INSTITUTIONS, TRANSACTION COSTS AND PRODUCTIVITY IN THE LONG RUN

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Institutions provide the incentive structure of an economy and therefore the productivity of an economy is a function of both the technology employed and the institutions of that economy. Surely this is a non controversial statement. Yet, except as something of an obligatory throw away line in studies of productivity, institutions and transaction costs play little role in the substantial literature on that subject.1 The literature is replete with arguments about the significance of the capital stock, technology, r&d, and savings in the rate of growth of productivity and there is an entire literature exploring the causes of the modern slowdown in productivity in these terms.2 But institutions play no role. The implicit assumption is that incentives either don't matter or are constant both across economies and over time in an economy.

The new growth economics literature has a similar theme. Successful economic growth is a result of human capital investment, physical capital, savings and sometimes a negative function of population growth but appears to have nothing to do with the rules of the game of an economy.3 An economic historian attempting to make sense of the widely varied patterns of economic performance over the past several millenia is particularly frustrated by such an approach to the study of productivity because it ignores the available historical evidence as well as being counterintuitive and appearing to be a consequence of monumental theoretical myopia. Surely the cataclysmic events of the past half decade in central and Eastern Europe and in China should have convinced even the most dedicated neo-classical economist that institutions matter and, more important for this essay and this conference, that they must be integrated with the classic sources of productivity change if we are to understand the long run--and for that matter short run--performance of economies.

The argument of this essay is that the immense productivity increases resulting from technological developments of the past century and a half could only be realized by fundamental changes in the institutional and organizational structure--a supply side argument; and that the consequent tensions induced by the resulting societal transformation have resulted (and are continuing to result) in politically-induced fundamental changes in the institutional structure to mitigate these tensions--a demand side argument. Both the supply side and demand side institutional changes have been and continue to be fundamental influences on productivity change.

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* I am indebted to Randy Nielsen for research assistance; to Art Denzau, John Nye, and Ken Sokoloff for improvements on earlier drafts; and to Elisabeth Case for editing the manuscript.

1. There are significant exceptions to this neglect. See for example Denison, 1979, Nelson, 1981, and Christainsen and Haveman,1981.

2. The study by Baumol, Blackman, and Wolff (1989) summarizes this literature

3. This literature makes clear the high rate of return on investing in human capital, etc. but leaves one with the unexplained puzzle: if there is such a high rate of return why don't third world economies make the proper investments?

In successive sections I specify what institutions are and how they change; describe the underlying source of modern productivity growth, the second economic revolution and its institutional/organizational imperatives; explore some of the institutional changes--both supply side and demand side-- that have influenced and continue to influence productivity change; and finally attempt to delineate the institutional dynamics associated with the evolution of modern economies and the consequences for productivity change.

I

Institutions are the humanly devised constraints imposed on human interaction.4 They consist of formal rules, informal constraints (norms of behavior, conventions, and self imposed codes of conduct) and the enforcement characteristics of both. In short they are the structure that humans impose on their dealings with each other. The degree to which there is an identity between the objectives of the constraints institutions impose and the choices individuals make in that institutional setting depends on the effectiveness of enforcement. Enforcement is carried out by the first party (self-imposed codes of conduct), by the second party (retaliation), and/or by a third party (societal sanctions or coercive enforcement by the state). Institutions affect economic performance by determining (together with the technology employed) transaction and transformation (production) costs.

If institutions are the rules of the game, organizations are the players. They are made up of groups of individuals engaged in purposive activity. The constraints imposed by the institutional framework (together with the other constraints) define the opportunity set and therefore the kind of organizations that will come into existence. Given the objective function of the organization-- maximizing profit, winning elections, regulating businesses, educating students--the firm, the political party, the regulatory agency, the school or college will engage in acquiring skills and knowledge that will enhance its survival possibilities in the context of ubiquitous competition. The kinds of skills and knowledge that will pay off will be a function of the incentive structure inherent in the institutional matrix. If the highest rates of return in a society are to piracy, then organizations will invest in knowledge and skills that will make them better pirates; if the payoffs are highest for firms and other organizations to increase productivity then they will invest in skills and knowledge to achieve that objective. Organizations not only will directly invest in acquiring skills and knowledge but will indirectly (via the political process) induce public investment in those kinds of knowledge that they believe will enhance their survival prospects.

Modeling institutional change requires identifying the agent, source, process, and path of Institutional change. Let me take each in turn.

The agent of change is the entrepreneur; the decision maker(s) in organizations. The subjective perceptions (mental models) of entrepreneurs determine the choices they make.

The sources of change are the opportunities perceived by entrepreneurs. They will stem from either external changes in the environment (technological or political changes, for example) or from the acquisition of learning and skills which, given the mental constructs of the actors, will suggest new opportunities. Changes in relative prices have been the most commonly observed external sources of institutional change in history, but changes in taste have also been important. The acquisition of learning and skills will lead to the construction of new mental models by entrepreneurs to decipher the environment. In turn, these models will alter perceived relative prices of potential choices. In fact it has usually been some mixture of external change and internal learning that triggers the choices that lead to institutional change.

Deliberate institutional change will come about therefore as a result of the demands of entrepreneurs in the context of the perceived costs of altering the institutional

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4. This section briefly summarizes the argument contained in North, 1990.

framework at various margins. The entrepreneur will assess the gains to be derived from recontracting within the existing institutional framework compared to the gains from devoting resources to altering that framework. Necessarily bargaining strength and the incidence of transaction costs are not the same in the polity as in the economy, otherwise it would not be worthwhile for groups to shift the issues to the political arena. Thus entrepreneurs who perceive themselves and their organizations as relative (or absolute) losers in economic exchange as a consequence of the existing structure of relative prices can turn to the political process to right their perceived wrongs by altering that relative price structure. In any case it is the perceptions of the entrepreneur--correct or incorrect--that are the sources of action.

Changes in the formal rules may come about as a result of legislative changes such as the passage of a new statute; judicial changes stemming from court decisions that alter the common law; regulatory rule changes enacted by regulatory agencies; and constitutional rule changes that alter the rules by which other rules are made.

Institutional change resulting from changes in informal constraints--norms, conventions, or personal standards of honesty for example--will have the same originating sources of change such as learning or relative price changes but will occur far more gradually and sometimes quite subconsciously as individuals evolve alternative patterns of behavior consistent with their newly perceived evaluation of costs and benefits.

The process of change is overwhelmingly incremental The reason is that the economies of scope, the complementarities, and the network externalities that arise from a given institutional matrix of formal rules, informal constraints, and enforcement characteristics will typically bias costs and benefits in favor of choices consistent with the existing framework. The larger the number of rule changes, ceterus paribus, the greater the number of losers and hence opposition. Therefore, except in the case of gridlock, institutional change will occur at those margins considered most pliable in the context of the bargaining power of interested parties. The incremental change will come from a change in the rules via statute or legal change. Alternatively, changes in informal constraints result from a very gradual withering away of an accepted norm or social convention or the gradual adoption of a new one as the nature of the political, social, or economic exchange gradually changes.

The direction of change is characterized by path dependence. The political and economic organizations that have come into existence in consequence of the institutional matrix typically have a stake in perpetuating the existing framework. The complementarities, economies of scope and network externalities mentioned above bias change in favor of the interests of the existing organizations. Both the interests of the existing organizations that produce path dependence and the mental models of the actors--the entrepreneurs--that produce ideologies "rationalize" the existing institutional matrix and therefore bias the perception of the actors in favor of policies conceived to be in the interests of existing organizations.

Altering or reversing paths is a result of external sources of change which weaken the power of existing organizations and strengthen or give rise to organizations with different interests, or it is a result of the unanticipated consequences of the policies of the existing organizations. That is, the mental models of the entrepreneurs that determine the choices they make may produce consequences at variance with their desired outcomes; this variance leads to the weakening of the power of existing organizations and the rise of organizations with different interests. The critical actor(s) in such situations will be political entrepreneurs whose degrees of freedom will increase in such situations and, on the basis of their perception of the issues, give them the ability to induce the growth of (or strengthen existing) organizations and groups with different interests.

II

Modern productivity growth is a consequence of the second economic revolution--a revolution which began in the last half of the nineteenth century and is still continuing.5 That revolution is the development of the scientific disciplines and the wedding of science and technology. It is a revolution because it is a fundamental change in the stock (and flow) of knowledge, which entails an equally fundamental change in the organization of human beings and the structure of societies to realize the productivity implications.

The development of the disciplines of physics, chemistry, biology, and genetics is a fundamental source of the growth in the stock of scientific knowledge. The systematic application of these disciplines to the basic economic problem of scarcity has not only purged the Malthusian spectre of diminishing returns from our purview but has created the vision of a potential world of plenty. To achieve that potential, however, entails a restructuring of economic, social, and political institutions and organizations in order to realize the increasing returns attributes of the technology in which this scientific knowledge is embodied.

The technology requires occupational and territorial specialization and division of labor on an unprecedented scale and in consequence the number of exchanges grows exponentially. In order to realize the gains from the productive potential associated with a technology of increasing returns one has to invest enormous resources in transacting. In the United States,for example, the labor force grew from 29 million to 80 million between 1900 and 1970; during that period non-agricultural production workers grew from 10 million to 29 million, while white collar workers (the great majority of whom are engaged in transacting) increased from 5 million to 38 million. The transaction sector (that part of transaction costs that goes through the market and therefore can be measured) in the United States in 1970 made up 45 percent of GNP.6

If transaction costs were simply the costs of coordinating the increasingly complex interdependent parts of an economy they would be simply information costs or more specifically the costs of acquiring the information to measure the multiple dimensions of what is being exchanged. But they are also the costs of enforcing agreements and making credible commitments across time and space, necessary to realize the potential of this technology.7 Let me briefly elaborate some of the measurement and enforcement problems that account for the size of the transaction sector. Necessary to be able to realize the gains of a world of specialization are control over quality in the lengthening production chain and a solution to the problems of increasingly costly principal/agent relationships. Much technology indeed is designed to reduce transaction costs by substituting capital for labor or by reducing the degrees of freedom of the worker in the production process and by automatically measuring the quality of intermediate goods. An underlying problem is that of measuring inputs and outputs so that one can ascertain the contribution of individual factors and the output at successive stages of production. For inputs there is no agreed upon measure of the contribution of an individual input. There is room for conflict

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5. The first economic revolution was the development of agriculture in the eighth millenium B.C. This section is further elaborated in Ch. 13, "The Second Economic Revolution" in North, 1981. I neglect in this essay discussion of a major source of pre-modern (and in less developed economies, modern) productivity growth stemming from improvements in health and nutrition. See Fogel (1991)

6. John Wallis and Douglass North, "Measuring the Transaction Sector in the American Economy" in S.L. Engerman and R.E. Gallman, eds. Long Term Factors in American Economic Growth, Chicago, University of Chicago Press, 1986

7. The recent essay by Becker and Murphy (1992) emphasizes the coordination costs associated with capturing the gains from trade but ignores the enforcement costs.

over the consequent payment to factors of production. For output, not only is there residual unpriced output, that is waste and pollutants, but also there are complicated costs of specifying the desired properties of the goods and services produced at each stage in the production process.

Firms using the technology of the second economic revolution have large fixed capital investments with a long life and (frequently) low alternative scrap value. As a result the exchange process embodied in contracts has to be extended over long periods of time, which entails uncertainty about prices and costs and the possibility of opportunistic behavior on the part of one of the parties to the exchange. A number of organizational problems emerge from the use of this new technology.

First, increased resources are necessary to measure the quality of output or the performance of agents. Sorting, grading, labeling, trade marks, warranties, licensing, time and motion studies and a variety of other techniques to measure the performance of agents are all, albeit costly and imperfect, devices to measure the characteristics of goods and services and the performance of agents. Despite the existence of such devices the dissipation of income is evident in the difficulties of measuring the quality of automobile repairs, of evaluating the safety characteristics of products or the quality of medical services, or of measuring educational output. The problems of evaluating performance are even more acute in hierarchies because of the difficulties of achieving low cost measurement of the multiple dimensions of the agent's performance.

Second, while team production permits economies of scale to be realized, it has done so at the cost of worker alienation and shirking. The "discipline" of the factory is a response to the control problems of coordination and shirking in team production. From the perspective of the employer the discipline consists of rules, regulations, incentives, and punishments essential to effective performance. Innovations such as time and motion studies are methods of measuring individual performance. From the viewpoint of the worker they are frequently viewed as inhuman devices to foster speedups and exploitation. Since there is no agreed upon measure of output that constitutes contract performance, both are right.

Third, the potential gains from opportunistic behavior increase and lead to strategic behavior both within the firm (labor-employer relations, for example) and in contractual behavior between firms. Everywhere in factor and product markets the gains from withholding services or altering the terms of agreement at strategic points offer large potential gains.

Fourth, the development of large scale hierarchies produces the familiar problems of bureaucracy. The multiplication of rules and regulations inside large organizations to control shirking and principal/agent problems results in rigidities, income dissipation, and the loss of flexibility essential to adaptive efficiency.

Finally there are external effects: the unpriced costs reflected in the modern environmental crisis. The interdependence of a world of specialization and division of labor increases exponentially the imposition of costs on third parties.

It is the institutional framework and the consequent costs of transacting (a product of both the institutional framework and the technology employed) that determine the degree of success of an economy in overcoming these obstacles to realizing the productivity implications of any given technology. Well specified and enforced property rights, decentralized political and economic decision making, and effective competition have been the underlying institutional structure for the organizational changes allowing modern economies to reap the productivity gains of this technology.

But the economic restructuring itself entails a still more fundamental restructuring of the entire society in order to create efficient economic markets This technology and accompanying scale economies entail specialization, minute division of labor, impersonal exchange, and urban societies. Uprooted are all the old informal constraints built around the family, personal relationships, and repetitive individual exchanges. Indeed the basic traditional functions of the family--education, employment (the family enterprise), and

insurance--are either eliminated or severely circumscribed. New formal rules and organizations and an increased role of government replace them.

The contention of Marxists was that the problems that resulted from this restructuring were a consequence of capitalism and that the inherent contradictions between the new technology and the consequent organization of capitalism would lead to its demise. The Marxists were wrong that the problems were a consequence of capitalism; they are ubiquitous to any society that attempts to adopt the technology of the second economic revolution. However, as the foregoing paragraphs have attempted to make clear, Marxists were right in viewing the tension arising between the new technology and organization as a fundamental dilemma.

It is surely one of the great ironies of history that Karl Marx, who first pointed out the necessity of restructuring economic and political institutions and organizations if a society was to realize the potential of a new technology, should have been responsible for the creation of societies that foundered on that specific issue. The demise of the centrally controlled economies of central and eastern Europe is a sober testimonial to the inability of economies to effectively reap the benefits of the technology of the second economic revolution with an institutional framework of centralized bureaucratic control of the economy.

For the less developed countries the radical alteration in economic, social, and political institutions and organizations that is necessary to realize the potential of the second economic revolution has in some cases been an insuperable hurdle. Indeed many third world countries have realized many of the social costs and tensions that have accompanied this revolution with few of the benefits.

These tensions have only partially been resolved in the market economies of the western world. The growth of government, the disintegration of the family, the incentive- incompatibility problems in many modern political and economic hierarchical organizations are all symptoms of the consequent problems besetting western economies.

However, the relative flexibility of the institutions of the western world--both economic and political--has mitigated these problems. Adaptive efficiency,8 while far from perfect in the western world, accounts for the degree of success that such institutions have experienced. The basic institutional framework has encouraged the development of political and economic organizations that have replaced (however imperfectly) the traditional functions of the family; mitigated the insecurity associated with a world of specialization; evolved flexible economic organization that has encouraged worker participation, reduced shirking and induced low cost transacting; resolved some of the incentive incompatibilities of hierarchies and encouraged creative entrepreneurial talent; and tackled (again very imperfectly) the external effects that are not only environmental but also social in an urban world.

III

A fundamental limitation of the traditional economics approach to the sources of productivity growth is that it fails to put the problems of growth and productivity in a dynamic institutional context. Even Baumol's study (1986) which has the virtue of "an appreciation of history" to use Jeffrey Williamson's felicitous phrase (J. Williamson 1991) misses the key element: that is, the growing size of the transaction sector that has been an integral part of the long run productivity increase of the American economy. Between 1870 and 1970 the transaction sector of the American economy grew from 25 to 45 percent of GNP (Wallis and North, 1986). A substantial part of that growth is accounted for by the increasing coordination costs associated with an economy of ever increasing division of labor. The development of specialized sectors of the economy to provide transaction services such as banking, finance, and insurance as well as the creation of

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8. For an elaboration of the concept of adaptive--in contrast to allocative--efficiency and the implications for economic performance through time see Pelikan, 1987

specialized departments inside firms (such as accounting, legal, and finance departments) was an essential part of the coordination process. The largest source of growth in the transaction sector between 1870 and 1970 came within firms. In 1870 only 10 percent of the transaction sector, 2 percent of GNP, was within firms in the non-transaction industries (industries other than wholesale and retail trade; finance, insurance, and real estate; and government). In 1970 over one third of the transaction sector, or 10 percent of GNP, was within those firms(Wallis and North, 1986). By now we have a substantial literature detailing the institutional and organizational changes--the supply side changes--that made the productivity growth possible from this new technology (Chandler, 1977, North 1981, O. Williamson, 1985, Nelson, 1981 and Nelson and Wright, 1992), and I would expect that the paper by Masahiko Aoki at this conference will explore this issue; so I shall not dwell on this aspect of the story.

But that is not all. The growth of the transaction sector has also been a result of the growth of rules and regulations that have evolved to deal with every facet of economic activity in the past century. They are a mixed bag of those that reduce transaction costs per exchange and those that raise transaction costs per exchange. Those that have reduced transaction costs have stemmed from well- specified and enforced property rights that provide incentives for productivity-enhancing behavior--both directly in terms of patent and trade secret laws, for example, and indirectly in terms of incentives to acquire knowledge--decentralized economic and political decision making, and effective competition in both economic and political markets.

But what have been the consequences of a century of the Interstate Commerce Commission on the productivity of United States transport industries? Do the laws with respect to competitition in the communications industries in the context of the radical changes in technology have no effect on the rate of productivity growth? What are the productivity implications of unitizing oil fields? Has the growth of environmental legislation had no effect on productivity growth? Does the growth of legislation dealing with safety, working conditions, seniority rules, etc. of the labor force influence productivity? Does the development of transfer payments affect incentives?

The frictionless, a-political framework of neo-classical economics does not lend itself to providing an integrated view of how economies operate. If pressed, most economists would agree that institutions make a difference but would not go beyond a gross distinction between a market economy and a planned economy or maybe a third world economy. If they did want to explore the institutional features of a market economy it would be in terms of rent seeking, which is described as though it were some kind of a disease that can afflict only such economies.9 It's not a disease--it's a feature of the incentive structure of any economy. It is not possible to create an institutional framework with unidirectional incentives all favoring efficiency.10 Even if it were economically possible, it would not be politically possible. There is no such thing as a neutral set of rules and their enforcement in an economy such as would be inferred from the use of the term, a laissez-faire economy. Everywhere and at all times the rules of the game are a mixed bag of incentives and disincentives with respect to their implications for productivity. And they are continually evolving. There is a complex on-going interrelationship between institutions, organizations, learning, the perceptions of the actors, and the choices they make.

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9. The study by Baumol et al (1989) concludes with a discussion of rent seeking as a potential source of productivity decline in the years ahead.

10. The study by Miller (1991) is an effective argument about the impossibility of creating unidirectional incentives in heirarchies.

Let me state five propositions about institutional change (derived from the variables described at the beginning of this essay) that will provide the analytical structure which I shall use to interpret the political/economic history of the second economic revolution.

1. The continuous interaction of institutions and organizations in the economic setting of scarcity and hence competition is the key to institutional change.

2. Competition forces organizations to continually invest in knowledge to survive.

3. The institutional framework dictates the kinds of knowledge perceived to have the maximum pay-offs

4. The mental constructs of the players, given the complexity of the environment, the limited feedback on the consequences of actions, and the inherited cultural conditioning of the players, determines perceptions.

5. The economies of scope, complementarities, and network externalities of an institutional matrix and the nature of learning make institutional change overwhelmingly incremental and path dependent.

The proper beginning for the political/economic history of the second economic revolution is in the distant past since it was the gradual evolution over many centuries of the decentralized and highly competitive polities and economies of the western world that provided the hospitable environment for both the development of the scientific disciplines of the second economic revolution and the relatively flexible and responsive political and economic institutions.11 The political institutions were those that established the rule of law and representative government. The economic institutions were embodied in relatively secure and enforced property rights that enabled economic organizations to make contracts across time and space. Those institutions provided not only the setting for the creation of the economic and political organizations that developed but also the incentive framework of high payoffs to productivity-raising activities.

The high pay-offs were embodied in the perceptions of entrepreneurs that the application of new scientific knowledge to solving economic problems would be fruitful but equally that the framework of rules and laws would be conducive to high rewards for those who were successful in harnessing the new knowledge to technology. The pioneering discipline was chemistry, which was applied to a wide range of industrial activities in the nineteenth century. It was German scientists who took the lead and German entrepreneurs who were the first to integrate chemical laboratories with chemical manufacturing(Rosenberg and Birdzell, 1986, and Mokyr, 1990). The systematic application of science to technology spread into every aspect of economic activity wherever the basic institutional framework provided a hospitible environment. The demand for educational investment and the growth of universities as the principal source of scientific knowledge was still another consequence. The restructuring of economic organizations to take advantage of this technology has been eloquently described by Chandler (1977). If these institutional changes were the whole story then our story would be one of sustained productivity expansion unleavened by other considerations.

An integral part of the second economic revolution, however, was a transformation into an urban, interdependent world with all the social problems I have briefly alluded to. In consequence that revolution is equally a social and political revolution. Its political and economic origins were observable in the late nineteenth century with the articulation of the discontent of those groups that perceived (rightly or wrongly) that they had not shared in the improved economic well-being. In the United States it was organizations such as the Knights of Labor, the Granger movement, the American Federation of Labor, the IWW, the Populist party that pressed for institutional change; change that was in part adopted by the Democratic party and eventually embodied in New Deal legislation and (at least partly as a result of the threat of court-packing by Franklin Roosevelt) judicial changes. The

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11. See North (1981) and Rosenberg and Birdzell (1986) for an analysis of this evolution.

resulting increase in the size and influence of government altered the relative gains to be realized by organizations as between economic and political policies. The growth of government; the increased insecurity associated with an interdependent world; the decline of the role of the family; and the external diseconomies (both environmental and social) all have led to the rise of new interest groups and ongoing institutional changes that are an integral part of the world we live in. While the particular timing and characteristics of the United States institutional change have been uniquely a feature of the path-dependent pattern of its institutional/organizational structure, the overall pattern of institutional changes embodied in the growth of government, transfer payments, and government intervention in economies has been a universal feature of modern economies.

While these social and political changes have been the subjects of a substantial literature, there has not, to my knowledge, been any successful effort to systematically integrate these demand-side institutional changes into the overall analysis of long run productivity change. It is not simply a consequence of neo-classical economics ignoring institutions; it is equally a consequence of the difficulty of developing macro-level data to measure their impact.12 It is one thing to measure the direct impact of environmental or regulatory legislation on transformation or production costs. Christainsen and Haveman suggest that federal regulations are responsible for from 12 to 21 percent of the slowdown in the growth of labor productivity in U.S. manufacturing during 1973-77 as compared to 1958-65 (1981, p 324). It is something else to measure the indirect impact in terms of increasing uncertainty and hence foregone choices. There is no easy way to measure the foregone production as a result of the time, costs, and increased uncertainty arising from the rules and regulations that today govern every aspect of production and exchange. One only measures transaction costs of existing economic transactions; unmeasured are production and exchange that do not occur because transaction costs are so great as to foreclose such economic activity. Yet to ignore these foregone opportunities because of the difficulties of measurement is to miss an essential aspect of the growth process. It is the exchanges that don't occur because of the high cost of transacting (and therefore producing) that are the real underlying source of poverty of third world economies and obviously critical in successfully analyzing sources of productivity change in modern economies.

Let me conclude this essay by suggesting ways by which institutions and transaction costs have influenced and continue to influence productivity change.

1. The most important insight on this subject is to recognize the critical facilitating role of a favorable institutional environment--political and economic--for creating the necessary conditions that made possible the second economic revolution. Creating such an environment is the most fundamental initial condition for the productive transformation of third world and eastern European economies.

2. There is a complex interdependence of institutional and technological change as an economy evolves. This subject is much too large to be dealt with here but I just mention several implications. The firm is concerned to minimize total costs, the sum of transformation costs and transaction costs. Minimizing total costs may result from a technological change that reduces transformation costs or from an institutional change that reduces transaction costs. But it may also occur by a technological change whose main impact is to lower transaction costs--development of the telephone, for example--or by an institutional change whose main impact is to lower transformation costs--unitizing an oil field, for example. Moreover, the productivity gains from the second economic revolution were sometimes initiated by technological changes which induced institutional change and sometimes by institutional changes which induced technological change.

3. The growth of government and government regulation has surely had, and continues to have, a major impact on productivity even if we have no direct way of

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12. Denison (1979) does attempt to examine the direct impact of such legislation

measuring its impact. While that impact would appear to be negative a more comprehensive measure of welfare might well modify that initial presumption if, in fact, regulatory and environmental legislation has had a positive effect on such a broader measure of welfare.

4. One consequence of the growth of government and government regulation has had an unambiguously negative effect on productivity and that is a shift in the locus of decision making of economic organizations from economic to political policies as the relative gains from using the political process have increased. It is this rent-seeking feature of institutional change that has received the attention of economists.

5. As economies have grown richer, they have increased the proportion of consumption of goods and, particularly, services--medical services being a conspicuous example-- with high transaction costs. The growth of the service sector of economies as they become richer has reflected this income elastic demand and has probably been a drag on productivity increase. This is another way of saying that the coordination costs of economies may increase as they become richer. However the advent of the computer should be a powerful force to help reduce transaction costs. The fact that it does not appear to have had a major influence on productivity, so far, has been a puzzle to economists concerned with the slowdown in productivity growth. Paul David, using the dynamo as an historical analogy, shows that the productivity consequences of that innovation were not realized until much later. In fact the striking advances in total factor productivity do not occur until the 1920s.13 David attributes the delay to the necessity of making complementary redesigns of the entire factory structure before the full productivity gains would be realized. I would add the complementary changes in institutions and organizations that would also have to occur as briefly alluded to in point 2 above. Recent evidence suggests we may be on the verge of realizing substantial productivity increase from the restructuring and reorganization of firms that has been made possible by the investment in data processing equipment.14 Whether that "re-engineering" will be sufficient to overcome the overall possible rising costs of coordination is an important task of future research.

We have only just begun the serious study of institutions and of the interaction of institutional analysis with more traditional economic analysis. The objective of this essay has been to suggest a redirection of research on productivity growth to a synthesis integrating institutional analysis with the traditional analysis of sources of productivity change contained in the growth accounting literature.

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13. David discusses the literature on the apparent paradox in "Computer and Dynamo: The Modern Productivity Paradox in a not-too-Distant Mirror" (1990)

14. See for example the Wall Street Journal, March 16, 1993 on the "Price of Progress".