instead with "liberal market" institutions and was therefore thus best served by "market-incentive policies" like antitrust enforcement, macroeconomic stabilization, and public goods provision that "induce actors to perform more effectively" (Hall and Soskice 2001); (3) therefore served to justify precisely the era of deregulation and reregulation that made the sorts of policies advocated by PCAST politically unfeasible.

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Moving beyond the mire of a paralyzing and counterproductive earlier debate is perhaps enough reason to scrap terminology. But there is another reason that is at least as important: the mix of policies required for industrial success today differs from those required just a quarter century ago. The issue, quite simply, is that the industries now targeted have in many cases been transformed (or even created) by the transition to what Walter Powell (2001: 35) refers to as a "new logic of organizing." This new logic is both cause and consequence of the demise of the vertically integrated behemoths that dominated much of the post-war era, and whose formation or protection animated the industrial policy debate not long ago. Those once insular national champions have in many cases been replaced by, or transformed by outsourcing into the sorts "network" firms that have led scholars like Paul DiMaggio, for example, to recognize that "most knowledgeable observers" had already by 2001 come to "believe that firms [were] engaging in more long-term collaborations - especially close information-sharing relationships with suppliers and collaborations around product development - [then] than during most of the twentieth century."

Those trends, of course, have by no means reversed in the last ten years, nor has the salient point lost its force: network firms are notably far less dependent on the scale economies got by internal coordination that had been the object of industrial policy when the industrial policy debate was last on tips of the tongues of American economic commentators. They rely instead on their ability to compete in "high-speed learning races" in which sustainable advantage is got by creating and leveraging knowledge across products and services (Powell 2001: 35). And this -- or so the authors of the PCAST report argue -- requires a concomitant set of transformations in the logics of state interlocution with the private sector. In particular, it requires that policies to support economic development in the high wage world, and manufacturing industries in particular, be governed by two main principles.

First, the government should "create a fertile environment for innovation" by "encouraging firms to locate R&D and manufacturing activities in the U.S.," by "supporting a robust basic research enterprise," and by developing policies that "cultivate and attract high-skilled talent." Second, the government "should invest to overcome market failures" in order to "ensure [that] new technologies are developed here and [that] technology-based enterprises have the infrastructure to develop here." In particular, this means supporting applied research programs and investments in a shared technology infrastructure, and, when possible, doing it by way of "co-investment with private actors ... whenever "identifiable market failures impede adequate private investment, and there are "industrial partners ... willing to co-invest with the government" in ways that will help anchor subsequent manufacturing in the United States" through "shared labs, pilot plants, technology infrastructure, ... creation of clusters," and the like, thus ensuring that state investments can be expected to have "a high potential payoff in employment and output."

There is a reason I have begun by summarizing the language and substance of PCAST's 2011 recommendations to the American President. My goal in this paper is twofold. First,

I aim to show that the contemporary American industrial policy debate -- by whatever name -- is moving in the right direction. A bulwark of scholars, industrialists and policymakers have recognized that a series of technological and, especially, organizational changes have changed the game. And they have therefore opened new space for policymaking to support the manufacturing sector, even as they have rendered some more traditional policies far less effective than they would have been not long ago.

Second, however, I also want to underscore that all is not rosy in our policy direction. My own research on the implications of outsourcing in metal manufacturing industries, coupled with insights drawn from recent empirical and theoretical work in the field of economic sociology, documents a major and continuing problem in contemporary understandings of the space for policymaking to effectively support the manufacturing sector. In particular, I have explored the implications of the fact that many of the activities now targeted by policymakers looking to foment industrial success do not occur just in firms or markets, but rather occur across the decentralized production networks increasingly characteristic of contemporary industry. It follows, I argue, that *network failures* are in many cases as threatening to industrial dynamism as are the market or organizational failures usually seen as the *sine qua non* for third party intervention into the governance of economic activity.

The PCAST report is interesting in this regard. The council is made up of some of "the nation's leading scientists and engineers" and is intended to represent and perhaps even to define the expert consensus. The report clearly highlights the growing importance of production networks. It notes, for example, that "technology and innovation often follow production as it shifts abroad" because innovation in "modern science-based industries" tends to require interactions between a "range of people from different backgrounds, often located across multiple organizations," and argues that Advanced Manufacturing should be favored by the proximate co-location of a diverse array not just of engineers but also of persons working in fabrication. And yet, the authors are unswervingly resolute in their claims that state action to foment innovation by private actors should occur if and only if "identifiable *market* failures impede private investment." This insistence is curious given that the report in fact advocates policies better framed as efforts to mitigate what I will in the remainder of the paper show to be better understood as network -- rather than market -- failures.

Why is this a problem? I also argue some of the sorts of policies that PCAST -- and I -- support already occur in the interstices of the decentralized American polity. More specifically, I show that there are many ways in which "street-level bureaucrats" engage in brokerage to mitigate network failures, but I show as well not just that many opportunities are missed, but that they are missed either (1) because they are not identified by actors encouraged to focus on market, rather than network failures; or (2) because actors who do focus on network failures may find their efforts stymied by a broader policy framing that requires them to justify their activities by showing that they have acted to mitigate a market -- and not network -- failure. In conclusion, and contra claims that traditional manufacturing industries cannot be a source of industrial dynamism, I show that properly coordinated state action to mitigate network failures in

those industries can stimulate new innovation among producers of intermediate goods, and that this will in turn benefit an array of end-user sectors (including workers in those sectors).

Concepts

Weimer and Vining's (2011) popular public policy textbook lists two classes of rationale for public policy. There are policies that serve distributional goals, and that must thus be shown to serve "substantive values" that run beyond just the easily justified (*ceteris paribus*) desire for economic growth; and there are policies rationalized because they mitigate market failure. Policies of the latter sort require in particular that the analyst make distinctions between, and evaluate the relative risks and benefits of, two key forms of "governance failure" (Krippner 2001). Market failures, which get the bulk of the attention, are classically defined by Francis Bator (1958: 351) as situations in which "a more or less idealized set of price-market institutions [fails] to sustain 'desirable activities' activities or to [impede] 'undesirable' activities." The existence of a market failure, as Weimer and Vining (2011: 37) explain, is however seen by most as a *necessary* but not *sufficient* condition for state action: "Sufficiency requires that the form of intervention not involve consequences that would inflict greater social costs than social benefits." The analyst who calls for policy intervention, they thus argue, must balance the gains to be had by mitigating an identifiable market failure against the risk that any proposed corrective action on the part of state actors might in fact generate an instance of *government* failure.

Government failure is a special case of *hierarchy failure*. Private hierarchy failure is usually called "organizational failure," while public hierarchy failures constitute "government failures." Hierarchies are defined by their rules and routines. Government failures occur when the rules and routines that are supposed to govern the activities of the state fail to promote the interests of that government's constituency, be that due to the standard travails of bureaucracy (i.e. agency problems when uncertainty abounds), to the ubiquity of regulatory capture, to the diffusion of authority across the sprawling state apparatus, or to any of myriad other causes. Organizational failures therefore occur when there is a "deterioration in [a private] organization's adaptation to its microniche and the associated reduction of resources within the organization" due to inadequacies in those rules or routines (Cameron, Sutton and Whetten 1988). Private organizational failures are not generally seen to justify actions by the state, except to provide impartial arbiters for bankruptcy proceedings.

These are standard distinctions. They also generate a widely accepted policy framework and a common language that can be used to discuss policy problems and solutions. This is useful. It allows, for example, the authors of PCAST report to frame the absence of infrastructure for technology-based enterprises as *prima facie* evidence for the existence of a market failure (or two!) somewhere. And this in turn helps policymakers and those they oversee in the state and federal bureaucracy to coordinate their energies and resources and to direct them towards the identification and mitigation of those failures. The advantages of that framework -- which derive largely from its wide acceptance --

must be weighed however against the sense among sociologists, scholars of organization, scholars of industry, and beyond that the standard distinction between the market and the hierarchy -- that is, between economic activity that occurs within a firm governed by labor law, and economic activity that occurs between firms governed by contract law -- renders it all but impossible to understand the intertwining of technological and organizational changes that defines the current era.

The degree to which this sense is broadly held today is easily found with even a cursory read of contemporary studies looking at the shifting boundaries of the firm. Reading those studies, it is glaringly obviously that great strides have been made to fill in the gaps in a scholarly agenda laid out in a seminal 1990 paper by Walter Powell. In that paper, Powell called for the development of a new "conceptual toolkit" to give order to the diversity of organizational forms that had emerged in the wake of the technological and economic shifts that had begun to wrack the global economy in the 1970s. Powell argued that many of those forms were in fact *networks*, and thus "more dependent on relationships, mutual interests, and reputation -- as well as less guided by a normal structure of authority" -- than could be captured in a framework that saw only markets, hierarchies, and "mongrel hybrids" of those more familiar forms. He did the preliminary work to show that those network forms were governed by a distinctive organizational logic premised on "a mutual orientation -- knowledge which the parties assume each has about the other and upon which they draw in communication and problem solving."

Subsequent studies have explored the diffusion of logic in greater detail. They have shown that networks are especially functional in sectors in demand is unstable and there is either rapidly changing knowledge or there are complex interdependencies between component technologies, but that they are feasible only when economic activity is somehow embedded in social institutions that simultaneously engender a continuous search for new information and safeguards against opportunism among existing or potential exchange partners (see Jones, Hesterly and Borgatti 1997 for reviews; Podolny and Page 1998). It is also somewhat common to read that particular *industries* are more or less suited to network governance, but this is in fact a misunderstanding of the main thrust of the organizations literature on network forms of organization. In fact, networks are found in -- and across -- a very broad swath of contemporary industrial landscape (i.e. at the innovative, and therefore more uncertain, edge -- often where industries and sectors as conventionally construed bleed together) (Schrank and Whitford 2011).

This framework -- in which networks are seen as akin to rather than hybrid between markets and hierarchies -- has a series of implications for industrial and innovation policy. I already alluded to the most important of these, which is that the "network failure" should be placed in the same conceptual space as are our more familiar understandings of market and organizational failure. To do that, we must define network failures, which we can easily do simply by building on Bator's established definition of the market failure. A network failure is a situation in which relational-network institutions fail to sustain "desirable" activities or to impede "undesirable" activities. This definition -- like the definition of market failure -- is of course relatively general. But, again like the definitions of market and organizational failure, its real purpose is to direct

the analyst to imagine and to investigate the possibility of a counterfactual. It forces the analyst to explore the possibility of a world in which some entity -- presumably but not necessarily the state -- is able to tweak the relevant relational-network institutions in ways that generate a superior outcome (superior, that is, for the constituents of that entity).

Recognizing that network failures might, in some circumstances, serve as a rationale for industrial and innovation policy renders the questions that policymakers must ask themselves both more complex and more useful. The standard framework writes off organizational failures as a matter of private concern, and demands that the policymaker determine whether real markets, which are never in fact perfect, are best improved, ignored, or eliminated. An imperfect market, by definition, has somehow gotten the pricing wrong, in the sense the private initiatives of atomized actors are not expected to generate a socially desirable outcome. Their policy implications as regards manufacturing are commonly seen to include especially a concern, rooted in the work of Arrow (1962), with the existence of "spillovers" of useful information generated in the production of goods and services. The standard framework worries that the free flow of ideas -- that were not, however, free to develop -- means that producers of innovation will not be able to reap the benefits of innovation, but will instead see those ideas stolen and sold for less by competitors (who can sell them for less because they don't have to recoup as many R&D costs). The result, of course, is that firms will be wary of investing in innovations -- or, in the language of economics, the existence of spillovers mean that the social value of production exceeds the private returns to producers, therefore causing firms to invest in the production of information that might spill over.

The policy prescriptions at that point either call for: (i) strong patent and copyright protection, so that information that spills over has no value; (ii) efforts to "get the prices right" by means of subsidies, tax benefits, or the like so that producers of ideas invest optimally; or (iii) replacing (eliminating) the market in question and direct hierarchical provision of the good or service in question; or (iv) no action, for fears of government failure. Patent and copyright laws certainly exist, of course, but are often hard to enforce and can in some cases in fact cause information to spill over even *more* easily (i.e. for manufacturing process improvements, where the codification required for a patent makes reverse engineering easier; or they may also be overly broad, destroying the value of others' work; Other options are therefore required, and in the case of innovation that might spill over, fights over public funding for research -- whether at universities, national labs, or the like -- are exemplary of the very public fights that are sometimes had as to whether (iii) or (iv) are more apt in particular situations. But interventions of the second type are common as well. They include everything from the American R&D tax credit to the strong enforcement of patenting rights or of "non-compete" covenants that impede labor mobility and that thus help firms to capture the returns of their investments in knowledge production.

Drawing the contrast

The alternative framework differs from the standard framework primarily because it is so much more attuned to the empirical richness of the real economy. In the specific, it

demands that the policymaker think more comparatively. She must first recognize that many activities in the economy are governed not just by price in markets or by fiat in hierarchies, but by custom in networks. And she must then try to determine whether the governance of those activities might -- in all cases -- be improved by corrective action, including corrective actions that aim not so much to "get the prices right" in market, or to "get the rules right" in hierarchies, but to "get the relationships right" in networks.

The underlying policy instruments available to policymakers do not necessarily differ across the standard and the alternative frameworks. If we take again our examples -- the PCAST report, and the generation of innovation -- we see reference to a variety of instruments, and we see a very different attitude towards the issues raised by the existence of information spillovers. In particular, the report calls for investments in a "shared technology infrastructure," which is certainly done in some cases through direct (hierarchical) state provision in the national labs; it calls for tax policies -- thus altering prices -- in order to encourage "firms to locate R&D and manufacturing facilities in the U.S."; but it also cites the possibility of "co-investment" in public-private partnerships and argues that they should move often be undertaken when "investments will help anchor subsequent manufacturing in the United States -- for example through shared labs, pilot plants, technology infrastructure and creation of clusters." Such investments naturally affect not just pricing, but shape also the relationships that firms in the economy have with each other and with the state. Moreover, they tend to be underpinned by a very different attitude towards knowledge spillovers. Co-location is favored, for example, because it allows and even encourages the transfer of tacit knowledge between producers and designers. But it also generates the sort of regional labor market that makes it possible -- and more likely -- that workers will change jobs more often and potentially bring with them information (i.e. spill it over),

The overlaps in instruments between the standard and alternative frameworks should not surprise. It is not in dispute that real economic actors regularly intermingle elements of market, hierarchy and network, and thus that the actions of the state might affect any or all of those modes of transactional governance. The purpose of a policymaking framework, moreover, is less to dictate the tools available, but to shape and order the decisionmaking processes by which those tools are selected, implemented and evaluated. And some policies are not in dispute. There is, for example, no dispute that patenting and copyright never have their place. At the same time, however, the different frameworks do in many situations have quite concrete -- and quite different implications -- for those who, at the street level, must implement policy and thus when and where they have their place.

Foreign examples

The best known exemplars of alternative industrial policy frameworks are most readily found in scholarship on Germany and on particular regions in central and northeastern Italy -- both of which have long been famed for communitarian institutions, often tied into the local and regional state, created conditions that allowed "flexibly-specialized" networks of independent to continuously innovate, and thus to compete more successfully

in quality-conscious (and higher-value added) global markets. The salience of these of these particular cases is not that they do nothing to solve market failures, or that they are unconcerned with the ways in which spillovers and resultant difficulties in capturing the returns of innovation might undermine investment. Their significance lies in their concomitant -- and arguably stronger -- concern with the *absence* of spillovers, as evidenced by the attention in each case to the formation of networks to ensure the easy flow of even strategic information.

The "German model" in particular is regularly cited as the best evidence for claims that it is at least possible to manufacture in the high wage world. The sector provides about 20% of the country's total output, compared with just 11% in the United States. It is widely credited with having allowed Germany to sustain its export and employment performance even through recent crises. Moreover, and more importantly for purposes here, there is evidence that the company's long tenure at the top of the manufacturing food chain is, if not entirely replicable, driven at least in part by the access its manufacturers have to an innovation and industrial policy apparatus that does offer some lessons for other wealthy nations. Vitols (1997), for example, showed in an overview of German industrial policy written in the 1990s that the role of the German state in "industrial R&D and innovation" was in fact "neither developmental nor laissez-faire." Instead, he explained, publicly funded research institutes that would perform applied R&D, often under contract with industry, but would rely also on a regionally embedded and "dense set[s] of sectoral and local associations."

More recent research suggests that this pattern persists. Gary Herrigel's (2010) reinforces and updates this underlying point in a recent book that documents, for example, the role of Laender governments in the formation of "supplier initiatives" in the 1990s in the automobile industry that rewired relationships by bringing "large automobile firms, their suppliers, and local technical universities into an informational network." And Rothgang et al. (2011) show that a "state-funded programme of industrial collective research (ICR)" that "promotes precompetitive, cooperative research activities of business firms and research institutes" has since its inception almost a half a century ago actively structured the disbursement of funds and programs in ways that have rendered it a "driving force for the development of a complex, multi-level network of industrial research associations, university, and independent research institutes, and firms of all sizes."[†]

Reference to the Italian economy in this paper will surely surprise some readers, given the recent travails of the country's government and generally lackluster industrial performance. For purposes of the argument here, however, those travails are more a feature than a bug, as it underscores that industrial policy as dictated by the alternative framework can be carried out at multiple levels of government. Moreover, the Italian case in particular underscores that regional interventions may be effective even when policymaking at the national level is ineffective or even counterproductive.

[†] The ICR was notably developed even before the academic literature had recognized the innovative potential of networks, leading Rothgang et al (2011) to observe that it "introduced a component into German technology policy which predates scientific reflection on innovation processes by many years."

The evidence for this claim is drawn from the varied experience of the country's "industrial districts" -- territorially circumscribed networks of small and medium sized firms that tend to specialize in just a single phase of production and which must thus work together to produce products for market. Italian industrial districts sprang to international fame in the 1980s due to the attention given the regions in Piore and Sabel's 1984 book, *The Second Industrial Divide* -- a book that has long been a touchstone for scholars interested in the implications that the spread since the 1970s of a "new logic of organizing" has had for industrial innovation policy.[‡] They got their fame because they showed in the 1980s and 1990s to show that globalization did not necessarily privilege the scale economies available to large multinationals. In more recent years, the difficulties of the Italian economy more broadly, and certain well-known districts in particular (i.e. textile production in Prato) have led some to argue that the district model has seen its day, given evidence that some firms and regions have been unable to transition from the manufacture of simple if high quality goods to more technologically sophisticated demand segments. A more nuanced analysis, however, makes clear that there are still important lessons to be gleaned precisely from the fact that some districts have done well, while others have done badly.

Russo and Whitford's (2011) study of the province of one of Italy's historic districts -- the Modenese metalworking district that served as the key example in a celebrated 1982 article by Sebastiano Brusco -- is exemplary in this regard. Russo and Whitford show that the province's regional metalworking industry's employment remains highly innovative, exports extremely successfully, and while it has undergone changes in its model of production, it still relies heavily both on dense production networks and on an industrial policy apparatus able to mitigate not just market but also network failures. In particular, they show that the network structure of the firm has become increasingly "vertical" -- by which they mean that an increasing share of the firms in the region now serve primarily as subcontractors to the 20 firms in the province with more than 250 employees. This, does not mean that those 20 larger firms have lost their ties to the region or to its institutions. To the contrary. Those firms purchase 70% of subcomponents for their products from suppliers in the region, and do so because subcontracting firms in the area increasingly provide them with design and R&D services.

This transition has required some rewiring of roles and relations has enabled final firms to draw on the one side on the deep knowledge of manufacturing processes and the ability to turn new knowledge into salable products that exists in the territory, and on the other to use their greater size and resources to become global players, seeking out knowledge and markets abroad (Russo and Whitford 2011). It also did not just "happen"; it requires instead a simultaneous collective recognition that region's once "horizontal" model of collaborative network production would not be able to incorporate more science-based innovations into their products, but that the more hands-on technical capabilities of the many suppliers in the region remained essential to the translation of those innovations into salable products. This recognition was facilitated and coordinated

[‡] Germany was prominently featured in that book as well. And while the crises of the 1970s that thrust those particular manufacturing economies into the international spotlight have since passed, some of the lessons gleaned already in the 1980s have stood the test of time.

by a regional government that is committed to the formation of consortia and other initiatives. Bianchi and Labory (2011) point, for example, to ERVET, an agency owned by the regional state that guides the regional policy framework and that is notably "participative" in the processes it uses to formulate those policies.

The contemporary American debate

I began with the observation that the PCAST report is suggestive in two ways. Firstly, it is self-conscious in its efforts to separate itself from the unproductive debates of a recent if bygone era -- debates which led many to believe that effective industrial policy was all but impossible in an American context. Secondly, it is explicit in its claims that manufacturing companies increasingly rely on an "innovation infrastructure" to compete in the sorts of fast-moving and technologically demanding markets that can support the necessarily high (by world standards) labor costs of an advanced economy. I argued, however, that PCAST did not go far enough in its break with the language and concepts of that earlier era. The problem is straightforward. The report focuses its attention on the putative "market failures" that impede the development of the necessary innovation infrastructure, but emphasizes in its policy recommendations policies that, in many cases, neither provide services directly nor use subsidies simply to alter relative prices (e.g. many of those policies call for the state to develop shared labs and technology infrastructures by "co-investing" with industrial partners).

I described a shift in the underlying conceptual schema that academic studies of organization and industry use to analyze the intertwining of innovation and production before turning to examples of industrial policymaking in Italy and in Germany. I discussed those two European cases with the intent of highlighting two ideas that are relevant for contemporary American industrial policymaking. First, some successful German and Italian industrial policymaking understands its *unit of initiative* not as the firm or the sector -- as is commonly the case in writing on American industrial policy -- but rather as the relation or the network. The activities of the government at the "street level" have therefore served at least in part to broker relationships -- that is, as much to fix network failures by getting relationships right (and not just to affect prices and thus to focus just of market outcomes). In Germany, for example, state R&D funding was disbursed and steered collaboratively with the country's federalized associational infrastructure in ways intended to affect not just the level of R&D spending, but also patterns of alliance in the performance and diffusion of the research. And in Emilia-Romagna, regional agencies aim to coordinate universities, associations and other third parties in ways that allow them to share resources.

The second point that stands out is that policies to mitigate of network failures in the German and the Italian cases rely heavily on activities and decision processes carried out at the state and local level. It is notable, for example, that Rothgang et al. (2011) describe the complex structure of the ICR in ways that underscore that decisions about resource allocation -- and thus the networks that will likely develop -- incorporate input from associations and research institutes across the country. It is notable as well that Bianchi and Labory (2011) focus on the activities of a single region in a country that has no

coherent national industrial policy, and emphasize the effectiveness of decentralized and shared decisionmaking structures within that region. The effectiveness of such policymaking is obviously suggestive of possibilities in the United States -- since the limits of a federal system of government coupled with the radical separation of powers enshrined in the American constitution has been cited by some as a barrier to effective industrial policymaking in an American context.

If we take that suggestion, moreover, and look into the interstices of the American decentralized that decentralized polity -- and look with an eye towards an alternative unit of initiative -- we can find evidence that American policymakers do sometimes act to mitigate not just market but also network failures. One especially celebrated example is, of course, the famed refusal of the state of California (and a few other states) to enforce "non-compete" clauses in labor contracts. That refusal allows for employee mobility and, at least potentially, greater tacit-knowledge "spill-overs" in labor markets in the labor markets in which workers may take that knowledge from firm to firm (Hyde 2011).[§] But there are many more examples, some of which I have documented in a series of papers and a book in progress (all in collaboration with Andrew Schrank).^{**} Schrank and I show that American industrial and innovation policy at the level of implementation is often engaged in brokerage and thus the rewiring of relations between firms and other actors in the economy. There are many examples that can be cited, but two of the most interesting are the National Institute of Standards and Technology's (NIST) *Advanced Technology Program* (ATP) and its *Manufacturing Extension Partnership* (MEP). Both were created as part of the Omnibus Trade and Competitiveness act of 1988, and were in their initial design very much products of the industrial policy debates of that era.

The ATP was designed to stimulate early stage technology by supporting "up to 50 percent of industrial research projects with economic benefit to the nation," while the MEP was designed to encourage the transfer of technology to small and mid-size firms by way of a nationwide network of regional manufacturing assistance centers. Each was conceived with a particular market failure in mind. The ATP's subsidies were to compensate firms for the "R&D spillovers" that are inevitable in early-stage research, and that would otherwise lead them to invest less in that research than they would in the absence of spillovers. Those given via the MEP aimed to reduce the cost of technology transfer services that could not otherwise be delivered in a cost-effective way to geographically diffuse small firms (Jaffe 1998; Shapira 2001). There is good evidence, however, that both programs have often served in practice as much to mitigate network as market failures.

Feldman and Kelley's (2003) explain that the ATP protocol favored the submission of joint projects, and that it thus forced firms to look for partners with which to collaborate. In their study, they compare ATP award winners to nonwinners (i.e. those who submitted

[§] It is notable that a focus on market failures would predict less patenting in states that do not enforce noncompetes since firms are expected to invest less in workers who might leave. In fact, the empirical evidence shows that venture capital, new business start-ups, and patenting are more common in metropolitan areas in which non-compete clauses are more weakly enforced (Samila and Sorenson 2011).

^{**} See Schrank and Whitford (2009; 2011; Forthcoming) and Whitford and Schrank (2010).

proposals but did not win). They show that the former were more likely to raise additional funding due to "halo effects" of a prestigious ATP award, more likely "share their research findings with other firms -- the spillovers for which the program was created -- and even to form research collaborations with new partners and to sustain those collaborations into the future. This suggests that "the profit incentive that motivates innovative activity by an individual firm also discourages information sharing and collaborative R&D activities between companies" (Feldman and Kelley 2003). Their findings therefore suggest that ATP has not just funded research but has generated changes in the network structure of research collaboration in American industry. And -- notable for purposes here -- their findings are matched in this regard by scholarly studies of the Manufacturing Extension Partnership with, for example, Whitford (2005) documenting the role of the Wisconsin regional MEP in the formation of an initiative in that state that sought quite clearly to rewire relationships in a part of the manufacturing economy in that state. In that initiative, a group of the state's large manufacturers formed a consortium, drew upon the brokerage and training skills of the MEP in an effort to improve both the quality of the regional supply base, and their relationships to those suppliers.

There are numerous other such examples across the American industrial policy infrastructure. Block and Keller (2011) argue, for example, that the "Small Business Innovation Research" has allowed government officials to get "acquainted with the capabilities of small entrepreneurial firms and the research laboratories at universities and federal laboratories from which a number of these firms had emerged," in turn allowing those officials "to develop the kind of embeddedness in a research community that Evans (1995) and Ó'Riain (2004) have seen as central to making government technology policies more effective." And yet, while evidence gleaned from SBIR, MEP, and ATP is intriguing, it does not mean that ability of bureaucrats at the street level to resolve the network failures they encounter as they go about their jobs is independent of the political and institutional context -- which brings me to an important caution. A further look at the ATP and MEP -- to stay with the same examples -- makes clear that the rationales and concepts that policymakers use to design and justify their policies are not just a matter of language. The histories of these two programs does show the possibility of creative actions by policymakers looking to face the challenge of an economy transformed by the decentralization of production. But there are countertrends as well. And those countertrends, underscore the challenges of such creativity in an American context in which networks and collaboration are seen as more the product of fortunate happenstance than of the deliberate activities of the state.

The eventual demise of the ATP is telling. The program was suspended in 2005, and eliminated in 2007 despite official evaluations showing that the social returns of the program had far exceeded its costs. Marian Negoita (2011), in a post-mortem explains why. The ATP he writes, lost its support in congress due to charges that it was funding projects that would have been funded anyway, and charges that the "government was interfering with markets by picking winners and losers." The former charge was in fact specious. The latter misunderstood the degree to which the industries and activities financed take place across production networks so that a "win" somewhere in the network

can generate substantial social returns across that network. But they did kill the program. The MEP has fared better, not least because it has centers delivering services to manufacturers in all 50 states, and has been able to mobilize the support of those manufacturers -- who pressure their own representatives -- and is thus relatively popular on Capitol Hill. Still, the program has had several near-death experiences in the last twenty years, and must regularly fend off charges that it is simply subsidizing the provision of services already available on the market (Hallacher 2005).

In the face of these persistent existential threats, the MEP has responded by evaluating the centers regularly especially on metrics like job creation and sales growth at client firms. However, while such metrics may provide evidence that the centers social surplus exceeds its costs -- prima facie evidence that they have resolved the market failure for which they were created -- they also encourage centers to tailor their efforts to meet those target metrics. And that, as a series of observers have recognized, may lead the centers to forgo “hard to measure or intangible activities” like the promotion of “customer-supplier dialogue or inter-industry networks,” and thereby give MEP officials “weaker incentives to conduct those activities—even though these activities may ultimately be more important for long-run fundamental upgrading” (Shapira and Kuhlmann 2003: 276). These worries, to be clear, are not anachronistic. While the Corporation for Enterprise Development advised NIST to make inter-firm collaboration a criterion of MEP effectiveness more than a decade ago (Rosenfeld 2002), the agency has continued to ignore collaboration in favor of more easily measured -- and thus more politically salable -- metrics like revenue and job creation (NIST 2008; NIST 2009).^{††}

Conclusion and implications

The United States is at a crossroads when it comes to industrial (or innovation) policy. American manufacturing is troubled but also in transition. There are enough bright spots to know that it is certainly possible to profitably manufacture in the United States. There is enough evidence across the globe to show that innovation and research and development cannot easily be severed from manufacturing to give reason to develop a more robust policy infrastructure to support the sector. There is, however, no consensus as to the content of that infrastructure. This lack of consensus is due in part to very real political disagreements as to the role of the state in the economy. But it is due also to the failings of a conceptual language used to discuss and evaluate different policy options that has yet to come to terms with -- or develop terms for -- a series of transformations in the underlying structure of manufacturing industries. Firms of course still matter. Arms-length transactions in markets remain important. But there is a clear consensus across the social sciences that few firms can master the current pace of technological change without the help of others, and that collaborative production and innovation networks will be central to the viability of advanced manufacturing industries going forward.

^{††} Evidence that these activities do take place on the ground can be found in semi-annual self-reports from the centers. An analysis of the most recent reports shows that 52 out of the 56 center reports in the analysis explicitly enumerate and describe collective events that create opportunities for clients to meet and form relationships by hosting workshops and discussion forums for the manufacturing industry; they are, in short, aiming to broker and are putting resources into brokerage. Nonetheless, the performance metrics that centers ultimately use as they defend their overall performance come back to the politically salable metrics demanded by NIST.

This transition has flummoxed an industrial policy debate that remains wedded, across the political spectrum, to the view that market failures are the *sine qua non* for state action. Certainly, market failures are *a* reason for the state to act -- but they need not be, and in fact should not be, the *only* rationale. To focus only on those dysfunctional spaces in the economy that can be identified as market failures of various stripes (outside of organizational failures, which are deemed a private concern) suggests in turn that their repair ought ideally to somehow approximate the outcome that might obtain in a functioning market. Studies of transactional governance, however, show that many technologically advanced sectors are more effective, efficient, and innovative when they rely as much (or more) on networks as they do markets -- by which I mean that decisions about investments and the like are not just driven by prices, but are oriented as well towards the maintenance of collaborative relations with knowledgeable parties who might be able to provide assistance in the future. There is good evidence that those relations are due not just to happenstance, but rather affect and are affected by firms' relations to an array of organizations somehow tied to the state (everything from NIST, to research institutes like the national labs, to universities that receive public funding, and beyond). And there is therefore in turn good reason to think seriously about the different sorts of failures that lead to dysfunction in the economy, and to recognize that generation of an imagined "market" outcome is not in all cases -- or perhaps even in many cases -- the optimal solution.

In practical terms, the lessons for policymaking follow from the guidelines laid out above. If the goal is to stimulate manufacturing industries in the United States, much of what must be done, especially in the short term, requires attention to the demand side -- which is of course beyond the scope of this paper. But medium and long-term policies must focus on the supply side, which in the case of manufacturing industries means at least in part allowing, encouraging, and even cajoling -- depending on the particulars of the agencies in question -- the existing industrial policy infrastructure to identify and mitigate not just market failures but network failures as well. It is essential first that policymakers recognize first and foremost that the firm is *not* the only possible unit of initiative in policymaking, but that taking the unit of initiative to be the relationship between firms may in some cases better serve the population at large. And it is essential second to underscore that market-making ought not always to be the option of "first resort" in the evaluation of policies to support innovation in manufacturing industries. An alternative framework for industrial policy demands, in short, that policymakers think comparatively, and that they recognize that many activities in the economy are governed not just by price in markets or by fiat in hierarchies, but by custom in networks.

By juxtaposing the standard and alternative policy frameworks we can see, for example, not just why regions that do not enforce non-compete clauses in labor contracts do better in terms of venture capital, business start-ups and patenting in fast-moving industries in which network governance is often most functional (Hyde 2011; Samila and Sorenson 2011). We can also understand both why many jurisdictions continue to enforce non-compete clauses and why there is pressure to do so. There are potential gains to society caused by the incentives for investment that follow from a decision to treat the tacit

knowledge that workers acquire on the job as an excludable property right -- and thus to make a market. Yet there are also gains to be had from encouraging the broader diffusion of tacit knowledge, and by recognizing that such know-how is not a pure public good (and thus cannot really be generated "hierarchically" through government investment). Rather, it only flows across real social ties. And state actors can and should encourage the formation of the social networks that enable those flows.

The standard framework sees only gains of the first type, while the alternative framework requires policymakers to assess the relative benefits of market and network-making, and allows that it may vary from place to place and from industry to industry. The political dominance of the standard framework, coupled with closer mapping to empirical realities of the alternative framework, thus explains why street level bureaucrats in the main American examples cited -- the MEP and ATP (now TIP) -- spend so much of their time and resources to connecting firms to each other and to sources of innovation, and why their budgets are constantly threatened despite evidence that they have by many measures generated benefits that vastly outweigh their costs.

The best solution is to balance the core underlying concerns. The hegemony of the standard framework demands that those agencies justify their budgets by regularly showing that the sum of measurable returns at the client level (in terms of jobs, cost savings, and so on) outweigh the costs of the program. These demands are driven by fears that to grant long term budgetary discretion to street-level bureaucrats increases the risk of government failure. The alternative framework recognizes government failure as a legitimate risk, but requires policymakers to recognize as well that street-level bureaucrats are not just delivering services. They are in many cases developing relationships that improve their capacity to develop and deliver those services. This is not to say that the activities of those agencies and their employees need not justify their budgets with clear metrics. It is rather to say that the metrics and justifications that are used to justify those budgets can and should reflect and acknowledge that the unit of unit of initiative is sometimes the relation or the network, and that therefore allow policymakers to measure social returns more broadly.

MEP and ATP are, moreover, hardly the only programs in which street-level bureaucrats are torn between market- and network-making. There are others, including the DOE, the NIH, the FDA, and beyond that have been identified by Fred Block (2008) and others writing on the activities of the a "hidden" American developmental state (see e.g. Fuchs 2010; Fuchs 2011; Keller 2010; Schrank 2010). These agencies, as Block notes, are hidden because many of their activities -- and some activities from which they refrain for fear of political fallout -- do not in fact serve simply to make markets. They also (or instead) foment the formation of networks by bringing universities, firms, the national labs, and so on together. There is hard -- and specific -- work to be done to understand when and whether they do so in ways that in fact increase the social surplus. New metrics that focus not just on outcomes at the particular client level (the old unit of initiative) but on outcomes at the level of the relation or the network will not be easy to develop. Still, governments can, do, and should resolve network failures when they can be identified. And we must hence recognize that industrial policymakers, and the street-level

bureaucrats who put those policies in place, would have much more to learn from each other and much more to teach us if they were not forced to mask the character of their activities and to defend their budgets against those who see networks as fortunate private happenstance, rather than as the result of deliberate policymaking.

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