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ACADEMIC CAPITALISM

In this book we examine ongoing changes in the nature of academic labor between 1970 and 1995, with an emphasis on the 1980s and 1990s. We argue that the changes taking place currently are as great as the changes in academic labor which occurred during the last quarter of the nineteenth century. As the industrial revolution at the end of the nineteenth century created the wealth that provided the base for postsecondary education and attendant professionalization, so the globalization of the political economy at the end of the twentieth century is destabilizing patterns of university professional work developed over the past hundred years. Globalization is creating new structures, incentives, and rewards for some aspects of academic careers and is simultaneously instituting constraints and disincentives for other aspects of careers.

The Scope of Change

We are not the only ones to argue that higher education as an institution and faculty as its labor force face change unprecedented in this century. David Breneman (1993b) deploys financial data persuasively, making the case that state and federal funds are diminishing as part of the higher education resource mix. He does not see these financial changes as an aberration in historical funding patterns, but as a new reality to which higher education will have to accommodate. James Fairweather (1988) studies how colleges and universities try to compensate for diminished government revenues through liaisons with business and industry, through partnerships focused on innovative product development, and through the marketing of educational and business services. Patricia Gumport and Brian Pusser (1995) examine the power accrued by state system administrative offices to shape programs and curricula and to standardize and routinize faculty work while costs are transferred to students. William Massy and Robert Zemsky (1990, 1994) speak to changing patterns of academic work, driven by an academic ratcheting process that encourages ever more research and is accompanied by a complex "administrative lattice" to

manage it, especially the growth of research on the perimeter of the university, where entrepreneurial centers and institutes bring in increasing amounts of external funds. Gary Rhoades (1997) writes about the legal and economic changes that promote increased management prerogatives to shape academic work and the concomitant loss of power on the part of unionized faculty. His analysis of union contracts reveals the erosion of faculty ability to set work loads, to establish staffing parameters, and to set broad curricular directions. Henry Etzkowitz and Loet Leydesdorff (1997) document the place of universities in the global knowledge economy.

Scholars of other countries address similar changes in higher education. Burton Clark (1993) writes about innovative European universities that are characterized by increased entrepreneurship; conflicting faculty and administrative values, especially around governance issues; and greater diversification of institutional funding. He points to a shift of cutting-edge institutional action from the liberal arts core to an entrepreneurial periphery. In the United Kingdom, Gareth Williams (1992, 1995) describes broad patterns of financial change which reduced government funding for universities and encouraged faculty to bring in increased external money for their units to survive. Michael Gibbons et al. (1994) study how changes in funding work to bring the university and its faculty in line with economic production and the managerial revolution taking place as a global economy develops. Although they emphasize the changes in science, engineering, and professional schools, which they now see as the center of the university, they also note that segments of all fields, including the social sciences and the humanities, are aligning themselves with the market. In Australia, John Smyth's (1995) edited volume *Academic Work* chronicles changes that, in broad outline, parallel those that have occurred in the United Kingdom. Simon Marginson (1993, 1995) elaborates on the "marketization" or increased market and marketlike behavior in which Australian institutions and faculty engage. In Canada, Howard Buchbinder and Janice Newson (1990), Buchbinder and Rajagopal (1993, 1995), and Newson (1994), too, describe diminished government funding and the beginning of marketization.

Our book draws heavily on the work of these scholars, using it to paint a broad picture of the changes faced by faculty and institutions of higher education, in particular, public research universities. Our work differs from that of these scholars in that we bring together topics that are usually treated separately, notably undergraduate and graduate education, teaching and research, student aid policies and federal research policies. Rather than looking at undergraduate education and the issues related to it (student aid policy, tuition costs, faculty productivity) as separate from graduate education, and at the issues that surround graduate education (national science and technology policy, including government research priorities, federal research funding, business and industry research funding), we bring these together so we can better grasp the degree of change taking place and begin to understand the forces driving it. We try to analyze change using a variety of theories and data sets, depending on our level of analysis: macro-political economic theory and national higher education policies to understand the global reach of change and how it plays out in higher education and research policies; resource dependence theory and data on national higher education financial trends to help us grasp the degree of postsecondary education change which has occurred at the level of the nation state; process theories of professionalization and case studies of institutions where faculty and administrators engage in entrepreneurial activities that are the spearhead of change: sociology of knowledge and case studies of faculty engaged in technology transfer which allow us to glimpse how faculty create new epistemologies in a changing world.

We divided our book informally into two parts and a conclusion. The first three chapters provide an introduction and overview. Chapter One introduces the key concepts and theories. In Chapter Two we examine global political economic change and then look at how Australia, Canada, the United Kingdom, and the United States developed national higher education and research policies that responded to the emergence of global markets. In Chapter Three we present data on higher education finance patterns for these four countries over a twenty-year period. These data show how the countries' postsecondary systems were shaped by the emergence of a global economy and resultant national higher education and research policy changes.

In the second part of the book, Chapters Four through Six, we present case studies of various institutions. The case studies concentrate on faculty and administrators engaged in the sorts of entrepreneurial activity so characteristic of academe's response to the macro-level changes presented in the first three chapters. In Chapter Four we examine how successful academic entrepreneurs assess the advantages and disadvantages of their work. We interviewed all faculty who generated external revenues above a certain cutoff point; the units they represented ranged from engineering centers to physical education. In Chapter Five we present case studies of faculty who were involved with a particular form of entrepreneurial activity, technology transfer, which is the movement of products and processes from the university to the market. In Chapter Six we focus again on faculty who transferred technology to the market, looking closely at how their work shapes their epistemology. We explore changing faculty values, norms, and beliefs.

In the conclusion, Chapter Seven, we sum up our findings and spell out the consequences for faculty and administrators in terms of academic life at the unit level (center and department), at the college level, and with regard to central administration. We also suggest likely impacts that increased faculty and institutional interaction with the market might have on different segments of the university, analyzing them in terms of closeness to or distance from the market.

During the industrial revolution, faculty in various nation states were able to position themselves between capital and labor, protecting themselves from the harsh discipline of the market.(Abbott 1988; Perkin 1989). Professionals negotiated a tacit social contract with the community at large, in which they received monopolies of practice in return for disinterestedly serving the public good (Furner 1975; Bledstein 1976; Haskell 1977). The very concept of a professional[1] turned on the practitioner eschewing market rewards in return for a monopoly of practice. Professionals made the case that they were guided by ideals of service and altruism. They did not seek to maximize profits: they claimed to put the interests of client and community first.

Although numerous scholars have questioned the degree to which professionals realized these ideals, for the most part professionals in the first half of the twentieth century did not participate directly in the market (Larson 1977; Starr 1982). Their interaction with the market was mediated by professional associations and by the law. Professionals did not advertise; they served clients, not customers; they often charged standardized fees that would have been considered price fixing on the open market. Persons not professionally certified were legally prevented from offering a wide variety of professional services (Brint 1994).

Faculty are a subset of professionals, although in some ways they are the paramount professionals because they have monopolies on advanced degrees and train and credential all other professionals. In this, their professional status is almost unique. In many ways, faculty historically have been more insulated from the market than have other professionals. Because they have worked for institutions that were nonprofit and often state funded, they have not become fee-for-service practitioners, whether solo or in group practice. Moreover, colleges and universities have had a tradition of autonomy from the market and the state (American Association of University Professors 1915; Berdahl, Levin, and Ziegenhagen 1978).

During the second half of the twentieth century, professors, like other professionals, gradually became more involved in the market (Slaughter and Rhoades 1990; Brint 1994). In the 1980s globalization accelerated the movement of faculty and universities toward the market in ways we will describe below. We think the 1980s were a turning point, when faculty and universities were incorporated into the market to the point where professional work began to be patterned differently, *in kind* rather than in degree. Participation in the market began to undercut the tacit contract between professors and society because the market put as much emphasis on the bottom line as on client welfare. The *raison d'être* for special treatment for universities, the training ground of professionals, as well as for professional privilege, was undermined, increasing the likelihood that universities, in the future, will be treated more like other organizations and professionals more like other workers.

The changes surrounding faculty and universities as they move into the market are complex and are seen most clearly at the increasingly permeable boundaries between the research university and its work force and the world outside the academy. Although these changes have far-reaching consequences for all of postsecondary education, we concentrate on public research universities because the changes in the nature of faculty patterns of work are most dramatic at these sites. Because these changes are impelled as much by organizations, institutions, and social forces outside higher education as inside, we use

1. All want to define themselves as professionals because professionalism is associated with status and prestige. In modern parlance the term is often used loosely to describe any occupation other than manual labor or blue collar work. In medieval times professionals were usually organized in guilds, were learned, and frequently possessed higher degrees, most often in theology, medicine, and law. In the nineteenth and twentieth centuries as specialization occurred, more occupations were classified as professions. Those included usually called for advanced learning and were often protected by state licensure from the pressures of the market, as was the case with medicine and law. University professors were not licensed by the state but were examined extensively by members of their specialties in the course of obtaining advanced degrees. From the 1950s through the 1970s sociologists of the professions frequently made the case that professionals were characterized by command of a body of specialized knowledge informed by theory, had sufficient autonomy to use that knowledge effectively, were licensed or accredited, and had a code of ethics and a tradition of service to society, in return for which they were exempted from market competition but received adequate compensation. Before the 1970s professionals were often, but certainly not always, self-employed. Professionals who met these criteria but were inadequately compensated were often referred to as members of the semiprofessions, which were often heavily dominated by women, for example, teachers, nurses, social workers, and librarians. In the 1970s and 1980s process theorists of professionalization challenged the earlier view, arguing that professionals were defined as much by their organizational ability and political power as by their expertise; they were deemed professionals when they were able to win jurisdictional wars and create monopolies of practice which ensured them prestige, power, and high salaries. In other words, the definition of a profession has always been hotly contested. Scholars agree that doctors, lawyers, and university professors are professionals, but these are only a very few of those who lay claim to being professionals. Professions are not fixed and static but always in the process of being socially constructed. For a more detailed review of the sociology of professions, see Chapters Five and Six as well as Larson (1977), Collins (1979), Abbott (1988), and Brint (1994).

theories and concepts that are not an integral part of the higher education literature to explain them. To deal with the complexity of the change we use different theories, data sets, and methods. At the international level, we use political economic theories, data on global economic change, and data on various higher education and research policies. At the national level, we use higher education finance data from Australia, Canada, the United Kingdom, and the United States, and we connect these data to resource dependence theory. At the institutional level, we use process theories of professionalization and sociology of science to help us interpret data from our case studies. In the course of this book we try to explain terms, to define what may be unfamiliar concepts, to provide an understanding of the several theories, and to clarify the way the theories articulate with each other at the several levels. We ask our readers to have patience and bear with us as we put forward our lines of argument, which at times are complex; we hope the material we present will repay close attention.

The political economic changes we examine are global and structural; they are not likely to disappear, allowing us to return to business as usual. In the 1970s and 1980s markets became global, in considerable part because of increased economic competition from Pacific Rim countries. Multinational conglomerates (large corporations manufacturing unrelated products) began to dominate the world economy. Established industrialized countries, such as the United Kingdom and the United States, lost shares of world markets to the Pacific Rim countries. Multinational corporations in established industrialized countries responded to the loss of market share by investing in new technologies so they would remain competitive in global markets. These corporations turned increasingly to research universities for science-based products and processes to market in a global economy.

The biological sciences exemplify the growing involvement of science and technology (or perhaps science *as* technology [Forman 1994]) in the marketplace. Before the 1980s, biology was a basic science whose faculty were concerned primarily with performing research for the National Science Foundation and authoring papers for scholarly conferences and journals. As corporations became more aggressive in their search for products for highly competitive global markets, they began to invest in molecular biology, the key to biotechnology. By the mid 1980s, most full professors of molecular biology held equity positions (they were given stock in return for their expertise) in spinoff companies (small corporations based on products developed in university or government laboratories) that sold products to large corporations and were on the national advisory boards of corporations with biotechnology products (Kenney 1986; Krimsky 1991). Corporations supplied 45 percent of the funding for academic biotechnology (U.S. Congress, Office of Technology Assessment 1991). When biology departments were restructured to feature molecular biology, many faculty became entrepreneurs.

Biology was not the only basic science that became entrepreneurial and whose faculty lost their relative insulation from the market. In the 1980s a variety of interdisciplinary centers and departments developed—materials science, optical science, cognitive science—which became involved increasingly in market activity. The shift occurred because the corporate quest for new products converged with faculty and institutional searches for increased funding.

As the economy globalized, the business or corporate sector in industrialized countries pushed the state to devote more resources to the enhancement and management of innovation so that corporations and the nations in which they were headquartered could compete more successfully in world markets (Jessop 1993). Business leaders wanted government to sponsor commercial research and development in research universities and in government laboratories. In the United States, the National Science Foundation, once regarded as the bastion of basic research, developed industry-university cooperative research centers in the 1980s and, under President Clinton, a national science and technology policy exemplified by the Advanced Technology Programs housed in the Department of Commerce (Slaughter and Rhoades 1996). In the United Kingdom, interdisciplinary research centers involving academic-industry-government funding emerged in the 1980s. Australia modeled its Cooperative Research Centers, founded in the 1990s, on the models provided by the United Kingdom and the United States (Hill 1993). Under Prime Minister Mulroney, Canada attempted to develop university-industry-government partnerships by tying increases in university research funding to corporate contributions for university research or for national research councils (Julien 1989). In all four countries, corporate CEOs worked with university leaders and government officials to develop partnerships aimed at bringing new products and processes to market (Slaughter 1990; Slaughter and Rhoades 1996). Faculty and research universities were willing to consider partnerships with business and government based on commercial innovation because government spending on higher education was slowing down.

The flow of public money to higher education was receding, in part because of increasing claims on government funds. In the 1970s the emergence of global financial markets made possible the financing of ever larger debts in western industrialized countries. These moneys were used primarily for entitlement programs (federally funded programs to which every citizen has a claim, e.g.,

primary and secondary education, health care, and Social Security), for debt service, and in the United States, for military expansion. As borrowing increased, federal shares of funding for postsecondary education programs, particularly research and development, decreased (Slaughter and Rhoades 1996).

In public research universities in the United States, the federal government is the primary funding agent for student aid and for research grants and contracts, but the several states[2] generally pay faculty salaries and institutional operating expenses. As the share of federal funds for higher education decreased, the states picked up some of the burden, but not all, because the states, too, were spending the bulk of their moneys on entitlement or mandated programs such as health care and prisons. After 1983, states periodically experienced fiscal crisis (state income failed to match state expenditures) that precipitated restructuring in higher education. In 1993–94 the several states, for the first time, experienced an absolute decline in the amount of money expended on higher education rather than a decline in the share of resources provided or in inflation-adjusted expenditures per student. Restructuring often put increased resources at the disposal of units and departments close to the market, that is, those relatively able to generate external grants and contracts or other sources of revenue. At the state and federal levels, then, conditions of financial uncertainty encouraged faculty and institutions to direct their efforts toward programs and research that intersected with the market.

To maintain or expand resources, faculty had to compete increasingly for external dollars that were tied to market-related research, which was referred to variously as applied, commercial, strategic, and targeted research, whether these moneys were in the form of research grants and contracts, service contracts, partnerships with industry and government, technology transfer, or the recruitment of more and higher fee-paying students. We call institutional and professorial market or marketlike efforts to secure external moneys *academic capitalism*.[3]

We had numerous and lengthy discussions with our colleagues about the term *academic capitalism*. Although some thought the term appropriate, others thought that it too strongly connoted a Faustian bargain with the "business class" (heads of large corporations who have regular face-to-face meetings on

2. When we use the term *state*, we mean the executive branch and administrative arm of government at the federal or national level. For the United States and Canada we will specify states or provinces or use the terms *the several states* or *the provincial governments*.

3. We are not the first to use the term *academic capitalism*. Edward J. Hackett (1990) uses the term to summarize important structural changes in academic science and notes that Max Weber described medicine and natural science as state capitalist enterprises sixty-five years earlier.

a series of boards and forums and are concerned with national policy formation [Useem 1984]). Especially in Australia, our somewhat social democratic colleagues saw *academic capitalism* as conjuring up stronger images of exploitation of the academic labor force than were warranted by current practices in colleges and universities. Others in Australia thought the term slighted the state, especially given that the state in most cases provided the great bulk of external moneys for universities and colleges, whether these were for basic or applied research, for university-industry partnerships, or for for-profit ventures handled through arm's-length corporations (corporations that are related to universities in terms of personnel and goals but are chartered legally as separate entities). Generally these (sometimes heated) discussions revealed the inadequacy of extant language to address changes that blur the customary boundaries between private and public sectors. The same kinds of language limitations make problematic descriptions of the increasing numbers of hybrid organizations emerging in a period of privatization and deregulation. In the end, because no one was able to formulate a more precise term, we decided to employ *academic capitalism* in part because alternatives—*academic entrepreneurism* or *entrepreneurial activity*—seemed to be euphemisms for *academic capitalism* which failed to capture fully the encroachment of the profit motive into the academy.

Of course, the word *capitalism* connotes private ownership of the factors of production—land, labor, and capital—and considering employees of public research universities to be capitalists at first glance seems a blatant contradiction. However, *capitalism* also is defined as an economic system in which allocation decisions are driven by market forces. Our play on words is purposeful. By using *academic capitalism* as our central concept, we define the reality of the nascent environment of public research universities, an environment full of contradictions, in which faculty and professional staff expend their human capital stocks increasingly in competitive situations. In these situations, university employees are employed simultaneously by the public sector and are increasingly autonomous from it. They are academics who act as capitalists from within the public sector; they are state-subsidized entrepreneurs.[4]

Although faculty and administrators at research-intensive universities may

4. We use the term *academic* to cover college and university employees who are professionals or quasi-professionals. In other words, we include tenure-track faculty, academic professionals, and administrators in the term *academic*, since academic capitalism is a phenomenon that encompasses the professorate, academic support staff, and administrators. We use the term *faculty* interchangeably with *professors* and mean by it tenure-track personnel. When we discuss a particular rank we will specify it, for example, *full professor*.

be state-subsidized entrepreneurs, their position in many ways is analogous to that of industrial researchers and entrepreneurs in primary sector industries (large, oligopolistic industries that produce critical goods and services and employ large numbers of persons, many of whom are unionized and receive a social benefits package as part of their wages and salaries [O'Connor 1973; Braverman 1975]). Many of these industries—for example, aerospace, computers, electronics, and nuclear industries, as well as pharmaceutical, chemical, and agriculture industries—are cushioned from the market by state support from a variety of federal agencies—for example, the Department of Defense, the Department of Energy, the National Aeronautics and Space Agency, the Department of Agriculture, and the National Institutes of Health. These industries are supported by the federal government because they are perceived to be critical to a number of national missions—primarily defense, food supply, and health. So important are these missions that the industries contributing to them are partially subsidized by the state rather than left to the vagaries of the market. Many of the science-based commodities and processes produced by these industries rely on the same technologies for which academic capitalists receive public and private support. In other words, academic capitalists are subsidized primarily from the same sources and for many of the same reasons as are industrial capitalists. The market, the state, and the academy (public universities are, of course, technically arms of the several states) are related in complex and sometimes contradictory ways. (For a fuller account of the relation among state-subsidized primary sector industry, universities engaged in basic research, and the emergence of market-oriented research, see Slaughter and Rhoades 1996.)

Another way to approach the idea of academic capitalism is through the widely accepted notion of *human* capital. What we mean by this is as follows. Almost everyone, today, is aware that the knowledge and skills possessed by workers contribute to economic growth. Conceptually, these worker capabilities make their contribution by adding to the *quality* of labor, which of course is one of the three factors of production, land and capital being the other two. Empirical demonstration of the importance of labor quality traces back at least to the work of Edward Denison (1962), who built national growth-accounting models. (Leslie and Brinkman [1988] update and synthesize the results of this long line of research up through the mid 1980s.) For production work, the quality of labor is built largely through formal education and on-the-job training. This brings us to the role of university academics in contributing to economic growth. Universities are the repositories of much of the most scarce and valuable human capital that nations possess, capital that is valuable because it

is essential to the development of the high technology and technoscience necessary for competing successfully in the global economy. The human capital possessed by universities, of course, is vested in their academic staffs. Thus the specific commodity is *academic* capital, which is no more than the particular human capital possessed by academics. This final step in the logic is to say that when faculty implement their academic capital through engagement in production, they are engaging in *academic capitalism*. Their scarce and specialized knowledge and skills are being applied to productive work that yields a benefit to the individual academic, to the public university they serve, to the corporations with which they work, and to the larger society. It is indeed academic capitalism that is involved, both technically and practically.

Academic capitalism deals with market and marketlike behaviors on the part of universities and faculty. *Marketlike behaviors* refer to institutional and faculty competition for moneys, whether these are from external grants and contracts, endowment funds, university-industry partnerships, institutional investment in professors' spinoff companies, or student tuition and fees. What makes these activities marketlike is that they involve competition for funds from external resource providers. If institutions and faculty are not successful, there is no bureaucratic recourse; they do without. *Market behaviors* refer to for-profit activity on the part of institutions, activity such as patenting and subsequent royalty and licensing agreements, spinoff companies, arm's-length corporations, and university-industry partnerships, when these have a profit component. *Market behavior* also covers more mundane endeavors, such as the sale of products and services from educational endeavors (e.g., logos and sports paraphernalia), profit sharing with food services and bookstores, and the like. When we talk about restructuring of higher education, we mean substantive organizational change and associated changes in internal resource allocations (reduction or closure of departments, expansion or creation of other departments, establishment of interdisciplinary units); substantive change in the division of academic labor with regard to research and teaching; the establishment of new organizational forms (such as arm's-length companies and research parks); and the organization of new administrative structures or the streamlining or redesign of old ones.

In this book we explore the emergence of academic capitalism by tracing the growth of global markets, the development of national policies that target faculty-applied research, the decline of the block grant (undesignated funds that accrue to universities, often according to formulas) as a vehicle for state support for higher education, and the concomitant increase in faculty engagement with the market. We argue from our data that a quiet revolution has already

taken place. Analysis of financial data shows a shift from state block grants to grants and contracts that are targeted on commercial endeavor. Within public research universities, fewer and fewer funds are devoted to instruction and more and more to research and other endeavors that increase institutional ability to win external funds. Faculty face a Catch-22 situation. Even when they are asked to focus on undergraduate teaching, most rewards are attached to bringing in external funds, funds that require them to perform research that may keep them from the classroom.

We concentrate our examination of changes in professional labor on four large English-speaking countries: Australia, Canada, the United Kingdom, and the United States, emphasizing Australia and the United States. We chose the major English-speaking countries because our research design and methods called for examination of documents and financial data and in-depth interviews and observations of faculty; and we are both essentially monolingual. Although we confined our study to English-speaking countries, we noted from various Organization for Economic Cooperation and Development publications that the public universities of *most* Western industrialized countries were moving toward academic capitalism, pushed and pulled by the same global forces at work in the English-speaking countries.

We did not consider private institutions because three of the four countries (Australia, Canada and the United Kingdom) have very little in the way of an independent (private) sector. The United States has a developed private sector but it serves only 20 percent of all students and only a relatively small number of private universities are heavily involved in the research enterprise. Although American exceptionalism figured in our decision not to study private research universities, the main factor in our decision not to include them was that private universities in the United States do not receive much in the way of government block grants; thus, the major factor we see as driving university destabilization did not affect private universities. Private universities in the United States have been involved in a variety of markets for a number of years and in some ways are prototypes of postindustrial universities, a concept we explore in the book's final chapter.

Movement toward academic capitalism is far from uniform; indeed, it is characterized by unevenness. Even within the English-speaking countries, there exists a continuum on this dimension, with Canadian academics probably least involved with the market and U.S. academics perhaps most involved. U.S. higher education institutions have always participated to some degree in commercial activity although we think the intensification in the last fifteen years has greatly exceeded past involvement and, as we said earlier, represents a difference *in kind* rather than in degree. In contrast, higher education in the United Kingdom and Australia has moved rapidly toward the market, the United Kingdom in the mid 1980s, Australia in the late 1980s.

We emphasized two of these countries, the United States because of our familiarity with it, and Australia because in 1991 we received Fulbright research grants to investigate the changing nature of academic labor there and the costs and benefits of commercial science and technology. Although the decision to emphasize the United States and Australia was to some extent happenstance, the two countries captured the political economic variation we sought to examine: incremental change and abrupt change, the United States under a Republican president, Australia under a Labor prime minister. Despite the great political differences between the United States and Australia in the relative power of the state, in the power of private capital, and in the rates of change in postsecondary education, both systems of higher education were moving toward what we called academic capitalism, providing an ideal situation for looking at the underlying forces moving the systems in the same direction.

We turn now to the plan of the book, providing a brief overview of the research questions that drive the several sections and separate chapters, a description of the data we use, and the theories that guide our interpretations of the data. The theories, the data, and the methods vary by level of analysis (global, national, institutional, individual), so in this section we concentrate on explaining the linkages among these. A more complete account of theory, data, and methods, as well as more detailed citations, is presented later in the book.

International Changes That Shape Higher Education

In Chapter Two we examine the growth of a global political economy and the development of Australian, Canadian, British, and American national higher education policies that seek to enhance national competitiveness by linking postsecondary education to business innovation. This linking is an effort to create national wealth by increasing global market shares through the discovery of new products and processes in order to increase the number of high paying, high technology jobs.

Two research questions inform Chapter Two. What forces are driving the restructuring of higher education? How are these forces manifested in national policy in the four countries? The data for the chapter are national policy documents, white papers, and legislation from the four countries which pertain to higher education. The method is comparative analysis of documents.

To answer the first question—what forces are driving the restructuring of

higher education—we look at political economic explanations of the emergence of global markets and explore the implications of global markets for research universities. Given that the changes occur across the four countries, we look to theories that deal with social forces shaping global change. We review three political economic interpretations of globalization: neoliberal political economics, as manifested in the Chicago school (Friedman 1981, 1991; Friedman and Leube 1987); liberal or post-Keynesian interpretations (Thurow 1985; Kuttner 1991; Reich 1991); and radical or post-Marxist ones (Jessop 1993; Barnet and Cavanagh 1994; Chomsky 1994). Although these theorists disagree markedly with regard to agency—be it market, capital mobility, or business class—all see the emergence, in traditional industrialized nations in the 1980s, of a global market creating conditions that mean less money for social welfare and education functions and more money for building corporate competitiveness. This trend has powerful implications for postsecondary education. National policy makers in advanced industrialized countries are moving discretionary research and training moneys into programs focused on the production aspects of higher education, programs that complement areas of innovation in multinational corporations, such as high technology manufacturing, development of intellectual property, and producer services (non–life insurance and reinsurance, accounting, advertising, legal services, tax consultation, information services, international commodity exchanges, international monetary exchanges, and international securities dealing [Thrift 1987; Sassen 1991]) and are reducing moneys that are targeted for programs for education and social welfare functions of the state. With regard to postsecondary education, some departments, colleges, and curricular areas gain revenue shares (e.g., some areas of the physical and biological sciences and engineering, business, and law), whereas areas such as the humanities, some physical sciences (e.g., physics), and most social sciences lose shares, as do fields such as education, social work, home economics, or family studies. In other words, policy makers at the level of the nation state, whether responding to pressures from the market, international capital mobility, or the business class, are concentrating state moneys on higher education units that aid in managing or enhancing economic innovation and thereby, competitiveness.

If changes in the global economy were causing national policy makers to shift resources to technology innovation, intellectual property, and producer services fields, we see changes in national legislation and in administrative directives to that effect in Australia, Canada, the United States, and the United Kingdom. Very generally, we found that all four countries developed national policies that promoted a shift from basic or curiosity-driven research to targeted or commercial or strategic research. We were particularly concerned with the ways in which national policies dealt with access to higher education, curricula, research, and autonomy for the postsecondary sector. In all four countries, policies that affected higher education were instituted, using a rhetoric about maintaining global market shares, creating national wealth, increasing the number of high paying jobs, and building prosperity. With regard to access, higher education policies encouraged greater student participation, but at a lower national cost. Most countries increased tuition, and most systems switched the balance from student grants to loans. In terms of curricula, national policies exhibited a strong preference for departments and colleges close to the market. The several countries, with the possible exception of Canada, were moving away from basic research toward entrepreneurial research. All of the countries, with one exception, started integrating higher education into broad government planning processes, processes that focused primarily on economic development. In short, national policies in three of the four countries moved decisively toward academic capitalism. At the same time, a variety of national policies pushed for greater higher education economy and efficiency, which turned universities toward restructuring and other adjustments.

In Chapter Three we look at the financing of postsecondary education in the four countries to see whether changes in national policy which foster market and marketlike behaviors have had an impact on colleges and universities. Specifically, we ask whether the changes in national policy described in Chapter Two have had concrete, measurable effects on spending patterns in the four countries. At the national level, we found resource dependence theory (Pfeffer and Salancik 1978) more useful than global political economic theory. At this level of analysis, we were no longer concerned with what caused changes in policy and how the new policies took shape. Instead, we wanted to analyze the national patterns of higher education revenue changes which these policies produced. Resource dependence theory suggested that public universities and colleges would focus on maintaining and expanding revenues, especially those most critical to the organization. We expected public research universities to respond to national policy directives and move toward marketlike behaviors because these organizations were heavily dependent on the state for funding, especially for research moneys.

Although there was some variation by country and postsecondary sector (research universities, polytechnics, community colleges), in general the results were in the expected direction. The percentage of gross national product devoted to postsecondary education did not always decline absolutely, but the rate of growth did decline. Further, revenue shifts were away from block grant

funding sources to those that reflected a "competition" or "market" base. Overall, general public funds for higher education were down, particularly when considered in constant dollars per enrolled students. However, revenue shares from other sources such as sales and services increased, as did shares from tuition. Private gifts, grants and contracts, and sales and services also were up. Expenditure patterns reflected the changes in the revenue environment. With regard to institutional expenditures, measured in shares of all expenditures, instructional funds declined, whereas research, public service, and administration expenditures increased. Relatively discretionary funding categories, such as operations and maintenance of plant and libraries, experienced large decreases, whereas student aid increased sharply. Very generally then, universities and colleges in all four countries seemed to be changing their revenue-generating patterns, moving from funding by general public means toward higher tuition and grants and contracts, private gifts, and other competitive sources of moneys.

Our analysis of financial patterns in the four countries demonstrated that all postsecondary institutions were receiving increasing revenues from market and marketlike activities, suggesting that academic capitalism may go far beyond research universities. Our case studies at public research universities indicate that academic capitalism is not confined to science and engineering and that faculty across a wide array of units engage in academic capitalism. Faculty seem to take for granted resources provided automatically by the state or several states—salary, space, some equipment—and actively seek those resources that go beyond standard institutional issue. In other words, money at the margins alters faculty behavior. If this pattern prevails throughout postsecondary education, academic capitalism will become the watchword of academic behavior.

Faculty and Institutional Response to Political Economic Change and Resource Dependence: Australian Cases

In Chapters Four through Six we look at the ways in which changes described in Chapters Two and Three play out in the daily lives of administrators, department heads, and faculty, using data from Australian research universities as our base. We pose two research questions: How do administrators and faculty describe the advantages and disadvantages of academic capitalism? How do individual academics respond to the rise of academic capitalism? We used qualitative analysis to deal with interview data from the several cases, although some interview data were quantified and used in cost-benefit taxonomies. In other instances institutional statistics were used to compare patterns of external income generation by departments at various institutions.

Resource dependence theory guides Chapter Four. Oversimplified, resource dependence theory suggests that organizations deprived of critical revenues will seek new resources. In the late 1980s Australian national higher education policies changed higher education financing so that faculty had to compete for government research funds rather than receive them as a prerogative of holding a university position. (A detailed account of these policy changes is presented in Chapter Two.) These government research funds were targeted increasingly on national priorities that were often concerned with Australian economic development. The federal government began to monitor institutions through a quality assurance scheme, rewarding universities that met agreed-upon goals and objectives. At the same time, the government share of funds for higher education decreased, and professors and institutions were encouraged to raise money from outside the government. Faculty and institutions began to recruit full-fee-paying overseas students, develop partnerships with industry for research and training, and create products and processes suitable for the market.

In other words, universities and faculty had to compete—engage in market and marketlike behavior—for critical resources. Research money is a critical resource for universities not only because most research money is raised competitively, but also because universities are prestige maximizers. Since most faculty teach, and many faculty perform public service, but fewer win competitive research funds from government or industry, research is the activity that differentiates among and within universities. Resource dependence theory suggests that faculty will turn to academic capitalism to maintain research (and other) resources and to maximize prestige. Put another way, if faculty were offered more resources to teach more students, it is not clear that they would compete for these moneys with the same zeal with which they compete for external research dollars. Further, faculty are selective in their pursuit of external research money. They go after basic or fundamental research funds with the same vigor as always, but increasingly they look for commercial research funding for frontier science and engineering projects that are tied to national policy initiatives and are partnered by prestigious firms, usually those that are national or multinational in scope.

Chapter Four uses two data sets. First, it examines the financial records of two Australian research universities. These were used to identify internal units that self-generated more than a few thousand dollars annually, regardless of the source of external funds. The associated entrepreneurial activities encom-

passed a broad array of projects, ranging from applied social science research contracts to moneys secured by engineering departments for the development of intellectual property. Second, we interviewed representative project managers and staff from the units that had entrepreneurial agreements as well as unit members who were *not* a party to these agreements or related work. The first part of each interview was a subjective discussion of the advantages and disadvantages of academic capitalism for the unit and for the university. The second part employed a technique used in economics research to impute quantitative values to qualitative variables, permitting a rough means of assigning dollar values to the qualitative criteria and for the calculation of a cost-benefit ratio.

Based on the data presented in this chapter, we suggest that faculty are willing to invest a great deal of professional energy in winning financial awards so long as the resources secured allow them to maintain or even enhance their place in the status and prestige system and permit some degree of discretionary spending. Faculty are quite willing to compete for commercial moneys if these resources do not conflict directly with traditional status and prestige hierarchies and compensate with symbolic rewards such as media association of science and technology with national economic competitiveness. In other words, faculty behavior may not be as difficult to change as scholars of higher education have thought. If resources do not undermine faculty status and prestige systems, a relatively small amount of money at the margins can alter faculty activity substantially. In resource dependence theory this is known as the *Rule of 10 Percent.*

The research questions that guided Chapter Five asked how university managers, center heads, and individual faculty responded to changing markets and changing resource mixes. How did faculty perceive the impact of academic capitalism on their unit, their universities, and their careers? Were they developing new strategies to deal with political economic change and national higher education policy change? If new strategies were emerging, did they result in organizational change?

Chapter Five uses resource dependence theory and process theories of professionalization (Larson 1977; Starr 1982; Abbott 1988; Perkin 1989; Brint 1994). Resource dependence theory sets the stage by establishing the limited funding faced by faculty and the likely direction they will take to handle austerity. But resource dependence theory, like the political economic theories we discussed earlier, is a theory of constraint which addresses social and political economic structures and perhaps does not concentrate as much on individual and collective human agency. Professionalization theory, more strongly

grounded in the daily practice of highly educated experts, helps us look at faculty as social actors in the drama of organizational change.

Process theories of professionalization view professionalization as a process for which knowledge, theory, expertise, and altruism are not enough; organizational, political, and economic skills are equally, if not more, important. Process theories of professionalization look at professionals' active agency, particularly at their intervention in the political economy, to gain a greater degree of control over their work lives and income streams, through, for example, state licensure laws. Because process theories of professionalization emphasize the ways that professionals act in moments of great change in the political economy—for example, the rise of industrialization (Bledstein 1976; Haskell 1977) and the formation of the welfare state (Finegold and Skocpol 1995)—they should help us understand how professors position themselves at the advent of global economy. Process theories of professionalization intersect political economic (Chapter Two) and resource dependence theories (Chapters Three and Four) in that the rise of a global economy exacerbates faculty and institutional resource dependence with regard to critical resources, especially those for research; faculty respond to these changes by attempting to develop new strategies to protect and enhance professional privileges at the level of the institution and the discipline.

The data for this chapter were interviews with forty-seven persons in eight units in three universities. We selected those units most deeply involved in technology transfer, which is the movement of products and processes from the university to the market. We selected faculty involved in technology transfer for close scrutiny because technology transfer is perhaps the most direct form of academic engagement with the market. Technology transfer often results in intellectual property, defined as patents and processes, trademarks or copyrights, and organized *consultancies* (an Australian term referring to faculty consulting activities that are channeled through the university and from which faculty receive one third of the profits, their college one third, and the university one third) aimed at the commercial market.

Generally, we found that faculty and institutional leaders were extremely sensitive to changes in the resource mix at the level of the institution and the field. In Australia, vice-chancellors encouraged faculty to act as entrepreneurs. Their hope was to develop products and services that would generate resources through for-profit activity such as licensing and royalties, direct sales, or shares of faculty consulting. The approaches administrators used to promote academic capitalism were various. Some administrators let faculty take the initiative. These administrators provided broad policy guidelines and offered incentives

to encourage faculty to discover and develop products and processes for the market, but they did not otherwise participate. Other administrators targeted particular products and processes and regulated their development closely. Yet other administrators worked with the business community and government leaders to create a large resource pool to support the development of complex technologies. In the last case, faculty were encouraged to band together in interdisciplinary arrangements to act as partners in relatively stable, ongoing enterprises.

Heads of departments or heads of centers very often aggressively developed procedures for generating revenues from faculty activity, including income from technology transfer activities that provided intellectual property, and from faculty consulting. They used new organizational structures to create interdisciplinary knowledge that tapped fresh revenue flows. Their tactics looked more like business plans than professionalization strategies. Very often the new units called for the addition of large numbers of professional officers and nonacademic staff, who were fiercely loyal to center or institute heads, did not engage much with faculty, and were not very interested in teaching. They were much more a part of the commercial culture than the academic culture and tended to bring commercial values to their work, concentrating on making their centers operate more like small firms, expanding commercial activity, and generating increased amounts of profit.

Faculty were more varied in their response than were central administrators and center heads. All of the full professors, most of the associate professors, but fewer junior faculty, regarded positively the entrepreneurial activity and development of intellectual property. Faculty especially valued the improved relations with external bodies, heightened prestige of their units, closer linkage to the economy (consulting opportunities, student employment opportunities), and added monetary benefits. Given that the faculty were primarily applied scientists or were from professional schools, they saw their entrepreneurial work as an extension of the research in which they were traditionally engaged, or, in the case of intellectual property, as a justifiable extension of that work. Junior faculty, postdoctoral fellows, and graduate students were less favorable in their views of academic capitalism. They felt that performance expectations had doubled because they were now supposed to demonstrate excellence in two research venues, fundamental *and* commercial.

For Chapter Six, we asked whether academic conceptions of the nature of knowledge were changing. Did the faculty still value fundamental or basic theoretical knowledge above all else, or were market pressures and resource dependence changing academic epistemology? How did professors deal with

the professional norm of altruism when they pursued the discovery and development of profit-making products and processes? If change was occurring, was it across all fields, or was it confined, in research universities, to fields that were close to the market? The complexity of the environment faculty faced pushed us to cross disciplinary boundaries, drawing on a variety of theories as we tried to understand the emerging epistemology of academic capitalism. As in Chapter Five, resource dependence theory set the stage for behavioral change on the part of faculty. Again, as in Chapter Five, we drew on professionalization theory to understand changes in faculty norms, values, and beliefs and the way the faculty, as organizational actors, manifested them. We pay particular attention to professionalization theory that examines faculty interactions with markets (Brint 1994). Because the majority of faculty we studied were scientists or engineers, we used sociology of science as well as science innovation theories to look at the intersection of science and markets (Gummett 1991; Etzkowitz 1994; Gibbons et al. 1994). We expected that faculty engaged in academic capitalism would begin to reconceptualize knowledge so that entrepreneurial research would be valued highly, especially entrepreneurial research on the frontiers of science and technology, research that involved discovery of innovative products and processes for global markets.

The data were from interviews with a subgroup of the sample in Chapter Five, the thirty tenure-track faculty located in units engaged heavily in academic capitalism. At the unit level—the interdisciplinary center or department—and in some fields or subfields, conceptions of knowledge were changing markedly. With regard to altruism, professors engaged in academic capitalism were ambivalent. Although they still hoped their research would benefit humankind, they began to speak about research paying its own way. If they were able to support their research with funds aimed at commercial targets, they saw no reason why other researchers could not. The same pattern held true in terms of basic versus applied research. They still considered basic research the bedrock of science, but they saw entrepreneurial research as folded into that stratum, forming a new composite. Merit was no longer defined as being acquired primarily through publication; rather it encompassed at least in part success with market and marketlike activities. Faculty were changing their conceptions of knowledge more rapidly than were administrators. For faculty in high technology fields close to the market, knowledge was valued as much for its commercial potential and resource-generating capability as for the power of discovery.

In our concluding chapter we explore the implications for the restructuring of postsecondary education, for patterns of professional work, and for emerging epistomologies of science. Although we draw on the data presented in our

cases, we also speak broadly to postsecondary education changes currently taking place in the United States. Finally, we present some alternatives for faculty and institutional leaders to consider as they respond to political economic and policy changes.

We conclude that a better understanding of academic capitalism will help faculty and staff make better sense of their daily lives; that successful academic capitalists will gain personal power within universities, both individually and collectively; that personal stress will increase for all organizational actors; that central administrators, too, will gain in the redistribution of power, whereas middle managers may become less important to organizational life; and that the concept of university-shared governance may suffer. In this we see a loss to the concept of the university as a community, where the individual members are oriented primarily toward the greater good of the organization. A major vehicle for redistributing power to the operating units of the university will be budget devolution, granting to the individual units both responsibility for raising revenues and the authority for spending it. We see governments that provide block grant funding and students whose tuitions cover only a relatively small share of instructional costs as possessing only limited power in effecting university response to their desires; this is in contrast with university responsiveness to those who provide money for specific purposes and mandate the accomplishment of those ends.

Perhaps our most keenly felt desire in writing this book was that the state and the electorate would become aware that the decline in undergraduate education perceived to exist in public research universities is a natural, almost unavoidable outcome of the decline in the share of revenues provided by government in block grant form. Reversing this trend will require greater state support, some way of inducing greater university responsiveness to the desires of the state, or some combination of the two. Although we believe that ultimately, in a competitive market environment, proportional shares of state block grant support and tuition revenues must follow students to the units that enroll them, we are not sanguine about this eventuality in the short or intermediate term. We hold that governments must create incentives for universities to allocate their resources along the general lines for which the state intends that they be spent.

2

ACADEMIC SCIENCE AND TECHNOLOGY IN THE GLOBAL MARKETPLACE

To PROVIDE A THEORETICAL grounding for our examination of higher education policies in Australia, Canada, the United Kingdom, and the United States, we begin this chapter by examining the differences between industrial and postindustrial political economies. Specifically, we look at which countries are winners and losers in the global marketplace, paying special attention to the four countries with which we are concerned, and especially to the United States, given its previous dominance of global markets. Next, we review briefly theories of globalization which purport to explain why particular nations are successful in the global economy. Then we link changes in the global economy to higher education by outlining the ways in which globalization theory explains the increased centrality of higher education systems to national strategies for securing shares of global markets. Finally, we examine changes in national higher education policies in the 1980s and 1990s in the four countries under consideration.[1] We are particularly concerned with the ways in which national policies deal with access to higher education, curricula, research, and autonomy for the postsecondary sector.

This chapter is informed by two research questions: What forces drove the restructuring of higher education and research in the 1980s and 1990s? How were these forces manifested in national policy in the several countries? The

We thank Philip Altbach, Robert Berdahl, Jan Currie, Ross Harrold, John Levin, Gary Rhoades, and Michael Skolnik for careful reading and helpful comments on this chapter.

1. Despite the recently created Department of Education, the United States does not have a national ministry of education equivalent to those of Australia and the United Kingdom. Like Canada, U.S. higher education is decentralized. Nonetheless, the United States makes national higher education policy through federal student aid policies as well through a wide array of research and develop agencies, ranging from mission agencies to the National Science Foundation to, most recently, the Department of Commerce. Policy directions established at the national level are often complemented by the several states, as with supplemental educational opportunity grants and university-industry-state government commercial development projects.

first question is important because it lets us gauge whether the changes we see are likely to be long lasting or short term. Are they the products of worldwide structural adjustments and therefore changes to which higher education must somehow accommodate, or are these changes (relatively) short term shifts with which we can cope by waiting for a return to business as usual? We argue that the changes stemming from globalization are of such magnitude that higher education systems will be strongly affected. The answer to the second question—how were these global forces of change manifested in national higher education policy—suggests the direction that change may take. Generally, we see three of the four countries moving toward academic capitalism, which emphasizes the utility of higher education to national economic activity and the preference for market and marketlike activity on the part of faculty and institutions. With regard to access, higher education policies encourage greater student participation but at a lower national cost. Rather than financing student participation, all countries are raising tuition, and most systems are switching from grants to loans. In terms of curricula, national policies exhibit a strong preference for departments and colleges close to the market. The several countries, with the partial exception of Canada, are moving away from basic research toward academic capitalism, and three of the countries have started integrating higher education into broad government planning processes that focus primarily on economic development.

Although we make the case that national higher education policies are converging in some very important areas, we do *not* see Australia, Canada, the United Kingdom, and the United States as necessarily responding to globalization in the same ways. As we point out in our treatment of the higher education policies in each of the several countries, the nations take very divergent paths to policies that support and strengthen academic capitalism. For example, higher education policies that promoted academic capitalism were initiated under conservative governments in the United Kingdom and the United States but under a Labor (liberal) government in Australia. In the United States and Canada the several states and provinces often pioneered partnerships that involved universities in academic capitalism, whereas in the United Kingdom and Australia centralized higher education ministries guided these processes. In contrast, in the United States, at the national level, Congress rather than the executive branch actively developed legislation that fostered academic capitalism. In other words, globalization is a systemwide force to which countries, the several states, and provinces develop unique responses, but the system effects are so powerful that higher education polices in some areas—access, curricula, research, autonomy for faculty and institutions—converge.

We identified these changes in national policy by looking at white papers, legislation, and policy directives from administrative agencies concerned with higher education. We also read numerous secondary sources on policy changes in the four countries. The method we used was comparative analysis of policy documents.

Industrial and Postindustrial Economies

What is the scope of economic change that characterizes the last quarter of the twentieth century, and how does it affect higher education? We have moved from an industrial to a postindustrial society, and higher education is more important to the latter. Postindustrial societies depend on higher education for training and research and development (R&D) to a greater degree than do industrial societies. Paradoxically, postindustrial economies may require fewer workers, regardless of their level of education, than industrial societies, and postindustrial society may not need these workers' skills for a lifetime, rendering obsolete the traditional concepts of career.

Many political economists see modern society in the throes of change as great as that which characterized the industrial revolution. They believe that current changes in the organization of work and the displacement of workers will be of the same or greater magnitude as was the shift from agricultural society to urban factory production. (For classic treatments of the dimensions of the shift from agricultural to industrial society, see Durkheim 1951; Weber 1958; Marx 1975.) Because we are enmeshed in the early processes of change, the outline of the future is not clear, and scholars are engaged in retheorizing macro–political economics and rethinking empirical indicators of change, fueling heated debates that offer widely different explanations for the causes of change and very different visions of the future. Although political economics is rife with controversy, a descriptive model of the differences between past and future is emerging.

Scholars address these differences through a variety of competing dichotomies: industrial versus postindustrial (Bell 1973), Fordist versus post-Fordist (Jessop 1993), mass production versus flexible production (Cohen 1993), manufacturing versus service industries (Thrift 1987; Sassen 1991), low technology versus high technology (Reich 1991; Tyson 1992), and industrial versus informational economies (Castells 1993). Within each of these dichotomies there is intense controversy (i.e., Bonefeld 1993 versus Jessop 1993; Reich 1991 versus Tyson 1992; World Bank 1993 versus Sakakibara 1993). We will refer to the differences between past and possible future as differences between indus-

trial and postindustrial political economies, not because we think that conventional industrial economies necessarily are disappearing or because we think industry and manufacturing are unimportant, but because the word *post* seems to characterize the nature of scholarly work on a number of fronts at this time—as in postmodernism, poststructuralism, post-Marxism—and captures our inability to name the present, let alone the future.

The industrial revolution was made possible by new sources of energy (steam, electricity, oil) which triggered mechanical invention in transportation (railroads, automobiles, airplanes), in agriculture (reapers, harvesters, processors), and in factory production (textiles, housing, food storage and processing), all of which served to move centers of population from rural to urban areas. The technological revolution that is sweeping the world today is powered less by harnessing new sources of energy and mechanical invention and more by advances in applied science and engineering, particularly in areas that deal with or make possible information generation, processing, and storage (Castells 1993). Among these new technologies are "advanced materials, advanced semiconductor devices and processes, digital imaging technology, high density data storage and optoelectronics . . . artificial intelligence, biotechnology, flexible computer-integrated manufacturing, medical . . . diagnostics and sensor technology" (Cohen 1993, 135). As important as the products derived from these processes are producer services—telecommunications packages, financial instruments, and legal tools that are as much product as service in that they can be sold and traded rather than immediately consumed—which make possible global trade and marketing of high technology goods and services (Thrift 1987; Sassen 1991).[2]

2. Producer services are tied to the rise of commercial capital, which has played an important role in globalization of the political economy. Producer services consist of non–life insurance and reinsurance, accounting, advertising, legal services, tax consultancies, information services, international commodity exchanges, international monetary exchanges, and international securities dealing. Business schools and law schools participate in the development of producer services and train graduates to use them (Thrift 1987; Sassen 1991). Castells (1993) argues that the change from an industrial to an information economy is more important than the change from manufacturing to services because the service sector encompasses so many diverse activities that it has become a residual category, ranging from producer services to janitorial services. He also points out, as do Thrift (1987), Cohen and Zysman (1987), and Sassen (1991), that there is "systemic linkage between manufacturing and the service sectors" so that many such activities are in fact "an integral part of the industrial production process." In other words, categories such as *manufacturing* versus *services* are less meaningful in a postindustrial economy, and scholars are attempting to develop new categories that break down old dichotomies and provide greater analytic leverage.

As many inventions of the industrial revolution were made by nonschooled amateurs and inventors as by trained scientists (Ben-David 1965; Noble 1976); most of the discoveries of the current technological revolution were made by persons with advanced degrees. The postindustrial technological revolution depends on universities.[3] Universities provide the training necessary for the increasing numbers of professionals employed by corporations to invent, maintain, and innovate with regard to sophisticated technologies and products. In an increasing number of cases universities are the sites where new technologies and products are developed, often in partnerships with business, through funding provided in part by the state.

The industrial revolution organized production through the assembly line, a mode of production often referred to as *Fordism* by non-American academics. As the term *Fordism* suggests, mass production was highly standardized, typified by the assembly line and *Taylorism* (scientific management, exemplified by supervisory control over workers' most minute movements on the assembly line), and usually occurred in vertically integrated, large-scale organizations. The system was fairly inflexible; products were not altered easily. It depended on massive accumulations of capital, top-down planning, and very long production runs. Tasks were repetitious and were supervised closely. In contrast, the organization of production in the dawning postindustrial era, exemplified by Japanese industry, is *flexible volume production*, which uses fewer workers, less space, and takes "half the investment in tools and machinery, half the engineering hours to develop a new product, and half the time to develop a new product. It also requires less than half the needed inventory on site, turns out products with far fewer defects, and yields a greater and growing variety of products" (Cohen 1993, 106).

Flexible volume production is a complex organizational strategy and is not a technological solution that could be imposed easily on manufacturing problems. Although the strategy can be learned, it is alien to Fordist organization of production and is correspondingly difficult for Fordist corporations to assimilate. Even though a number of Fordist corporations have attempted Japanese style management aimed at incorporating production workers into organizational decision making with regard to manufacturing, these efforts, often

3. As always, there are notable exceptions to generalizations such as the notion that the science and technology discoveries of the postindustrial revolution were made by college graduates. For example, Steven Jobs, of Apple Computer, and Bill Gates, of Microsoft, both dropped out of college but were nonetheless inventor-entrepreneurs of two of the most successful high technology corporations formed in the United States in the last quarter of the twentieth century.

labeled *total quality management*,[4] are not notably successful, in large part because Fordist management and workers seem unable to abandon their historic adversarial relationships.

Globally successful systems of flexible production are usually embedded in multinational corporations. As the trust was to the national economies of the twentieth century, so the multinational conglomerate is to the emerging global economy of the twenty-first century (Fligstein 1990). Multinational corporations are at the cutting edge of the market in most industrialized countries. From 1975 to 1990, U.S. multinationals' annual sales grew substantially faster than the U.S. economy as a whole: "the sales of the fifty largest industrial multinationals were 28 percent of U.S. GNP [gross national product] in 1975 and 39 percent of U.S. GNP in 1989" (Carnoy 1993, 49). Multinational services, particularly financial services, grew rapidly. The world's fifty largest banks more than doubled their assets between 1980 and 1990 (Carnoy 1993, 51, Figure 3.2; see also Sassen 1991; Cohen 1993).

The significance of multinational corporations to the world economy was enhanced in the 1980s when computers, harnessed to new telecommunications infrastructures, created a global market. For industrial corporations this meant managers were able to supervise far-flung business empires electronically, "so that the national economy now works as a unit at the world level in real time. In this sense we are not only seeing a process of the internationalization of the economy, but a process of globalization—that is, the interpenetration of economic activities and national economies at a global level" (Castells 1993, 19). With regard to financial services, advances in telecommunications in the 1980s made possible for the first time global trade in equities, bonds, and currency as well as more speculative financial instruments (Sassen 1991). Multinationals, then, were key organizational vehicles of globalization.[5] The infrastructure of

4. Total quality management focuses on the customer and the point of production rather than on management. Customer feedback is very important as is worker input. Workers committed to the corporation should be able to criticize constructively and improve the production process, creating more satisfied customers. Total quality management depends on shared commitment by management and workers to company goals as well as on a commitment on the part of management to workers and vice versa (Peters and Peters 1991). Under total quality management, managers would be unlikely to fire large numbers of workers during restructuring because that would create distrust, resistance, and undermine efforts to increase productivity. Given the adversarial relationships that often characterize Fordist manufacturing, the requisite level of trust is difficult to achieve, especially during periods of downsizing.

5. As a number of scholars note, the nationality of a corporation is sometimes very difficult to determine. For example, joint ventures allow U.S. automakers to market under their company names popular Japanese cars, as in the case of Mazda Navajo, which is a Ford Explorer made in Kentucky, and Geo Prism, which is a Toyota Corolla made in California. Conversely, Jaguars are made in England by a wholly owned Ford subsidiary. The United States insists that foreign companies manufacturing in the United States have a large local content. The Japanese government takes the position that "more than 60 percent of 931 Japanese-owned companies in the United States obtain at least 'two thirds of their materials in America,' but many of these 'American' suppliers are Japanese owned." Increasingly, multinationals, regardless of country of origin, use their "overseas subsidiaries, joint ventures, licensing agreements, and strategic alliances to assume foreign identities when it suits their purposes" (Barnet and Cavanagh 1994, 279, 280).

the global economy—computers, telecommunications, producer services—depends on university-trained personnel for continued innovation and for maintenance.

In the industrial era, labor was divided into craft and unskilled workers, with highly skilled craft unions gradually disappearing as increased emphasis was placed on mass production, a process that called for less skill on the part of labor (Braverman 1975). Mass production relied on large numbers of interchangeable blue collar workers in oligopolistic sector industries such as steel and auto and food processing, which were heavily unionized. The work was often boring, physically demanding, and dirty. These workers were full time, relatively highly paid, and had many fringe benefits—health, pension, vacation, time-and-a-half for overtime (O'Connor 1973). Assembly-line production was usually marked by hierarchy, with dramatic social and cultural distance between workers and managers, differences perhaps best captured by variations in education. Generally, assembly-line production required workers to have little education, often not asking for more than rudimentary reading and writing skills; not even completion of high school was necessary. In contrast, managers usually had some college (Jencks and Riesman 1968).

Under the postindustrial organization of production, labor looks very different, especially in Japan and the newly industrializing countries. Flexible volume production does away with the assembly line, taking instead a team approach. The distance between supervisor and worker is somewhat ambiguous, given that all employees are team members. Moreover, the team approach requires all workers to have a substantial grasp of design, engineering, and production processes. Sometimes production workers are even encouraged to participate in discussions about the organization of work and to introduce product and process changes. Workers who engage in the new organization of production—particularly in Japan, Sweden, and Germany—are well paid and receive a substantial array of benefits.

However, much of the work in established industrial countries has not shifted to flexible volume production, or it has adopted some features of the new organization of production and not others. Generally, redesign of work in

traditional industries in established industrial countries means that labor costs are reduced by forcing down wages while reducing expenditures on working conditions and social benefits, so that, all else equal, profit ratios increase proportionately (Henderson and Castells 1987). Productivity and profitability are also increased by elimination of redundancies, reduction of work time, introduction of technical innovations, and speedup (Henderson and Castells 1987; Harrison and Bluestone 1990). In their home countries multinationals in traditional industries employed declining numbers of workers who labored longer hours for less pay and substantially reduced benefits.

As part of the process of making production "lean," automation increased, and jobs were relocated to less costly production sites; the use of part-time labor grew, and unemployment increased. In Europe, unemployment has been about 12 percent since the late 1980s. In the United States, "if part time employment was calculated as partial unemployment, if the military was excluded from the employed (as it had been until the Reagan Bureau of Labor Statistics revised the basis for computing the number of job holders), and if discouraged workers—those who had stopped looking for work—were factored into the jobless figure" (Aronowitz and DiFazio 1994, 2), the percentage of U.S. unemployed would be about the same for Europe—12 percent.

In sum, industrial political economies were fueled by new sources of energy and invention which moved production from agricultural to urban areas. Postindustrial political economies are fueled by new advances in science-based knowledge and are powered by computers and telecommunications. Industrial political economies were organized along Fordist or assembly-line models of production, whereas postindustrial political economies use flexible volume or just-in-time production. The central organizational unit of the industrial economy was the trust or oligopolistic corporation, operating at the level of the nation state. The central organization unit of the postindustrial economy is the multinational corporation, which retains strong oligopolistic tendencies, operating globally. Under industrial economies, workers were not educated, and their jobs were often dull and repetitive. In postindustrial political economies the jobs of workers organized for flexible volume production are often varied and interesting and call for substantial knowledge and decision making. However, the numbers of flexible volume production jobs are not great. Product innovation almost always depends on university-educated personnel, often persons with advanced degrees. Managerial positions too are almost always filled by college-educated persons, many of whom now have advanced degrees.

Although we posit a set of neat dichotomies to mark the differences between industrial and postindustrial political economies, reality is less tidy. Neither

corporations nor countries adopt technologies and strategies for organization of production in a uniform manner. This unevenness is perhaps clearest with regard to the labor force. In established industrial countries some workers who are involved in flexible volume production have interesting and responsible, well-paid jobs with high benefits. But other workers, particularly in manufacturing jobs that still rely on many aspects of traditional industrial work organization, have had their jobs redesigned so that they work longer hours for less pay at repetitious jobs that have fewer and fewer benefits (Harrison and Bluestone 1990; Phillips 1993). And more and more workers are employed only part time or unemployed for significant segments of their careers.

Although the inventions that power postindustrial economies are likely to be made by scientists and engineers, MBAs and attorneys, computer and information scientists, the productivity gains embodied by these discoveries may reduce the demand for highly skilled professionals. A college degree no longer guarantees a good job. The percentage of net job growth for employees with some college or more in the low income stratum (less than $11,104 [in constant 1986 dollars]) increased by 12 percent from 1963–73 to 1979–86; the percentage of net job growth for employees in the middle income stratum ($11,104–44,412) decreased by 9.2 percent in the same period; the percentage of net job growth for the high income stratum ($44,413+) decreased by 7.8 percent (Harrison and Bluestone 1990, Table A.2) Postindustrial economies depend on personnel trained in colleges and universities and highly reward many, but they do not absorb all of the graduates these institutions produce, posing problems for higher education's claims to provide social mobility and adequate returns on students' investment in learning.

Winners and Losers: Theories of Globalization

Theories of globalization are those that purport to explain why some countries do better than others as political economies become more global. At first glance, globalization theories do not seem to speak directly to higher education. However, they do outline the magnitude of the political economic changes occurring across the four countries. These changes are putting pressure on national higher education policy makers to change the way tertiary education does business.

As the world makes the transition to postindustrial political economies, some countries do better than others. Overall, the rise of Japan and of a number of industrializing countries in Asia, often referred to as the Tiger Republics —Singapore, Malaysia, South Korea—as well as China, and now Vietnam, has

destabilized the bipolar trade relations that dominated world trade for most of this century. Twentieth-century trade was dominated first by the United Kingdom and, after World War II, by the United States. Trade relations were bipolar in that most world trade flowed between the United States and Europe. In the 1970s as established industrialized countries lost some of the advantages conferred by early industrialization and empire and neocolonial trade relationships, world trade became multipolar (Carnoy 1993; Cohen 1993). Indeed, some argue that the center of global economic growth has moved to the Pacific Rim (Castells 1993).

If we look at national shares of world output, we see that Japan increased its share from 5.8 percent in 1967 to 7.7 percent in 1986, and the developing Asian countries increased from 10.8 to 17.4 percent. Japan and China raised output more rapidly than any other country in the world, and the developing Asian countries far outdistanced any others. The United States and the United Kingdom lost shares, Australia and New Zealand held steady, and Canada made a very slight gain. The United States declined from 25.8 percent in 1967 to 21.4 percent in 1986; the United Kingdom declined from 4.8 to 3.5 percent. Australia and New Zealand held steady a 1.2 percent share, and Canada grew from 2.1 to 2.2 percent (Castells 1993, 25, Table 2.1). If we look only at gains and losses in manufacturing exports, the sector of national economies usually seen as most important to global competition, the shift with regard to winners and losers is even more dramatic. Again, Japan and the newly industrializing countries of Asia made the greatest gains, whereas the United States and the United Kingdom suffered the greatest losses. Calculated in 1/1,000 parts of world trade, Japan increased its performance in manufacturing exports in the period 1967–73 by 15.6, in 1973–80 by 9.0, in 1980–86 by 10.4. For the same periods, the increases for the newly industrializing countries of Asia were 14.7, 17.0, and 9.4, respectively. In contrast, in 1967–73 the United States change was –22.9, in 1973–80, 1.5, and in 1980–86, –21.1. For the same periods, the figures for the United Kingdom were –17.8, 2.0, –13.1; for Canada, –5.4, –4.3, and –3.4; for Australia–New Zealand, 3.8, –4.2, –2.2 (Castells 1993, 26, Table 2.2). If we look at productivity in the period between 1960 and 1990, the story is essentially the same. In this period the United States increased productivity by 2.9 percent, Canada by 2.9 percent, and the United Kingdom by 3.7 percent, while Japan increased by 6.9 percent. Established industrial countries increased their productivity by about 1 percent per decade; Japan increased productivity at a much greater rate (Cohen 1993, 11).

As world output was redistributed, several of these countries increased their national debt. The U.S. net government debt as a percent of GNP/GDP (gross

domestic product) increased from 19.2 percent in 1979 to 25.3 percent in 1984 to 31.2 percent in 1990. Canada's increased from 12.0 percent in 1979 to 26.1 percent in 1984 to 40.3 percent in 1990. The United Kingdom's debt decreased from 47.9 percent in 1979 to 47.4 percent in 1984 to 28.9 percent in 1990. Although the United Kingdom decreased its debt substantially, it still remained quite high, comparable to that of the United States, although not as high as Canada's. Only Australia brought its debt level close to that of Japan. Australia's debt was 27.7 percent in 1979, 25.1 percent in 1984, and 13.2 percent in 1990. Japan's net government debt was 14.9 percent in 1979, 27.0 percent in 1984, and 10.9 percent in 1990 (Oxley and Martin 1991, 148, Table 1).

At the same time, Australia, the United Kingdom, and the United States increased the inequality of income between the late 1970s and mid 1980s. "There was virtually no change in Canada. . . . Changes of around 1 percentage point in the Gini coefficient are observed in . . . Australia . . . [I]n the United Kingdom and the United States there was a more than 3 percentage point increase" (Atkinson, Rainwater, and Smeeding 1995, 49, Table 4.8).

Given that the United States dominated global markets from World War II through the 1970s, let us consider the U.S. case in somewhat greater detail. "Up to 1979, the United States had been the leading exporter of such [direct foreign] investments. By 1981, it had become the leading recipient, and had fallen to second place as an exporter of capital, behind the United Kingdom" (Sassen 1991, 37). In terms of balance of trade the United States was unable to uphold a "positive merchandise trade balance," falling from an indexed –2.3 in 1971 to –141.6 in 1985 (Cohen and Zysman 1987, 62, Table 5.1). The U.S. share of world exports fell "in value terms from 26 percent of world markets in 1960 to 18 percent in 1980—before the dollar aggravated matters" (Cohen and Zysman 1987, 64, Figure 5.1). Even the U.S. high technology position was weak, with the majority of high technology exports concentrated in military goods (Business–Higher Education Forum 1986a, 1986b; Cohen and Zysman 1987).

What loss of share in world output, loss in manufacturing output, declines in productivity and standards of living, and increases in national debt suggest is that the Fordist era of high wage, mass production, and mass consumption which characterized the established industrial countries from 1940 to 1970 is over. The rise of Japan and the other Asian countries destabilized the bipolar world trading patterns that had built prosperity within the established industrial countries. Political economists, together with politicians and business leaders, began to try to explain and correct the disturbing decline among the established industrial countries.

For the most part, the various political economic theories that explain pat-

terns of winners and losers among countries are partial and incomplete, with visible lacunae, a situation not unexpected in a transitional period. The debates surrounding these theories are intense because the theories are at once explanations and proscriptions, the voice of research and attempts to influence the policies of nations. We present these theories in broad outline, hopefully not oversimplifying to the point of caricature, even though we gloss over the controversy among and within the various theoretical camps. In very rough terms, these theories can be characterized as neoliberal, liberal or post-Keynesian, and radical or post-Marxist.

The neoliberal or Chicago school perspective deemphasizes the polity, instead stressing the role of the market in national economic success. The neoliberal school sees market forces as impersonal, disembodied, and inexorable, as supplanting national economies with a global market. To compete successfully in the new global market, nations have to cut back, reducing social welfare and entitlement programs, freeing capital and corporations from taxation and regulation, allowing them to operate unfettered (Friedman 1981, 1991; Friedman and Leube 1987). In the neoliberal model the only acceptable role of the state is as global policeman and judge, patrolling the edges of the playing field to make sure it remains level, adjudicating trading infractions and transgressions. In this model the private sector is privileged as the engine of competition, and the state is no more than a drag on economic growth. A major problem for this explanation of losers and winners in global competition is that the most successful countries in the past twenty years are Japan and the newly industrializing Asian countries, all of which have well developed industrial policies, relying heavily on the state to coordinate their multinationals' global strategies. (For a dramatic instance of conflict over the Chicago model, see the Japanese objection to the World Bank [1993] report; for further elaboration, see Sakakibara [1993]). Indeed, the Asian countries seem not to employ the same rigid distinctions as do Western, English-speaking countries with regard to private and public, or, to speak somewhat more broadly, between civil society and the state, and instead see public and private as permeable and complementary.

Keynesian political economics were built at the level of the nation state. Federal control of the money supply was used to stimulate or slow national economies, thereby avoiding depression. As global markets emerged and national controls on international flows of capital were eased to take advantage of expanded opportunities, capital mobility increased. Greater international capital mobility made manipulation of the economy at the national level more difficult. At the same time, the warfare-welfare approach to the political economy characteristic of the United States and the United Kingdom became more

difficult to sustain. The end of the Cold War, together with the growing critique of defense R&D as a tool for technology innovation, made stimulation of the economy through military expenditures problematic. Simultaneously, increased global competition made political and economic justification of the social wage or social safety net more difficult (Thurow 1980; Melman 1982). In other words, the growth of a global economy, the increase in capital mobility, the end of the Cold War, and the erosion of the social wage made Keynesianism inadequate in the postindustrial era.

Liberals or post-Keynesians have tried to devise industrial policies that enable established industrial nation states to compete more successfully in traditional "smokestack" industries and to stimulate new high technology industries, largely through increasing R&D and productivity (Porter 1990; Reich 1991; Tyson 1992). In this view the nation state plays a role in stimulating high-technology innovation, in building human capital to exploit high technology in multinational corporations, and in creating a climate favorable to investment at home (Carnoy et al. 1993).

Although post-Keynesian political economists emphasize the stimulating and supportive role the state plays with regard to the economy, they simultaneously embrace free trade. For the most part, they eschew direct mechanisms for planning, relying instead on a bottom-up approach, in which industry, by taking advantage of government-subsidized opportunities for R&D stimulation—for example, the Advanced Technology Program in the United States—targets areas for state support in developing products for the global market (Etzkowitz 1994). A major problem for proponents of this type of post-Keynesian approach to the political economy is that the United States and United Kingdom had substantial increases in productivity in the late 1980s and early 1990s, but these did not translate into increases in wages and standards of living. According to the most recent Organization for Economic Cooperation and Development study (1990a), income distribution in Australia, the United Kingdom, and the United States showed a rise in inequality between the late 1970s and middle 1980s, particularly in the United Kingdom and the United States (Atkinson, Rainwater, and Smeeding 1995).

Post-Marxists continue to develop an important critique of global capitalism, even as they recognize that highly centralized state socialism is no longer a viable political economic alternative (Bowles 1992). Post-Marxists see the private sector working through the apparatuses of the several nation states and various international trade organizations and tribunals to level the playing field so that stateless multinational corporations can dominate the global economy, establishing a new international division of labor. In this new international

division of labor multinational conglomerates move production facilities to those parts of the world which provide the most profitable combination of capital and labor, disproportionately to the lowest wage states that offer the greatest incentives to multinationals (Frobel, Heinrichs, and Kreye 1980; Chomsky 1994). Multinational CEOs are able to manage far-flung global production through the information superhighway and telecommunications. In this model, owners and managers of stateless multinationals, as well as owners and managers of the many ancillary businesses that serve them, are winners; and workers, whether high technology or low, and the unemployed, rooted or trapped in nation states, are losers.

The major problem for this explanation, as other post-Marxists as well as post-Keynesians have noted, is that there is little relationship between labor costs and international competitiveness. Much more important than labor costs in predicting an economy's productivity is the technological level of the industrial sector (Castells and Tyson 1988; Castells 1993). In other words, when multinationals relocate plants they choose industrializing countries with relatively high levels of technological development, avoiding the lowest cost, least developed countries, especially in Africa and in parts of South America, which political economic geographers now refer to as the *Fourth World* (Castells 1993).

Political economists who are neither post-Keynesians nor post-Marxists, but perhaps fall somewhere in between the two camps, argue for established industrial countries modeling themselves more closely on the Japanese and newly industrializing Asian countries and developing state planning capacities as well as mechanisms for capturing and redistributing more equitably the profits from multinational enterprises. They argue that national policies strongly influence competitiveness, especially national policies on labor availability and technological infrastructure, on R&D, on high technology and management training, and on protection from foreign competition and concessions from foreign multinationals (Harrison and Bluestone 1990; Carnoy 1993; Barnet and Cavanagh 1994). However, they do not speak to the political strategies and governmental mechanisms that would make such policies viable, particularly in countries such as the United States and the United Kingdom, which have traditionally tried to minimize the role of the government in economic planning.

Globalization and Higher Education

Globalization has at least four far-reaching implications for higher education. First is the constriction of moneys available for discretionary activities such as postsecondary education. Second is the growing centrality of techno-

science and fields closely involved with markets, particularly international markets. Third is the tightening relationships between multinational corporations and state agencies concerned with product development and innovation. Fourth is the increased focus of multinationals and established industrial countries on global intellectual property strategies.

Despite the lack of a coherent conceptual understanding of why some countries are winners and others losers, three of the four established industrial nations that we studied, the exception being Canada, responded to increased global competition with conservative political economic policies. The policies are conservative in that they are aimed at regaining the nation's past positions, in the case of the United States and the United Kingdom, positions of global preeminence; in the case of Australia and Canada, positions that retain prosperity rooted in material abundance based on agricultural and extractive industries. In the 1980s and 1990s three of the four nations, the exception again being Canada, regardless of the political party in power, pursued supply-side economic policies, shifting public resources from social welfare programs to economic development efforts, primarily through tax cuts for the business sector but also through programs that stimulated technology innovation, whether through military or civilian R&D (Jessop 1993; Mowery 1994). (Although Canada was not able to institute such policies at the national level, a number of provincial governments did [Bell and Sadlak 1992; Michael and Holdaway 1992].) At the same time, all four countries attempted to reduce government expenditures to their national debt. As supply-side economic and debt-reduction policies were instituted, entitlement programs, particularly Social Security, Medicare, and primary and secondary education, expanded enormously, largely in response to demographic changes.

This combination of policies—supply-side economics, debt reduction, and increased entitlements—had powerful consequences for postsecondary education. Although postsecondary participation rates vary greatly among the four countries, none of the nations treats higher education as an entitlement program. Given the fiscal constraints imposed by conservative supply-side economic and debt-reduction policies, together with the growth of entitlement programs, less public money was available for postsecondary education, and what new money was available was concentrated in technoscience and market-related fields in what amounted to a higher education version of supply-side economics. In the words of a recent British white paper, postsecondary education in all four countries was directed toward national "wealth creation" and away from its traditional concern with the liberal education of undergraduates (White Paper 1993).

Whether scholars write about "high technology" (Reich 1991), the "information economy" (Castells 1993), or "technoscience" (Aronowitz and DiFazio 1994), they see as central to global competition national strength in computers, telecommunications, electronics, advanced materials, artificial intelligence, and biotechnology, whether as the basis for whole new industries or as a means for streamlining old industries. Technoscience makes impossible the separation of science and technology, basic and applied research, discovery and innovation (Touraine 1974; Lyotard 1984; Aronowitz and DiFazio 1994). Technoscience is at once science and product. It collapses the distinction between knowledge and commodity; knowledge becomes commodity. Telecommunications and biotechnology exemplify technoscience (Sassen 1991; Keyles and Hood 1992).

Although discussion of technoscience is usually confined to the physical and biological sciences that are related directly to manufacturing, the distinction between manufacturing and services is increasingly difficult to maintain (see Note 2), and the social sciences and professional schools are developing services with technoscience components which are marketed as products. Examples are legal tools and financial instruments as well as software packages that depend on sophisticated mathematical and statistical capabilities. In some ways technoscience is congealed intellectual labor, embodied in infrastructure, product, and software, authoritative, almost irrefutable, because its functions and formulas are inaccessible, distanced from ready manipulation and intuitive understanding (see Latour and Woolgar [1979] on the ability of technology to resist intellectual challenge). Universities, whether through R&D or education and training, are the font of technoscience for postindustrial economies.

As movement from bipolar to multipolar world trade heightens global competition, corporations and state agencies often work together to stimulate technoscience. Business leaders want increased civilian R&D to develop technoscience products competitive in global markets (Mowery 1994; Etzkowitz 1994; Slaughter and Rhoades 1996). Political leaders seek to stimulate technoscience as a way out of the impasse created by the failure of the Keynesian nation state. Leaders of nations, corporations, and universities hope that subsidy of technoscience innovation will recreate the prosperity of the post–World War II period (1945–70). Specifically, they see technoscience as generating numerous high paying jobs that will replace the well-paid blue collar manufacturing jobs characteristic of Fordism. In the four countries, leaders of state as well as business leaders have come together around programs to stimulate innovation, usually through building industry-government-academic partnerships led by

industry, held together by government, and serviced by universities on the technoscience side (Business–Higher Education Forum 1983; Buchbinder and Newson 1990).

Because multinationals and nation states are pursuing technoscience as the way to increase shares of world markets, they are simultaneously pursuing intellectual property protection strategies. To reduce multipolar competition, especially from states with low labor costs and rising educational attainment, established industrial countries have worked assiduously to protect the intellectual property embodied in technoscience. The European Community (EC), General Agreement on Tariffs and Trade (GATT), and North American Free Trade Agreement (NAFTA) all recognize copyright and patents and attendant royalty and licensing agreements and have strong sanctions for violation.[6] Universities are a source that corporations and governments look to for discovery that will yield intellectual property. (To some degree, universities, at least in the United States, also compete with corporations, given that many universities have established technology licensing programs to increase institutional revenues [Slaughter and Rhoades 1993].) Leaders of corporations, government, and tertiary institutions increasingly see faculty work as possible intellectual property, more valuable in global markets as product or commodity than as unremunerated contribution to an international community of scholars.

Globalization theories underline the importance of higher education to technoscience, to industrial policy, and to intellectual property strategies. Universities are the central producers of technoscience, the primary product of postindustrial economies. At the R&D level, faculty and graduate students participate in innovation, increasingly working with industry on government-sponsored technoscience initiatives. Advances in R&D create new fields of knowledge—materials science, optical science, electronic communications, biotechnology—which reshape undergraduate education. Universities provide the high level of training, at the undergraduate and graduate levels, essential to technoscience. Increasingly the service component of universities is being rein-

6. Copyrights and patents are monopolies, protecting their holders from competition for various periods of time. Patents provide a seventeen-year period, with possible renewal at the end of that time. The Copyright Act of 1976 provides for copyright for the lifetime of the author plus an additional fifty years. During the period in which the patent or copyright is held, it is possible for the owner to gain control of markets and eliminate competition. The counterargument is that authors and inventors would not create intellectual property without the possibility of being rewarded through royalties and licenses derived from copyright and licensing, nor would businesses invest in new products unless they were able to reduce risk somewhat through purchase of copyrights and patents.

terpreted as contributing to national wealth creation (White Paper 1993). As Guy Neave puts it, "education is less part of social policy but is increasingly viewed as a subsector of economic policy" (1988, 274).[7]

National Higher Education Policies

To understand more concretely the impact that globalization has had on higher education policy, we review policy development in the four countries from 1980 forward. We look at both science and technology policy (research and graduate level education) and access, curricula, and financial aid policies (undergraduate education). We think that graduate and undergraduate policies cannot be understood separately, given the degree to which graduate education drives undergraduate, particularly at research universities. We also look closely at the way changes in higher education policy at the national level shape institutional and faculty autonomy. And, of course, we examine the degree to which national policies promote academic capitalism.

The United Kingdom

The United Kingdom demonstrates dramatically the pattern of change that has taken place in tertiary education in the four countries in response to global competition. With regard to access, in a twenty-year period the system moved from an elitist binary system, with the greatest numbers of students in the lower tier, to a unitary system that was expanded at the expense of the higher tier. In terms of career training and curricula, national policies privileged science and technology in terms of the numbers of student places and research. National research policies moved away from basic or curiosity-driven research to research tied more tightly to state initiatives aimed at increasing industrial competitiveness. Overall, the system lost autonomy because of major changes in governance structures, and professors lost many of their prerogatives with regard to control over their work.

Like many others, the British higher education system expanded greatly in the post–World War II period, nearly quadrupling in size between 1945 and

7. Neave writes about European countries generally rather than the four countries with which we are concerned. Overall, the European Community is developing policies on commercialization of science and technology congruent with those discussed here, strengthening the established industrial countries' attempts to maintain global shares through technoscience. There are, however, setbacks to the general direction of European Community policies, as in the case of the rejection of patents for living things, whether animal, plant, or person. The United States permits the patenting of life.

1970, doubling from 7 percent in 1964 to 13 percent in 1971 (Kogan and Kogan 1983; McFarland 1993). In 1963 the high point of expansion was probably reached with the Robbins Committee, which articulated the principle that all those who qualified for entry and wanted a place should be able to attend college or university. Universities were characterized by a powerful professional culture that explicitly rejected entrepreneurial initiatives and business goals (Robins and Webster 1985). Universities enjoyed a great deal of autonomy (Berdahl 1959). The University Grants Committee (UGC) acted as a buffer between the state and the institutions and had the authority to make decisions on institutional resource requests for research, drawing funds directly from the Treasury Department after making decisions about research funding on the basis of national needs for research in particular areas and on academic criteria for excellence in research (Shattock and Berdahl 1984).

Although tertiary education was not favored in terms of resources in the 1970s, higher education policy did not change dramatically in the United Kingdom until the 1980s. Thatcherism was the driving force behind the change (Gamble 1989). According to Michael Shattock (1989, 34),

> Within three days of Mrs. Thatcher's taking office in 1979, 100 million pounds were cut overnight from the universities' budgets, and, between 1980 and 1984, 17 percent was removed from the grants made by government to the UGC (University Grants Committee, which, at that point provided about 90 percent of the operating costs of British universities). . . . Four thousand academic posts were lost, mostly through government-funded early retirement. And, from 1985 onwards, the universities have lost a further 2 percent per annum from their budgets.

In the mid 1980s British business leaders worked with the Thatcher government to build an enterprise culture in tertiary education. In 1985 the push was articulated forcefully by the Jarrett Committee, chaired by a leading industrialist, which called for higher education to adopt more efficient managerial styles and structures. Business leaders organized the Council for Industry and Higher Education, an independent body supported by corporations. The council was composed of thirty-two heads of large companies and twelve heads of tertiary institutions. "Its aim was to encourage industry and higher education to work together, and its policy paper *Towards Partnership* (1987) argued for greater access to and more variety in higher education, as well as a shift toward science and technology provision" (Pratt 1992, 38). This group sought successfully to increase places in science and technology, particularly in the less costly polytechnic sector, and to increase civilian R&D, integrating it with economic development.

The work of politicians, industrialists, and higher education managers bore

fruit in a 1987 white paper and the 1988 Education Act. The white paper called for "major changes . . . to improve the effectiveness and purposes of higher education." In particular, "higher education should serve the economy more effectively" and "have closer links with industry and commerce, and promote enterprise," and expand access "to take account of the country's need for highly qualified manpower," including studying the needs of the economy so as to achieve "the right number and balance of graduates." Research should be targeted "to prospects for commercial exploitation" (Secretary of State for Education and Science 1987).

The 1988 Education Act began to make these intentions law. It diminished differences between universities and polytechnics, abolishing the UGC along with the polytechnic board, and replacing them with smaller boards, dominated numerically by business leaders (Fulton 1991). This was a powerful attack on the autonomy of academics, symbolic of the end of an era of independent academic culture (Shattock 1994). Along with the demise of the UGC, the government directed that "state expenditures on higher education should be regarded as payments for services provided rather than as block grants to institutions" (Johnes 1992, 173). Universities and polytechnics were forced to develop competitive bidding schemes for students to increase institutional cost effectiveness.

In 1992 the binary system was abolished by the Department of Education and Science (DES). Teaching and research, once considered a single function in university funding, were differentiated and each allocated to institutions on a separate bidding system. Teaching moneys depended on numbers of undergraduate students and quality assessments, which looked at quantifiable outcomes and which were performed by agencies outside the institutions (Peters 1992). The research allocations previously incorporated in large institutional grants given automatically to universities were taken away, and competition for research was opened up to the system as a whole.

According to Martin Trow, Sir Peter Swinnerton-Dyer, head of the Universities Funding Council, which oversees the new unitary system, takes the following position,

> (i) Enrollments in higher education in the U.K. are going to grow over the next decades. (ii) Public money for the system may grow also, but not at current cost levels and not as fast as enrollments. (iii) Therefore the unit of resource must and will continue to decline, although the Government is not prepared to say when the unit will hit bottom, nor is it prepared to discuss capital costs at this time. (iv) On the whole, capital growth will be a problem for the universities and not of the central government. (v) Public policy for higher education in this country has as its main goals to get more teaching and research for less public money, at less per unit of teaching and research. On the whole this is to be seen as an improvement in the efficiency of your institutions. (Trow 1992, 214)

In other words, abolishing the binary divide was a way of reducing the very high costs of universities by allowing less prestigious polytechnics and colleges to compete openly with them. By competing among themselves, institutions in the postsecondary sector would provide the finances for expansion of the system to meet rising enrollment demands by leveling down, not up, undercutting the rich resource base of the universities yet not providing the polytechnics with the same resources as universities.

The demise of the binary system and the institution of competition for research funds formalized the steady erosion of the research component of general university funds (GUF) throughout the 1980s. Between 1980 and 1987, GUF funding in the United Kingdom grew by 10 percent, while separately budgeted funding increased by 32 percent (Martin, Irvine, and Isard 1990). Rather than automatically receiving institutional funds for research, professors increasingly had to compete for funds targeted to strategic goals in technoscience areas. Following evolutionary theorists of science and technology, the government moved away from "the assumption of neoclassical economics that scientific and technological information moved freely between organizations" and instead viewed innovative technologies "as developing largely independently of science," or, when technology was related to science, as developing "in a more complex way than linear models suggest" (Gummett 1991; see also Gibbons et al. 1994). Government science and technology policy began to focus on "university-industry relations and upon the development of 'strategic' research to underpin new fields of technology, often across the boundaries of established disciplines," with special attention to "exploitable areas of science," and at the same time greatly increased assessment and evaluation of R&D programs (Gummett 1991, 35; see also Leydesdorff 1994). These policies led to a concentration of research resources in Interdisciplinary Research Centres won through competitive bidding and to the development of patent exploitation and technology licensing programs (Williams 1992; Gering and Schmied 1993). This direction was reaffirmed by a 1993 white paper that addressed the research function of postsecondary education and pressed universities and colleges to make a more direct contribution to wealth creation through research (White Paper 1993).

The United States

Although Mrs. Thatcher and Mr. Reagan had similar political philosophies and were heads of state at approximately the same time, their specific policies for higher education were quite different, at least in part because of dissimilar state structures, political economies, and academic cultures. In contrast to the United Kingdom, where change was systemic, initiated by the government through DES, and encompassed undergraduate education as well as graduate education and research, in the United States change at the federal level in the 1980s was piecemeal, emanating as much from the Congress as from the executive branch, and concentrated on the research function. Corporate leaders worked with political leaders and heads of universities to shift research away from basic and military research to civilian technoscience that met postindustrial needs (Etzkowitz 1994; Slaughter and Rhoades 1996).

With regard to student access, change started even earlier. In the early 1970s the Nixon administration, working with national policy groups such as the Committee for Economic Development, foundations such as the Carnegie Foundation for the Advancement of Teaching, and private and public higher education institutions, introduced the idea of market forces in higher education. Together they developed a high tuition–high aid policy through which government gave aid to students rather than institutions, thus making students consumers in the tertiary education marketplace. Institutions competed with each other to attract students and their Pell grants, which policy worked as long as grants matched costs and were equally available to students in all higher education sectors. (For an extended discussion of these policy changes and their consequences for research universities, see Chapter Three in this book.)

With regard to access, the numbers of students increased somewhat but varied greatly by sector. Community colleges absorbed the majority of *first generation* students and *students of color*—euphemisms for working and underclass college students (Grubb and Tuma 1991). In part these students concentrated in the lowest tier because costs were lower, especially in four-year institutions, although students in low-cost community colleges received the least aid of all postsecondary students because of eligibility rules that penalized part-time students and lack of financial aid services for students (Hearn and Longanecker 1993). High tuition–high aid policies did not cover the full costs of most students as the price of higher education rose, and the proportion of the costs borne by students increased concomitantly. As costs increased, federal legislation promoted loans as a way to bridge the growing gap between federal aid grants and college costs (Breneman 1993a).

Table 2.1 Selected U.S. Legislation Enabling a Competitiveness R&D Policy

1980	PL 96-480	Stevenson-Wydler Technology Innovation Act, as amended in 1986 and 1990
1980	PL 65-517	Bayh-Dole Act, and Reagan's 1983 Memo on Government Patent Policy
1982	PL 97-219	Small Business Innovation Development Act
1983	PL 97-414	Orphan Drug Act, as amended 1984, 1985, and 1990
1984	PL 98-462	National Cooperative Research Act
1986	PL 99-660	Drug Export Amendments Act of 1986
1987		Presidential Executive Order 12591
1988	PL 100-418	Omnibus Trade and Competitiveness Act
1993	PL 103-182	North American Free Trade Agreement
1993	PL 230-24	Defense Appropriations Act, Technology Reinvestment Program

In the 1980s and 1990s despite marked differences in the political institutions of the United Kingdom and the United States, leaders of large corporations, heads of universities, and political leaders in both countries used their unique institutions to develop competitiveness policies with regard to R&D. The vehicles for policy development were organizations such as the Business–Higher Education Forum (1983, 1986a, 1986b) and the Government-University-Industry Research Roundtable (1992), but these organizations were only two of many (see, e.g., Committee on Science, Engineering, and Public Policy 1992, 1993; President's Council of Advisors on Science and Technology 1992). Moreover, organizations that brought together leaders of industry, academia, and government developed in the several states in the 1980s and 1990s (Johnson 1984; U.S. Congress 1984; Lambright and Rahm 1991).

At the same time, a strong competitiveness coalition emerged in Congress and was ready to translate competitiveness policies into law (Slaughter and Rhoades 1996). (A selection of the many laws passed promoting technoscience research in universities and industry is presented in Table 2.1.) Generally, these laws allowed universities to participate in profit taking, permitted corporations exclusive access to government-funded research performed in universities and federal laboratories, and promoted joint ventures between universities and corporations, breaking down the relatively rigid organizational boundaries that had previously guarded universities' autonomy.

The Bayh-Dole Act of 1980 signaled the inclusion of universities in profit making. It permitted universities and small businesses to retain title to inventions developed with federal R&D moneys. In the words of the Congress, "It is the policy and objective of the Congress . . . to promote collaboration between

commercial concerns and nonprofit organizations, *including universities*" ([emphasis ours] Bayh-Dole Act 1980). Before the Bayh-Dole Act, universities were able to secure patents on federally funded research only when the federal government, through a long and cumbersome application process, granted special approval. In a very real sense the Bayh-Dole Act encouraged academic capitalism.

The several technology transfer acts, beginning with the Stevenson-Wydler Act of 1980, pioneered the legal and administrative mechanisms for transfers between public and private entities. These acts were aimed primarily at federal laboratories but also touched on universities. For example, in the Federal Technology Transfer Act of 1986, federal laboratories were able to enter into cooperative R&D agreements with "other federal agencies, state or local governments, industrial organizations, public and private foundations, and nonprofit organizations, *including universities*" (emphasis ours).

The place of universities in the competitiveness agenda was underscored by the Small Business Innovation Development Act (1982). This act mandated that federal agencies with annual expenditures greater than $100 million devote 1.25 percent of their budgets to research performed by small businesses, which were deemed the engines of economic recovery. It passed despite the opposition of major research universities. The research universities wanted to retain the moneys for fundamental research, but the needs of business were paramount, outweighing claims for basic science (Slaughter 1990).

The Orphan Drug Act (1983) provided incentives for the development of drugs to treat rare diseases. Through tax advantages and market monopolies this act encouraged biotechnology firms—which drew heavily from academically based, federally funded R&D, whether through university spinoff companies or through licensing—to pursue niche markets for vaccines and diagnostics for diseases such as Huntington's chorea, which struck relatively small groups of victims. Such companies received a 50 percent tax credit for the cost of conducting clinical trials, often performed by universities, as well as a seven-year right to exclusivity in marketing the products (U.S. Congress 1991). University spinoff companies profited from the Orphan Drug Act, for example, Genentech, which was started by faculty at the University of California–San Francisco, where recombinant human growth hormone was first produced and then patented (Goggin and Blanpied 1986).

The 1984 National Cooperative Research Act afforded special antitrust status to R&D joint ventures and consortia. This act was crucial to university-industry collaborations. Previously, the courts had ruled that collaborations at the enterprise level were inappropriate, barring joint R&D efforts by firms in

the same industries on grounds of restraint of trade. The National Cooperative Research Act made an exception for R&D, enabling broad government-industry-university funding of R&D, such as occurred with Microelectronics and Computer Technology Corporation.[8] Currently, there are more than one hundred such ventures (National Science Foundation 1989). The National Cooperative Research Act was also a counter in business leaders' strategy to overhaul national antitrust policy, promoting cooperation at home and competition abroad (Dickson 1984; Fligstein 1990).

A series of acts—the Drug Export Amendments Act of 1986, the Omnibus Trade and Competitiveness Act of 1988, NAFTA of 1993, GATT of 1994—embodied the global intellectual property strategy of the competitiveness coalition. By and large, these acts decreased regulation, specifically in the biotechnology area, and increased protection of intellectual property and enforcement of intellectual property rights. By emphasizing knowledge as a commodity, they reinforced the importance of academic capitalism in universities. (For a more detailed discussion of the provisions of these acts, see Slaughter and Rhoades 1996.)[9]

Neither President Reagan nor President Bush was enamored of a competitiveness policy if it in any way suggested that the United States was adopting an industrial policy. However, during the last two years of the Bush administration, his science and technology staff worked closely with the Council on Competitiveness in developing a bottom-up industrial policy that relied heavily on R&D (Slaughter and Rhoades 1996). In his campaign President Clinton borrowed heavily from these policy initiatives. He said, "We must go beyond sup-

8. Microelectronics and Computer Technology Corporation (MCTC) was a computer firm whose CEO, Admiral "Bobby" Inman, formerly of the Central Intelligence Agency, wanted to create a research consortia of U.S. electronics firms interested in developing technologies that would enable them to beat the Japanese in the race to develop a fifth generation. The consortia required modification of national antitrust rules. MCTC was ruled precompetitive and therefore allowable.

9. Legislation is only one aspect of the rule-making structures that shape competitiveness R&D policies in the United States. Other legal structures are administrative interpretations of new laws, rulings by administrative law judges, and litigation in civil courts. For example, the Internal Revenue Service does not tax the royalty income of universities, thus creating a strong incentive for universities to encourage patenting and copyrighting (Martino 1992). In 1980 in Charkabarty v. Diamond, the U.S. Supreme Court ruled that living organisms were patentable. In the same year the Patent and Trademarks Office issued the Cohen-Boyer patent on rDNA to Stanford. In 1988 the Patent and Trademarks Office issued Harvard a patent on the transgenic mouse (later globally marketed by DuPont as oncomouse, a laboratory animal for researchers). In 1990 the California Supreme Court ruled that a patient did not have a property right to his body tissues after they were used by researchers to develop a commercially important cell line (U.S. Congress 1991). Rule-making modalities other than legislation interact with new statutes to create a dense administrative-legal infrastructure for the new competitiveness policy.

port for basic research and a reliance on 'spinoffs' from defense R&D" (Clinton and Gore 1992, 2). As his position paper points out, "At present, 60 percent of the federal R&D budget is devoted to defense programs and 40 percent to nondefense programs. . . . At the very least, in the next three years the federal government should shift the balance between defense and nondefense programs back to a 50-50 balance, which would free up over $7 billion for nondefense R&D" (13–14).

In terms of university curricula and training there was little formal policy discussion at the national level in the 1980s and 1990s, in large part because higher education was the province of the several states, and curricula were set by faculty at the institutional level. However, federal grant and contract moneys for technoscience increased somewhat while moneys for the humanities and social sciences decreased dramatically (Rhoades and Slaughter 1996). Given that the number of places for graduate students was strongly—albeit indirectly—influenced by grant and contract moneys, the R&D function of universities concentrated increasingly on the sciences and engineering. In the period 1983–93 federal R&D in the science and engineering fields became more applied. Universities' share of basic research remained the same, but applied research increased by 6 percent and development by 4 percent (National Science Foundation 1993; see also Rhoades and Slaughter 1996).

Overall, in the 1980s and 1990s, U.S. policy at the federal level shifted so that colleges and universities were able to engage in academic capitalism. As in the United Kingdom, the U.S. federal science and technology policy promoted science and engineering that encouraged academic capitalism and rewarded universities that pursued these initiatives. Professors were discouraged from pursuing curiosity-driven research and were urged to engage in more commercial research (Etzkowitz 1994; Etzkowitz and Leydesdorff 1996). Given the power of the several states with regard to education, the U.S. government did not institute anything like quality assessments at the national level; however, a number of states began instituting the equivalent of quality assessments—rising junior exams, junior writing exams, value-added assessments, more standardized teaching evaluations, and performance-based budgeting—which regulated faculty's instructional work more closely (Guthrie and Pierce 1990). Although occurring in piecemeal fashion, policy changes in the United States were not dissimilar to those that took place in the United Kingdom.

Australia

During the 1980s and 1990s, Australia, like the United Kingdom and the United States, moved toward developing a closer relationship among industry, academe, and government in an effort to strengthen the national ability of private corporations to compete in a global economy. In many respects the Australian process was similar to that of the United Kingdom, although in some instances—for example, abolishing the binary divide—Australian policy developments preceded those in the United Kingdom (Williams 1992; Miller 1995). Like the United Kingdom, Australia, which also had a relatively low tertiary participation rate, saw breaking down its binary divide as a means of forcing institutions to compete with each other for students, thereby increasing the total skill output and expanding the overall number of places relatively cheaply, and to compete with each other for research moneys, ensuring more, if not cheaper, research. Unlike the United Kingdom, the Australian creation of a unified national system called for colleges of advanced education (CAEs), formerly in the lower tier of the binary system, to merge with universities, formerly in the higher tier. Before unification, Australia had eighty-five CAEs and thirteen universities. In 1987, after the organization of the unified national system, there were thirty-five universities. Because CAEs, historically concerned with vocational and technical education, were incorporated into the management and programming of universities, they tilted the system as a whole in the direction of technoscience.

Like the United Kingdom and the United States, Australia promoted science and technology at the graduate level, targeting specific areas and building university-industry-government centers and partnerships. Like the United Kingdom, the organization that buffered universities from the state was disbanded; and like the United Kingdom and United States, changes in organizational practice involved universities in academic capitalism. Unlike the United Kingdom and United States, these changes were instituted by a Labor government.

In 1988 the Hawke government instituted major organizational changes in higher education as part of an attempt to respond to the globalization of capital and labor (Pusey 1991). The Australian Labor government saw the rising productivity of nearby Asian countries as making Australian labor less competitive in southeast Asian markets. Australians were highly paid, with a minimum wage of A$11.85 (U.S.$10.00) per hour, and relatively poorly educated, with only about 10 percent of 18- to 21-year-old students going on to higher education. The Labor government saw reorganization of higher education as stimulating preparation of students in high technology fields and contributing to economic growth. "The society we want cannot be achieved without a strong economic base. In Australia this now requires a greatly increased export income, a far more favorable balance of trade and a considerable reduction in our external debt. Our industry is increasingly faced with rapidly changing in-

ternational markets in which success depends on, among other things, the conceptual, creative and technical skills of the labour force and the ability to innovate and be entrepreneurial" (Dawkins 1988, 6).

To attain that end, the Labor government reorganized its education portfolio in 1987, replacing the Commonwealth Tertiary Education Commission (CTEC), an organization that, like the UGC in the United Kingdom, served to buffer higher education from other government bodies, with the National Board of Employment, Education, and Training, which included a Higher Education Council that provided advice but had no executive role. Generally, tertiary education was overseen by the Department of Employment, Education, and Training (DEET), foregrounding the economic component of education. The head of the new ministry, John Dawkins, made a number of organizational changes in higher education. Given that the federal government paid most of the bill for the tertiary sector, he had a relatively free hand. The three most significant changes for academic labor were: (1) amalgamating universities and CAEs; (2) developing policies that established targeted commercial research funding priorities; and (3) developing policies for establishing and monitoring institutional profiles (Dawkins 1988).

Creating a unified national system of higher education was probably the greatest of the three changes. Before the Dawkins organizational reforms, Australian higher education was organized into two sectors, universities and CAEs. The universities had a long history, often predating World War II, whereas the CAEs were relatively recent. The universities were geared toward research as well as teaching and focused particularly on preparation for entry into the established professions. The CAEs were focused on teaching and education for entry-level jobs in the more applied professions. The Dawkins reforms were an effort to eliminate these distinctions. Formerly, university professors were expected to do research one day in five, and they received a proportionately greater salary to cover this cost. The Dawkins reforms "clawed back" salaries from university professors and used the moneys retrieved for research for which professors throughout the unified system had to bid competitively. Similarly, professors in all universities had to compete for high status programs (Marginson 1995). The Labor government thought amalgamation would create more university places for students and stimulate more research. As in the United Kingdom, government resource flow did not match the increased number of university-level places, creating a situation in which the tertiary system was likely to be leveled downward rather than upward.

As amalgamation took place, Dawkins developed a policy of targeting research priorities, by and large concerned with political economic goals, such as

technology to stimulate job growth, to protect the environment, and to build energy self-sufficiency. Intense competition for available moneys made professors more willing to consider new ways to fund research. By 1993, federal agencies funded only 20 percent of research grant applications (Wood, Meek, and Harman 1992). The most obvious pots of money were under the rainbows of the targeted areas, which usually focused on commercial endeavors that moved academe closer to the market. Securing these funds often involved university collaborations with industries and governments, usually through the formation of centers of excellence or centers in key technology areas (Turpin and Hill 1991; Hill 1993; Hill and Turpin 1993). At the same time, institutions, often working in concert with the several states, began to develop technology licensing programs and technology parks (Joseph 1989a, 1989b). Altogether, large amounts of research moneys spent previously on professors' curiosity-driven research were redirected toward government and industry goals that focused on building Australian competitiveness in global markets (Wood 1992).

As the unified system was directed toward more targeted research, DEET began to monitor institutions of higher education, whether universities or CAEs, more closely. Each year, universities and colleges were asked to develop institutional profiles in concert with the ministry as part of the federal funding process. As a condition of funding, institution and ministry had to reach common priorities. In 1993 DEET began conducting quality assurance exercises. These exercises reviewed internal university procedures for quality control, and institutions able to demonstrate efficacy with regard to quality procedures were eligible for a share of A$76 million that was set aside as a reward. Although these moneys were but a small part of university budgets, institutions that won them enhanced their student-drawing power immeasurably.

Before the 1990s, unlike those in the United Kingdom and the United States, the Australian private sector did not play much of a role in bringing tertiary education closer to economic development issues. In the early 1980s in countries other than Australia, business groups and organizations worked closely with the government and the tertiary education community to reform postsecondary education in ways that attended more closely to economic needs. In Australia peak business associations and other industry groups did not join with higher education leaders until 1990, when the Australian Business/Higher Education Round Table was organized (Marshall 1995). In other words, change in Australia was led by a Labor government concerned with industrial competitiveness rather than by industry or university groups.

As in the United Kingdom and the United States, the Australian government developed national policies that turned R&D away from basic or fundamental

research and toward academic capitalism. Before the United Kingdom did so, Australia abolished its binary divide, expanding access by forcing institutions to compete with each other for student places and faculty to compete with each other for research dollars, overall giving rise to academic capitalism. At the same time, as in the United Kingdom at the national level and the United States at the level of the several states, the instructional and curricula work of faculty was monitored more closely through institutional profiling.

Canada

As in the United States and the United Kingdom, in Canada business leaders worked closely with university and government leaders to push for change in the tertiary system, and some changes were initiated at the federal level when the Conservative government took office in the mid 1980s (Miller 1995). As in the United States, change at the federal level was largely concerned with the research function because the Canadian division of powers between provincial and federal governments gave provinces the responsibility and budget for tertiary education.[10] As in the several states in the United States, a number of provinces in Canada pushed university-industry R&D programs that were aimed at stimulating regional economic development. Again, as in the United States, change was incremental. Despite the push by industry leaders and some university and federal government and provincial leaders, little change occurred in the higher education system, making Canada the outlier in that respect among the four nations.

In the early 1980s the Corporate–Higher Education Forum was organized; its membership consisted of corporate executives and university presidents. The goals of the Corporate–Higher Education Forum were similar to those of the Council for Industry and Higher Education in the United Kingdom and the Business–Higher Education Forum in the United States. "Corporate collaboration helps to optimize the use of Canada's limited human, financial, and physical resources in research and education while tuning the research effort and the university curriculum more closely to the needs of the marketplace" (Maxwell and Currie 1984, 2).

The agenda of the Corporate–Higher Education Forum was developed during a period of university underfunding by the federal and state governments

10. Unlike the United States, the Canadian provinces do not tax directly for all funds for higher education. Instead, the federal government reallocates tax moneys to the provinces for education, health, and social services. When these moneys are returned to the provinces, no strings are attached, and the provinces are able to decide how to allocate the moneys among functions. For a comprehensive account of Canadian funding of postsecondary education, see Elliott (1995).

(Elliott 1995). Because universities were searching for new streams of revenues the development of a partnership between higher education and business which led to academic capitalism had an almost inevitable logic (de la Mothe 1987; Buchbinder and Newson 1990; Newson 1994).

The government was a third party to the partnership between business and higher education. Like political leaders in the United States, the United Kingdom, and Australia, Canadian leaders viewed technoscience as a vehicle for creating high-paying jobs that preserved shares in the global market. A goal of the Mulroney government was to double the share of GNP spent on R&D by 1991. Mulroney established a National Council for Science and Technology, which he chaired, and a program to stimulate corporate giving for academic R&D. As a proportion of total R&D, Canada's privately funded R&D was the lowest of any major industrial country. The government tried to encourage contributions to R&D from the private sector by tying increases in university research support to corporate contributions to universities or the national research councils. As Julien (1989, 69) puts it, "The aims of this policy could not be clearer, the intention being, firstly, to encourage the private sector to fund university research and, by so doing, acknowledge its social and economic importance and, secondly, to strengthen the links between universities and the private sector and thereby promote and quicken the transfer of knowledge."

This policy was reflected in goals and priorities of the Science Council of Canada (1987, 17), an advisory body to government: "Teaching and basic research are major roles of the university and must remain so. But as knowledge replaces raw materials as the primer of the world economy, the universities' part in creating wealth—too often understated—becomes crucially important. The intellectual resources of the university are needed to help revitalise mature industries and generate the product ideas needed to create new ones. Canada's future prosperity increasingly depends on designing effective ways to integrate the university and the market place."

The federal government supported its commitment to harnessing research to economic innovation through a wide array of projects, often sharing costs with provincial and local governments. The InnovAction program, an agreement signed by the federal government and provincial and local governments, was an early example (Julien 1989; Buchbinder and Newson 1990). The federal government also worked in partnership with provincial governments to develop research parks and centers of excellence. In Canada research parks linked universities with high technology companies and promoted technology transfer from academy to corporation. In the early 1990s there were twelve such parks, with the majority started in the 1980s (Bell and Sadlak 1992).

"Centers of excellence," also called "university-industry research centers," were modeled on the U.S. National Science Foundation programs that had begun promoting university-industry interactions as early as the 1970s. Like the National Science Foundation centers, the Canadian centers were run by boards with university and industry representatives. The province of Ontario was especially active in creating centers of excellence in the 1980s, for example, the Ontario Laser and Lightwave Centre, the Waterloo Centre for Groundwater Research, the Manufacturing Research Corporation of Ontario, the Ontario Centre for Materials Research Centre, the Telecommunications Research Institute of Ontario, the Information Technology Research Centre, and the Institute for Space and Terrestrial Science. In the early 1990s the federal government began funding centers of excellence across the rest of the provinces (Bell and Sadlak 1992).

National commitment to science and technology innovation in commercial fields tipped Canadian R&D from fundamental to applied science. In a Natural Sciences and Engineering Research Council Survey in 1978–79, "33.6 percent [of scientists] stated they were doing applied work, and 66.4 percent characterized their work as toward the advancement of knowledge. By 1987–88 the figures had almost reversed themselves with 54.8 percent in the applied category and 45.2 percent in the advancement of knowledge category" (Buchbinder and Newson 1990, 375).

Throughout the 1980s, business and government leaders in Canada proposed initiatives to create industry–higher education–academic partnerships (Skolnik 1983a, 1983b, 1987). However, this policy direction was never adopted; instead, Canada gave the highest priority to increasing and widening access, overtaking the United States in terms of participation rates in 1988 (Jones and Skolnik 1992). Although Canadian scientists view themselves as doing more applied work, for the most part Canadian academics have resisted rapproachment with business, despite promptings from some federal agencies. In the words of Glen Jones (1991), there have been "modest modifications and structural stability." Canadian academics have perhaps been able to resist pressures by the business and the federal government because Canada has by far the most decentralized higher education system of the four countries (Skolnik 1990; Jones and Skolnik 1992).

Convergence of Higher Education Policies

In the 1980s and 1990s the higher education policies of three of the four countries, Canada being the exception, began to converge. The areas of convergence were science and technology policy, curriculum, access and finance, and degree of autonomy. For the most part, these policies are concerned with economic competitiveness: product and process innovation, channeling students and resources into curricula that meet the needs of a global marketplace, preparing more students for the postindustrial workplace at lower costs, and managing faculty and institutional work more effectively and efficiently. Each of the countries developed a number of policies outside these parameters which did *not* converge. Even in the areas of convergence, the four countries arrived at similar policies by very different paths. Australia and the United Kingdom used their ministries of education, the former led by a Labor government, the latter by a Conservative government. In Canada and the United States the provinces and the several states, as would be expected in relatively decentralized systems, often developed their own initiative to promote academic capitalism. In the United States, Congress was more aggressive than the executive branch in creating an infrastructure for academic capitalism. Despite the very real differences in their political cultures, the four countries developed similar policies at those points where higher education intersected with globalization of the postindustrial political economy. Tertiary education policies in all countries moved toward science and technology policies that emphasized academic capitalism at the expense of basic or fundamental research, toward curricula policy that concentrated moneys in science and technology and fields close to the market (business and intellectual property law, for example), toward increased access at lower government cost per student, and toward organizational policies that undercut the autonomy of academic institutions and of faculty.

R&D was probably the area in which the most dramatic policy changes occurred. In three countries national policy shifted from promoting basic or fundamental research to privileging science and technology policy aimed at national wealth creation. Even in the United States and the United Kingdom, where fundamental R&D in the postwar period was to some degree conflated with defense R&D, strong civilian science and technology policies emerged (Etzkowitz 1994; Slaughter and Rhoades 1996). The very words used to describe R&D changed. R&D was no longer focused on basic or fundamental research, which came to be referred to rather derisively as "professors' curiosity-driven research," but on precompetitive, strategic, or targeted research (Wood 1992; Etzkowitz 1994; Slaughter and Rhoades 1996).

Precompetitive research usually refers to research that benefits corporations at the enterprise level, before specific firms try to gain exclusive knowledge advantage. The Microelectronics and Computer Technology Corporation agree-

ment in the United States (see Note 8) is a good example of precompetitive research. *Strategic research* refers to broadly targeted research, for example, some areas of biotechnology. *Targeted research* refers to narrower commercial programs, for example, the five areas identified by the Clinton administration as areas for R&D investment—areas addressed by the Advanced Technology Program. Similarly, we now speak of science and technology policy, not of science policy, stressing the product/manufacturing dimension of technoscience (Gummett 1991; Mowery 1994). So too, notions of the way science and technology move from academy to industry have become more complex, changing from *spinoff*, a concept that did not dwell on the causality of the leap from laboratory to commercial product, to *technology transfer*, which envisioned a relatively linear but highly managed transfer, to *evolutionary explanations*, which make the process more complex (Gummett 1991; Leydesdorff 1994). The three countries have adopted discourses on science and technology policy which go far beyond, sometimes even do away with, basic and fundamental research as central categories. All three countries see R&D as the font of technoscience, necessary for home-based multinationals to compete successfully in the global economy.

As part of the transformation of R&D, all four countries have seen the growth of technology parks, usually sited close to universities, sometimes partially funded by local or state/provincial governments, but often receiving some federal subsidy. So too all four countries have seen universities develop technology licensing schemes that join universities and corporations. Sometimes these are federally sanctioned, as was the case when the U.S. Congress turned patent ownership over to the institutions. More often, universities share royalties with the federal and state agencies that supported the research from which the invention was derived.

A number of these policy initiatives involve universities in profit making. The clearest cases are university technology licensing and university equity positions in faculty spinoff enterprises. In these instances universities profit to the degree that products sell. However, technology parks bring profits directly to universities, if only in the form of rent and sometimes through housing joint ventures. Centers of excellence, consortia with industry, and various university-industry partnerships most often provide multiyear government and corporate funding for commercially geared R&D but can utilize any of the profit-sharing schemes described above: share of royalty or licensing income, joint venture, or equity position. Changes in R&D policy in the several countries, then, have moved universities into academic capitalism.

Curriculum policies in all four countries have resulted in cutbacks in the arts

and humanities (with the exception of Australia) and in the social sciences (Martin and Irvine 1992). In countries in which the power and budgets for tertiary education are not reserved for the states and provinces—namely, in Australia and the United Kingdom—the changes were made through allocation of student places (and, indirectly, faculty positions), with more students being funded in science and technology than in other areas. In the United Kingdom, for example, the fees allocated for social sciences and humanities students were cut by 30 percent, to £1,300, whereas fees for science and engineering laboratory courses rose to £2,772 per student (Halliday 1993). In the United States changes were made indirectly through cutbacks in research funding in non–science and technology areas, which resulted in fewer graduate student places.

In the United States, where salaries are partially determined by professors' viability in the market and through individual negotiation between professor and administration, marked increases in salaries in technoscience areas reallocated institutional resources to these fields, making them more attractive to students. Analysis of changes of U.S. faculty salaries by field from 1983 through 1993 shows that faculty with the highest salaries and percentage increase (70 percent and above) were in fields concerned with technology (engineering and computers), producer services (business and management, law) and health sciences, all fields focused on knowledge as commodity and on intellectual property strategies (see Table 2.2 and Slaughter and Rhoades 1996). The greatest gains were made by engineering, an applied science geared closely to R&D competitiveness policies, and by business, health sciences, computer and information science, and law, all also connected closely to R&D competitiveness policies; the physical sciences and mathematics, the doyens of "pure science," did not make nearly such dramatic gains. Even if salary level rather than percentage of increase is considered, the physical sciences and mathematics are substantially below the top tier, with $10,000 to $23,000 annual salary differences that range between them and salaries in the top tier. The lowest salaries and the lowest percentage increases are in the third tier, in fields furthest from the market, those closer to the social welfare functions of the state.[11] The difference in the percentage of salary increases between the lowest six fields in the third tier (philosophy and religion, foreign language, home economics, letters, education, and performing arts) and the five fields in the top tier ranges from 22 to 30 percent. As other countries move toward differential salaries, as the

11. With the exception of philosophy and religion, these fields have majority female student bodies. For an analysis of the gender implications of the restructuring precipitated in part by competitiveness R&D, see Slaughter (1993).

Table 2.2 Average Salaries of Full Professor by Field, 1983–1993

Field	*Average salary*	*% Increase*
	($75–90,000)[a]	
Law	$89,777	71.1
Engineering	$77,985	84.6
Health science	$77,913	78.7
Business and management	$77,535	79.0
Computers and information science	$75,964	74.8
	($60–74,000)	
Physical science	$65,914	63.2
Mathematics	$63,776	59.7
Psychology	$62,567	59.5
Public affairs	$62,435	57.6
Social science	$62,352	59.9
Library science	$61,827	59.5
Interdisciplinary	$61,808	59.0
	($50–60,000)	
Architecture	$59,322	57.0
Agribusiness	$59,178	63.8
Communications	$58,933	61.3
Philosophy and religion	$58,424	53.7
Foreign language	$57,344	52.4
Home economics	$57,157	54.3
Letters	$56,744	52.3
Education	$56,605	55.9
Performing arts	$52,495	61.4

Source: From the American Association of University Professors (1994) Annual report on the economic status of the profession. 1993–1994, *Academe* March/April: Table 5. Based on data from the National Association of State Universities and Land Grant Colleges.

[a] Average salary of full professor.

United Kingdom has, the resources concentrated in technoscience curricula, already rich in student places, will be concentrated further.

In all four countries, despite projections to the contrary, enrollments went up, tuition went up, government share of costs went down, and governments turned more to loans than grants to support students. Generally, working class and first generation college students were concentrated in the lower tiers of the system in all four countries. With the end of the binary divide in Australia and the United Kingdom, this may change somewhat, although it is likely that middle class students will move into the space created by competition among institutions, much as middle class students in the United States moved into state-

funded four-year and comprehensive institutions, and less well-off students into the community colleges (National Center for Education Statistics 1995). As tuitions continue to increase and the rate of government spending continues to decrease, able students from families willing to purchase tertiary education are likely to occupy the most prestigious places.

The degree of autonomy possessed by institutions and professors has been reduced in the several areas discussed: R&D, curricula, and access. The loss of institutional autonomy was clearly seen with regard to R&D. In the United Kingdom the government agency responsible for buffering institutions from the state—the UGC—was abolished and replaced with agencies dominated by members of the business community. In Australia the CTEC, a body modeled on the British UGC, was abolished, and many of its functions were taken over by DEET, an agency the very title of which stressed the relationship between education and the economy (Marshall 1995). In the United States the agency concerned with pure science—the National Science Foundation—began to promote industry-led research (Slaughter and Rhoades 1996). To a substantial degree, the divisions between private and public organizations which had long protected institutional autonomy began to break down. The rule changes allowed public and nonprofit entities, whether universities, government agencies, or nonprofit research institutes, entry into the market, changing our commonsense understanding of what is public and what is private. Institutions still labeled public and nonprofit were able to patent and profit from discoveries made by their professional employees. Simultaneously, private, profit-making organizations were able to make alienable areas of public life previously held by the community as a whole: scientific knowledge, data bases, technology, strains and properties of plants, even living animals and fragments of human beings (Slaughter and Rhoades 1996). With the exception of Australia, this privatization was industry led, held together by government policies and government funding and serviced by tertiary institutions trying to augment funds.

Professors lost autonomy when research policies shifted from support for basic (professors' curiosity-driven) research to more applied research geared to economic development. Professorial autonomy with regard to curricula was also eroded. National competitiveness policies, supported by industrialists, government bureaucrats, university administrators, and some faculty, to a considerable degree determined the direction of curricula through resource flow. Decisions about the growth or decline of curricula were no longer made exclusively by faculty operating in collegium. Instead, decisions were made at a national level to strengthen technoscience in hopes of stimulating national wealth creation. As market considerations began to influence professorial salaries, the

collegial model of governance was attenuated as faculty who professed certain curricula were, quite literally, valued more than faculty who professed in less well-funded fields.

Professors lost autonomy in other aspects of their work. The various quality assessment and accountability schemes developed in the four countries often called for evaluation from bodies outside tertiary institutions and frequently from bodies outside specific disciplines. As decisions about professors' performance of academic work were moved outside the purview of professional expertise, professors became more like all other informational workers and less like a community of scholars. Again, Canada was an exception; it has no external review at the federal level, and only one province has instituted an external evaluation system.

Since 1980, the higher education policies of three of the four countries have converged, although the countries remain divergent on a number of important dimensions: for example, degree of centralization, student participation rates, and student support. The United Kingdom and Australia dealt with higher education and academic science and technology policy through relatively centralized state agencies, the United States through less centralized state agencies. Although the United Kingdom and Australia disbanded the buffer organizations that protected higher education from the state, the same degree of centralization in these countries persisted throughout the 1980s and 1990s. The United States did not develop more centralized agencies, although its policies on the relation of education to the economy began to converge with those of Australia and the United Kingdom. Before the 1980s, Australia and the United Kingdom had relatively low higher education participation rates, with 10–12 percent of the 18- to 21-year-old cohort attending higher education institutions, whereas Canada and the United States had relatively high participation rates, with about 30 percent of the 18- to 21-year-old cohort attending. Canada overtook the United States in 1988 and now has the highest participation. Although all countries made plans to increase participation, given their very different starting points, enrollment patterns held throughout the 1980s and 1990s. With regard to student financial aid, the United States moved toward high tuition and toward loans rather than grants, and Australia and the United Kingdom explored similar policies while continuing to offer much more generous government support to students, as does Canada, than does the United States. In the United States, graduate students in technoscience fields are supported primarily from their professors' federal grants and contracts, whereas in the other countries graduate students are supported by policies of low or no tuition and often receive government stipends for living expenses (Lederman 1991).

Despite persistent divergence with regard to organization, access, and student support, a remarkable degree of convergence in higher education and R&D policy occurred in three of these four countries over the past twenty years. That convergence cannot be explained solely by the political party in power, given Australia's Labor government. We think that the convergence is best explained by globalization theory. The rise of multipolar global competition destablized Keynesian nation states, rendering problematic the implicit social contract between the citizenry and government with regard to entitlement programs and social safety nets. In the three countries, policy makers responded to increased competition for shares of global markets by reducing overall rates of increase in state expenditures and reallocating money among government functions. Generally, funds were taken away from discretionary programs, particularly from programs thought likely not to contribute in a direct way to technological innovation and economic competitiveness.

These macroeconomic policy changes had tangible consequences for tertiary education in the four countries. Academic R&D policies, the lifeblood of graduate education, became science and technology policies, more concerned with technoscience innovation and building links with the private sector than with basic or fundamental research that articulated more with learned and professional associations than with the economy. For the most part, technoscience fields gained funds while fields that were not close to the market, such as philosophy and religion, foreign languages, letters and performing arts, or fields that served the social welfare functions of the state, such as education and home economics, lost funds. Positions for faculty, places for students, and research money turned technoscience fields into growth areas in tertiary education.

Although technoscience areas generally received more money, and policy makers took the position that a postindustrial economy called for higher numbers of highly educated workers, policy makers in all four countries planned to expand student participation rates without comparably augmenting resources for tertiary education. The increase in student numbers together with the slowing in the rate of increase of state resources began to change the conditions of faculty labor in contradictory ways. On the one hand, faculty were encouraged to engage in academic capitalism. On the other hand, faculty became responsible for larger numbers of students and were watched more closely with regard to the instructional aspects of their work.

The exception was Canada. Although there was a decline in real operating funding per student and some targeted funding for high technology research and for collaborations with industry (see Chapter Three in this book), Canadian higher education did not undergo the same degree of change as the other

countries. Even though the conservative Mulroney government tried to initiate a rapprochment among universities, industry, and government, for the most part there was little structural change in Canada. Canada's dissimilarity from the other countries is usually explained in terms of its extreme decentralization (Jones and Skolnik 1992). Canada, then, offers an alternative to the higher education policies developed by the other countries. The crucial question in the immediate future is whether this model can be maintained, given the size of Canada's national debt. Canada's national debt as a percent of GNP/GDP stood at 40.3 percent in 1990, almost ten percentage points higher than the other three countries (Oxley and Martin 1991, 148, Table 1).

The national policies of three of the four countries promoted academic capitalism—market and marketlike behaviors—on the part of faculty and institutions. In terms of access, institutions in Australia and the United Kingdom began to tender competitive bids for student places, contracting with the government to educate students for a fixed cost. In the United States, institutions increasingly compete to attract high-tuition- and fee-paying students. In all three countries, curricula are supported differentially by the state. The United Kingdom has moved furthest in this direction, providing differential state support per student according to curricula. All four countries have instituted policies that treat R&D as a source of national wealth creation, although Canadian faculty and institutions are resisting this change. Faculty and institutions lost autonomy as higher education was integrated more closely with the market. Individual professors' freedom to pursue curiosity-driven research was curtailed by withdrawal of automatic funding to institutions to support this activity and by the increased targeting of R&D funds for commercial research. Faculty and institutions were pushed toward academic capitalism by policy directives and by shifts in the resource mix. And some faculty and institutions turned eagerly to academic capitalism, viewing it as an opportunity to exercise entrepreneurial skills, as a means to capture resources, or as a strategy for a prosperous future.

Although these countries promoted academic capitalism as a means of stimulating national growth, the success of these policies to date is mixed. Productivity and GDP increased somewhat in the 1990s, but income inequality increased in three of the four countries (Australia, the United Kingdom, and the United States, with the increases being greatest in the last two [Atkinson, Rainwater, and Smeeding 1995]). National wealth creation, as a policy, may be succeeding in terms of productivity and profitability, but recovery is not generating highly paid jobs. Indeed, relatively high levels of unemployment combined with the growth of poorly paid full-time jobs and an increasing number of part-time jobs have given rise to the concept of *jobless recovery* (Rifkin 1995). Even those with "some college and more" are no longer assured of a high return on their investment in higher education (Harrison and Bluestone 1990). (However, young workers entering the job market *without* some college or more are very likely to fare less well than their college-educated counterparts.) Paradoxically, national policies that promote technoscience and its attendant automation and corporate restructuring may play into the elimination of professional positions formerly filled by college-educated workers (Abbott 1988). The longevity of these trends and what they will mean in terms of popular support for higher education are not yet clear.

In sum, postindustrial economies are replacing industrial ones even as globalization of the political economy has destabilized traditional industrialized economies by replacing bipolar trading relationships with multipolar ones, causing the traditional industrialized nations to lose shares of global markets. In areas where higher education intersects with the global economy, three of the four countries have responded by developing policies that promote academic capitalism. Despite very different political cultures and institutions, the higher education policies of three of the four countries converged on science and technology policy, curriculum, access and finance, and degree of autonomy. These policies are, for the most part, geared toward increasing national economic competitiveness; they are concerned with product and process innovation, channeling students and resources into well-funded curricula that meet the needs of a global marketplace, preparing more students for the postindustrial workplace at lower costs, and managing faculty and institutional work more effectively and efficiently.