Investment in Human Capital of a Powerful Interest Group: The Case of the Medical Profession in Britain, France, Sweden and the United States from 1890 to 1970*

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Abstract

This paper presents a new agenda for analyzing the consequences from investments in human capital by suggesting that sociological research should focus on particular sectors of society, that performances other than economic growth and productivity should be considered, and that the role of the state influences the impact which investments in human capital have on system performance. The research assesses the impact which investments in doctors and medical specialists have on social effectiveness (measured as reductions in mortality) and social efficiency (the level of health achieved relative to the cost per capita) in Britain, France, Sweden and the United States during the period between 1890 and 1970. In addition to evaluating the impact of investments in human capital on social efficiency and social effectiveness, the paper contributes to the literature on the state by developing measures for assessing the contribution of state structure on system performance. As hypothesized, investments in human capital are socially effective but not socially efficient. When the state intervenes in the delivery of medical care, it has a multiplier effect on the impact of human capital on social effectiveness.

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Dieses Papier stellt einen neuen Anlauf zur Analyse der Konsequenzen von Investitionen in Humankapital dar, indem es vorschlägt, sich in der Forschung auf spezifische Gesellschaftsbereiche zu konzentrieren, daß Leistungsmaße jenseits ökonomischen Wachstums und ökonomischer Produktivität Berücksichtigung finden. Auch der intervenierende Einfluß des Staates auf die Wirkungen, welche Investitionen in Humankapital auf die Leistungsfähigkeiten des Systems haben, sollte berücksichtigt werden. Die in diesem Aufsatz dargestellte Forschung schätzt die Wirkungen ab, welche Investitionen in Ärzte und medizinische Spezialisten auf die soziale Effektivität (gemessen als Verminderung von Sterblichkeit) und soziale Effizienz (das Gesundheitsniveau im Verhältnis zu den Gesundheitskosten per Einwohner) in Großbritannien, Frankreich, Schweden und den Vereinigten Staaten während des Zeitraums von 1890 bis 1970 hatten. Über diese Evaluation hinaus ist der Aufsatz ein Beitrag zur staatstheoretischen Literatur, indem er Maße entwickelt, mit denen die Wirkung staatlicher Strukturen auf die Leistungsfähigkeit spezifischer Systeme abgeschätzt werden können. Investitionen in Humankapital erweisen sich als sozial effektiv aber nicht effizient. Immer dann, wenn der Staat in das System medizinischer Dienstleistungen eingreift, hat dies einen Multiplikationseffekt hinsichtlich des Einflusses von Humankapital auf soziale Effektivität.

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1. Introduction

Much of the research on human capital has been micro-level analysis and has focused on how investments in the training of individuals have led to higher levels of productivity and income (Becker 1964; Rosen 1977; Dean 1984; Jorgenson 1984). Following the lead of Denison (1965, 1974), a few sociologists and economic historians have evaluated the impact of human capital on productivity or economic growth at the level of the nation state (Walters/ Rubinson 1983; Lundgreen 1976; Hage/ Garnier/ Fuller 1988). Whereas most previous work on human capital has operated within an economic paradigm (Becker 1964; Schultz 1961, 1971), we propose to examine human capital within a more sociological perspective, one with a four fold agenda. First, our research strategy is at the macro rather than the micro level of analysis. We wish to understand how investments in human capital shape consequences at the societal level. Second, we propose an agenda that is broader than one which focuses exclusively on economic growth or productivity. Specifically, our agenda assesses the impact of human capital at the nation state level on such performances as social effectiveness (e.g. the level of health) and social efficiency (e.g. the level of effectiveness relative to cost). Third, the evaluation of the consequences of human capital should be made in the context of the political institutional arrangements of the society. Fourth, rather than focusing on the consequences of investments in human capital for the entire society, we argue that the research agenda should concentrate on specific institutional sectors. A sociological approach should recognize that the normative order and mechanisms of control differ across institutional sectors, and reductionism implied by most human capital models which cut across institutional sectors should not be assumed until demonstrated.

Thus, the theoretical concerns of this paper are with a sociological approach to the study of human capital at the macro level by examining the impact of investments in human capital on social effectiveness and social efficiency in social services. The specific focus of the research is on the medical systems of Britain, France, Sweden, and the United States during the period between 1890 and 1970. The striking contrasts among the medical systems of the four nations

provide an ideal opportunity to examine the impact of investments in the training of physicians and the sectoral pay-off this has had under differing conditions of state intervention.

2. Theoretical Framework

The micro perspective of the human capital analysts in economics is quite easily summarized (Becker 1964; Schultz 1961, 1971; Jorgenson 1984; Dean 1984; Rosen 1977). Increases in the productivity and income of individuals result from increases in training. Extrapolating, some scholars have moved to a macro level, and have attempted to assess how societal investments in human capital have influenced national rates of change in productivity and economic growth (Denison 1965, 1974; Lundgreen 1976; Kaestle/ Vinovskis 1980; Walters/ Rubinson 1983; Fuller et al. 1986; Hage/ Garnier/ Fuller 1988). To date, however, there has been little attempt in macro-oriented studies to move beyond an economic paradigm and to ask whether or not investments in human capital might have other consequences. Moreover, most macro-oriented studies have tended to focus on the entire economy rather than on specific sectors of the society - such as health, education etc., and have paid little attention to the role of the state.

There are several reasons why the consequences of human capital investment might vary across institutional sectors. Some industries have a very technical or vocational orientation towards education, and under these circumstances training is closely linked to problems confronted by the sector, and one might expect training to have consequences quite different when more general education or training is unrelated to problems which employees encounter on the job. Even Collins (1971), a strong critic of the human capital thesis, acknowledges that technical education might have positive pay-off when the training is directly linked to job tasks.[1]

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[1] Recent literature which suggests a linkage between vocational training and productivity in various European industries are Wolfgang

Most critics of the human capital thesis have also operated at a micro level of analysis. Credentialist theory argues that, because contributions by workers to firms are difficult, if not impossible to measure, employers reward people with more qualifications, especially diplomas. But, it is argued, there is no necessary relationship between pay and performance on the job (Berg 1970; Collins 1971, 1979). We also wish to extrapolate from the credentialist micro perspective and move to a macro level of analysis. But at the macro level, we are proposing that scholars should examine the relationship between human capital and performances other than economic growth and productivity.

Credentialling and specialized training (Collins 1971; Berg 1970) can create conditions for increased interest group consciousness and powerful organizations among technical workers (Starr 1982; Freidson 1970; Larson 1977). In some cases, this may result in practitioners exercising professional dominance in the governance of institutional sectors. In medicine, law, and education, this kind of professional dominance is often sanctioned by the state (Larson 1977). This type of control may be translated into the pursuit of material and status aggrandizement of professionals, resulting in higher costs and lower efficiency.[2]

The assessment of the credentialling critique should also focus at the sectoral level. Whether state sanctioned or not, the role of professio-

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Streeck (1987) and Streeck et al. (1987). These studies indicate that only specific types of vocational training within particular kinds of institutional arrangements can bring about effective productivity returns. To date there has been no rigorous testing of this stimulating argument.

[2] There has been a rapidly growing, but independent body of literature which highly complements the credentialist perspective (see Bourdieu, 1984, 1989; Bourdieu/ Passeron, 1977, 1979; Bernstein, 1977). For example, Bourdieu - implicitly expanding on Weber's work on status - argues that dominant groups use their cultural capital and power in order to establish monopoly privileges and to exclude other groups from high status positions. This is done in a very subtle and symbolic way in order to establish legitimate power. For illuminating commentary, see Lamont/ Laureau (1988).

nals in governance is sector-specific, as is their autonomy and power. The normal market mechanisms implied in the human capital thesis are less relevant in sectors dominated by professionals such as physicians, lawyers, academics etc.. In most of the literature, the connection between the collective self governance of a profession and institutional performance has been sketchy and unsystematic, but there is potential for remedying this with sectoral analysis.

However, the consequences of investment in human capital will vary depending upon the role of the state in a particular institutional sector. For example, if there is considerable state intervention to control and coordinate a particular sector in the social services, the consequences of investments in human capital will be very much affected. Moreover, the role of the state as either a promoter or regulator of professional autonomy is highly variable historically and cross-nationally within the same sector (Rueschemeyer 1973, 1978, 1983, 1986; Dingwall/ Lewis 1983).

Since changes in economic growth and productivity are not necessarily the only or best performance measures with which to evaluate the impact of human capital, we propose to recast the economic paradigm of human capital into a sociological one by focusing on such performance measures as social effectiveness and social efficiency and by considering how the state influences the relationship between increases in human capital and these system performances. We are especially interested in these problems in the context of institutional sectors that are both technologically intensive and have powerful and well-organized professional groups. With this perspective, we believe we can expand the human capital perspective to the sociological literature and combine it with the credentialist critique at the macro level.

As we attempt to advance the theory about these issues, it is critical to make the distinction between social effectiveness and social efficiency, as we will assess the impact of investments in human capital on both. Social effectiveness is defined as the output achieved (e.g. the level of health), whereas social efficiency is defined as the cost (e.g. medical cost) relative to the effectiveness achieved. It is impor-

tant not to confuse our use of the sociological concept "social efficiency" with the economists' use of the concepts technical and allocative efficiency. For us, "social efficiency" is a very broad concept concerned with the ratio between the output performance of the entire society and a societal effort, with outputs not measured in monetary units. That is, this research is concerned with the performance of an entire institutional sector of a society, rather than the cost-benefit or "technical" efficiency of a particular program or organization (Office of Technology Assessment 1980; Klarman 1981; McGuire/ Henderson/ Mooney 1988; Weisbrod 1971). For example, two systems that have similar levels of health but spend very different sums of money on medical care are judged to have different levels of social efficiency.

2.1 Human Capital and Social Effectiveness

In this research, we hypothesize that more investments in human capital in social services such as education, medical care, welfare, and the like result in greater social effectiveness. Investments in physicians can be expected to be effective because medicine is a technical field with a substantial body of knowledge based on both applied and pure research. Many of the improvements in levels of health at the end of the nineteenth century and the beginning of the twentieth, for example, were due to the diffusion of bio-medical knowledge which demonstrated that diseases were carried by microbes and that sanitation, water purification, and other public health measures were effective measures for reducing mortality (Preston/ Van de Walle 1978; Condran/ Cheney 1982; Condran/ Crimmins-Gardner 1978; Meeker 1972; Rosen 1964).

A central argument for the effectiveness of human capital in the medical area is that important contributions to improvements in levels of health result from better access to physicians and to the diffusion of bio-medical knowledge throughout the society. McKeown and others (McKeown 1975, 1976a, 1976b, 1978; Powles 1973; McKinlay/ McKinlay 1977; Grob 1983) have argued that specific technological interventions had little direct effect in explaining most of the

decline in mortality during the past two hundred years. While there is merit to their arguments, physicians during the past century, as both public health officials and in clinical practice, have been instrumental in diffusing information about the importance of sanitation, cleanliness, exercise, changes in diet, child care, and vaccinations as a means of improving levels of health. A point that McKeown and others with similar thinking have overlooked is how the increase in the number of physicians and changes in "bio-medical knowledge" have contributed to the diffusion of this information.[3] Whereas McKeown and others have argued that mortality declined during the nineteenth century as a result of a rising standard of living, it is significant that after 1800, levels of health in many western countries did not improve - despite increased agricultural output and rising wages - until after the late nineteenth century (Floud/ Gregory/ Wachter 1990; Fogel 1986; Higgs 1971: 68; 1979; Meeker 1972) when there was diffusion of information about specific forms of diet and sanitation and when societies began to change their behavior in response to new "bio-medical knowledge" (Apple 1987; Oddy 1982; Fogel 1986; Oddy/ Miller 1976; Preston/ Van de Walle 1978; Woods/ Woodward 1977; Condran/ Cheney 1982; Condran/ Crimmins-Gardner 1975; Toutain 1971).

Extending this argument, investments in the *quality* of human capital in medicine (e.g. increases in the level of specialization) should have a parallel impact on social effectiveness, that is, improvements in the level of health. Typically, specialists in human services do not increase the *quantity* of production but do improve the *quality* of services. Usually, the argument for increasing the number of physicians and their level of specialization is to improve social effectiveness (Stevens 1971; Fuchs 1986). Increases in specialization represent a proxy for higher levels of knowledge. Thus, the higher the level of

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[3] Of course the medical profession does not always embrace the latest bio-medical knowledge. On a number of occasions, epidemiologists have reached very accurate conclusions about the etiology and prevention of diseases, only to have clinicians object that laboratory scientists had not definitively demonstrated the pathophysiologic mechanisms involved (see Hollingsworth et al. 1990).

specialization in a society, the greater the likelihood that more knowledge diffuses among physicians through the society, with the potential to increase improvements in levels of health. There has not been much research on the relationship between specialization and levels of health in national medical systems, but there is a literature which suggests that increases in specialization in the community hospital do improve health outcomes. One example is the literature that demonstrates that the more surgery surgical teams perform, the lower the mortality rate among their patients (Luft/ Bunker/ Enthoven 1979; Fuchs 1986). We can summarize these ideas in two hypotheses:

1. In social services, increases in the *quantity* of human capital investment (as measured by the density of the providers) will result in greater social effectiveness (e.g. the level of societal health).

2. In social services, increases in the *quality* of human capital investment (as measured by the proportion of specialists) will result in greater social effectiveness (e.g. the level of societal health).

Specifically, this proposed research suggests that there is a close link between investments in the training of physicians and the diffusion of bio-medical knowledge throughout the society, with a resulting improvement in societal levels of health.

2.2 Human Capital and Social Efficiency

Even if technical education tends to improve levels of health in the aggregate, it may not be socially efficient. Critical theorists of the professions have suggested that professionals as a group, and physicians as a particular case, are able to obtain increases in their standard of living not because they are highly productive, but because they are powerful and believed to be effective (Larson 1977; Johnson 1972; Rueschemeyer 1986; Friedman/ Kuznets 1945; Freidson 1970; Hollingsworth 1986). Partly for these reasons, medical costs tend to increase more rapidly than their effectiveness - meaning that increases in human capital do not lead to more social efficiency.

One component of the cost of medical care is the number of medical interventions. Because they are the technological gatekeepers, physicians control medical consumption much more than do consumers. Most patients cannot evaluate the correctness of the diagnosis or of the treatment plan. Furthermore, the consumer or the patient tends to remain loyal to his/her doctor and is not likely to "shop around," as information and opportunity costs are very high, particularly when physicians are self governing (Donabedian 1976; Arrow 1963; Freidson 1961; Fuchs 1986). In the absence of external regulation, medical providers have a substantial capacity to determine the level of demand for their own services. And there is considerable evidence that increasing the number of physicians increases costs relative to their effectiveness (Fuchs/ Kramer 1972; Evans 1974; Reinhardt 1983; for a critique of this position, see Sloan/ Feldman 1978; Enthoven 1980). Thus, physicians may be socially effective, but because of these and other market failures, they tend not to be socially efficient.

Medical consumption is not the only way whereby the number of and the status of physicians have an impact on the social efficiency of the sector. Another is in determining the capital intensity, and hence the total cost of the medical delivery system. Because physicians usually have considerable influence on the management of hospitals and clinics, they can exert leverage on the development, purchase and routine use of expensive equipment. Throughout the century, physicians, especially specialists, have wanted newer hospitals with the most advanced technology, and have often been supported by public and private administrators who have appreciated the prestige of having the latest technology (Pauly 1980; Fuchs 1986; Lee 1971; Rosner 1982). The addition of expensive equipment for patient testing and treatment call for the proliferation of specialists and trained support staff to manage equipment and to conduct tests. In medical care, most technology is an aid to diagnosis, but does not reduce the costs or provide economies of scale (Fuchs 1986).

Self governing professions also exert power when they are able to determine the method of payment and the prices of service (Friedman/ Kuznets 1945; Abel-Smith 1965). In some countries, many physicians have typically received higher fees when they admit

patients to hospitals. This provides an economic incentive for higher rates of hospital utilization, as medical care in the hospital - for the same intervention - is more expensive than on an outpatient basis (Luft 1981; Enthoven 1980, 1981; Glaser 1980; Rosner 1982). And physicians to date appear to have more power than any other single actor to shape medical technology and consumption (Abel-Smith 1965; Klein 1983; Hollingsworth 1986; Stone 1980; Freddi/ Bjorkman 1989; Glaser 1970). These ideas can be summarized with the following hypotheses:

3. In social services, the greater the investment in the *quantity* of human capital (measured by the density of the providers) the lower the social efficiency.
4. In social services, the greater the investment in the *quality* of human capital (measured by the proportion of providers who are specialists) the lower the social efficiency.

2.3 Physicians, the State, and Social Performances

During the past ten years, sociologists have successfully placed the state on the discipline's research agenda. Much of the literature on the state has focused on why particular state structures or policies have emerged (Orloff/ Skocpol 1984; Skocpol 1985; Skocpol/ Amenta 1986; Offe 1985; Block 1988), though there has been relatively little attention to the consequences of particular state structures. But in this research we wish to consider how variation in state structures influences the relationship between system performance and investments in human capital. There are several issues which should be considered in any such discussion about the role of the state. First, if we are to advance our theoretical understanding of the consequences of state intervention, we must recognize that there are several dimensions of state structure. From reading the histories of medical systems of these four countries (Stevens 1967, 1971, 1989; Ito 1980, 1982; Glaser 1970, 1980; Hollingsworth 1986; Hollingsworth/ Hanneman 1984; Klein 1983; Abel-Smith 1964; Immergut 1987), we conclude that the dimensions which are the most important in shaping system

performances are the extent to which the state (a) provides the revenue for medical care, (b) employs medical personnel, and (c) controls the prices of medical services. The state may provide the revenues to finance the medical care of consumers, but all the personnel may be employed in the private sector and all prices may be set in the private sector. For example, the contemporary British system is one in which state intervention is high on all three dimensions, but in the United States, the state has increasingly intervened to finance medical care, but has had low intervention in employing personnel and in controlling prices. Second, the state can intervene at the central, provincial, or local level of government. In other words, there is a continuum with the concept centralization, ranging from the situation whereby all coordination and control are in the private sector, with numerous decision making points, to one in which coordination and control are at the local or central level - with the number of decision making points decreasing as the system becomes more centralized. Following from these issues, whether the state intervenes to finance services, to employ personnel, and to control prices and whether it does each of these at the local or the central level, or in the private sector influences the relationship between investments in human capital and such system performances as social effectiveness and social efficiency.

Investments in the quantity and quality of human capital can also lead to the creation of a powerful interest group, and this has been especially true with physicians. The relative power of the providers to control consumption is not the only kind of power that a profession can have. Their power may also be used to bias the form of state intervention. Powerful professions rarely want the state to control prices and the appointment of personnel and will mobilize their power to prevent state intervention in these and other areas. Medical providers may reluctantly accept state financing of medical care, but they will oppose limits being placed on their power, arguing the need for professional autonomy (Rueschemeyer 1983, 1986; Larson 1977; Hollingsworth 1986; Friedman/ Kuznets 1945).

State intervention generally causes some group to profit (Stigler 1968; Buchanan/ Tullock 1962; North 1981) and physicians generally strive to shape most forms of state intervention to their advantage. For example, physicians attempt to use the legal and fiscal power of the state to minimize their transaction costs, to regulate competition, and to provide tax subsidies for medical education, research, and capital equipment. In general, the less the state intervenes in medical systems, the more autonomy and power physicians enjoy to shape the behavior of medical systems (Starr 1982; Stevens 1971; Hollingsworth 1986; Rueschemeyer 1983, 1986).

Because the power of providers is very great under extensive self-governance, provider interest groups generally attempt to influence the expansion of state control in their sector (Larson 1977; Freidson 1977; Dingwall/ Lewis 1983; Johnson 1972; Rueschemeyer 1986; Hollingsworth 1986; Weller/ Manga 1983). Just as in our discussion of the human capital and credentialling perspectives we made a distinction between social effectiveness and social efficiency, here in our discussion about the role of the state we highlight the distinction between state intervention to control prices and appoint personnel, and state intervention to finance medical care.

The state has more capacity than any other actor to ration medical resources (Aaron/ Schwartz 1984). By controlling the number of doctors as well as specialists, and by regulating the distribution of these across regions, as well as the financing and access to care, the state can have considerable impact on costs. By controlling the number of doctors as well as fixing the prices of services, the state can limit the number of hospitals, hospital beds, and many other forms of capital equipment. Thus, one of the most important ways the state can control costs is by setting prices for medical services and by actually employing the doctors. Historically, private insurers and other private third party payers have found it difficult to exercise control over the prices of particular medical services and physician fees and to limit the number of physicians (Glaser 1970, 1978, 1980; Hogarth 1963; Abel-Smith 1965).

If the medical professional is able to deliver services without the state intervening to finance medical care and control prices and personnel, there will be substantial consequences for the performance of a national medical system. However, we are not arguing that the medical profession by itself prevents state intervention. How states become involved in financing services and in controlling prices and the appointment of personnel is complex and is related to a number of specific historical factors, including the timing of state intervention, the strength of the state, the power of the working class, etc. (Rochaix 1959; Hatzfeld 1966; Abel-Smith 1964; Hollingsworth 1986). But if medical prices and personnel are not controlled by the state - that is if privatization prevails as the dominant institutional arrangement - then the consequences of this for social effectiveness and social efficiency are different. State intervention modifies the consequences of investment in human capital.

The state may assist in making investments in human capital effective by financing medical care and by preventing spatial concentration of providers, thus helping to provide access to care for all citizens. Again, only the state can effectively do this by employing doctors and dictating where they can or cannot practice (Maynard/ Ludbrook 1981; Hurst 1985; Hollingsworth 1986). If providers succeed in preventing the state from coordinating medical care, they can choose where they practice, and the result is likely to be large spatial imbalances in access to services. This in turn reduces access, but effectiveness as well. With social efficiency, a major task is to control costs, and during the past half century only the state has been powerful enough to do this effectively. If the state finances medical care but does not control the prices of medical care, medical costs will tend to rise faster than inflation (Maxwell 1983).

But to understand the context within which this occurs, one must be sensitive to the two human capital variables and to both state intervention variables as well. Over time, increases in state control over finances have eventually led to greater state control over prices and personnel (Stevens 1966, 1971; Glaser 1970; Hollingsworth 1986), but it is state control over prices and personnel that is most important in shaping the effectiveness and efficiency of national medical systems.

Consistent with our line of reasoning, we would expect greater state control over prices and personnel to cause more investments in human capital to lead to more social effectiveness and social efficiency. In other words, we expect state intervention to control prices and personnel to have a multiplier effect on investments in human capital. On the other hand, we would expect state control over the financing of medical care to have little or no effect in causing investments in human capital to be more socially effective and socially efficient. These relationships are expressed in the following hypotheses:

5. In social services, the more the state intervenes to *control prices and personnel,* the more *socially effective* investments in the *quantity* of human capital will be, but more state intervention to control financing does not cause investments in the quantity of human capital to be more socially effective.
6. In social services, the more the state intervenes to *control prices and personnel,* the more *socially efficient* investments in the *quantity* of human capital will be, but more state intervention to control financing does not cause investments in the quantity of human capital to be more socially efficient.
7. In social services, the more the state intervenes *to control prices and personnel,* the more *socially effective* investments in the *quality* of human capital will be, but more state intervention to control financing does not cause investments in the quality of human capital to be more socially effective.
8. In social services, the more the state intervenes *to control prices and personnel,* the more *socially efficient* investments in the *quality* of human capital will be, but more state intervention to control financing does not cause investments in the quality of human capital to be more socially efficient.

The evaluation of these hypotheses must be done in the context of various factors that influence social effectiveness and social efficiency independently of human capital and the role of the state. Just as economists (Denison 1974) and sociologists (Walters/ Rubinson 1983; Hage/ Garnier/ Fuller 1988) have controlled for the size of the labor force and the amount of capital formation in assessing the contribu-

tion of human capital to increases in economic growth, we propose to control for those variables that influence social effectiveness and social efficiency. To do this, we will construct an index of social development that includes a number of measures of demand for medical care. Consistent with our desire to move beyond an economic paradigm, the index will include social variables that influence the level of demand for medical care.

3. Research Design, Data, and Methodology

The data for the analysis are drawn from a pooled cross-section and time series design consisting of observations for Britain, France, Sweden, and the United States at decade points from 1890 to 1970. The selection of nations and time ensure substantial variability both in the organizational development of medical institutions and in the extent and form of state intervention. While each national medical system has many unique institutional features, the major forces and trends affecting the relationship between the development of human capital intensity and societal performance measures are comparable.

The period between 1890 and 1970 covers not only the rise of modern "scientific" medicine, but it is also the period when states became much more active in coordinating medical care by financing care, fixing prices, and employing personnel. Although there has been a general movement towards greater state control over national medical systems, the four countries of Britain, France, Sweden, and the United States were chosen because they provide striking contrasts on every variable in the analysis (Rimlinger 1971; Raffel 1985; Flora/ Heidenheimer 1981; Freddi/ Bjorkman 1989; Glaser 1970; Stevens 1966, 1971; Immergut 1987).

In France and Sweden, the state was somewhat more involved in the delivery of medical care in the late nineteenth and twentieth centuries, for in those countries most hospitals were state-owned. For this reason, the state early employed many doctors and established the prices of hospital based services. In contrast, hospitals developed

primarily in the private sector in Britain and the United States (Ito 1982; Glaser 1980; Stevens 1989; Rosenberg 1987; Hollingsworth/ Hollingsworth 1987; Abel-Smith 1964).

Since the state controlled much of the hospital sector of France and Sweden in 1890, there was much greater state control of the medical systems early on in those two countries, though they have subsequently evolved in very different ways. In Sweden, the state has become much more involved in controlling prices and personnel, though much of that control is at the county level, while in France there has emerged a strong private hospital sector with a more mixed system of public and private funding of medical care (Ito 1982; Glaser 1970, 1978, 1980). Britain and the United States displayed quite limited forms of state intervention in 1890, but since then, they too have evolved in very different directions. In Britain the state, at an earlier date than in the United States, began to fund medical care, a process which eventually led to much stronger forms of state intervention - culminating in the National Health Service in 1948 when the state controlled most prices and employed a very high proportion of personnel. In the United States, it was not until 1965 - with the adoption of Medicare and Medicaid policies - that the state began to fund medical care on a substantial scale, but by 1970, the state had still intervened only modestly to fix prices for medical services and to employ personnel (Stevens 1971, 1989; Rosenberg 1987; Hollingsworth 1986).

In each of the four countries, the development in the quantity and quality of human capital was quite dramatic between 1890 and 1970. Here too, however, there was substantial variation among the four countries. Physician density in Britain increased from 69 per 100,000 in 1900 to 101 in 1970, in Sweden from 22 to 136, and in France from 41 to 133. The United States is more complicated, as there was a high rate in 1890 but only a small percentage graduated from medical school. For our analysis, we use only the number of medical school graduates, as we believe it more adequately represents the number of doctors involved in the diffusion of the latest bio-medical knowledge throughout the society. By 1970, the rate per 100,000 was 163, the highest of the four (Stevens 1971). In all four countries, specialization

as a percent of physicians was very low in 1900. But, by 1970, the proportion of specialists had risen to 34 percent in Britain, 42 percent in France, 56 percent in Sweden, and 77 percent in the United States.

Table 1: Indications of Investments in Human Capital

Year	United States*	Great Britain	France	Sweden
	Physicians and Surgeons per 100,000 Population			
1890	17	68	32	17
1900	16	69	41	22
1910	69	65	51	23
1920	90	66	52	28
1930	125	77	61	37
1940	125	88	66	48
1950	145	72	89	69
1960	144	92	105	95
1970	163	101	133	136
	Percentage of Specialists Among Physicians			
1890	0.5	2.5	3.2	6.2
1900	1.1	3.1	3.8	10.0
1910	3.6	5.2	3.6	16.0
1920	9.6	7.0	4.8	18.8
1930	17.0	7.8	19.0	33.5
1940	23.5	8.2	24.6	50.1
1950	36.8	24.2	28.7	50.1
1960	57.3	27.2	35.8	55.9
1970	77.0	34.1	42.4	55.7

* Figures represent the numbers of physicians who were medical school graduates. In the United States between 1890-1920, there were a number of people who practiced medicine but were not graduates of a medical school, and those practitioners are excluded from the analysis.

Source: See Appendix.

3.1 The Dependent Variables: Social Effectiveness and Social Efficiency

The two dependent variables are social effectiveness and social efficiency. Social effectiveness of the medical system is measured by taking the logarithm of age - sex standardized mortality rates. Age and sex standardization is necessary to eliminate the considerable variation in age structures and sex ratios across countries and over time. The age-sex mortality rates were standardized on England and Wales in 1931, which represents the central tendency of age and sex

distributions in all four countries and a midway point in the eight decades.[4] The logarithm of standardized mortality rates is used to reflect the decreasing marginal returns in the relationship between medical inputs on the one hand and on the other, reduction in mortality (Manton 1982; Keyfitz 1978; Hayflick 1965, 1975; Fries 1980).

Social efficiency is measured as a ratio of levels of health [measured as 1000-(age-sex standardized mortality rate)] to costs of medical care. Estimating the costs of medical care is intricately connected with how one conceptualizes a national medical system. In estimating medical expenditures, we have deliberately not included all of those activities which have known impacts on health, as we are focusing our attention on how the investment in the human capital of providers influences mortality. Thus, we have excluded collective public health activities - e.g., the costs of public sanitation and water supply systems, as well as the costs of maintaining a better social and physical

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[4] Cross national and cross temporal measures of morbidity and disability do not uniformly exist - though this kind of data would be very useful as a measure of societal health. Even if age-sex standardized death rates are not ideal measures for levels of health, they are highly useful indicators for cross temporal and cross national analysis and give a sound general measure of societal health and physical well-being. For a general discussion of this issue, see Preston 1976, 1977.

There is a long and impressive tradition of disaggregating mortality data and of attempting to explain the decline in disease specific death rates (for a good discussion, see Preston 1976). While we applaud these efforts, we choose in this study to work with data aggregated across all causes of death because of the questionable reliability of the disaggregated data for these four countries during the period between 1890 and 1970. Even in the present day, despite enormous improvements in diagnostic techniques, examinations of cause of death as reported from autopsies reveal that the clinically diagnosed cause of death tends to be inaccurately reported in approximately twenty-five percent of cases (Waldron/ Vickerstaff 1977; McKeown 1978; McKinlay/ McKinlay 1977). If there is a one-quarter error in the diagnosis of death in our own age, there is good reason to believe it would be just as high or higher when one is analyzing mortality data almost a century ago.

environment. However, we have included preventive medical measures administered directly to individuals by medical personnel, such as vaccinations. We have also included the costs of those activities which are clearly medical in nature - e.g., the costs of physicians, nurses, drugs, general and specialized hospitals, etc.. The measure for social efficiency of the medical system is

$$\text{Social Efficiency} = \log \frac{1000 - (\text{age-sex standardized mortality rate})}{\text{Real medical expenditure per capita}}$$

As the age-sex standardized mortality rate becomes smaller, the efficiency of the system increases, all else remaining constant. The denominator of the social efficiency measure is medical expenditure per capita, in constant 1938 U.S. dollars. As costs increase, efficiency declines, all else remaining constant.

General GNP (Gross National Product) deflators (Brown/ Browne 1968; Historical Statistics of the United States 1975) are used to convert medical expenditures for each nation into constant 1938 values. Market exchange rates among the four currencies, averaged across twelve months during 1938 are used to express the medical expenditures in constant U.S. dollars (Whitaker 1938). The logarithmic transformation of the ratio is used to recognize the inherent non-linearity of decreasing marginal returns to the relationship between medical expenditures and the health of a population.

We label both effectiveness and efficiency as social to distinguish our strategy from traditional economic cost-benefit analysis. That is, we do not place explicit and differential monetary values on each unit of mortality. While social efficiency is not the same as productivity, it is akin to this concept because it is measuring the marginal costs of incremental improvements in social effectiveness. In other words, our analysis of "social efficiency" addresses a somewhat different problem from that of most economists who study efficiency in the delivery of medical services. Our concern is with the reduction in mortality at the nation-state level, rather than with the cost benefit analysis of specific treatments, programs, or organizations that is common in the

economics literature (McGuire/ Henderson/ Mooney 1988). At this macro level of analysis, social efficiency is the aggregate result of the performance of the parts of the national medical system.

3.2 The Independent Variables

(1) Investment in Human Capital

In the medical area, it is important to distinguish between quantitative and qualitative aspects of investment in human capital. The quantitative dimension is addressed by the number of physicians per capita. We infer the level of education or investment in human capital from the number of practicing doctors who are graduates of medical schools and who are licensed to practice. Although there is some modest variation in the level of physician training across countries, the use of all licensed doctors permits us to standardize the small variation in type of training which has existed across countries and time (Stevens 1966, 1971; Glaser 1970; Freidson 1970). Because we consider specialization as a measure of the quality of training, the qualitative dimension is measured by the proportion of doctors who are specialists.[5]

(2) The Institutional Variables: Privatization vs. State Intervention

Hypotheses five through eight suggest that the effects of human capital development on social effectiveness and efficiency vary,

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[5] Physicians/per capita and the proportion of physicians who are specialists capture only a portion of the development of health professions in these countries. They are, however, the "leading indicators" of the largely parallel development in the number of pharmacists, public health officials, nurses, and other medical professions. The development of specialization among physicians may also be interpreted as an indicator of broader trends in the qualitative development of medical capital - including the rise of the modern hospital and the expansion of bio-medical research (OECD 1985).

depending on the degree to which the medical system is privatized or state controlled. Our measures of state intervention indicate the degree to which certain medical system activities are governed directly by the state or by private sector actors. Within the state sector, we further distinguish between more and less centralized control. That is, whether decision-making rests with national or local authorities. By thinking about state intervention as a form of centralization, we are essentially focusing on the degree to which the power to coordinate a society's medical system is concentrated within the state.[6]

Since national systems are extremely complex, there are several dimensions along which the state may intervene in its efforts to affect system performance. Some dimensions are highly correlated; others are quite independent. Because the most consequential involve the financing of medical care, appointment of personnel, and setting the prices of medical services (Hollingsworth/ Hanneman 1984; Meyer/ Scott 1983), we have chosen to distinguish between two basic areas of state intervention: decisions about financing and decisions about the setting of prices and the appointment of personnel. After studying considerable literature on the history of national medical systems (Stevens 1966, 1977; Stone 1980; Ito 1980, 1982; Glaser 1970, 1978, 1980; Hogarth 1963; Abel-Smith 1965; Hollingsworth 1986; Immergut 1987), we have concluded that these two dimensions capture most of the variation in state intervention among medical delivery systems studied here. Both dimensions are necessary because of the existence of certain interactions. For example, a system in which the state provides funding for medical services but makes no effort to control

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[6] Although it is hypothetically possible for the medical system of a country to be highly centralized in the private sector, this type of institutional arrangement has not existed in the history of any Western country. The Federal Republic of Germany is often described as a privatized system with a relatively high level of centralization. Even though there are large sickness funds, the system is highly privatized, fragmented and decentralized, having 1,425 different insurance funds in 1976, each averaging 23,509 members (Stone 1980: 79). Thus, our strategy for measuring state intervention along a dimension of centralization is appropriate not only for these four countries but for other western systems as well.

or coordinate prices or the appointment of personnel will spend more and be less socially efficient than one in which the state also appoints personnel and controls prices (Hollingsworth et al. 1990).

The degree of state intervention in financing medical care is measured by using data on the sources of funding for medical care. For each observation, the proportion of system revenues contributed by the central government, local and regional governments, and private sector actors were weighted five, three, and one, respectively, and then summed. The particular weights chosen are somewhat arbitrary, as the relative numbers of authorities within the central governments, local governments, and private sectors vary considerably across both nations and time (Hollingsworth/ Hanneman 1984). Nonetheless, the resulting index appropriately gives considerably greater weight to the capacities of governmental actors, and particularly to central authorities. Several alternative weights were explored, but resulted in little substantive change in statistical results. The values resulting from the procedure described above could vary, logically, between five, indicating that all revenues were controlled by central governmental authorities, to one, indicating that all revenues were controlled in the private sector.

The degree of state intervention in controlling the appointment of personnel and in setting prices is measured by using data on the employment of physicians and data on expenditures in national medical systems. The state control over personnel index is constructed by assembling data on the proportion of physicians employed by central government, local governments, and private authorities (including self-employment) for each nation and year. Parallel to the previous state control variable, these proportions are given weights of five, three, and one (for central government, local governments and private sectors, respectively) and then summed. The state control over price index was constructed in similar fashion, using data on the proportion of all expenditures in the medical system that occurred at prices regulated by central authorities, local authorities, and mechanisms of the private sector. These proportions were weighted as described previously. Because the indices on price and personnel are so highly correlated, we combined them into a single index. Since the two

series have somewhat unequal variances (calculated across the pool of both nations and time), they were normalized prior to being summed to create a single "price-personnel" index, in effect giving each of the component parts equal weight in the final index. The values of the two indices of state intervention varied considerably across both nations and time.

(3) Control Variable: Social Development

There are many variables which can influence mortality and the costs of medical systems. Some of the most important are education, income, communication, and age structure, particularly the proportion of the population age 65 and over (Preston 1976, 1977; Maxwell 1983; OECD 1985). While we are not directly concerned with these factors here, it is necessary to control for them in order to evaluate the effects of human capital on social effectiveness and social efficiency. To do this, we constructed a social development index of four indicators, reflecting three different dimensions of modernization and development. The level of educational attainment of the population and levels of communication form one dimension, the age structure of the population the second, and the level of GNP per capita the third. The three dimensions are given equal weight in composing a summative index of social development.

Educational attainment was measured by the percentage of age-eligible population enrolled in secondary schools twenty years prior to each time point in question (i.e., the index values for 1930 reflect enrollment rates in 1910). The level of communication was measured by the number of telephone conversations per capita for the year in question. To give each of these components equal weight, they were normalized and summed. Each of these components was then given a weight of .5 in the final social development index.

The age structure of the population was measured as the ratio of the number of persons 65 or more years of age to the total population at each year in question. The level of income was measured as the real gross national product per capita, converted to 1938 U.S. dollars at

average market exchange rates. The values of these variables were normalized by subtracting the mean and dividing by the standard deviation pooled across nations and time. The resulting normalized variable received a weight of one in the final social development index. The final social development index was constructed by adding together the weighted and normalized scores on the four indicators (education, communication, age structure, and real GNP).

3.3 Data

The data consist of 36 observations for Britain, France, Sweden and the United States taken at every ten years between 1890 and 1970. While additional time points and countries would be desirable, there are serious problems in data availability. For example, the data on medical expenditures in the private sector before 1930 required very time consuming historical analysis of family budget data in each country. Moreover, the demographic data over time within and across countries is published with different age categories. To standardize this data over time and across countries required the investigators to visit the census offices in each of the four countries in order to obtain standardized demographic data on population and mortality. One member of our team spent an entire year in France collecting the data, while another spent more than a year collecting the British and Swedish data. To obtain reliable comparable data on other countries would have required considerable additional time, effort, and resources. Thus, our research team chose to do the analysis with the 36 observations analyzed herein (for data sources, see Appendix).[7]

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[7] Data were incomplete for Great Britain at 1890 and were partially estimated by extrapolation. A comparison of OLS (Ordinary Least Squares) estimates of parameters with and without the estimated data revealed no significant differences. In our research design, we could easily have had more observations in order to test the relationship between the human capital variable and social effectiveness - for example, by doing a pooled cross-section and time series analysis based on American states. However, because there is not reliable medical expenditure data reported by American states, we could not have done the analysis of social efficiency with such a

3.4 Data Analytic Techniques

To test hypotheses one through four, we use a regression approach of predicting performance variables (e.g. social efficiency and social effectiveness) from human capital, state intervention, and control variables. To test hypotheses five through eight, we used a more complex model, one which contains the state, human capital and social development variables plus the state intervention variables interacting with human capital variables. Here we also used a regression approach in predicting performance variables from the various independent variables. As the metrics of the variables are not meaningful, and as our interest focuses on the directions and relative magnitude of effects, we focus our attention on the standardized forms of parameter estimates.

The parameters of the model are estimated from pooled cross-sectional and time-series data, and raise some problems of error correlation (Kmenta 1971; Maddala 1971; Johnston 1984). Preliminary analysis of the models suggested significant first-order auto-correlation of errors in most equations for each of the nations. It is also reasonable to anticipate cross-sectional error correlations due to historical events affecting these national systems simultaneously. Faced with such difficulties of correlations in the error structure, a generalized least squares approach suggested by Parks was adopted (see discussion in Kmenta 1971: 512-514), and estimated using SAS TSCSREG routines (Drummond/ Gallant 1983). This approach assumes the operation of a first-order auto-regressive process in the errors, as well as contemporaneous correlation between cross-sections. The models assume that it is reasonable to characterize the relationships in question as constant across time and space, but varying in realization due to nation-specific and time specific disturbances and trends.

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design. Moreover, we wanted to analyze how variation in state structure interacts with human capital to shape social effectiveness and social efficiency. Only by doing a cross-national study would it be possible to obtain appropriate variation on our state variables. Thus, a pooled cross-section and time series design such as that employed in this study permits us to confront the theoretical questions we set out to address.

4. Findings

4.1 Trends in Mortality and Social Efficiency

Age-sex standardized mortality rates declined almost continuously in all four nations during the period between 1890 and 1970 (see Figure One). The rising per capita expenditures (in constant dollars) were much more varied, however, resulting in a more complex pattern of change in the social efficiency measure (see Figure Two). Not only did the standardized mortality rates substantially decline between 1890 and 1970, but they converged somewhat across countries. While the largest portion of the total variation is across time, there were persistent differences among the countries, with France long having the highest mortality rate and Sweden the lowest. In recent decades, the trend toward lower mortality has generally slowed, reflecting the difficulty of accomplishing major improvements at the margin.[8] The slowing decline, however, has not occurred to the same degree in all four countries. It has been quite modest in the United States and even retrogressed somewhat in France; but until 1970, continuing reduction was apparent in Sweden and Great Britain.

Age-sex standardized mortality rates in ratio to real per capita medical expenditures, or what we have called social efficiency, changed substantially in each of the four nations between 1890 and 1970 (see Figure Two). And all four cases have become less socially efficient with the passage of time, reflecting the increased costs of medical care relative to decline in age-sex standardized mortality rates.

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[8] In recent years, there has been some improvement in the duration of life for those age 65 and over. But prior to 1970, the age-sex standardized mortality rates for this population changed little in these four countries (see Manton 1982).

Figure 1: Long-term Trends in Mortality

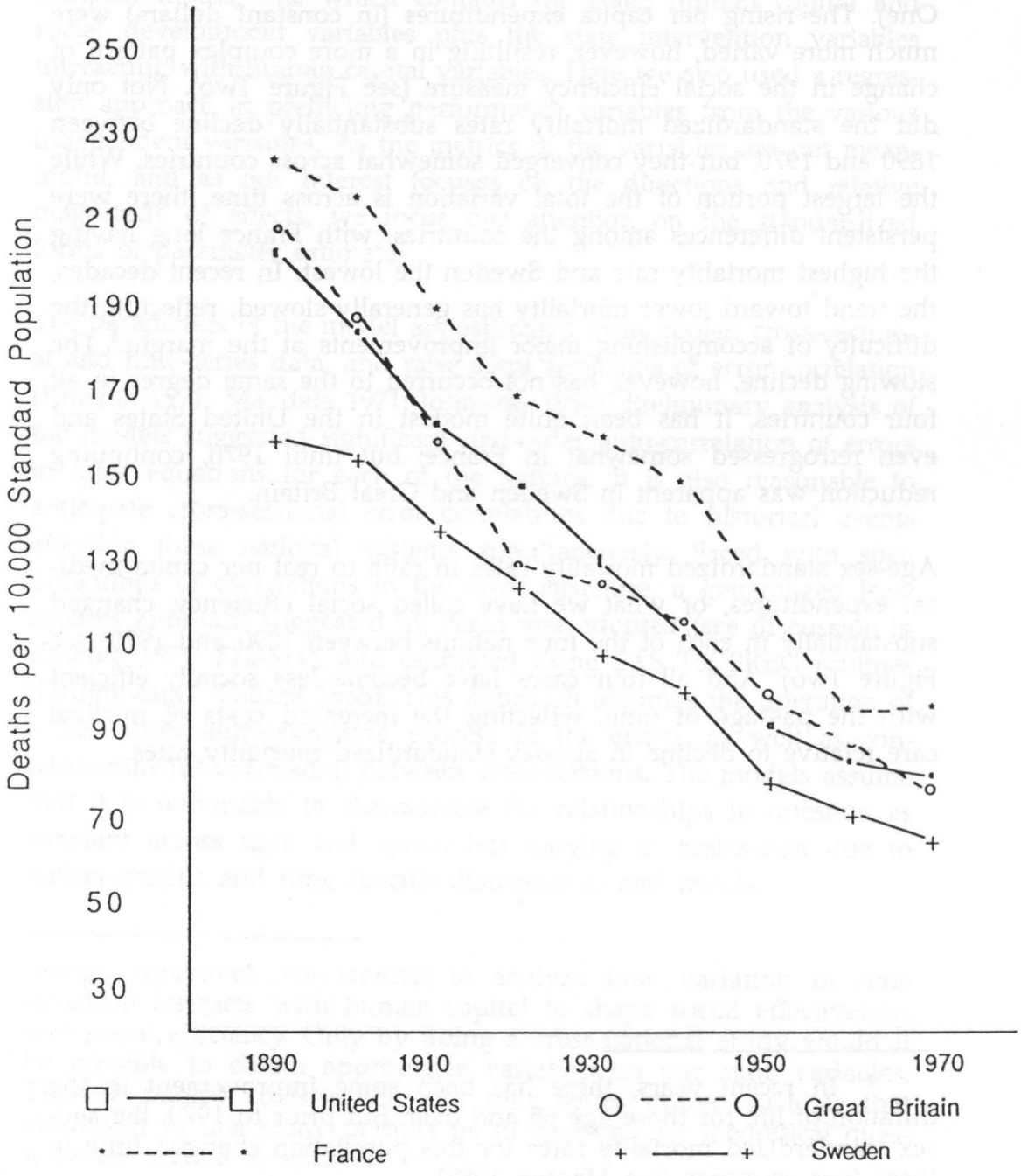
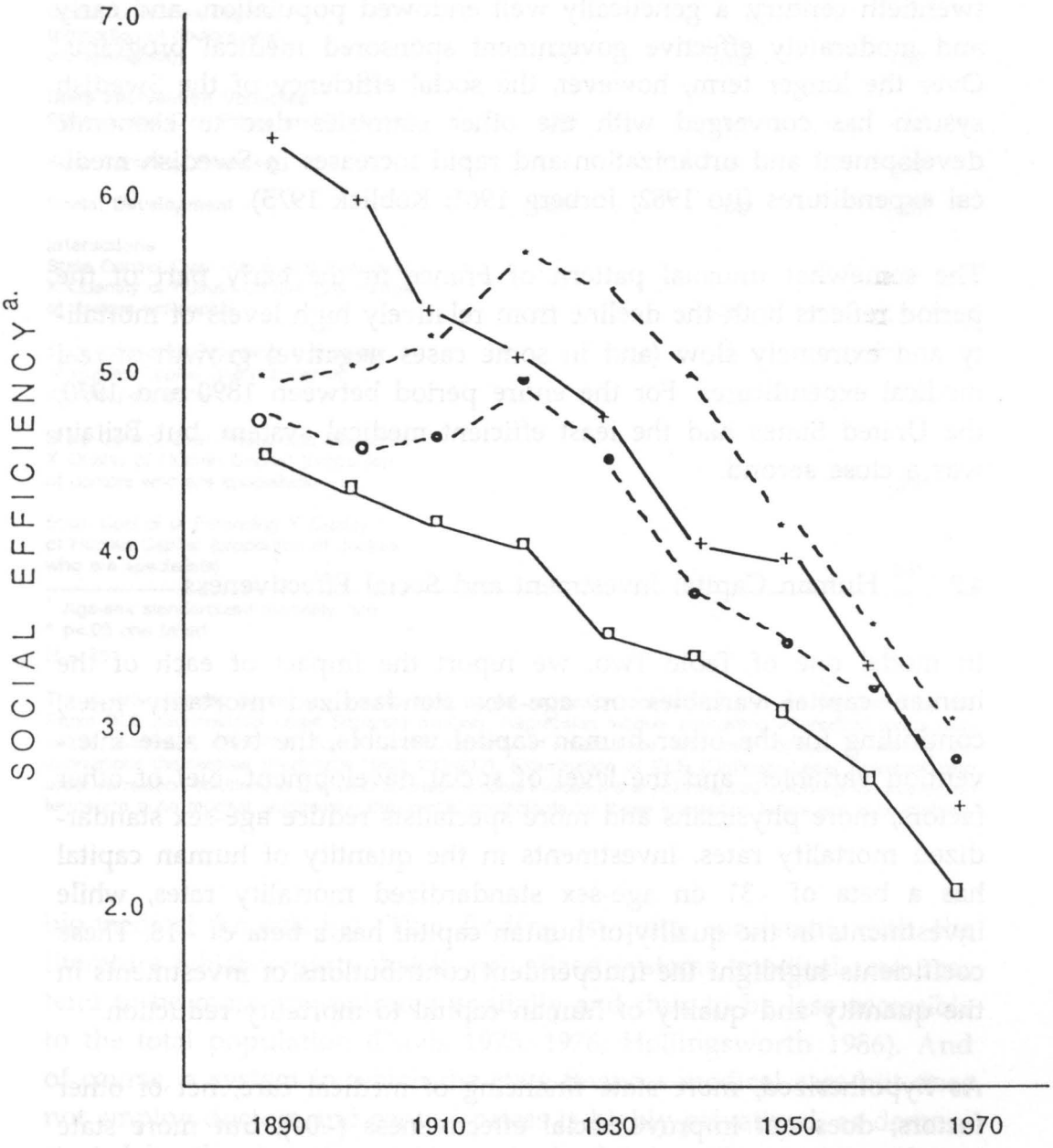


Figure 2: Trends in Social Efficiency



a. log (1000 - Age-sex standardized mortality rate / real per capita medical expenditure)

□ ——— □ United States ○ - - - - - ○ Great Britain

• - - - - - • France + ——— + Sweden

The Swedish case is perhaps the most striking, with an initial high level of social efficiency. This is primarily the result of remarkably low mortality rates due to a variety of reasons, including the low density of population, low level of urbanization at the turn of the twentieth century, a genetically well endowed population, and early and moderately effective government sponsored medical programs. Over the longer term, however, the social efficiency of the Swedish system has converged with the other countries due to economic development and urbanization and rapid increases in Swedish medical expenditures (Ito 1982; Jorberg 1961; Koblick 1975).

The somewhat unusual pattern of France in the early part of the period reflects both the decline from relatively high levels of mortality and extremely slow (and in some cases negative) growth of real medical expenditures. For the entire period between 1890 and 1970, the United States had the least efficient medical system, but Britain was a close second.

4.2 Human Capital Investment and Social Effectiveness

In model one of Table Two, we report the impact of each of the human capital variables on age-sex standardized mortality rates, controlling for the other human capital variable, the two state intervention variables, and the level of social development. Net of other factors, more physicians and more specialists reduce age-sex standardized mortality rates. Investments in the quantity of human capital has a beta of -.31 on age-sex standardized mortality rates, while investments in the quality of human capital has a beta of -.18. These coefficients highlight the independent contributions of investments in the quantity and quality of human capital to mortality reduction.

As hypothesized, more state financing of medical care, net of other factors, does not improve social effectiveness (-.01), but more state control over medical personnel and prices increases social effectiveness (-.32). More state control over personnel and prices increases the tendency for medical resources to be less concentrated in particular areas and increases the likelihood that there will be more access to

Table 2: The Impact of Human Capital on Social Effectiveness[1]

	Model One *(Betas)*	Model Two *(Betas)*	Model Three *(Betas)*
Human Capital Variables			
Quantity of Human Capital (the number of doctors per capita)	-.31*	-.17	-.26*
Quality of Human Capital (proportion of doctors who are specialists)	-.18	-.13*	-.09
State Intervention Variables			
State Control Over Prices and Personnel	-.32*	-.44*	-.33*
State Control of Financing	-.01	.04	-.05
Social Development	-.28*	-.53*	-.53*
Interactions			
State Control Over Prices and Personnel X Quantity of Human Capital (the number of doctors per capita)		-.27*	
State Control of Financing X Quantity of Human Capital (the number of doctors per capita)		.36*	
State Control Over Prices and Personnel X Quality of Human Capital (proportion of doctors who are specialists)			-.28*
State Control of Financing X Quality of Human Capital (proportion of doctors who are specialists)			.24*

[1] Age-sex standardized mortality rate
* p<.05 one tailed
N = 36

The results reported herein are standardized partial regression coefficients and are calculated by the Parks GLS (Generalized Least Squares) method. Regression models containing interaction terms may cause estimation difficulties due to multicollinearity of interactions with main effects or among the interactions themselves (Pedhazur 1982: 232-247). Examination of OLS (Ordinary Least Squares) zero order correlation coefficients and GLS bivariate models indicated that collinearities involving the interaction terms are quite modest, suggesting that partial coefficients for these interaction terms are quite stable.

bio-medical knowledge. This finding is quite consistent with the literature which reports that in privatized systems, medical resources tend to be more concentrated spatially and thus to be less accessible to the total population (Davis 1975, 1976; Hollingsworth 1986). And of course, a system in which the state finances medical care but does not employ doctors and control prices is highly privatized, as demonstrated by the American system. And while we do not have direct measures of the spatial concentration of physicians, the finding that increases in physician density in a privatized system reduce their effectiveness is consistent with the literature (Weller/ Manga 1983).

Higher levels of social development are also associated with reductions in mortality (-.28), consistent with the argument that rising standards of living and the dissemination of information about bio-medical knowledge lead to better health (McKeown 1975; 1976a, 1976b; Preston/ Van de Walle, 1978; Fogel 1986; Apple 1987).

In sum, this analysis supports hypotheses one and two. The relation between the quality of human capital and social effectiveness is somewhat weaker than the relationship between quantity of human capital and social effectiveness, but the direction of the relationship is the same with both variables. Because doctors who are not specialists are more involved in disseminating a broad array of bio-medical knowledge throughout the society than are specialists (Stevens 1966; Klein 1983), we are not surprised that investments in the quantity of human capital are more socially effective than the quality of human capital.

In models two and three of Table Two, we include interaction terms to test our hypotheses that more state control over medical prices and personnel causes investments in the quantity and the quality of human capital to be more socially effective but that more state financing of medical care - when interacting with the human capital variables - is socially ineffective. The analysis lends support to the hypotheses. Net of other factors, more state control over prices and personnel, when interacting with more investment in the quantity of human capital, has a beta of -.27 with age-sex standardized mortality rates; state control over prices and personnel, interacting with the quality of human capital, has a beta of -.28 on social effectiveness. On the other hand, net of other factors, more state involvement in the financing of medical care does not cause more investments in the two human capital variables to be more socially effective. In other words, over time and across countries, net of other factors, state intervention to finance medical care does not cause more investment in the quantity and quality of human capital to accelerate the decline in mortality.

Together, these three models suggest that state institutional arrangements to control prices and personnel not only have the unique effect

of increasing social effectiveness but that they also moderate the effect of both human capital variables on social effectiveness: the more the state intervenes to control prices and personnel, the more socially effective investment in the quantity and quality of human capital become. Thus, the data analysis supports hypotheses five and seven.

4.3 Human Capital Investment and Social Efficiency

In Table Three, we employ the same analytical models to explore the impact of investment in human capital on social efficiency, defined as the level of health [1000- (age-sex standardized mortality rates)] in ratio to medical costs per capita. Model one of Table Three supports hypotheses three and four: more investment in each human capital variable is associated with lower levels of social efficiency, controlling for the other human capital variable, the two state intervention variables, and the level of social development. Investment in the quantity of human capital has a beta of -.17, while investments in the quality of human capital has a beta of -.28. Net of other factors, more investments in the quality of human capital are thus both less socially effective and socially efficient than investments in the quantity of human capital.

More state intervention to finance medical care - net of other factors - leads to less social efficiency (beta = -.39): if the state becomes very much involved in financing medical care without controlling personnel and prices, there are substantial increases in costs, relative to improvements in levels of health. On the other hand, the more the state employs doctors and controls prices, the more socially efficient the system (beta = .62). In other words, how the state allocates resources in the medical area influences the social efficiency of national medical systems. However, as the level of social development rises, medical systems have become less socially efficient (beta = -.34).

A number of interesting findings emerge when we consider in models two and three of Table Three how the state intervention and human capital variables interact to influence social efficiency. As predicted in the last part of hypotheses six and eight, more state

Table 3: The Impact of Human Capital on Social Efficiency[1]

	Model One *(Betas)*	Model Two *(Betas)*	Model Three *(Betas)*
Human Capital Variables			
Quantity of Human Capital (the number of doctors per capita)	-.17*	-.28*	-.09
Quality of Human Capital (proportion of doctors who are specialists)	-.28*	-.32*	-.29*
State Intervention Variables			
State Control Over Prices and Personnel	.62*	.41*	.60*
State Control of Financing	-.39*	-.26*	-.30*
Social Development	-.34*	-.24	-.46*
Interactions			
State Control Over Prices and Personnel X Quantity of Human Capital (the number of doctors per capita)		-.23*	
State Control of Financing X Quantity of Human Capital (the number of doctors per capita)		.07	
State Control Over Prices and Personnel X Quality of Human Capital (proportion of doctors who are specialists)			-.21*
State Control of Financing X Quality of Human Capital (proportion of doctors who are specialists)			.01

[1] Social Efficiency = $\log \frac{1000 - \text{(age-sex standardized mortality rate)}}{\text{Real medical expenditure per capita}}$

* $p<.05$ one tailed

N = 36

The results reported herein are standardized partial regression coefficients and are calculated by the Parks GLS (Generalized Least Squares) method. Regression models containing interaction terms may cause estimation deficiencies due to multicollinearity of interactions with main effects or among the interactions themselves (Pedhazur 1982: 232-247). Examination of OLS (Ordinary Least Squares) zero order correlation coefficients and GLS bivariate models indicated that collinearities involving the interaction terms are quite modest, suggesting that partial coefficients for these interaction terms are quite stable.

intervention to control the financing of medical care does not cause investments in the quantity (beta = .07) or the quality (beta = .01) of human investments to be more socially efficient. However, hypotheses six and eight also predict that more state control over prices and revenue would cause more investments in both the quantity and quality of human capital to be more socially efficient. The data analysis rejects this part of both hypothesis six and eight. More state control over prices and personnel, interacting with more investments

in the *quantity* of human capital, leads to less social efficiency (beta = -23). More state control over prices and personnel, interacting with more investments in the *quality* of human capital, also leads to less social efficiency (beta = -.21).

Why does the data analysis reject the first half of hypotheses six and eight? To confront this problem, we turn once more to the histories of the medical systems of these four countries (Stevens 1967, 1971, 1989; Ito 1980, 1982; Glaser 1970, 1980; Hollingsworth 1986; Hollingsworth/ Hanneman 1984; Klein 1983; Abel-Smith 1964; Aaron/ Schwartz 1984; Immergut 1987).

The data analysis supports our hypotheses that, net of other factors, more state control over prices and personnel independently leads to more social efficiency and that more doctors as well as more specialists independently lead to less social efficiency (see model one in Table Three). Why would more doctors and more specialists, interacting with more state control over prices and personnel, lead to less social efficiency? Here we must address the issue of the autonomy of the state and the considerable power which medical providers exercise. State bureaucrats do have a commitment to controlling medical costs and to enhancing the social efficiency of national medical systems. However, physicians and surgeons are the most powerful actors in shaping medical policies in each of the four countries (Klein 1983; Hollingsworth 1986; Hollingsworth/ Hanneman 1984; Ito 1980, 1982; Hogarth 1963). And, as medical technology has been perceived as being more efficacious, providers have been able to use their knowledge, status, and power to influence the state to provide more capital expenditures for new and better hospitals and the latest equipment for diagnoses and treatment. During the period between 1940 and 1970, as the state began to exert greater control over prices and personnel, the state simultaneously became more involved in financing expensive care and equipment. Thus, more state control over prices and personnel interacted with the increase in the number of doctors and specialists and with their considerable status and power at this historical moment, leading to greater cost escalation and a decline in social efficiency. Even though societies with greater state control over prices and personnel have more socially efficient

systems than is the case with systems which are highly privatized, as doctors and specialists interact with state institutional arrangements designed to increase state coordination and control, the consequences have resulted in social processes by which the preferences of providers have been translated into systems with decreasing efficiency. In other words, the power and status of physicians both independently and in concert with strong forms of state intervention lead to decreasing social efficiency.

5. Discussion

In recent years, much of the discussion between human capital and credentialist theorists has centered around the arguments of Becker (1964), Schultz (1961, 1971), Denison (1965, 1974) and others (Rosen 1977) that the major pay-off from investments in human capital is in the form of higher levels of productivity. Much of the debate has been focused at a micro level of analysis, but some has been at a societal level as well, often suggesting that increases in human capital influence economic growth and productivity at the level of the nation state. This study argues that the formulation at the macro level needs to be broadened to a more sociological perspective, that performances other than economic growth and productivity should be considered, that research should consider the state institutional arrangements within which human capital investment occurs, and that research should be sensitive to how investments in human capital operates within specific societal sectors.

We have addressed two views about the impact of human capital investment on the performance of national medical systems. From the logic of a human capital perspective, we infer that more investments in the quantity and quality of human capital lead to more social effectiveness and that gains in effectiveness outstrip increasing costs to produce greater social efficiency. Alternatively, the logic of a credentialist perspective - in its strongest form - suggests that much of the power of the medical profession is due to the successful organization of practitioners as an interest group with considerable

power and status. Historically, as the process of exclusionary association and credentialling has occurred, the medical profession has been able to obtain societal resources for medical services far out of proportion to gains in actual effectiveness - leading to declining social efficiency, coupled with limited gains in effectiveness.

Controlling for several major societal factors and the changing role of the state in coordinating and controlling medical production, this research demonstrates that higher levels of investments in both the quantity (physician density) and quality (proportion of physicians who are specialists) of human capital are associated with greater effectiveness, or declining age-sex standardized mortality rates (hypotheses one and two). However, the data analysis also suggests that these gains have not been proportional to cost increases. That is, higher levels of investments in both the quantity and quality of human capital are associated with declining social efficiency (hypotheses three and four).

Why is investment in the medical profession effective but not efficient? The medical sector is a technical field with the potential for the rapid diffusion of medical information and technology which are designed to address specific health needs. Therefore, relative to effectiveness, the human capital perspective makes some sense. However, medical care is a highly valued social service, but it is not a sector in which historically there has been a great deal of concern with social efficiency. Physicians and surgeons are socialized to a set of norms stressing the obligation to provide the best service possible, doing the maximum to save a life, with little consideration for cost. Historically, consumers have either shared the same perspective, or have been relatively ineffective in bargaining for lower costs (Fuchs 1986; McGuire/ Henderson/ Mooney 1988).

We have already observed that most medical technologies do not operate with economies of scale. In general, they add to the total cost of medical care, but do little to process people more rapidly. Medical knowledge has tended to lead to a proliferation of tests, treatments, and the like, but not to the rationalization of the medical system. At a more profound level, the whole concept of quality in most areas of

social service tends to reflect higher staff ratios. For example, higher quality service in hospitals frequently means more staff and more costs, as well as expensive equipment. And certainly, the staff-patient ratio has steadily grown in all countries. This type of social process tends to increase costs and reduce social efficiency.

In order to assess the role of institutional arrangements in shaping system performance, we have examined the unique effects of different forms of state intervention on social effectiveness and social efficiency, as well as the consequences of the interaction of different forms of state intervention with investments in the quality and quantity of human capital. The data analysis demonstrated that the more the state intervenes to control prices and personnel, the more socially effective investments in both the quantity and quality of human capital become. Not only does more state control over price and personnel independently increase social effectiveness, but above and beyond this, it causes human capital investments in the medical system to be more effective. State control over the behavior of physicians and the prices of medical services results in greater social effectiveness of medical systems - especially as the density of physicians increases.

Over time, medical systems have become less socially efficient. The data analysis indicates that *social inefficiency* increases as a result of higher levels of social development, more human capital investment, and more state intervention to finance medical care. Greater state control over the employment of physicians and the prices of medical care enhances the social efficiency of medical care. However, more state control over personnel, interacting with more investment in the quality and quantity of human capital does not lead to more social efficiency. As European states increased their employment of specialists they simultaneously were investing heavily in the capital equipment demanded by larger numbers of doctors and specialists, resulting in decreasing levels of social efficiency. The power and preferences of doctors and specialists have been able to override the efforts of the state to control medical costs.

The analysis demonstrates that only one form of state control enhances social effectiveness. Net of other factors, more state control over medical revenues improves neither social effectiveness nor social efficiency. The distinction between the two forms of state intervention contributes to our knowledge about the various dimensions of state structures and helps us to understand the consequences of state institutional arrangements for system performance.

This research has attempted to confront the credentialist-human capital debate by suggesting a set of contingencies: the nature of the sector, the nature of the performances, and the importance of the state context in which the investment in human capital occurs. In conclusion, we wish to emphasize several points: *First*, the credentialists are correct to have reservations about claims of contributions of investments in human capital to efficiency - particularly social efficiency measured at the level of the nation state. We suggest that is especially true in most sectors involving social services. *Second*, although human capital theorists did not make their argument in terms of social effectiveness, our findings indicate that investments in human capital tend to improve system effectiveness. In the social services, investments in both the quantity and the quality of human capital are more likely to be driven more by considerations of social effectiveness than social efficiency. This distinction has not previously been considered in the debate but should be. *Third*, the debate has ignored the consideration of the various state institutional arrangements which influence the effects of investments in human capital. The pay-off for effectiveness is very much influenced by whether increases in human capital takes place within a state with high or low levels of coordination and control. These ideas can advance a sociological theory of human capital and improve our understanding of how investments in human capital can become more or less socially effective and socially efficient. *Fourth*, by identifying several dimensions by which we can measure the consequences of state intervention, these ideas also represent an advance in theorizing about the state. Fifth, the findings that more specialization does not necessarily lead to social efficiency suggest the need to make revisions in a long tradition in the history of social thought which has argued that

increasing the division of labor and specialization will lead to more productivity and efficiency.[9]

[9] Historically, this perspective developed in regard to sectors in manufacturing, and the argument about the consequences of increasing the division of Labor has a history of several hundred years. For an excellent overview and critique, see Rueschemeyer (1986). For a contrary position in manufacturing sectors, see Marglin (1974). Because structural arrangements have different performance consequences across economic sectors, we need research which is sectorally specific. See Hollingsworth and Lindberg (1985).

APPENDIX: DATA SOURCES

1. Expenditures on Medical Care

United States

Historical Statistics of the United States; Reports of the U.S. Commissioner of Labor for 1890 and 1903; Barbara S. Cooper, et al., *Compendium of National Expenditures Data* (Washington, D.C.: G.P.O., 1976); *Statistical Abstract of the United States,* various years.

Great Britain

Burdett's Hospitals and Charities for the years 1914, 1921, 1933; Robert Pinker, *English Hospital Statistics* (London: Heinemann, 1966); Ministry of Health, *Annual Reports; Statistical Abstract of the United Kingdom,* various years; Richard Stone and D. A. Rowe (eds.), *Studies on the National Income and Expenditure of the U.K.,* vol. II (Cambridge: Cambridge University Press, 1954).

France

Statistique Generale: Statistique d'Institutions d'Assistance for 1901, 1911, 1921, 1931; *Annuaire Statistique de la France,* various years; various studies of household budgets, one of the more useful ones being *Seventh Annual Report of the Commissioner of Labor, 1891: Cost of Production* , Vol. II, Part III -- "The Cost of Living" (Washington, D.C.: G.P.O., 1892).

Sweden

Statistisk Arsbok, various years; Medicinalstyrelsen, *Allman Halso-och Sjukvard,* various years; Statistiska Centralbyran, *Folkrakningen,* various years.

2. Mortality

United States

Vital Statistics of the United States, various years; *Census of the United States,* various years. 1890 data are based on Massachu-

setts death rates. After 1900, data are based on each state which complied with national registration requirements. See discussion in *Historical Statistics Office of the United States*, pp. 44-45.

Great Britain
Decennial Census, 1891-1971; *Registrar General Reports*, 1891-1971.

France
Statistique General de la France, various years; *Recensement General de la Population*, various years.

Sweden
Sveriges officiella statistik i sammandrag (1896, 1906); *Sveriges officiella statistiska: Folksmangden och dess forandringer, folkraknin-gen*, various years; *Befolkningsforandringar 1970*, vol. 3.

3. **Number of Doctors**

United States
Decennial Census, various years; *Historical Statistics of the United States.*

Great Britain
Census of England and Wales, various years; *Census of Scotland*, various years.

France
Annuaire Statistique de la France, various years; Statistique General, *Statistique du Personnel Medicale* , various years; *Recensement de la Population*, various years.

Sweden
Statistisk Centrallyran, *Folkrakningen*, various years; *Statistisk Arsbok*, various years.

4. **Proportion of Doctors who were Specialists**

United States

Census of the United States, various years; Health, Education and Welfare, *The Supply of Health Manpower*, various years; *Health Resources Statistics*, various years; Rosemary Stevens, *American Medicine and the Public Interest* (New Haven: Yale University Press, 1971).

Great Britain

Census of England and Wales, various years; *Census of Scotland*, various years. *Health and Personal Social Services Statistics for England and Wales*, adjusted with reference to Rosemary Stevens; *Medical Practice in Modern England: The Impact of Specialization and State Medicare* (New Haven: Yale University Press, 1966) and Odin Anderson, *Health Care: Can There Be Equity?* (New York: John Wiley, 1972).

France

Guide Rosenwald, various years; *Annuaire Statistique de la France*, various years; Statistique Generale, *Statistiques du Personnel Medicale*, various years; Statistique Generale, *Recensement de la Population*, various years.

Sweden

Socialstyrelsen, *Allman Halso-och Sjukvard*, various years; Swedish Institute, *Public Health and Medicine in Sweden* (Stockholm: Forum), various years.

5. **Sources of Revenue, whether State or Private Sector**

Same as sources for expenditures for medical care, listed above.

6. **Control over Prices and Personnel**

a) The variable state control over prices was constructed by examining the data on expenditures on medical care, listed above.

Modifications were made to reflect the actual locus of price setting.

b) Control over Personnel

United States

Benevolent Institutions, 1904 (Washington, D.C.: G.P.O., 1905; *American Medical Association Directory,* various years; *Health Manpower Source Book* (Washington, D.C.: G.P.O., 1952). H.E.W., *Public Health Service,* Publication No. 263 (Washington, D.C., 1959, 1961). *Journal of the American Medical Association,* 45, Pt. 2 (August 1, 1971).

United Kingdom

Ministry of Health, *Health and Personal Services Statistics,* various years; *Hospitals Survey* (HMSO, 1945); Stevens, *Medical Practice in Modern England.*

France

Annuaire Statistique de la France, various years; *International Studies on the Relation Between the Private and Office Practice of Medicine* (London: Allen and Unwin, 1935), Vol. II.

Sweden

Statistisk Arsbok, various years; Arnold J. Heidenheimer and Nils Elvander (eds.), *The Shaping of the Swedish Health System* (New York: St. Martin's Press, 1980); Hirobumi Ito, *Health Policy Dynamics in Two Scandinavian Democracies: The Development of the Health Care System and Modernization in Denmark and Sweden, 1850-1950.* (Copenhagen: Institute of Social Medicine, 1982).

7. Social Development Index

(a) Communication

United States

Historical Statistics of the United States.

Great Britain

B. R. Mitchell, *European Historical Statistics, 1750-1975* (London: Macmillan Press, 1975, 1981) first and second editions. *Annual Abstract of Statistics, 1971* (HMSO).

France

Mitchell, *European Historical Statistics; Annuaire Statistique de la France,* various years.

Sweden

Mitchell, *European Historical Statistics; Statistisk Arsbok,* various years.

(b) **Population 65 and over**

United States

Census Reports, various years.

Great Britain

Decennial Census, various years.

France

Annuaire Statistique de la France, various years.

Sweden

Sveriges Officiella Statistik i Sammandraq, various years; *Folkrakningen,* various years; *Befolkningsforandringar,* 1970.

(c) **Gross National Product**

United States

Historical Statistics of the United States.

Great Britain

Statistical Abstract of the United Kingdom, various years; Mitchell, *European Historical Statistics.*

France
Annuaire Statistique, various years; *European Historical Statistics.*

Sweden
Mitchell, *European Historical Statistics; Statistisk Arsbok*, various years.

(d) **Education**

United States
Census of the United States, various years.

Great Britain
Parliamentary Papers, various years; Education and Science, *Statistics of Education, 1972*, Vol. 1 (HMSO).

France
Ministere de l'Education, *Statistiques des Ecoles Primaires*, various years; *Annuaire Statistique*, various years; *Information Statistiques* (Paris: Ministere de l'Education), various years after 1957.

Sweden
Statistisk Arsbok, various years.

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