Health Inequalities in the Era of the Knowledge Economy
Editorial Summary

Overview

People with higher incomes, more education, and more prestigious jobs tend to live longer, healthier lives. This is true throughout the industrialized world, at both the individual and society level, as public health research has demonstrated for several decades.

Today, fundamental economic structure is changing, with knowledge becoming more valuable than services (which earlier displaced industry) as the primary driver of growth and prosperity. That raises a question: How does worker health relate to the health of the economy in this new system, and what public policies will promote the health of both?

The relationship between health and socioeconomic status (commonly abbreviated SES) has been measured in numerous ways. Various theories attempt to explain the data. A 2006 study of European economies, prepared for the European Commission, offers new insights that may be especially valuable to policymakers.

Most intriguingly, the authors found a *powerful positive relationship between the level of self-employment in a society and the health of its citizens*—even in the face of frequent change in an economy where knowledge produces benefits. This suggests that policies encouraging entrepreneurship—even inside large corporations—may provide a cushion against job loss and promote a mutually beneficial cycle of individual health and group prosperity. Such policies may also address problems created by the increasing division of the workforce into highly skilled knowledge workers and unskilled service workers, who are marginalized (or excluded) because of their status.

Data and Analysis

How do income, education, and job status affect a person's physical, psychological, and emotional health? Although the relationships are complex and few have been definitively established, data at least partially support the following explanations:

Income

A person's income obviously affects the quantity and quality of goods and services—including medical services—he or she can buy. Additionally, researchers hypothesize that people who make more money have stronger

social networks (numbers and quality of relationships ranging from casual acquaintances to family members), which promotes health by reducing stress and helping them locate appropriate medical resources when needed.

On the other hand, unemployment, which produces stress in addition to limiting the ability to pay for medical care, is strongly associated with higher rates of illness and death. Some research suggests that people who become unemployed may be more vulnerable to illness for many years, even after they regain employment.

Education

Research demonstrates that highly educated people are more knowledgeable about ways to safeguard their health and about the treatments available if they become ill. Many studies have shown that being better educated reduces a person's risk of contracting or dying from a range of diseases—especially those influenced by lifestyle choices such as nutrition, activity levels, and smoking.

Of course, more educated people tend to earn more money, so both education and income are likely to have a positive impact on health.

Occupational Status

The diverse academic research in this area examines the relationship between an individual's health and what might broadly be called the quality of his or her work experience. The factors most commonly identified as damaging to workers' health are high work demands combined with very little autonomy and/or ability to make decisions. Other researchers believe the effort required to do a job compared with the rewards received influences the level of job stress and the resulting threat to worker health.

Finally, job insecurity—the real or perceived risk of losing one's job—creates stress and the risk of illness. This is a particularly important factor in the knowledge economy, where job stability is decreasing even as overall productivity and economic output increase.

Most of the data described above pertain to the experience of individual workers or specific groups of workers within specific workplaces. In order to shape policy, we must look for the "big picture"—economic *markers* (or *indicators*) that point to conditions that will positively or negatively influence personal health and economic growth. Based on a variety of analyses, but particularly the 2006 European Commission study, the following emerge as key indicators:

GDP Per Capita

Gross domestic product per capita is the basic measure of a society's prosperity. It is also the strongest predictor of overall health level of the members of that society. Higher GDP can promote better health in several ways by:

- raising individual incomes;
- making money available for medical research and the delivery of medical care;
- creating greater opportunities for education, especially the lifelong education workers need to keep pace with new technologies; and
- expanding the benefit packages associated with employment and strengthening the social safety net.

Although the level of *income inequality* in a society shows some relationship to overall health outcomes—as many theorists have said in recent years—it appears to be a less powerful predictor than simple GDP per capita.

Self-Employment

The strong relationship of self-employment levels to health is a new and potentially profound finding of the European Commission study. This finding is particularly significant for knowledge-based economies, because prominent knowledge sectors are highly compatible with entrepreneurship (such as medicine and law, retail and wholesale trade, and entertainment and restaurant enterprises).

Further, policies that promote self-employment and entrepreneurship can potentially lessen the significant disadvantages of the knowledge economy—the unbridgeable gap between skilled and unskilled workers, and the economic cycles that leave even skilled workers without jobs at times.

In theory, self-employment contributes to workers' health because it offers the autonomy (or independence) and control often lacking in corporate jobs. Self-employment contributes to the health of the economy not only directly, but indirectly by serving as an incubator for innovations and technological advances that larger corporations may later adopt.

Logically, therefore, these two factors—GDP and self-employment—appear to reinforce one another. That is, in prosperous societies, resources are available to support the creation of new small businesses; then as those businesses take hold and flourish, the economy prospers even more. Economic prosperity and the satisfaction of self-employment boost the health of workers and increase their ability to produce greater economic gains.

The Shadow Economy

Another new finding of the European Commission study is that the more economic activity takes place in the *shadow economy*—or outside the officially sanctioned structures of government support, regulation, and taxation—the lower the overall level of societal health. In other words, a society whose economic activity is supported and encouraged by the government tends to have greater health.

Policy Implications

For creating new public policy, the data described imply:

- The level of a population's health can serve as a measure of the quality of the working environment within that society or economic sector.
- Investments in human capital—education, continuing education, research and development, et cetera—should boost worker health as well as productivity.
- Policies that support entrepreneurship and self-employment should pay off on both the health and economic fronts in a variety of ways.
- Even large corporations may benefit from creating multiple, fairly autonomous divisions in response to shifting economic opportunities—especially if they help workers acquire training and skills needed to move easily from one business unit to another.

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ABSTRACT

As advanced industrial societies move into the era of the knowledge economy, the distinction between those in highly skilled and educated occupations and those in lower skilled, lower education occupations becomes more pronounced, as do health inequalities. Although prior research on the relationship between socioeconomic status and health has revealed that societies characterized by higher levels of income inequality have higher rates of illness and mortality, this paper posits that gross domestic product (GDP) per capita and overall economic growth are more important predictors of mortality differences and other health disparities. In addition, the proportion of the workforce engaged in self-employment and the prevalence of shadow economic activity also strongly correlate with mortality rates among the workforce population. In light of these observations, policy implications are discussed.

Keywords

knowledge economy, health inequality, self-employment, health disparities, income inequality

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Introduction

Rates of illness and mortality are highly related to socioeconomic differentials—the higher the educational, occupational, and income status of a person, the less likely it is for that individual to suffer from chronic illness, disability, accidents, suicide, homicide, or early death. This basic research finding is true in virtually all industrialized countries. Advanced economies have moved beyond agriculture (primary), manufacturing (secondary), and even general services dominance (tertiary) into a "knowledge economy," where pure information is the dominant element of both production and consumption. This "advanced tertiary economy" has created a disjuncture between two major classes of occupations: one dominated by science and engineering and requiring an increasingly sophisticated and educated workforce, and the other dominated by less-skilled workers in retail trade, hotels, restaurants, and the like.

Research conducted across five areas of study has consistently revealed the relationship between health and socioeconomic status: (1) income and occupational skill level, (2) unemployment, (3) education, (4) occupational stress, and (5) locus of control. While the dominant thesis in this literature has been that illness and mortality rates are higher when a country is characterized by high levels of income inequality, a study I conducted for the European Commission (European Commission, 2006) found that gross domestic product (GDP) per capita (and economic growth overall) has been determined to be the outstanding factor in the health of the working population. This revelation was further expanded by the finding that a second important factor that beneficially influences mortality rates is the extent to which there is self-employment in contrast to wage and salary employment.

Self-employment and small-firm employment represent central elements of the advanced tertiary sector, or what we call today the "knowledge economy." The key occupational enterprises associated with small-firm employment include professional, technical, managerial, and retail sales groups. These small firms and self-employed individuals constitute the engine of economic growth that is an intrinsic part of larger industrial structures, signifying relatively prosperous conditions of investment and consumption that enable development of innovative industries.

A third important variable, albeit one that represents a risk factor for mortality across industrialized countries, is the extent to which GDP consists of "shadow" economic activity—i.e., employment that is undertaken without the payment of government taxes; is not regulated through health and safety measures; and does not provide unemployment insurance, disability insurance, or pensions. The proportion of the economy that is estimated as shadow-based is strongly

positively correlated with higher death rates among the working-age population. This represents an entirely new finding in demographic epidemiology.

In summary, macroeconomic indicators that predict mortality have been newly determined to include low GDP per capita, low rates of self-employment, and a large shadow economy, along with the well-established hypothesis of high rates of income inequality. The next section discusses the fundamental relationships of socioeconomic inequalities in the health economy to mortality differentials.

Health Inequalities

Our most basic finding in the history of public health is that the rates of illness and mortality are highly related to socioeconomic differentials. Even at the individual level, the higher the educational, occupational, and income status a person has compared with others of similar social and demographic background, the less likely it is the individual will suffer from chronic illness, disability, accidents, suicide, homicide, or early death. This observation has been found for nearly all industrialized societies, including North American and Western European countries, Australia, Japan, and the former communist countries of Eastern Europe. Research in epidemiology and public health indicates that the overwhelming effect of socioeconomic status (SES) on health has likely been true since at least the industrial revolution of the mid-19th century.

What is the importance of the stability of such findings for urban life in contemporary U.S. society? The United States has a special urban living situation in the early 21st century in that we are confronted with what is called a "knowledge economy." As previously stated, this implies that our advanced economies have moved beyond agriculture (primary), manufacturing (secondary), and even general services (tertiary) dominance, and we have gone much further in the introduction of pure information as the dominant element of both production and consumption in the advanced tertiary economy. In this urban economy, four principal sectors predominate. The first is professional occupations (e.g., medicine, law, accounting, architecture), heavily infused by the modern rapid movements in information technology. The second is the large sector of wholesale and retail trade, which has absorbed much of the female working population in particular. Third is the sector emerging out of manufacturing, which includes both services and manufacturing and refers largely to the office work that is dominated by middle-class white-collar workers and management in large complex firms. Finally, the fourth area comprises the less-skilled occupations found in restaurants, hotels, and grocery stores. This sector is heavily populated by immigrant groups of many ethnicities as well as a large proportion of African Americans in the modern urban United States.

The problem, in a nutshell, is that our economic civilization is creating a disjuncture between two major classes of occupations. The first is heavily dominated by the sciences and engineering, biotechnology, and artificial intelligence—and these occupations require increasingly sophisticated education, which is undergoing rapid change under the development of research universities and the growing importance of research and development investment in major firms. At the same time, we are finding increasingly important social requirements for workers with relatively low educational skills—for example, many of these low-wage occupational sectors (e.g., retail trade, hotels and restaurant industries, clerical work) are becoming more and more gender and ethnic specific.

We now know there will be an greater overall burden of illness, mortality, social depression, and alienation predicated by the extent to which educational and occupational skills and incomes are differentiated within a population. Such indications of poor mental and physical health as well as alienation, in turn, greatly decrease the motivation for achievement and upward social mobility. This is, of course, contrary to the classic American view of the world (e.g., "pick yourself up by the bootstraps" viewpoint), and particularly afflicts U.S. "minority" groups, especially Hispanics and African Americans. Thus, the situation is that while the "majority," or at least more highly educated groups of the population, experience increasing returns on income and health, the less-skilled populations benefit from overall economic growth, but at a much lower rate of return than the highly educated groups. This causes not only increasing income inequality, as discussed by empirical economists, but also an increasingly widened gap in health, mental health, and criminal justice problems that divide our higher skilled and educated from our lesser skilled and less educated population.

It is one thing to describe these phenomena based on the existing literature, which can be seen in urban life in North America and Europe. It is quite another to propose "solutions" to this state of affairs. Our situation is deeply complicated by globalization—especially by the emergence of China, India, Brazil, and other mid-level developing countries as the new primary producers of manufactured goods. This emergence has profoundly impacted those working in the manufacturing sector in America.

This paper attempts to describe the nature of our economic and health inequalities problem by referencing the existing literature and identifying competing strategies which have been proposed to minimize the severity of the problem. The most recent evidence involves a large-scale study, prepared for the European Commission (2006), which attempts to take many of the basic findings on the connections between socioeconomic status and health at

the individual level and convert these findings to macroeconomic and health indicators that can be used at the national policy level. This study has replicated the individual-level epidemiological relations of SES and health, but in a way that allows us to understand the broader macroeconomic factors that shape the national patterns of SES and health.

Beginning with a review of the now classic SES–health relationship, this paper emphasizes its traditional components: income and occupational skill level, unemployment, education, occupational stress, and locus of control. Next, the paper describes the principal economic factors that correspond to the macro SES predictors of mortality: low GDP per capita, low rates of self-employment, a large shadow economy, and high rates of income inequality. These findings are then examined in light of their theoretical and empirical importance to social well-being and life expectancy. Some policy strategies are explored with particular attention to urban economic development.

Income as a Key Factor in Mortality

In our models, income represented by gross domestic product (GDP) per capita—calculated at purchasing power parity (PPP) exchange rates[1]—is the beneficial driving force behind national mortality rates and accounts for the largest proportion of their variance. The literature provides substantial evidence for this statement. It is well known, though the reasons are not well understood, that socioeconomic status (SES), with income being one of the three pillars of SES, is strongly and inversely related to mortality and, most specifically, disease outcomes, including occupational health. Likewise, it has been shown repeatedly that income is equal to—if not stronger than—the other two components of SES (educational and occupational status) when used as a predictor of mortality (at least when based on U.S. data: Daly, Duncan, McDonough, & Williams, 2002). For example, it has been shown that cardiovascular disease (CVD) mortality likely follows economic cycles (Brenner, 1997). Additional support comes from a San Francisco intervention study designed to estimate the magnitude of health improvements that would result from a proposed living wage ordinance. The study results showed substantial health improvements, including an increase in education and occupational status—the other two SES indicators (Bhatia & Katz, 2001).

An ongoing dispute in the epidemiological literature concerns the causal mechanism in the SES–health relationship. It has been suggested that this

[1] In economics, purchasing power parity (PPP) exchange rates are frequently used to compare the standard of living or the cost of goods and services in different countries. Ideally, once the exchange rate is adjusted for, goods and services should cost the same in different countries.

relationship might reflect an association between income and health at the individual level. This idea is known as the absolute–income hypothesis, which contends that rising income enables individuals to purchase more or better goods and services beneficial to health. The association is alleged to be nonlinear because households with rising incomes will eventually spend a smaller proportion of their total income on goods and services compared with those households with lower incomes.

There is also evidence that income inequality at the population level affects measures of health, such as mortality, infant mortality, and life expectancy, at all levels of income (U.S.: Lynch et al., 1998; Australia: Turrel & Mathers, 2001). Hypotheses that have become important in the past 10 years suggest that the population-level relationship between income inequality and health works through layers of hierarchy (see Wilkinson, 1992), with health at the individual level being affected mainly by relative social status or social capital (social relations hypothesis), or mainly by relative income (relative income hypothesis). The social relations hypothesis is based on the premise that the higher the social status, the more social capital an individual possesses, and as a result the more likely the individual is to have more positive health outcomes. In contrast, the relative income hypothesis implies that absolute income is not nearly as important as the relationship of an individual's income to the income of others. In their extensive review on this subject, based on U.S. population data and supported by the World Bank, Wagstaff and van Doorslaer (2000) concluded that "overall, the absolute-income hypothesis, although more than 20 years old, is still the most likely one to explain the frequently observed strong association between population health and income inequality levels" (p. 543; see also Fiscella & Franks, 1997).

However, in direct comparisons between Canadian provinces or metropolitan areas and U.S. states or metropolitan areas, the Canadian example seems to counter the association between income inequality and mortality at the societal level, indicating different ways in which social and economic resources are distributed (Gorey, 2000; Ross et al., 2000; Sanmartin et al., 2003). Kawachi and Kennedy (1997) argue that the large gap between the rich and the poor in the United States leads to higher mortality through the breakdown of social cohesion. Interestingly, data taken from the Israel Longitudinal Mortality Study, after adjustment for individual income, showed "men living in relative disadvantage compared with their neighbors had lower risks of mortality than those living in concordance with their area" (Jaffe, Eisenbach, Neumark, & Manor, 2005, p. 989). This would appear to strengthen the argument that wealthy surroundings might contain facilities that protect the relatively deprived. For example, a

population-based cohort study during the Taiwan earthquake in September 1999 found that the degree of vulnerability to a natural disaster increased with decreasing monthly wages; earthquake deaths were strongly related to absolute individual income (Chou et al., 2004). This study illustrates the overall effect income has on health.

A large study that compared health outcomes among 23 wealthy countries found that income inequality and characteristics of the psychosocial environment, such as indicators of social capital (trust, control, and organizational membership), do not seem to be key factors in understanding health differences; rather, the authors argued that the associations that do exist are largely limited to child health outcomes and cirrhosis (Lynch et al., 2001). The Lynch et al. findings largely contradict both Wilkinson's and those that focus primarily on social capital (see previous section).

In contrast, a large study from the United Kingdom (U.K.) found that socioeconomic conditions in childhood as well as early adulthood remained an independent predictor of survival for British people born in the immediate post-war era, even after adjustment for income in adulthood (Kuh, Hardy, Langenberg, Richards, & Wadsworth, 2002). Important differences emerge for selected specific occupations beyond those accounted for by social status, income, and education. According to a U.S. study, "high-risk specific occupations include taxi drivers, cooks, longshoremen, and transportation operatives; while low-risk specific occupations include lawyers, natural scientists, teachers, farmers, and 'a variety of engineers'" (Johnson, Sorlie, & Backlund, 1999, p. 355). However, other epidemiologists argue that models focusing exclusively on income as a measure of the impact of SES on mortality are not complete, and that health spending and unemployment may be even more important than income growth and dispersion (Laporte & Ferguson, 2003).

According to a study by Kunst, Groenhof, and Mackenbach (1998), European countries (EU-12) are very similar with respect to mortality by occupational class among men aged 30 to 64. Essentially, they argued that data problems accounted for biases in inequality estimates. Other recent publications have hinted that adjustments for ethnicity (in United States) or education—both markers of early-life social circumstances—cause the association between income inequality and health to disappear (Pearce & Davey Smith, 2003). Pearce and Davey Smith further argue that across countries, the association between current income inequality and health may or may not exist "depending on the choice of countries and their historical, cultural, political, and economic context" (p. 124).

Unemployment and Health

Unemployment is consistently associated with poor health. Part of this association may be a selection effect—people who are healthier are more likely to be employed. However, sufficient evidence exists to suggest that employment protects and fosters health. Béland, Birch, and Stoddart (2002) discuss the unemployment–health relationship in depth. The set of modulators is complex and includes financial strains, social support, psychosocial factors (such as stress), and contexts (e.g., business cycles).

The effects of unemployment on health may be mediated through pessimism about the future and financial strain. A survey comparing young unemployed men and women during both an economic boom and an economic recession showed that each gender reported more somatic and psychological symptoms during a recession than a boom (Novo, Hammarstrom, & Janlert, 2001). Moreover, it is not only the current economic situation, but also experiences of disadvantage at any time over the life course that can lead to poor health in the future. A study by Bartley and Plewis (2002) showed belonging to a "semi- or unskilled social class" or being unemployed in 1971 independently contributed to an increased risk of chronic limiting illness 20 years later.

In 2004, the Karolinska Institute in Sweden published a large study on unemployment and early cause-specific mortality. Hailed as one of the most interesting studies on the effects of unemployment because of its unusual design, Voss, Nylen, Floderus, Diderichsen, & Terry (2004) followed 20,632 twins, female and male, tracing their mortality from 1973 through 1996. The results suggested the following:

> Unemployment is associated with an increased risk of early death even after adjustment for several potential confounding factors, including socioeconomic status, lifestyle factors, and genetic and early childhood factors. In particular, unemployment was associated with increased mortality from suicide and (deaths due to) external undetermined causes; for men, deaths from malignant neoplasms are also elevated. (Voss et al., p. 2158)

However, there is growing evidence that not only do experiences of disadvantage matter, along with unemployment, but so too do experiences of solidarity.

Education and Health

It is well accepted that the more highly educated a person, the more likely he

or she is to be informed about health hazards and risk management strategies, including the use of health care facilities. The socioeconomic gradient in mortality has been described above. In most studies, income is the strongest predictor of these gradients, followed by education, especially for "preventable" causes of death such as fatal occupational injuries (Blakely et al., 2002; Sorlie, Backlund, & Keller, 1995; Steenland, Halperin, Huh, & Walker, 2003).

Income and education are strongly interlinked. The better a person's education, the more likely he or she is to obtain a high-income job, or the less likely he or she is to become or remain unemployed. The higher the family income or—at least in some countries—national wealth, the better the education available for children. As Davey Smith et al. (1998) pointed out, "social class can change throughout adult life, while education is unlikely to alter after early adulthood" (p. 153). In that prospective study, cardiovascular disease as a cause of death was most strongly associated with education. It was concluded that "the stronger association of education with death from cardiovascular causes than with other causes of death may reflect the function of education as an index of socioeconomic circumstances in early life" (Davey Smith et al., 1998, p. 153).

Johnson et al. (1999) analyzed data from a large national cohort in the United States (380,000 persons, aged 25 to 64) and found that "mortality differences obtained for social status groups of specific occupations are almost completely accounted for by adjustments for income and education" (p. 355). The same was true for a study from Italy—education and income largely explained the mortality differences by social class in men, while income showed the highest contribution in women (Mamo, Marinacci, Demaria, Mirabelli, & Costa, 2005).

A broad study from the Netherlands compared differences in total and cause-specific mortality by educational level (as a proxy for SES) and gender. Seven countries were included and provided data from 1980 to 1990: the United States, Finland, Norway, Italy, the Czech Republic, Hungary, and Estonia. Except for breast cancer, higher mortality rates among lower-educated men and women were found for most causes of death; among men, the differences were even more pronounced (Mackenbach et al., 1999, 2003). Similar results from an analysis of two American Cancer Society (ACS) cohorts (1959–1996) found that "temporal trends showed increasing mortality differences by education for coronary heart disease, diabetes, and lung cancer for women" (Steenland et al., 2002, p. 11). In contrast to the Mackenbach et al. findings discussed above, education accounts for the frequency of cancer screening examinations or the stage of cancer at the time of diagnosis (Merkin, Stevenson, & Powe, 2002).

According to Marshall, Chevalier, Garillon, Goldberg, & Coing (1999), cancer occurrence during working life is strongly associated with SES measures, although the authors did not specifically control for education per se.

Regarding disability pensions (rather than mortality), Krokstad, Johnsen, and Westin (2002) demonstrate that education was an even stronger predictor of disability pension than medical factors. However, it is plausible that individual education level accounts substantially for the type of job obtained. The more formal education a person has, the more likely he or she will find a job with high-decision latitude or autonomy; communication skills are also likely to be positively related to education. Thus, education might be closely linked to, but more clearly described through, variables like job strain or social support.

Occupational Stress, Job Satisfaction, and Health

Job satisfaction and occupational stress are often discussed interchangeably. In reality, the terms are based on two distinct concepts. The basic difference is that job satisfaction is only a measure of individual self-perception, while stress can serve both as an individual (e.g., self-perceived stress) and an aggregate parameter. Moreover, many aspects of stress go beyond self-perception and can be measured directly.

In the occupational health context, sources of stress include poor working conditions, work relationships, an unclear role in the organization, long hours, organizational climate, and lack of job security. It is plausible, and has been argued repeatedly, that economic recession and the resultant high unemployment rates create a climate of uncertainty, resulting in increased absenteeism because of more illness. Interestingly, absenteeism, which is a common measure in the epidemiological literature, does not always reflect disease, especially for short-time absenteeism (Kivimäki et al., 2003b; Vahtera, Pentti, & Kivimäki, 2004). There is little doubt that ongoing recession is accompanied by decreases in short-time absenteeism from work (which does not necessarily reflect decreases in illness) because employees are frightened of losing their jobs and are more likely to attend work even when ill (Markham, 1991). Even among young adults, as demonstrated by Hannan, Ó Riain, and Whelan (1997), unemployment is the most significant influence on levels of psychological distress. The impact of unemployment increases more when combined with feelings of lack of control and, especially in this context, when the responsibility of employment is attributed solely to structural or political factors.

Another argument strengthening the role of unemployment in stress production is that reemployment leads to a reduction of distress—especially for workers gaining permanent employment (Bjarnason & Sigurdardottir, 2003).

Reynolds (1997) has noted that, besides the stress induced by job insecurity itself, the effect of unemployment on stress could also result from greater competition. There have been many attempts to describe and measure key determinants of occupational stress. Unfortunately, it is difficult to establish a simple and feasible concept applicable for all kinds of work settings.

One model of job stress developed by Karasek highlights two key elements of work stressors. As Schnall asserted, "Karasek's 'job strain' model states that the greatest risk to physical and mental health from stress occurs to workers facing high psychological workload demands or pressures combined with low control or decision latitude in meeting those demands" (1998, ¶ 4). Workload demand is defined here as meaning employees feel they are working very fast or very hard or do not have enough time to get the job done. Job decision latitude is defined as both the ability to use skills on the job and the decision-making authority available to the worker. Research supports this distinction. In the Maastricht cohort study, for example, decision latitude was one of the strongest predictors for sickness-related absence of at least one month (Andrea et al., 2003; see also Ariens, Bongers, Hoogendoorn, van der Wal, & van Mechelen, 2002; Vaananen et al., 2003). Decision latitude works not only as a "metaphor" or proxy for autonomy, but also for organizational justice, both at the individual and work unit levels (Elovainio, Kivimäki, Steen, & Vahtera, 2004).

The job strain model described by Karasek "emphasizes another major negative consequence of work organization; [*sic*] how the assembly,line [*sic*] and the principles of Taylorism, with its focus on reducing workers' skills and influence, can produce passivity, learned helplessness, and lack of participation" (Schnall, 1998, ¶ 7). Thus, this model provides a justification for efforts to achieve greater worker autonomy as well as increased workplace democracy.

The largest cohort study to support Karasek's model was designed to prospectively examine the relation between psychosocial work characteristics and changes in health-related quality of life in a cohort of working women in the United States (Cheng, Kawachi, Coakley, Schwartz, & Colditz, 2000). According to Cheng et al.:

> Low job control, high job demands, and low work-related social support were associated with poor health status at the time of baseline measurement as well as with greater functional declines over the 4-year follow-up period. Examined in combination, women with low job control, high job demands, and low work-related social support had the greatest functional declines. These associations could not be explained by age, body mass index, co-morbid disease status, alcohol consumption,

> smoking status, education level, exercise level, employment status, or marital status. (p. 1432)

Similar results could be demonstrated by Schrijvers, van de Mheen, Stronks, and Mackenbach (1998).

The issue of work time control must be emphasized. Especially for women, work time control is an independent predictor of health (Ala-Mursula, Vahtera, Kivimäki, Kevin, & Pentti, 2002). In a study of Swedish hospital employees in the 1990s, increasing work demands were accompanied by deteriorating mental health, and decreasing work planning time showed the strongest association with increasing long-term sick leave (Petterson, Hertting, Hagberg, & Theorell, 2005).

Another widely recognized model is Siegrist's effort-reward imbalance (ERI) model. This model claims failed reciprocity, in terms of high efforts spent and low rewards received, is likely to provoke recurrent negative emotion and sustained stress responses in exposed workers. A major specification of this theoretical perspective concerns the work role and, particularly, its contractual basis. A cross-sectional analysis revealed that effort-reward imbalance was significantly associated with self-reported health for both genders (Niedhammer, 2004). When studied as separate variables, reward remained significant for both genders, while effort was a significant factor for men only. Consequently, self-reported (poor) health exists as a well-established predictor of mortality and disability (Idler & Benyamini, 1997; Mansson & Rastam, 2001; Miilunpalo, Vuori, Oja, Pasanen, & Urponen, 1997; Sundquist & Johansen, 1997).

Despite substantial evidence for the validity of both the job strain and ERI models (e.g., Baker, 1996; de Jonge, 2000; Kivimäki et al., 2002; de Lange, 2002), adopting universal measures for different types of jobs proves problematic. Bliese and Jex (2002) have suggested a multilevel perspective that can be incorporated into occupational stress research. This appears to be useful because there may be cases in which a group-level intervention may be far more effective than one that focuses on individuals.

Job satisfaction is not only a variable that influences work-related health, but also an antecedent of selection from contingent to permanent employment, and thus may work as a possible confounder. In other words, the less satisfied people are with their job, the more likely they are to remain in a fixed-term job and, therefore, remain at risk of unemployment. A cohort study of hospital staff at the Finnish Institute of Occupational Health potentially revealed that job satisfaction predicted a permanent job contract with an operating room (OR) of 1.86 (Virtanen, M., Kivimäki, Elovainio, & Vahtera, 2002), or that,

respectively, receiving a permanent job contract after fixed-term employment is associated with job satisfaction (Virtanen, M., Kivimäki, Elovainio, Vahtera, & Ferrie, 2003).

Interestingly, in another Finnish study (Virtanen, P., Vahtera, Kivimäki, Pentti, & Ferrie, 2002), the "association of low perceived security with psychological distress was significantly stronger in permanent employees than among fixed-term and subsidized employees, indicating that perceived security is more important among employees with a permanent contract" (p. 569). As Leino-Arjas, Liira, Mutanen, Malmivaara, & Matikainen (1999) pointed out, occupational stress predicts unemployment, whereas self-perceived stress further increases with the onset of unemployment.

Sverke, Hellgren, and Naswall's (2002, Stockholm University) meta-analysis on job insecurity showed a strong and significant relationship between job satisfaction and job security. They also highlighted the need for consensus on the measurement of job insecurity and called for a multidimensional measure reflecting both threats of imminent job loss and fear of losing important job features. Perceptions of threat to continued employment also have important empirical associations with employee job attitudes, organizational attitudes, and health (Maurier & Northcutt, 2000).

Evidence from laboratory experiments (Probst, 2002) and survey data (Grunberg, Moore, & Greenberg, 2001) has demonstrated that workers faced with the threat of layoffs violated more safety rules than controls. Threats of layoffs may have a different effect on people who end their job anyway after a fixed period and have already adapted to changes of work or worksite than on permanent employees who, for years, have not developed strategies of coping with job loss or job change. There is also evidence that moving from temporary to permanent employment is associated with a lower risk of death than remaining continuously in permanent employment (Kivimäki et al., 2003a).

This is supported by Strazdins, D'Souza, Lim, Broom, and Rodgers' (2004) new model of work stress, which combines job strain with job insecurity—a combination increasingly prevalent in contemporary economies. Workers reporting both strain and insecurity showed markedly higher odds for mental and physical health problems (depression, 13.88 [odds ratio to 1]; anxiety, 12.88; physical health problems, 3.97; and poor self-rated health, 7.12). Moreover, job strain and insecurity showed synergistic associations with health, and employees experiencing both could be at heightened health risk. Comparable results were published by D'Souza, Strazdins, Lim, Broom, and Rodgers (2003) in an analysis of a representative sample of the European Union total active population (aged 15 years and older); high job demands, low job control, "and

high strain and passive work" (p. 850) were associated with higher work-related sickness absence.

Powerlessness, or lack of control over destiny (which, in our societies, is closely related to not having a job), materializes as an important risk factor for disease in general, and specifically for occupational health (see also Wallerstein, 1992). For example, in a recent study of the U.S. chemical industry, span of control and level of empowerment predicted one third of the variance in safety measures (Hechanova & Beehr, 2001).

A Finnish study investigated the effects of workplace bullying. According to the study's author, "of the single forms of bullying, judging a person's work unjustly or in an offending manner, restricting a person's possibilities to express his or her opinions, and assaulting one's private life were the most clearly connected with all the stress reactions measured" (Vartia, 2001, p. 63). Interestingly, not only the targets of bullying suffered, but bystanders also suffered when someone was bullied in the workplace (Vartia). In a large National Health Service (NHS) study from the United Kingdom, staff who had been bullied had significantly lower levels of job satisfaction and higher levels of job-induced stress, depression, and anxiety (Quine, 1999).

Locus of Control

Although research on social and behavioral determinants of health has been conducted throughout the 20th century, it has become more common since the 1980s. Specifically, in the "mini-environment of the workplace" (Syme, 1988, p. 635), concepts of control and participation have become central themes (Banduara, 1995; Karasek & Theorell, 1990; Yen & Syme, 1999). This focus is noteworthy because it offers increased possibilities of intervention. (The effect of locus of control was discussed in greater detail in a prior section on stress, in relation to the job strain model.)

Principal Macroeconomic Risk Factors

Macroeconomic health indicators should identify the known SES–health relations at the individual level for a nation. It is apparent that the fundamental macroeconomic indicator that should theoretically influence health and safety monitoring and enforcement is gross domestic product (GDP) per capita. Per capita GDP measures overall national income. It is, therefore, the basis for potential financing of the development and diffusion of new technologies supporting employee health (thus contributing to national productivity) by industry as a whole, by specific firms, and by national governments. Equally

important is the potential, via GDP growth, for investing in sciences and education of the working population, which will be the basis for sophisticated utilization of more highly productive technologies.

From the work stress viewpoint, GDP per capita represents the capacity for employees to earn both direct incomes and non-wage benefits. The latter includes unemployment insurance, health and disability insurance, and pensions. The increase of GDP per capita points to the potential of the economy to increase social mobility, and thus not only elevating the social status of workers, but also—through that greater elevation of status—providing further motivation and incentive for high productivity work and greater life satisfaction. With respect to income, note that greater levels of economic resources permit individual employees to obtain goods and services in accordance with their life preferences, which will depend on personal values. Moreover, increasing economic resources not only permits greater satisfaction with respect to an arbitrary set of preferences, but also allows individuals greater advancement in those areas in which they have strong interests and to which they are committed over the life course.

As the report for the European Commission study (2006) stated:

> It can be successfully argued that not only are health and safety at work enhanced by economic growth, but the other principal areas of job quality, identified by the European Commission, are similarly enriched. These include (1) intrinsic job quality (including job satisfaction), (2) investment in skills, life-long learning and career development, (3) flexibility and security (including access to employment and social protection systems), (4) work organisation and work-life balance (including hours worked and the incorporation of family and leisure elements within employment policy), (5) diversity and non-discrimination based on increasing diversity of occupations in cosmopolitan/urban settings, and (6) overall work performance, especially emphasising labour productivity. (p. 17)

Finally, in modern philosophy of ethics, individual happiness is not only dependent on daily pleasures and comforts, but also on the achievement of the most important things in life involving both career and family. It is apparent that economic growth provides the basis for enhanced levels of achievement in most human endeavors, and also provides increasing diversity of occupations and division of labor where individual workers can express their talents and commitments.

Clearly, GDP per capita is the outstanding factor that, theoretically, should influence overall quality of working life, as well as health and safety at work, in order to produce lower illness and mortality rates among the working population in nearly all areas of physical and mental health. This general hypothesis, though plausible and indeed logical, is *not* the reigning hypothesis in the social epidemiology of occupational health. Rather, over the past 15 years, the dominant thesis in research literature has been that illness and mortality rates will be higher to the extent that a country is characterized by high levels of income *inequality*. Within this hypothetical framework, the issue of overall GDP per capita and economic growth has been essentially discarded. However, the principal findings of the European Commission's study (2006) indicate that GDP per capita and economic growth overall are indeed the most important sources of the health of the working population.

The second most important factor found to beneficially influence mortality rates across countries among the working population is the extent to which there is self-employment (and/or family employment), in contrast to wage and salary employment. The principal literatures governing the original hypothesis are prominent within the management sciences, industrial psychology, and sociology, as well as epidemiology. The key issue is autonomy of employees in comparison with their relative lack of authority in complex and large bureaucracies and hierarchies of work organization. For example, cardiovascular and mental health of individual workers generally increases as greater control over the work process is acquired. Recent studies at the individual level by the European Foundation for the Improvement of Living and Working Conditions independently pointed to greater job satisfaction for self-employed workers (as independents or within small firms) as well as greater subjective health.

Despite considerable research showing the importance of autonomy to employee mental and physical health, I contend that the 2006 European Commission study's finding of the significance of self-employment rates to national working population health is also an indicator of a more widespread social phenomenon. One would expect that, because self-employment is relatively high among agricultural populations, mortality would therefore be lower among agriculturalists. We find, nevertheless, that agricultural populations have distinctly *higher* mortality rates when compared with populations having high numbers of occupations in the manufacturing and service sectors. Therefore, it appears as if the beneficial effect of self- and small-firm employment applies mainly to the service sector (because self-employment is more prevalent in this sector) and is especially prominent for employment in wholesale and retail trade and hotel and restaurant employment. These latter occupations are most

prevalent in the advanced tertiary sector and particularly in highly developed urban settings.

The beneficial health effects pertaining to self-employment are thus likely a feature of late economic development most prevalent in the "knowledge economy." This information economy has produced not only great increases in real per capita economic growth, but has also made the value of education (and human capital more generally) considerably greater with the passage of time. There has, however, been a profound downside to the development of these services—especially information economy in comparison with the decline in manufacturing employment. That is, with the increase in productivity, economic growth over the past few decades has been associated with considerably slower growth in the production of jobs. This has meant, in the words of economist Schumpeter, heightened "creative destruction" of jobs and industries and therefore greater recessional as well as technological unemployment. The unemployment aspects of this creative destruction and their deleterious effects on health have been described at length in epidemiological literature and macroeconomic studies produced by the European Commission (e.g., Brenner, 2000, 2002).

However, in the course of such structural changes to technology and the economy, it appears that self-employment, despite decade-long trends of per capita decline, has now experienced resurgence in many countries. The reasons for this trend are numerous and complex. However, there is general agreement in the literature and the 2006 European Commission study data indicating that work inactivity and particularly unemployment are predictors of an increase in the rate of self-employment. Together with the increase in the professional occupations, wholesale and retail trade, and hotel and restaurant employment, there appears to have been a considerable push into self-employment as a result of firms undergoing rapid structural change.

Self-employment has additionally tended toward representing the most innovative and entrepreneurial sector of the labor force, frequently providing the inspirational prototypes for subsequent industrial development. The self-employed are additionally highly resilient and able to "reinvent" themselves in the face of recession and structural change, thus maintaining security for themselves and their small firms. There is also evidence that one of the successes of the European Commission's active labor market policy has been the provision of incentives to former employees of larger firms to engage in self-employment. Overall, then, it seems evident that self-employment provides a gateway to heightened innovation and prototypical economic growth in economies where the dominant industries consist of complex hierarchical firms where adjustment

to technological change is difficult and often threatens the existence of the large firms themselves. This is not only an issue of globalization—that is, changes in international competition and the international division of labor—but also represents actual changes in the scientific basis of production, services provision, and changes in the technological basis of the division of labor within firms.

We devote considerable time to the self-employment issue not only because it is the central issue of competitiveness and industrial survival during our era, but also because of its status as a clear determinant of health outcomes. In accordance with the 2006 European Commission study data, self-employment is second only to GDP per capita as the dominant health issue for working-age populations in the industrialized world for nearly every important cause of illness and mortality.

Self-Employment in the Era of the Advanced Services Economy

As indicated, the literature in epidemiology supports fundamental relationships between high illness and mortality rates on the one hand, and both high stress levels and extensive hierarchical systems on the other. Taken together, these literatures support our findings that self- and small-firm employment are conducive to higher levels of health and longevity in the working population. However, it is also possible that the self-employment variable, given its power to influence mortality across countries in the entire industrialized world, represents an indicator, or "proxy," of a much larger international phenomenon that relates to the progressive sectorial development of national economies over their trajectory of long-term economic growth.

Commonly, the traditional distinctions among sectors within economic development are primary (largely, agricultural production), secondary (industrial-manufacturing), and tertiary (dominated by services industries). There is evidence signifying that the resurgence of self- and small-firm employment (and proportionately, family employment) is characteristic of late or advanced tertiary sector development. In order to understand the economic and epidemiological meaning of employment in this most recently developed sector, it is necessary to identify the literature that has made similar distinctions between *industrial* and *post-industrial* society.

The industrial period, or *Fordist* period (as certain French sociologists have described it), includes the following:

(a) Capital-intensive, large-scale plants;
(b) An inflexible production process;
(c) Rigid hierarchical and bureaucratic structures;
(d) The use of semiskilled labor performing repetitive and routine tasks, often subject to the discipline of "scientific management;"
(e) A tendency toward strong unionization and the vulnerability of production to industrial action; and
(f) The protection of national markets.

While these innovations began in the interwar period with the production of cars in the United States, the general methods were rapidly employed in other sectors of manufacturing and were increasingly viewed as the organizational basis on which the advanced economies could continue to develop and prosper, especially after World War II. It should also be noted that industrialization-based ideas of scale, centrality of control, standardization, and mass consumption not only influenced the agenda of capitalist production, but also underpinned the nature of Soviet industrialization and the creation and delivery of welfare services in free-market democracies.

Post-industrial society (and to a large extent *Post-Fordism*) refers to the new economic possibilities opened up by the rise of microchip technology, computers, and robotics in the production and exchange of information and commodities. In contrast to the industrial society, the distinguishing feature of the post-industrial era is usually held to be the foundation of *smaller units of enterprise, catering to segmented markets by the flexible production of specialized goods or services.*

Social and economic changes associated with the post-industrial transition include:

(a) The decline of old manufacturing and smokestack industries, together with the emergence of the so-called sunrise computer-based enterprises;
(b) More flexible, decentralized forms of the labor process and work organization;
(c) A labor market reorganized into a skill-flexible core of employees and a time-flexible periphery of low-paid insecure workers performing contract labor;

(d) A consequent decline of the traditional, unionized, blue-collar working class and of the preeminence within the occupational structure of white-collar professional, technical, managerial, and other service-sector employees;
(e) The feminization of many service occupations affected by new technologies;
(f) The promotion of types of consumption around the concept of individually chosen lifestyles, with an emphasis, therefore, on taste, distinctiveness, packaging, and appearance;
(g) The dominance and autonomy of multinational corporations in a global process of capitalist production; and
(h) A new international division of labor, based on the new flexibility, within which global production can be organized.

For the purposes of the European Commission study (2006), the key occupational groups associated with self- and small-firm employment are those involving the professional, technical, managerial, and retail sales groups. On the other hand, it is incorrect to claim that the post-industrial service economy ceases to involve classic bureaucracies. Indeed, the great majority of service work, often directly connected with industrial production, involves office work (components of white-collar work). Among students of the post-industrial transformation, it is a customary observation that modern, computerized office work is highly standardized. Indeed, it is standardized as fully as more traditional work in industrial production—both are heavily controlled by machine operations. Furthermore, epidemiological literature focusing on work stress identifies computer-based office work as classically tied to a lack of autonomy, as has been true in traditional industrial production systems.

Since the 1980s, self- and small-firm employment in advanced industrialized societies can be seen as representing the advanced tertiary sector. These forms of employment, most specifically, point to the importance of innovation and entrepreneurship. Such innovation is the ultimate basis for economic growth, and it is typically individual-based smaller firms developing the initial sources of innovation. Such firms, if highly successful, tend to grow in size, ally themselves with existing industry, or eventually are absorbed by existing industry (via mergers and acquisitions). In these ways, the emergence of the individual-based and small-firm enterprises constitutes the engine of economic growth that is ultimately an intrinsic part of larger industrial structures. Interestingly, the emergence of individual-based and small firms requires relatively prosperous national economic conditions. Not only must sufficient investment for their emergence be present, but consumers must also be sufficiently solvent and

optimistic to increase, or at least maintain, consumption levels that support the viability of such firms. We can therefore conceptualize the individual-based and small firms of the late 20th and early 21st centuries as signifying relatively prosperous conditions of investment and consumption that will enable the future development of innovative industries in the most competitive economies.

Combining Real GDP Per Capita and the Rate of Self-Employment

For the first time, the European Commission project (2006) has identified that at least two macroeconomic factors are of central importance to the health of industrialized country populations: (a) real GDP per capita and (b) the proportion of the working population that is self-employed. The findings show remarkable consistency across causes of death, age groups, and gender. Total mortality, cardiovascular mortality as well as mortality due to malignancies, cirrhosis, suicide and homicide, overall accidents, motor-vehicle accidents, and non-motor-vehicle accidents all show strong and robust inverse relationships with GDP per capita and self-employment. In one sense, these findings are not surprising—they confirm two research literatures within epidemiology.

The first and most prominent finding is that in nearly all industrialized societies, mortality from virtually all causes of death at all ages and for both sexes is inversely related to socioeconomic status (SES). This relationship has been most significantly observed when occupational skill level and educational level have been identified as primary indicators of SES. In the last two decades, however, income has become the more widely used indicator of SES in which this inverse relationship has been found.

Second, the literature on psychophysiological stress now indicates that all of the major causes of illness and death have in common a significant relation to emotional disturbance. The mechanisms involve cardiovascular responses; disturbances to immune system functioning (involving malignancies and infection); depression; aggression and fatigue (involving accidents, suicide, and homicide); and psychophysiological coping responses, including the use of alcohol, tobacco, fats, and probably carbohydrates (involving diabetes, cirrhosis, and other metabolic diseases). Since shocks to GDP growth and work stress are known to influence these causes of illness and death, it is clear that the research literature at the individual level of analysis provides a plausible foundation for, and is consistent with, our findings at the macroeconomic and national levels.

Finally, the literature indicates there is a special, symbiotic relationship between GDP and the self-employment rate in higher-income industrialized societies. It appears that financing for the initial development, existence, and continued survival of self-employment and small firms greatly depends on a

relatively prosperous business and investment climate. This is especially true when the new entrepreneurial firm is typical of those representative of scientific and commercial innovation that often characterize the knowledge economy. Thus, a relatively high self-employment rate will tend to coexist with high GDP per capita in a highly urbanized society dominated by the advanced tertiary sector. Nevertheless, ironically, such a combination of high GDP per capita and self-employment may also be accompanied by relatively high unemployment rates in the same highly urbanized societies. This appears to be characteristic of trends in the past two decades where increased productivity was not accompanied by similar increases in job growth.

The Shadow Economy and Income Inequality

The extent to which GDP consists of shadow economic activity is the third macroeconomic factor of considerable importance to many different types of mortality. The shadow, or black or informal, economy (depending on its official designation) consists of employment undertaken without the payment of government taxes, and does not include unemployment insurance, disability insurance, pensions, or formal regulation through health and safety measures. The 2006 European Commission study found that for total mortality, cardiovascular mortality, and accident mortality, the proportion of the economy that can be estimated as "shadow" is strongly positively related to higher death rates within the working-age population. For this reason, the shadow economy is the third most important variable representing a risk factor for mortality across industrialized countries. As in the case of self-employment, this is an entirely new finding in demographic epidemiology.

By contrast, for the past decade and a half, income inequality has been hypothesized as a major factor potentially elevating the mortality rate of industrialized as well as developing societies. For this reason, we have felt it important to at least control for the Gini Index (a measure of national income inequality) in the development of general models predicting mortality. Consequently, we find that the Gini Index is positively related to higher mortality rates in overall mortality and cardiovascular mortality, but this relationship does not reach statistical significance if we include only the European Union member states and the Organisation for Economic Co-operation and Development (OECD) countries in our sample. It is only when we enlarge our sample to include the Commonwealth of Independent States (CIS) countries (especially Russia, Ukraine, and Georgia) that the Gini Index attains firm statistical significance. Whether this is due to the need for a large sample or to the possibility that the international importance of the Gini Index is only definitive for countries with relatively low GDP per capita must still be investigated.

Policy Considerations

A principal consideration for policy is whether the quality of work life has implications for physical and mental health where such implications can be measured. If so, two statements follow. The first is that measures of health outcomes, such as overall and cardiovascular mortality in the working population, can serve as "hard" quantitative measures of the benefits of an acceptable quality of working life. They can therefore also be used as outcome measures in the evaluation of the effectiveness and efficiency of labor and macroeconomic policies.

Second, if employment and social policies beneficially affect health outcomes through their influence on macroeconomic and labor market indicators, then productivity gains should also result, largely because such policies lead to improved physical and mental health of workers. There is firm consensus within the human capital literature that improved employee health is a principal source of enhancement of labor productivity.

A second issue for policy consideration is whether conventional or innovative types of labor market or macroeconomic policy are applicable to measures of health outcome according to the 2006 European Commission study findings. It is clear, in the first place, that policies that increase productivity—and therefore result in higher real GDP per capita—are among the most important factors in improving the health of working populations. Therefore, it requires little argument to plausibly assert that investments in research and development as well as education—and lifelong learning in general (i.e., human capital improvement)—are important sources of improved employee health through enhancement of productivity.

Industrialized countries face the new challenge, however, that continued increase in productivity has been accompanied in the past few decades by stagnation in (net) job creation, which would normally accompany economic growth. Some theorists and researchers have argued that the continuation of such trends will result in a society of well-to-do professionals and others whose occupations depend on the knowledge economy. At the same time, these shifts will also increase the larger and relatively low-skilled population with increasingly diminished job opportunities. However, this vision of a society with economic cleavage is largely intolerable on political grounds. Furthermore, it would generate a society where many low-skilled members participate only minimally in the economy and are at risk for poverty.

The question is how we can continue to have high productivity growth with its accompanying changes in the structure of industry without causing large-scale technological unemployment and underemployment. At present, for

example, several European countries with relatively high rates of productivity growth nevertheless have high and sustained unemployment rates. One important possibility, as suggested by this study, is that unemployment or work inactivity due to rapid structural changes inherent in the modern knowledge economy are, depending on policy, responded to by increases in self- and small-firm employment. Thus, in the era of the knowledge economy, self- and small-firm employment is a potential "shock absorber," where displaced workers at varying levels of skill can (a) re-enter employment, and (b) do so at higher levels of autonomy and perhaps even income. Much of the importance of self- and small-firm employment during periods of rapid technological and societal change is their remarkable capacity for innovation and adaptation. Quite simply, a small and highly creative firm can rapidly adapt to markets and even create innovative market possibilities through their own activities. Indeed, it is argued in the management literature that the vast majority of innovations leading to greater productivity in the entire economy result from innovative activities of individual proprietorships and small firms.

This is in contrast to the somewhat outdated notion—held even by experts—of the classic "bureaucratic" organization. The rules and culture of such organizations are understood to be firmly entrenched within the interests of their management structures, which typically have large-scale investments in maintaining the status quo against (external and internal) competitors. Similarly, large groups of employees in these organizations are deeply invested in the current structure in terms of seniority, job skills, and position. Thus, important changes are appropriately feared as signaling short- or long-term career damage. As stated frequently in policy documents, an economic framework encompassing both flexibility and security of employment is optimum for a satisfying work environment.

One approach to this ideal would be to encourage the development of smaller and individual-based firms, specializing in research and development, professional services, retail trade, and other urban amenities. From the research literature, it appears this tendency is already present in the development of the advanced tertiary sector (i.e., knowledge economy) of urban civilization (Castells, 2000; Mingione, 1997). It is indeed part of the phenomenon referred to as the post-industrial era, especially by French and American sociologists of technology. However, concentrating only on small or individual-based firms would neglect the majority of employment that occurs in medium-to large-sized and complex organizations.

If the generalization stemming from this research is correct—that smaller and more adaptable work units, resilient to the pressures of recession and

structural change, are highly beneficial to mental and physical health—then that prototype might be utilized in imagining larger-firm organizational structure. This means we view the larger complex organization in terms of its structural components—"mini firms." These mini firms can conceivably operate at different levels of technological sophistication or innovation. In other words, as new vital technology emerges in an industry, quick restructuring of the entire organization would generate considerable internal conflict and ultimately push many employees out of the firm. An alternative is to introduce a major technological entity, or set of innovations, in a small part of the firm or in a newly created division, leaving the remainder temporarily intact.

This is not unusual in many firms now experiencing technological change, but it would be worthwhile to carry this logic somewhat further. Specifically, much of an entire firm, in its multiple components or divisions, could operate as semi-independent units—each unit with its own leadership, innovating or adapting to different parts of the external market, thus maintaining its own growth pattern and ultimate survival. This is a pleasant vision until we recognize that competition and "creative destruction" will eliminate, or threaten to eliminate, specific divisions of such a firm. The potential response is to shift workers from divisions likely to suffer reduced employment to those where investment and employment are growing and finding a more sustainable niche in the external market.

How, though, can we rapidly shift employees from one division to another, considering variations in skill requirements between divisions? A solution is to develop internal training methods—perhaps in conjunction with universities or secondary schools—that maintain the general skill requirements, but enable employees with some additional in-house training to shift from one division to another under conditions of rapid technological change. Economy-wide, this would mean a new or refreshed linkage between industrial or service firms and the educational system. In other words, it would imply a well-developed program of lifelong learning. Such learning, of course, would equip employees not only to shift their positions among divisions in a single firm, but also to move from firm to firm, or even from one industry to another. This model is not entirely visionary. It almost certainly exists today in many high-technology firms and is routine practice in universities.

In the university setting, and within academic departments, the lines of scientific discovery and development change many times over the course of an individual career. Individual scientists or scholars must alter specialization or even academic discipline to remain productive within the intellectual

community. The same can often be said for entire academic departments, and even disciplines within a university. In the knowledge economy, therefore, it would be logical to propose an "industrial" model based on the prototype of highly productive universities. In this scenario, employment security lies in employment flexibility, which refers here to the capacity of employees to shift from one job to another—with minimal legal restrictions—because of having obtained the necessary skills. To the extent that this situation is feasible for the economy as a whole, there would be a material reduction in the level of unemployment and underemployment due to structural change. The smoother adjustment of the working population to technological change (i.e., without fundamental disruption to career patterns) would significantly improve the physical and mental health of the working population and, therefore, long-term productivity as well.

The basis for such flexibility—or interchangeability of roles through skill development—relates to the knowledge base of the worker. A knowledge base gives a worker relative autonomy in decision-making in the work setting. Of course, this is appropriate and necessary in a knowledge economy, where much of the output of an employee is in the production and dissemination of knowledge itself. This will be especially true when it is recognized that, even in the "production" of goods and services, those goods and services embody (or are based on) the creation of new knowledge.

Is this scenario overly optimistic in the current highly competitive environment? Of course, there is no completely logical, technocratic solution to the "problems" of change introduced by competitive economies. There are no substitutes for investment in research and development, entrepreneurship, physical and human capital, continuous industrial reorganization, and social protection. Without these investments, the likelihood of a healthy and productive society is considerably diminished.

From a more encouraging perspective, there is little doubt that many high technology firms across the entire industrialized world are now internally organized in structures of largely autonomous divisions. These firms make a major effort to retain and promote employees whose skills can be adapted to work in multiple divisions. Perhaps the "indicator" of a high proportion of self-employed and small firms in the knowledge economy signals the necessity for this model. The view that even modern, large, high-technology firms do not function optimally in the absence of small, specialized firms from which innovations are obtained and to which particular projects can be outsourced is equally significant.

Altogether, the existence of self- and small-firm employment—and

internally specialized work organizations even in larger firms—can be taken as a partial indicator in highly urbanized societies of the presence of the knowledge economy. At the same time, we must not forget that self-employed and family-employed firms are of numerical importance among craftwork and in retail trade, restaurants, and hotels. While these do not necessarily refer to high-technology occupations, they represent the standard pattern of advanced service employment in the urban setting of the early 21st century.

Implications for Urbanism and Industrial Development

Given the central importance of both socioeconomic status (income, education, occupational skill level, and African American and Hispanic ethnicity) and bureaucratically organized firms in the knowledge-based economy to health inequalities, how do these relationships translate into the profile of urban health? To understand urban health profiles and their implications for regional urban development, we need to see how urbanization itself has historically depended on industrial development—and how it currently seems to depend on "reverse" or "counter" urbanization. This later pattern is typical of the development of the knowledge-based economy of the last quarter of the 20th century and the early years of the 21st.

In this latest urban developmental pattern, the key variables are persistent economic growth and the formation of small firms, especially those initially based on self-employment. The "counter urban" industries involved are those of the high-technology industrial park, the professions, corporate headquarters based on information technology control, and small businesses prevalent in the service sector which link suppliers and customers. The development of this knowledge sector is the basis for new economic growth and employment, together with the small businesses that serve it (such as restaurants, hotels, retail shops, entertainment, and tourism); therefore, it is the foundation for improved health in the past 30 years.

A widely debated basic question of urbanism in industrialized countries is to what extent this phenomenon is an exclusive, inevitable, and progressive effect of industrial development. The assumption behind industrialism is that industrial development brings about continually rising economies of scale through progressive concentration in large cities. This is because large cities attract economic resources and labor to foster the growth of industrial production, which, in turn, increases the city's population. Then economic activity acts as a basis for attracting new resources and promoting even higher levels of growth and concentration. However, this assumption is now the target of a whole host of criticism. It has been noted that in many cases, the

features of urbanism depend on historical conditions and factors existing *prior* to industrial development, as is the case in most cities in continental Europe, as well as on elements largely independent of industrial concentration and the growth of employment in manufacturing—the case in capital cities. Next, clearly there is a whole series of technical, social, and economic limits to the idea of a progressive interlinking between industrialization and the growth of large cities. These limits, which vary considerably in different contexts and ages, are the cost and time needed to construct the transportation network, the difficulty of settling in already overpopulated cities, issues of urban congestion, and environmental problems.

For these reasons, industrial development may be considered the most important source for the spread of urbanism, but under variable and discontinued conditions and in conjunction with other factors. Among these, it is important to consider welfare policies—above all, those relating to housing and transportation, but also the greater or lesser concentration of services in general and the variability in time and space of specific socioeconomic mixes. It is also important to consider the persistence of small- and medium-sized firms versus the large industrial and financial concentrations, the diversification of the urban economy as against the presence of highly specialized single industries, the impact of labor-saving strategies and economic decentralization in contrast with economies of scale, as well as the possible role of critical environmental conditions such as pollution, traffic, congestion, and the high cost of housing and of living in general.

By adopting more sophisticated approaches than industrialism, it is possible to explain the features that urbanism has been taking on during the informational age of globalization. The idea of counter-urbanization (Perry et al., 1986) has been put forward in response to the fact that, starting in the last quarter of the 20th century, the population of central metropolitan areas has been either diminishing or increasing more slowly than in small- and medium-sized towns and the countryside. This phenomenon is believed to be the result of industrial restructuring, the decline in the system of large manufacturing industry, and the new phase of tertiarization, in which self-employed workers and small firms with up-to-date technology (but also potentially freedom from the necessity of location in large urban areas) are assuming increasing importance (Castells, 1996).

However, the decline in the importance and attraction of large metropolitan areas has gone no further than a drop in manufacturing employment and the decentralization of some industries to smaller towns and industrializing countries. In contrast, features of global cities (Sassen, 1991)—the nerve centers

for the worldwide control of economic/financial activities—are becoming the predominant pattern. Beyond the debate on global cities, urbanism today reflects processes of notable social change; the increasing instability of employment and family life, longevity, and the decline in birth rates; the importance of information technologies, tertiarization, and increasingly heterogeneous and complex social stratification; and the spread of postmodern cultures (Beauregard & Body-Gendrot, 1999). Cities are becoming more articulated and fragmented with urban segregation in less clear forms, extreme ghettoization and gentrification, and greater anxiety about security and the environment.

New socioeconomic patterns of commerce have developed. The industrial base is disappearing, and a knowledge economy has risen to take its place. What are the implications of this massive change in urbanization in terms of the economic trends and public health?

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