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ABSTRACT

This document proposes methods by which the public purposes of postsecondary vocational education may be more effectively implemented. Part 1 reviews the public purposes of public vocational education (which are postulated as: to increase individuals' satisfaction at work; to increase the access to employment of underrepresented groups; and to increase the economy's total output of goods and services) and considers how to measure outcomes that indicate whether those purposes are being served. Part 2 describes how the multiple purposes of public vocational education conflict with one another and points out tradeoffs that become necessary when multiple purposes are pursued in a finite span of time. Analytic procedures for evaluating programs with multiple objectives are discussed. Part 3 discusses cost-benefit considerations in school-based and company-based public vocational education, describes as an example of subsidized on-the-job training a program funded by the California Employment Training Panel and located at New United Motors Manufacturing, Inc., and considers who should pay for public vocational education. A 56-item bibliography concludes the document. (CML)

PERFORMANCE-BASED PUBLIC POLICY TOWARD POSTSECONDARY VOCATIONAL EDUCATION: SOME ECONOMIC ISSUES

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PERFORMANCE-BASED PUBLIC POLICY TOWARD POSTSECONDARY VOCATIONAL EDUCATION: SOME ECONOMIC ISSUES

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This paper seeks to clarify the public purposes of postsecondary vocational education (PVE), and proposes methods by which these purposes may be more effectively implemented. The paper consists of three parts. Part I reviews the public purposes of PVE. These are postulated: to increase individuals' satisfaction at work, by facilitating appropriate choices of occupation; to increase the employment of under-represented groups in occupations to which they have been denied access; and to increase the economy's total output of goods and services. PVE can accomplish this last purpose by increasing the supply of labor or by increasing the productivity of labor and capital.

Defining these purposes is more straightforward than measuring the degree to which they are achieved. The most commonly used outcome measures are placement rates and wage gains of individuals who have spent time in PVE. However, evidence on employment and earnings of individuals does not necessarily imply whether PVE is achieving its public purposes. It is possible that individuals could experience more economic success after PVE, even while the program as a whole contributes nothing to total economic output, access, or job satisfaction. This seeming paradox is discussed in the first part of the paper. The conclusion is that labor market outcomes for PVE graduates are not sufficient for judging whether the program accomplishes its public purposes. However, economists argue that positive labor market outcomes are a necessary indicator of program effectiveness; that is, no program can be effective if participants do not obtain employment. By the same reasoning, no program can be effective if participants learn nothing from it. The implication is that measures of learning and labor market outcomes should both be included.

Part II discusses how to handle multiple measures of performance. Various tradeoffs may exist. For example, in selecting participants for the program there is a tradeoff between improving access of under-represented groups and increasing total economic output if members of some under-represented groups on average require more costly instruction or other services in

order to succeed in the program. For any individual participant in PVE, the simple fact that time is limited means that some skills and knowledge can be taught only at the expense of other subject matter. Given tradeoffs in producing the various desired outcomes of PVE, it is necessary to consider multiple outcomes simultaneously in evaluating PVE programs. Analytical methods for doing this are described in the second part of the paper. Measuring efficiency in attainment of measured objectives is a more tractable problem than deciding exactly what objectives to measure in the first place.

The third part discusses implementation. Various public agencies, private firms, and nonprofit organizations can provide PVE. Schools and employers have done most of it in the U.S., though community-based organizations have played a major part in training sponsored by CETA and JTPA. The degree to which particular programs in schools or firms produce benefits for taxpayers should be reflected in differential rates of governmental subsidy. A strategy for implementing performance-based policy toward PVE is briefly described.

I. The Public Purposes of Postsecondary Vocational Education

Three major purposes of PVE will be discussed here. These are: improving individuals' satisfaction in their work, increasing access of under-represented groups to certain occupations, and augmenting the economy's total output of goods and services. This list excludes preparation for the responsibilities of citizenship or parenthood, and enhancing the value of leisure time (except as leisure is enhanced by more goods and services). Excluding these goals acknowledges that the purposes of vocational education are narrower than the purposes of education in general.

What makes the three stated purposes public rather than private is that they refer to ***aggregate*** outcomes. It serves no public purpose if one person's job satisfaction or productive output is increased at the cost of someone else's being decreased by the same amount—unless the person being helped is a member of a more deserving under-represented group. It is the aggregate nature of these public purposes that makes evidence about individual outcomes, by themselves, inconclusive. This will be explained further below.

"Public" here does not mean governmental. Private individuals who participate in PVE, and their employers, are part of the public. Benefits to employees and employers are therefore considered public benefits. The net benefit of a program to the public may be positive even if the taxes paid on additional earnings or output do not exceed the program's cost to government. Whether government or taxpayers receive net benefits from PVE is an important question, and is considered separately in Part III.

Increase Non-Pecuniary Rewards from Work

This is listed first here because it is so often ignored (for a notable exception, see Schumacher, 1979). If PVE has the effect of making people more satisfied with their work than they would otherwise be, this is a real contribution. Since non-pecuniary rewards from work are not included in conventional measures of national income or product, they have to be accounted for separately.

This is difficult, because answers to questions about job satisfaction cannot be compared between individuals, unlike questions about income or hours of work. Different individuals presumably mean the same thing when they refer to a dollar of pay or a week of work. But two individuals in identical jobs could express different levels of satisfaction, depending on their tastes, endowments, and expectations. Recognizing the multidimensionality of job satisfaction does not make individual assessments more comparable, and it complicates the problem: for instance, one person might like the physical surroundings and social contacts with co-workers on a particular job, but dislike the lack (or excess amount) of challenge, etc.; another person might have the opposite response. Economists have made some attempts to attach monetary values to non-pecuniary characteristics of jobs. They have relied on Adam Smith's hypothesis that, in a competitive labor market, disagreeable jobs would have to pay ***higher*** wages in order to attract people. However, these empirical efforts have yielded only partial success (Lucas, 1977; Smith, 1979; Stern, 1979; Duncan and Holmlund, 1983). Non-monetary aspects of work have not yet yielded to researchers' efforts to apply a monetary meter stick. Accordingly, non-monetary rewards from work are customarily ignored in evaluations of PVE and other employment-related programs, even though these would be inversely correlated with income (among equally able individuals) if Adam Smith's hypothesis is true.

Nevertheless, public policy toward vocational education and job training in this country staunchly preserves the right of individuals to choose occupations, in large part because individual satisfaction at work is so important. It would be un-American to propose a policy of assigning individuals to jobs without taking their preferences into account. Choice leads to greater non-pecuniary satisfaction, through the individual "pursuit of happiness" at work. Indeed, a whole profession of career counselors, and the research discipline of vocational psychology, have arisen to help individuals choose occupations in which they will be most satisfied. We are consumers of work, as David Riesman one remarked, and the principle of consumer sovereignty applies. Enabling individuals to enter occupations where they expect to be happy is certainly one purpose of PVE.

Increase Access of Under-Represented Groups to Certain Occupations

Choice of occupations is considered such an important right in this country that public policy has tried to extend it to those who have lacked it. The federal and state governments have enacted laws prohibiting discrimination in employment on grounds of race, sex, age, and other criteria. Employment and training programs have been created to help disadvantaged groups obtain desirable jobs. Although this was not among the originally stated purposes of federally supported vocational education, the federal law authorizing expenditures for vocational education has been amended in recent decades to include stipulations and set-asides for improving access of disadvantaged and handicapped students, and for reduction of sex-stereotyping.

Like the other public purposes of PVE, the objective is defined in terms of aggregates. For example, increasing the access of women to jobs as automotive mechanics means increasing the proportion of all auto mechanics who are women. If one woman is placed as an auto mechanic at the expense of another woman, the public purpose is not served. If the pool of applicants for auto mechanics' jobs is predominantly male, it would be reasonably safe to assume that placing one woman will not displace another woman from that profession. In this instance, simple placement data would be reasonably conclusive in judging whether a PVE program was promoting sex equity.

However, in occupations where there is an ongoing history of discrimination, employers may still relegate women to the back of the job-applicant queue, along with racial minorities, linguistic minorities, and other under-represented groups. It would be quite possible, therefore, that a female PVE graduate who got a job in one of these occupations would be displacing a male who belonged to another under-represented group. There would be a gain in sex equity, but perhaps no gain in overall equity. To be certain that PVE contributes to overall equity, it would be necessary to keep track of the total proportions of people employed in the target occupations who belong to under-represented groups, and to see how those proportions change as a result of placements from PVE programs.

Increase Total Output of Goods and Services

The market value of goods and services produced by the economy in a given period of time is the Gross National Product (GNP). Modifications of the GNP concept have been proposed, to include non-market (household) production and to account for the costs of congestion and pollution associated with economic growth (Nordhaus and Tobin, 1972), but GNP is still the

conventional measure of total economic output. For economists, the most obvious criterion for judging PVE would be whether its contribution to total output exceeded its cost.

PVE can increase total output in two distinct ways. It can increase the supply of labor, or it can increase the amount of output produced by given amounts of labor and capital, i.e., it can increase factor productivity.

Statements about the aggregate effects of PVE necessarily imply some sort of macroeconomic model, either implicit or explicit. There is a virtue in being explicit, because the underlying assumptions then become clear. There is also a risk, because macroeconomic theory is driven by unresolved controversies, and no model will command universal assent (especially in an election year). Despite the risk, it is worth considering a simple macroeconomic model. This is depicted in Figure 1, which is a diagram that appears in contemporary textbooks on macroeconomics. Its purpose is didactic; it does not include the complexities and dynamics necessary in a model that would be used for empirical forecasting. Nevertheless, it serves the purpose of this paper.

Figure 1

Aggregate Demand and Short-Run Aggregate Supply

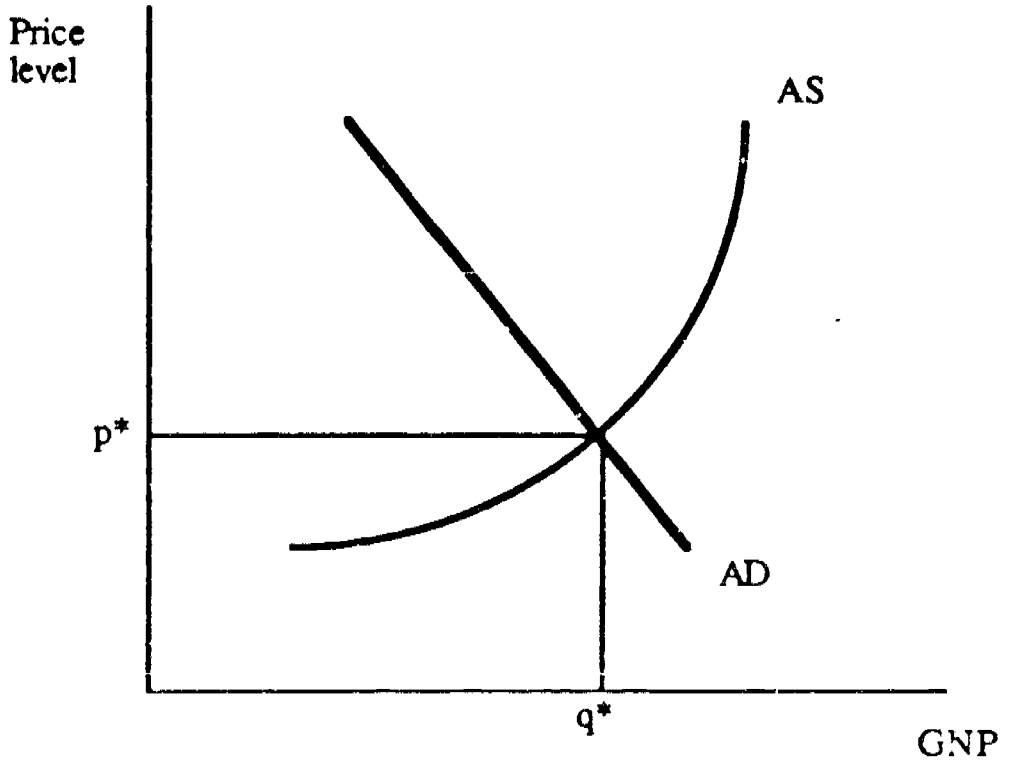


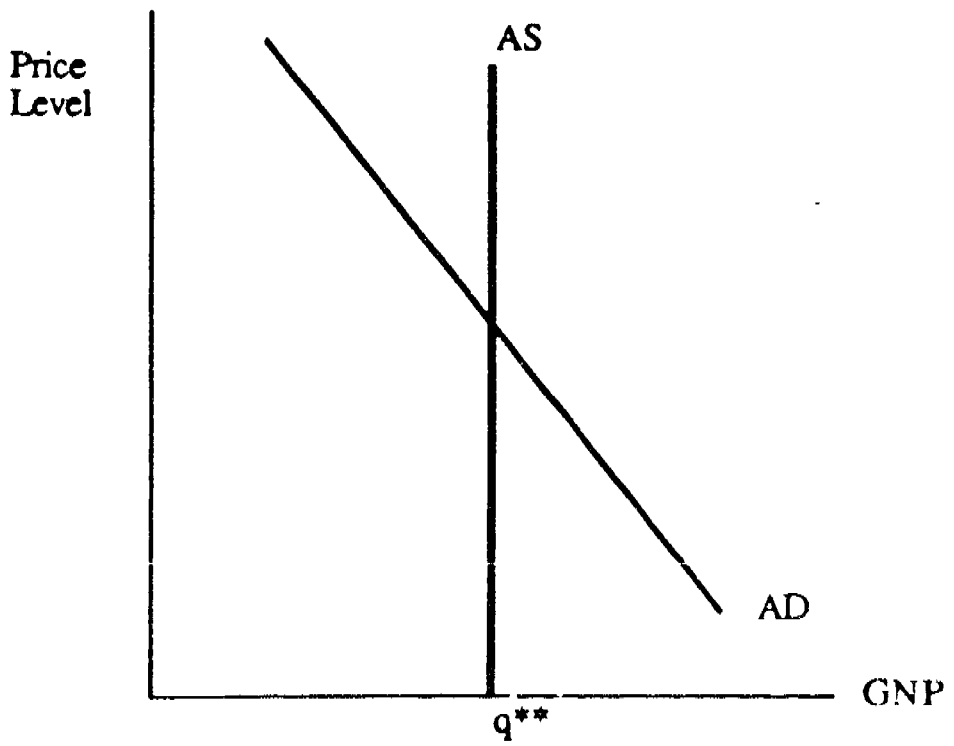
Figure 1 shows two curves crossing. One is an aggregate demand (AD) curve, and the other is aggregate supply (AS). The point where they intersect is where the price level and the

volume of economic activity are in equilibrium, with values p* and q*. The aggregate demand and supply curves themselves each represent a locus of equilibrium points. The aggregate demand curve shows combinations of price level and GNP that equilibrate investment, exports, and financial markets. Given a certain nominal supply of money and a certain level of government taxation and expenditures, a lower price level would entail less demand for money, which would be offset (through adjustments in interest rates) by higher levels of investment and net exports, thus higher GNP. That is why the aggregate demand curve has a negative slope.

The aggregate supply curve has a positive slope in the short run. This reflects an assumption that prices change faster than wage levels. Lower prices therefore imply higher real wages for some period of time. Employers respond to higher real wages by employing less labor, thus reducing total output. In the long run, however, lower prices would lead to lower money wages, as unemployment retarded wage growth. The long run aggregate supply curve is therefore a vertical line at the full-employment level of GNP. This is shown in Figure 2, where q** denotes full-employment GNP. (The price level corresponding to q** is determined by monetary and fiscal policies, which shift the aggregate demand curve.)

Figure 2

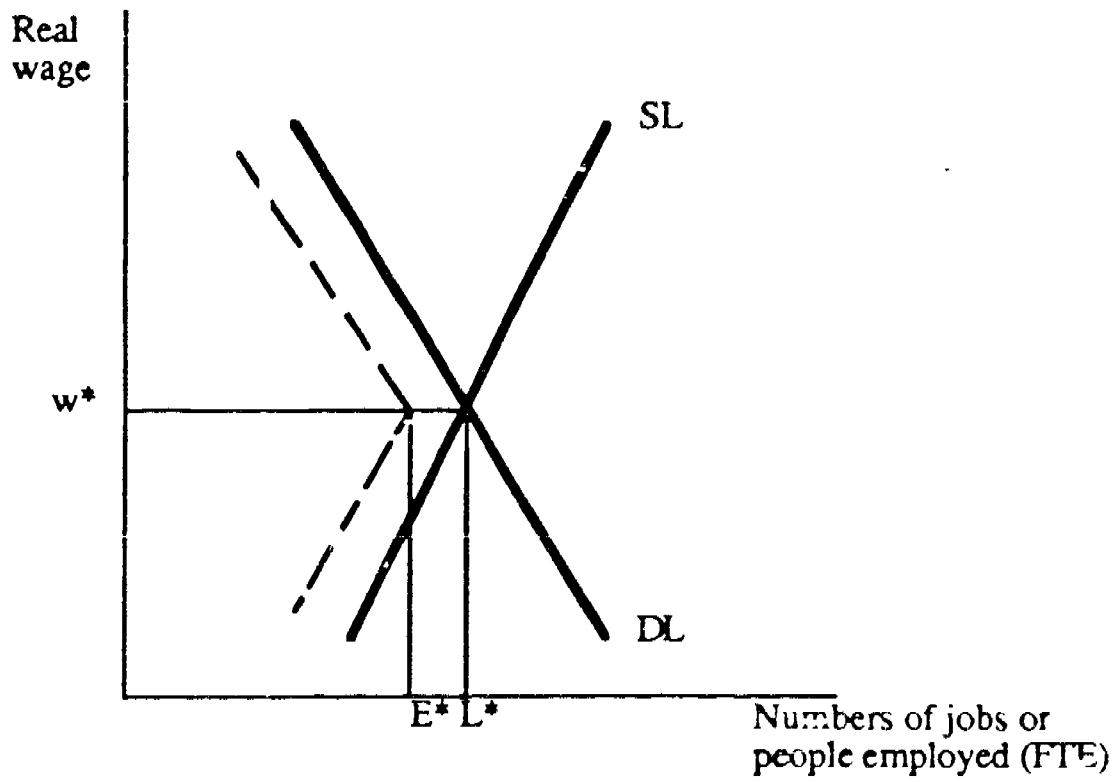
Aggregate Demand and Long-Run Aggregate Supply



The effect of PVE on GNP would occur by shifting the long-run aggregate supply curve to the right. This would happen through the interaction of employers and employees in the labor market, a simple model of which is shown in Figure 3. Here DL denotes demand for labor. Given the quantity of productive capital and the parameters of the production function, the demand for labor is inversely related to the real wage. SL denotes supply of labor. Given such things as the age composition of the population and the perceived non-pecuniary rewards from paid work compared to other alternatives, the supply of labor is positively related to the real wage. The market-clearing wage level, w* in Figure 3, is where the supply and demand curves intersect. However, the process of matching people to jobs takes time, so there are always some job vacancies and some unemployed people. The dashed line in Figure 3 shows what quantity of labor would actually be employed at any given wage level. The horizontal distance between the dashed line and the demand curve is the number of vacant jobs; the distance between the dashed line and the supply curve is the number of unemployed people. At the market-clearing wage level, the numbers of vacant jobs and unemployed people are the same: L* - E* in Figure 3, where L denotes the amount of labor supplied or demanded, and E denotes actual employment.

Figure 3

The Labor Market



If wages were below the market-clearing level, the number of job vacancies (the horizontal distance between DL and the dashed line) would exceed the number of unemployed people (the horizontal distance between SL and the dashed line). This rarely occurs, if ever. Instead, the number of unemployed people almost always exceeds the number of job vacancies. Abraham (1983) has estimated that, in the United States, the number of unemployed people exceeds the number of job vacancies when the unemployment rate is higher than three or four percent, which it almost always is. This implies that actual wages tend to remain above the market-clearing level. Economists have been seeking to explain this for about fifty years. Current theories postulate the existence of an "efficiency wage," which is kept above the market-clearing level because employers want to induce skilled workers to stay on the job, or because the threat of unemployment keeps employees working hard, or because norms of fairness in workplaces oblige employers to overpay low-paid workers in order to be able to give high-paid workers their market-clearing wage (Akerlof and Yellen, 1988).

Even though labor markets do not clear in the usual sense, Figure 3 is useful for suggesting how PVE or other training programs can increase total output. First, expanding PVE would make it cheaper and easier for some individuals to learn skills related to work they want to do. At any given wage level, therefore, the number of people available for work would increase. Some of the new supply of workers might be people who would otherwise have engaged in unpaid work at home or elsewhere, others might have been retired from, or not yet in, the labor force, and some might have been working part-time but now seek employment in an occupation for which PVE would prepare them to work full-time. The result would be to shift the SL curve to the right. This would lead to a higher level of employment and output, with a lower real wage.

Expanding PVE could also increase total output by making the existing labor force more productive, even if the number of workers available for work at a given wage level did not increase. In the framework devised by economists to account for the various causes of economic growth, education contributes directly to improvement in the "quality of labor" and indirectly increases "total factor productivity" (Denison, 1962; Jorgenson, 1984). The "labor quality" effect consists of education enabling people to perform more highly paid jobs. The effect on "total factor productivity" occurs when more highly educated workers, using a given capital stock, are able to use known technology more efficiently. This distinction is somewhat arbitrary. Growth-accounting research offers a plausible procedure to account for the sources of growth, but not an empirical demonstration that education (or anything else) really causes growth. In particular, the measured contribution of education to labor quality depends on average differences in earnings

between individuals with different amounts of schooling, and these earnings differences could arise from the "screening" effect of schooling (Winkler, 1987) rather than from any real effect of schooling on productivity. Attempts to test directly whether the aggregate level of schooling is associated with total output over time have produced mixed results (Walters and Rubinson, 1983). What direct evidence we have that education in fact does increase productivity comes from micro-level studies of small scale farming (Jamison and Lau, 1982; Wozniak, 1987), where the productivity of the enterprise can be directly related to the educational attainment of the operator. These studies have demonstrated that general schooling increases productivity. There is not yet any published evidence on whether PVE, in particular, increases productivity.

If PVE does increase productivity, it causes the demand for labor to shift to the right, as employers want to employ more people at any given wage level. With a given supply of labor, the shift in demand for labor would increase total employment and output, and raise real wages.

The two output-increasing effects of PVE—enlarging the supply of labor and enhancing factor productivity—might both occur at the same time. The effects on output and employment would be unambiguously positive. The real wage might increase or decrease, depending on the relative sizes of the shifts in labor supply and demand, and on the relative steepness of the two curves in Figure 3.

The process of increasing employment and output in response to PVE entails some redeployment of capital. When PVE increases the supply of labor, the reduction in real wage induces employers to substitute labor for capital at the same time that they expand output. The expansion of output requires additional capital, so the net effect of an increase in labor supply might be to increase or decrease the amount of productive capital used. Similarly, an increase in labor productivity induces substitution of labor for capital, but also leads to expansion of output which entails use of more capital.

If the net effect of PVE is to increase the amount of capital used, the additional capital must come either from abroad or from increased domestic saving. Capital would be attracted from abroad in response to higher returns on productive investment in this country. The same higher returns might also induce a larger amount of saving by domestic households, firms, and governments, although empirical studies of how interest rates affect aggregate saving have yielded mixed results.

Can PVE Increase Employment by Filling Job Vacancies Faster?

As shown in Figure 3, unemployed people are looking for work at the same time that employers are looking for people to fill vacant jobs. The process of matching people to jobs takes some time. This gives rise to "frictional" unemployment, which may be defined as the amount by which unemployment would be reduced if all existing job vacancies were filled. It ***seems*** obvious that speeding up the process of matching people to jobs would reduce frictional unemployment and therefore reduce total unemployment. If unemployed people lack the skills required for the jobs that are vacant, and if this is an important reason why it takes time to fill those jobs, then it also seems obvious that training programs such as JTPA or PVE can reduce unemployment.

Some support for this conclusion comes from evidence compiled by Medoff (1982). He found that the job-matching process apparently slowed down in the U.S. labor market during the 1970s. Specifically, at any given level of unemployment, the number of job vacancies—as indicated by the rate of help-wanted advertising—was larger during the 1970s than in the two preceding decades. (Equivalently, the amount of unemployment was greater at any given level of job vacancies.) Furthermore, this trend coincided with a large increase in the number of reports of skill shortages published in a set of 71 business and industry periodicals. Medoff concluded "with caution, that a significant fraction of the recent growth in labor market imbalance has to do with a worsening match between the skills possessed by labor force members and the skills required in jobs" (p. 6). Medoff's evidence of more apparent job vacancies at any given level of unemployment, or vice versa, implies, in terms of Figure 3, that the distance between the dashed line and the solid supply and demand curves increased during the 1970s.

Would total employment increase if the dashed line in Figure 3 could be shifted up closer to the supply and demand curves? If the supply and demand curves did not move, employment certainly would increase when the dashed line moved to the right. The question is whether the supply and demand curves themselves would move. In particular, the question pertains to the demand curve, since employment is almost always limited by demand, not supply (unemployed people usually outnumber job vacancies). Would increasing the proportion of jobs offered (demand curve) that are actually filled (dashed line) have the effect of reducing the number of jobs offered at any given wage? If employers become aware that the chances of filling positions within a given period of time have increased, because qualified people are more readily available (thanks to PVE, JTPA, or some other program), will they advertise fewer positions? This seems likely, since there are costs of advertising and screening applicants. Employers are interested in achieving their employment targets at minimum cost. They do not want to have unfilled

positions, but they also do not want to be swamped with applicants. Therefore, as job vacancies are filled more quickly, fewer jobs would be offered. In Figure 3, reducing the distance between the dashed line and the demand curve would induce a leftward shift of the demand curve itself. The gain in total employment, if any, would probably be very small. It would be very useful if empirical research could shed some light on this. In the meantime, it seems unwise to base public policy on the dubious assumption that filling job vacancies faster will increase total employment.

The assumption that PVE can reduce unemployment by filling job vacancies is not necessary to the rationale for PVE's existence. Even if unemployment were completely eliminated, the public purposes of PVE would remain, including the purpose of increasing total output. In terms of Figure 3, even if the dashed line disappeared so that the labor market cleared at wage w^* and employment $E^* = L^*$, the purpose of PVE still would be to shift the demand and supply curves to the right, especially the demand curve. Enhancing productivity is a prime purpose of PVE even when the economy is at full employment.

Why Evidence on Labor Market Experience of PVE Graduates is Inconclusive

Unfortunately, data on how many PVE graduates get jobs cannot resolve the question whether PVE increases total employment and output. The reason is simply that some or all of the jobs obtained by PVE graduates would have been filled by other job-seekers if the PVE program did not exist. The number of job-seekers displaced should be subtracted from the number of PVE graduates who are placed in jobs, to give a ***net placement*** rate. Only if the net placement rate is positive would it be correct to say that PVE increased total employment and output by reducing job vacancies. In practice, net placement rates have not been collected, though it might be possible to estimate them by comparing different local labor markets with and without PVE programs.

Gross placement rates are also inadequate for calculating PVE's effect on employment of under-represented groups in particular occupations. Again, some or all of the jobs obtained by target group members who participated in PVE would have been filled by other members of the same groups if the PVE program did not exist. The net placement of under-represented group members would be computed by subtracting the number of target group members who are displaced from the number who are placed. Again, net placement rates might be estimated by comparing local labor markets that do and do not have PVE programs.

Data on earnings and non-pecuniary rewards of PVE graduates are no more conclusive than gross placement rates. PVE graduates may obtain jobs with high pay and attractive non-monetary

characteristics, but some or all of those jobs would have been filled by other job-seekers if the PVE program did not exist. Those other job-seekers may therefore have to settle for jobs with lower wages and less desirable characteristics. Again, some measure of net gain in wages or non-pecuniary characteristics could be defined, as the difference between the gain to PVE participants and the loss to non-participants. Actually measuring the loss to non-participants would be very difficult, however.

The argument here is that opening job opportunities for PVE participants necessarily reduces opportunities for non-participants. Counting the gains to participants without counting the losses to non-participants therefore *over* states the gains from PVE.

This conclusion is just the reverse of the argument put forward by Gustman and Steinmeier (1982) about vocational education in high schools. They conclude that vocational education might have a positive effect on aggregate earnings even when there is no difference between the earnings of vocational and non-vocational high school graduates, if the vocational program has expanded to include all students who want it. In other words, the additional earnings of vocational compared to non-vocational graduates would *under* state the aggregate gains from vocational education. This is an important conclusion, but the model on which it is based assumes that labor markets clear in a competitive fashion, through wage adjustment. This assumption implies, in the Gustman-Steinmeier model, that employees who get general training on the job must pay for it. The empirical accuracy of this proposition is uncertain, given the mixed evidence, referred to earlier, on whether wage differences do or do not compensate for differences in non-pecuniary characteristics of jobs. Competitive wage adjustment also implies, in the Gustman-Steinmeier model, that as the number of vocational graduates increases and the number of non-vocational graduates decreases, the average wage difference between the two becomes smaller. However, in reality the persistence of unemployment and job rationing implies that the wage difference between the two groups could actually become larger, as vocational graduates who are not needed in high-wage jobs start bumping non-vocational graduates out of jobs they would have held, leaving some non-vocational graduates unemployed (Thurow, 1975).

The discussion so far has explained why it is difficult to know whether PVE (or any job training program) has accomplished its public purposes even if there is clear evidence that the program has improved participants' employment and earnings. In fact, however, it is also quite difficult to establish whether PVE has really caused participants' employment and earnings to improve. The evaluation of PVE and other job training programs is beset by problems of selection bias (Ashenfelter and Card, 1985; Burtless and Orr, 1986; LaLonde, 1986). Ideally, an evaluation of PVE would accept some applicants to the program at random (assuming there are

more applicants than places, which is not always true), and rejected applicants would all receive no training or else some well-defined alternative treatment. The difference in post-program employment and earnings would then be reasonably regarded as the result of the program. However, conducting true experiments is always expensive and sometimes impossible.

In the absence of random assignment, any differences between PVE participants and non-participants could be attributed to unmeasured, prior differences between the two groups instead of to the program. Differential success in the labor market could overstate the true effect of PVE if PVE participants possess greater unmeasured abilities, more productive personality traits, or more helpful social connections than non-participants. Conversely, differential outcomes could understate the true effect of PVE if participants had less of these positive, unmeasured characteristics. Systematic differences between participants and non-participants could result from self-selection into PVE programs, selection by institutions, or both. Given the difficulty and expense of conducting true experiments, econometricians have spent considerable effort devising statistical procedures to correct for selection bias, and this remains an active area of research.

Furthermore, actual evaluations of PVE and other employment training programs are usually limited to measuring outcomes for only a short time after participation in the program. It is very costly to keep following people for decades, and the interest of evaluators and funding agencies tends not to last that long. Yet results from the few long-term, longitudinal studies that have been done indicate that some effects of schooling do not show up in earnings until many years later (Bishop, 1985).

The importance of long-term effects is recognized by vocational educators, according to Hoachlander, Choy, and Brown (1988). Vocational educators object to evaluating their programs on short-term placement and employers' initial satisfaction, because PVE is rightly intended to give students a variety of skills that will increase their productivity as their careers advance. Chasing job vacancies may distract PVE programs from their public purpose of improving employees' productivity. The tradeoff between achieving high placement rates and improving long-term productivity is more acute if placement is supposed to be "related to training" because, if PVE programs focus on giving their graduates an edge in competing for a narrow range of jobs, they will presumably emphasize a narrow set of skills at the expense of more generally applicable skills and knowledge. More narrow training may not make PVE graduates as productive in the long run even if they do stay in jobs related to their training and, by definition, it will not pay off as much as broader training if they take jobs in other fields. The tradeoff between specific and general training is discussed further by Grubb (1988).

Conclusion: Measure PVE Graduates' Productive Capabilities Also

It is very difficult to get conclusive evidence on how much PVE increases participants' employment or earnings. More important, even if it were known with certainty that PVE improved participants' success in the labor market, it would not be at all clear whether or how much PVE had achieved its public purposes of enlarging the economy's total output of goods and services, increasing employees' job satisfaction in the aggregate, or improving access for under-represented groups to certain occupations.

On the other hand, it is unlikely that a program achieves these purposes if participants do not find employment where they are more productive than they would have been without the program. Positive labor market outcomes for participants may not be sufficient to establish that PVE accomplishes aggregate purposes, but they are necessary (unless the Gustman-Steinmeier model is true). Therefore, such outcomes should be included as indicators of program success.

In using data on employment or earnings to measure aggregate outcomes of PVE, there should be some attempt to estimate ***net*** effects. This means trying to estimate how many non-participants in PVE would have been placed in jobs taken by PVE graduates, and what happens to the non-participants' employment, earnings, and expressed job satisfaction. In attempting to measure how much PVE improves access of under-represented groups to certain occupations, it would be desirable to find out whether people displaced by PVE graduates are themselves members of under-represented groups. Failure to make such corrections seriously reduces the value of labor market outcomes as indicators of program success.

In addition to labor market outcomes, indicators of the effectiveness of PVE should also include measured gains in participants' knowledge and skill. One reason is that labor market outcomes are usually measured only in the short run, seldom more than a year after program completion, but the increased productivity of PVE participants may take considerably longer than that to become evident. However, these long-term productivity benefits cannot be considered results of PVE unless the program actually produces gains in participants' knowledge and skill. These gains should be measurable when participants leave the program, even if the payoff in productivity and earnings does not occur until much later and is never measured.

Measuring gains in participants' skill and knowledge also verifies whether PVE really produces aggregate benefits. The problem with relying on labor market outcomes alone is that PVE may to some extent serve a pure screening function, enabling participants to obtain more employment and higher earnings which are offset by reductions in employment and earnings for non-participants. However, if gains in participants' knowledge and skill are measured directly,

then these gains provide evidence that the program has augmented society's aggregate productive capacity.

In addition to providing a check on whether PVE increases total output of goods and services, measuring increases in students' knowledge and skill also is relevant to the other two public purposes of PVE. Adding to the number of under-represented group members who are ***demonstrably*** qualified for certain occupations has the effect of raising the cost of discrimination for employers who avoid hiring them while other employers do. Enlarging the pool of qualified members of under-represented groups does not by itself ensure an end to discrimination, but it does create the conditions which are necessary for affirmative action to succeed. Likewise, achieving the public purpose of increasing individual satisfaction at work depends on individuals becoming competent in their chosen fields and possessing the capacity for continued growth. These are, to some extent, measurable outcomes of PVE.

Another reason to measure the gain in participants' knowledge and skill is that this is what PVE programs most directly affect. Teachers have more control over what students learn than over whether they get jobs. This is important if the behavior of teachers and administrators is to become more closely related to measured performance.

Although in principle there are good reasons to measure knowledge and skill acquisition as outcomes of PVE, in practice it is quite difficult to know what to measure. Three broad possibilities are specific occupational competencies, generic cognitive skills, and overall mental ability. Specific occupational competencies have been developed by vocational educators and employers in recent decades. Their obvious advantage is that they relate directly to knowledge and skill required for particular jobs. The disadvantage of specific competencies is that they change relatively fast, so that an individual who acquires the right competencies today may find they have become useless in a few years. Therefore, it is desirable to include some measures of skill that do not become obsolete. In recent years psychologists and cognitive scientists have made progress in identifying more generic intellectual skills that are involved in learning and problem-solving (see Resnick, 1987). However, the measurement procedures that have been developed in this research often pertain to limited tasks performed in laboratory settings; their validity as measures of general thinking or problem-solving abilities is uncertain. On the other hand, more traditional measures of mental ability such as IQ tests or general aptitude tests are not designed to measure the distinct intellectual processes studied by contemporary cognitive science. Furthermore, the power of mental ability test scores to predict actual job performance is a matter of current dispute (Schmidt, Hunter, Outerbridge, and Trattner, 1986; Levin, 1988; Sticht, 1988).

There is no simple answer to the question of how to measure the outcomes of PVE. There are no short-term measures that are known to correlate highly with individuals' long-term productivity. It is true that PVE cannot be considered successful unless it produces positive labor market outcomes for participants (assuming the Gustman-Steinmeier argument does not hold), but there are serious problems in measuring labor market outcomes and in making inferences from them, as explained above. PVE also cannot be considered successful if participants do not learn anything from it, but exactly which kinds of gains in knowledge and skill to measure is not at all obvious. In response to these issues, economists tend to argue in favor of measuring labor market outcomes, while educators prefer to measure participants' gains in knowledge and skill. Benson (1985) has observed that

> "In simplified terms, there are two opposing views about vocational education. The dedicated educator takes the position that supply of trained people creates its own demand, whereas the economist is more likely to hold the opinion that demand for skills will create its own supply—or induce such capital-labor or labor-labor substitutions that any perceived shortage of skills vanishes. If either position were thoroughly correct, then no government would need to develop a detailed policy for skills development." (p. 9)

A compromise position is to measure labor market outcomes to ensure that PVE is creating human capital for which there is some demand, and also to measure gains in participants' knowledge and skill to ensure that programs are not regarded as failures merely because such demand is temporarily lacking.

II. Pursuing Multiple Objectives

The public purposes of PVE conflict with each other to some extent. Pursuing multiple objectives in a finite span of time means there are tradeoffs even if the objectives do not actually conflict. These conflicts and tradeoffs are briefly described here. Analytical procedures for evaluating programs with multiple objectives are then discussed.

Conflicts and Tradeoffs among Objectives of PVE

Two of PVE's public purposes are increasing total output and improving access of under-represented groups to certain occupations. The tradeoff between these two purposes is a manifestation of the general conflict between efficiency and equity, which is familiar to economists (e.g., Okun, 1975). The equity-efficiency conflict has been analyzed in the specific context of student financial aid for higher education (Hoenack, 1971), and in discussions of job-training programs this tradeoff is described as the well-known problem of "creaming" (e.g., see

Barnow and Constantine, 1988). If members of under-represented groups are more likely to lack certain prerequisite knowledge, or if they are more costly to teach (for instance, because bilingual instructors to teach members of certain linguistic minorities are scarce and therefore expensive), then students in a PVE program that recruits members of under-represented groups would be expected to achieve lower levels of skill than a program that ignores the equity objective—assuming the two programs have the same amount of resources. Lack of prerequisite skills can be taken into account by using ***growth*** in students' skills, in addition to level of skill at the end of the program, as a measure of the program's success. If achieving a given amount of growth is more costly with certain groups, however, then simply including growth as an objective does not eliminate the conflict between efficiency and equity in PVE.

On the other hand, it is possible that equity and efficiency complement each other under some circumstances. If some group (e.g., females) has been kept out of a certain occupation just because members of that occupation have had a "taste for discrimination," then opening up the occupation to the excluded group makes a fresh pool of talent available. Overall productivity would tend to increase.

In theory, then, increasing economic output and improving access may or may not be conflicting objectives. The degree of tradeoff presumably varies from one situation to another. Fortunately, no prejudgment about this is necessary. The important thing is to include enough information in the performance-monitoring system. The necessary information includes levels of skill and knowledge attained, growth in skill and knowledge during the program, and the proportions of students belonging to particular under-represented groups.

The remaining purpose of PVE is to facilitate individuals' "pursuit of happiness" at work, by enabling them to enter their chosen occupations. Does this contribute to increasing GNP, or is there a tradeoff between these objectives? Presumably, individuals are both happier and more productive in an occupation that they have chosen than one they have been forced into it. This should be all the more true if individual choice is informed by evidence about what it is like to work in various occupations, and how certain personality characteristics seem to be related to success in certain kinds of work. On the other hand, some individuals may be attracted by non-pecuniary rewards (e.g., glamor, freedom to express oneself) to occupations where the chance of success is so small that many end up unemployed, unproductive, and unsatisfied. Free choice includes the option to take a long shot and fail. To fulfill its purpose of supporting free choice, PVE should give students objective information about their likelihood of success, but PVE can be held accountable only for how much it improves students' capabilities in their chosen fields, not for the wisdom of their choice.

Free choice for all individuals does conflict clearly with improving access for certain groups. If PVE is to help under-represented groups more, it must help others less. Some individuals who do not belong to an under-represented group will therefore have less opportunity to fulfill their occupational aspirations. The public purpose of favoring under-represented groups implies that their satisfaction has higher priority.

Finally, in addition to the tradeoffs that arise from conflicts among the various purposes of PVE, there is a general tradeoff that results from the limits of time. Given the number of instructional hours in a program, decisions have to be made about what to teach and what to leave out. Even if the curriculum is standardized nationally or regionally, local administrators and teachers always have some discretion. Therefore, different programs in the same field might develop quite different sets of skills and knowledge. A performance-based evaluation system must reckon with this somehow.

In sum, any PVE program has a multiplicity of objectives, including:

- positive net labor market outcomes,
- occupationally specific skills and knowledge,
- general work-related capabilities,
- level of achievement of each skill at the end of the program,
- growth in achievement of each skill during the program,
- separate accounting of these results for each member of an under-represented group.

Furthermore, these objectives should be achieved in a cost-effective fashion. That is, with a given budget, a PVE program should be operated so that the only way to achieve more of one objective would be to achieve less of some other objective: there should be no "slack."

Analyzing Cost-Effectiveness of Programs with Multiple Outcomes

If PVE programs in a given field were responsible for only one objective—e.g., maximizing participants' score on a single proficiency test—then it would be relatively easy to determine the cost-effectiveness of programs at different institutions. Programs that achieved a high ratio of mean student score to per student expenditure would be more cost-effective. This would be a straightforward measure of "bang for the buck."

When multiple outcomes are considered, analyzing cost-effectiveness becomes more complicated. For instance, suppose two programs in the same field are to be compared. Both enroll the same number of students, but one has a larger proportion of handicapped students and the other has a larger proportion of economically disadvantaged. One program achieves bigger gains in occupationally specific skills, but the other produces more growth in students' general work-related capabilities. To make the comparison as simple as possible, suppose the two programs have equal cost. Which is more cost-effective?

One approach to this problem is to combine different outcomes into a single score. If the combination procedure is linear, this means assigning fixed weights to the different outcomes, giving more weight to outcomes that are considered more important (e.g., see Grizzle, 1984). The resulting score then can be treated as a single outcome, and cost-effectiveness comparisons can proceed on the basis of a single ratio. This is what Levin (1983) calls "cost-utility analysis."

In practice, assigning weights to different outcomes would require, first, a procedure to select judges and, second, a procedure to elicit their judgments about the relative values of different outcomes. The first procedure is political. If the weights attached to different outcomes are to represent preferences of some constituency, representatives of that constituency have to be included. The constituencies interested in PVE include students, teachers, administrators, taxpayers, and employers. A legitimate set of weights on different outcomes would have to represent these different groups. The judges who assign these weights would have to be selected accordingly.

Once a sample of judges is chosen, there are various possible procedures for determining weights. A simple procedure would have each judge assign a number—from one to ten, one to a hundred, or whatever—to each outcome, where a larger number signifies greater importance. These numbers can then be simply averaged across judges to derive weights.

An example of a more complicated procedure for deriving weights is "conjoint analysis" (see Rao, 1977). This has been used in marketing research to discover what differences between competing brands are important to consumers. A sample of respondents is asked to make hypothetical choices—in this case, the choice would be among a set of hypothetical programs. Each program would be described in terms of outcomes: high on some, low on others. Respondents' ratings of programs can be analyzed to provide numerical weights signifying each outcome's importance. Results would probably be more accurate, in the sense of predicting how people might actually choose among programs, than would results from the simpler weighting procedure. However, conjoint analysis is usually done with only three or four dimensions to be

considered. In PVE it would be difficult to reduce the number of dimensions to less than a dozen.

Whether simple or sophisticated, procedures for eliciting weights are inevitably artificial and somewhat arbitrary. Arbitrariness is also a problem in selecting the judges. In practical terms, the resulting weights are likely to be unstable. If new weights are generated in subsequent years, they are likely to cause changes in the cost-effectiveness rankings of different programs—changes that are not due to changes in actual performance. Arbitrary and unstable weights will not guide a steady effort toward educational improvement, but, instead, will promote fickle and superficial changes.

A final drawback of these weighting schemes is that they should be non-linear, but existing procedures produce only fixed weights for making linear combinations. Non-linear combinations are theoretically preferable because the value of a one-point gain in a particular outcome presumably is greater if students are performing at a low level than if they are already at a high level ("diminishing marginal utility"). Also, the value of a one-point gain in one outcome may be greater if students are performing at high levels on other outcomes than if the other outcomes are low ("diminishing marginal rate of substitution"). However, it is difficult to elicit statements of preferences that satisfy these theoretical criteria.

There is an alternative method for analyzing cost-effectiveness which takes multiple outcomes into account but does not impose arbitrary, fixed weights on different outcomes. This is a linear-programming procedure developed by Charnes, Cooper, and Rhodes (1978). They call the procedure "data envelopment analysis" (DEA). The purpose is to determine which "decision-making units," among a set of similar decision-making units, can be considered efficient. PVE programs are an example of decision-making units. The application of DEA in education has been demonstrated by Bessent and Bessent (1980), who used it to analyze public schools in Houston, Texas.

DEA computes an efficiency index for each decision-making unit. The index is the ratio of a weighted sum of outputs to a weighted sum of inputs. A different set of weights is computed for each decision-making unit, to maximize its efficiency index (constrained not to exceed unity). If the maximum efficiency index computed for a given decision-making unit, using the set of weights that make it look as efficient as possible, is less than the efficiency index computed for another decision-making unit using that same set of weights, then the first decision-making unit is deemed relatively inefficient.

Figure 4

Data Envelopment Analysis

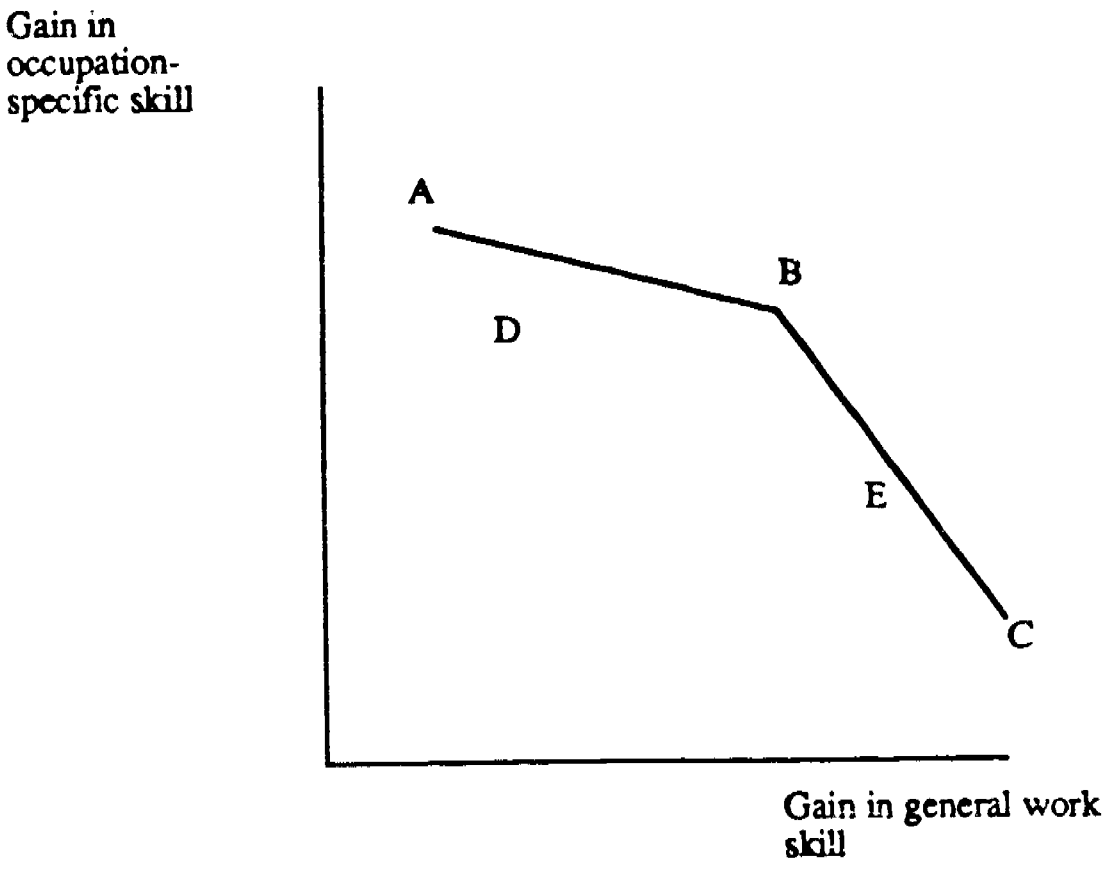


Figure 4 illustrates what can be learned from this procedure. A, B, C, D, and E are five programs. For simplicity, we consider only two outcomes, and assume here that all five programs cost the same amount of money per student. Among the five programs, A, B, and C would have maximum efficiency ratings, but D and E would not. The lines connecting efficient programs represent the production possibilities frontier. Programs A, B, and C are on the frontier, but D and E are not.

Procedures like DEA have certain drawbacks. One problem is that results can sometimes change drastically if only one or a few observations are excluded from the analysis. For instance, in Figure 4, program E would appear efficient if program C were not included. In addition, errors in measurement can produce large distortions in DEA results. Sexton, Silkman, and Hogan (1986) discuss these and other drawbacks of DEA, and suggest possible modifications of the technique.

Standard economic procedures for estimating production functions may be more robust than DEA against errors in data or model specification, but these standard techniques do not

handle more than one output at a time (Forsund, Lovell, and Schmidt, 1980; Levin, 1974). It is possible to handle multiple outputs using a cost function instead of a production function (e.g., Cavin and Stafford, 1985), but cost functions can be estimated only if different programs pay different prices for the same inputs. The main input to PVE programs is teachers' time, but comparing the prices of teachers would require some adjustment for quality, and this is difficult. Among the available techniques, DEA seems most appropriate for the problem at hand.

III. Implementing the Public Purposes of Postsecondary Vocational Education

PVE may be initiated either by individuals or by employers. PVE programs that respond to demand by job seeking individuals take place mainly in schools, where revenues depend on the number of students enrolled. Private and proprietary schools depend directly on students' tuition payments, and most public schools are reimbursed on the basis of student headcount. If students do not enroll, schools cannot operate programs. Some individually initiated PVE also occurs outside of schools, in firms that offer it to employees on a voluntary basis. Most PVE in workplaces, however, is initiated by employers as on-the-job training (OJT), in which employees are expected to participate. Although employers may contract with schools or other training agencies to provide OJT, most employer-initiated PVE occurs at the work site (Carnevale and Goldstein, 1983; Lillard and Tan, 1986). Therefore, the two main agencies that deliver PVE are schools, which traditionally specialize in responding to student demand, and firms, which mainly provide required OJT.

Benefit-Cost Considerations in School-Based and Firm-Based PVE

The DEA procedure described above is a method for identifying PVE programs that are relatively cost-effective. However, it is possible that even a relatively cost-effective program would not pass a conventional benefit-cost test. Cost-effectiveness analysis determines whether a program is relatively efficient in converting resources into desired outcomes, where neither resources nor outcomes have to be measured in monetary terms. A conventional benefit-cost analysis, on the other hand, compares the value of benefits and costs, both measured in money. In analyzing an educational program, conventional benefit-cost analysis compares the value of additional output produced as a result of the program (usually measured by the additional earnings of participants) with the program's cost. The program is judged to be a worthwhile investment if the present value of benefits exceeds the present value of costs when future benefits and costs are discounted at an appropriate interest rate, or if the internal rate of return is higher than the rate of return to alternative investments.

Since school-based PVE is often subsidized by taxpayers, students do not pay the full cost. Therefore, it is possible that benefits exceed costs for students but not for society as a whole. In fact, the subsidization of schooling by government makes the private rate of return higher than the social rate of return in all parts of the world and all levels of education, though the social rate of return to schooling is still positive virtually everywhere (Psacharopoulos, 1985). The gap between social and private rates of return is generally largest at the postsecondary level of schooling. Furthermore, the rate of return to vocational education, both secondary and postsecondary, has generally been found to be lower than the return to academic education, according to Psacharopoulos (1987). The reason is that the gain in earnings from additional vocational education is about the same as from additional academic education, but vocational schooling tends to cost more because it often requires costly equipment and class sizes are often smaller. While existing evidence on the social rate of return to school-based PVE still cannot be considered definitive (Breneman and Nelson, 1981; Grubb, 1984), the available evidence does not suggest that the rate of return is particularly high. Furthermore, Grubb (1983) has found that enrollment growth in school-based PVE programs leading to particular occupations does not conform very closely to growth in those occupations. Students may enroll in subsidized, school-based PVE because they are attracted to the non-pecuniary rewards from certain occupations, or because they are misinformed about the prospects of employment.

In contrast, employers initiate PVE only if they expect to profit from it. Since employers are in a better position than individuals to know what skills and knowledge are in demand, their expectations about the payoff from PVE are likely to be more accurate. Furthermore, only a fraction of the gain from PVE accrues to employers (the rest accrues to employees and consumers, as discussed below), so the total value of benefits from employer-initiated PVE must be expected to exceed its cost by a wide margin. Indeed, there are reasons to believe that employers systematically overlook profitable opportunities for OJT. One reason is that employers cannot fully insure themselves against the risk of losing employees in whose training they have invested (Stern, 1982). Another is that investment in OJT, like investment in physical capital, traditionally has had to be justified on grounds of cost saving, rather than improving product quality or increasing total sales (Business Week, 1988). Bishop (1985) has argued that imperfect capital markets, imperfect information about an individual worker's productive potential, and progressive tax rates also lead to underinvestment in OJT.

For these reasons, economists have proposed subsidizing employer-based training instead of, or in addition to, school-based vocational education (Thurow, 1970; Bishop, 1985; Psacharopoulos, 1987). Benson (1985) has suggested conditions under which it is more efficient

to subsidize OJT instead of school-based training. OJT will be more efficient, according to Benson, if the demand for skills is difficult to predict, the technical content of skills is changing fast, the pool of potential trainers is small and there are well-paid alternative uses for their time, equipment requirements are large or changing fast, and trainees are not familiar with the workplaces in which they are seeking employment. On the other hand, Benson points out that employers are less likely than schools to teach theory, and instruction in theoretical concepts is warranted if jobs in a particular occupation vary in the complexity of skill required, or if there is more opportunity for workers to innovate.

An Example of Subsidized OJT: The California Employment Training Panel and New United Motors

California has a unique provision in its Unemployment Insurance (UI) program that sets aside $55 million each year from the UI fund to support training of individuals who are unemployed or "likely to be displaced". A seven-member Employment Training Panel (ETP) allocates money to particular training projects. The authorization to spend money for employees who are likely to be displaced means that employers can apply for funds to train existing employees in connection with changes in technology or business operations. In effect, this is publicly subsidized OJT.

An example of how such a program can achieve the public purposes of PVE is provided by New United Motors Manufacturing, Inc. (NUMMI). This company is a joint venture between General Motors and Toyota. It was formed in 1984 to operate an automobile assembly plant in Fremont, California. General Motors had closed the plant in 1982 because it was unproductive and unprofitable. Labor relations between General Motors and the United Auto Workers had gone from bad to worse. When NUMMI reopened the plant in 1984, however, both the union and the new management proclaimed their intention to work together in a spirit of cooperation. This intention was written into the first collective bargaining contract, which also included unusual pledges to protect workers' employment security.

NUMMI started with virtually the same plant and equipment General Motors had operated, and almost all the employees at NUMMI in 1984 were hired from among those who had been working in the plant when it closed two years earlier. What was new was the way production was organized. The number of job classifications on the factory floor was reduced from about 80 to only two: team member and team leader. Most teams consist of four members plus the leader. The team handles a given section of the line, and has responsibility for dividing the work, defining work standards, and maintaining quality. The new production system, along with

greater employment security and a more cooperative ethos, have enabled NUMMI to achieve approximately 50 percent higher productivity than General Motors did in the same plant (Krafcik, 1986).

This phenomenal increase in productivity was facilitated by an intensive program of training. The ETP (Employment Training Panel) has invested more than $5 million at NUMMI, and the company has also spent a great deal of its own money on training. The first ETP project provided training for team leaders and "group leaders" (formerly called foremen) in the new production system, which was copied from Toyota; 120 hours of that training was conducted in Japan. The second ETP project trained team members in setting work standards the Toyota way, "kaizen" (which means good change, progress, or continuous improvement), quality, safety, and problem-solving techniques. A third ETP project retrained skilled crafts workers (steamfitters, stationary engineers, electricians) to be general maintenance mechanics as at Toyota. A fourth ETP project, which started in 1988, is teaching team members about new technologies, as NUMMI is now making a reported $200 million investment in retooling its production line.

One of the interesting aspects of OJT at NUMMI is that participants in classes on problem solving, kaizen, and quality can be said to "do by learning." For instance, in the problem solving class taken by all hourly employees in February and March, 1988, each team picked a real problem to analyze. Some of these classroom exercises produced real gains for the company and the workers. For example, one team figured out how to eliminate down time in the stamping plant. This directly increased productivity. It also improved product quality and safety, because shutting down the machines and starting them up again damages work in process and produces sharp metal pieces which have to be extracted by hand. Training becomes more affordable when it produces such immediate gains. The process of production and the process of learning have become closely integrated at NUMMI.

This example shows how publicly subsidized OJT can serve at least two of the public purposes of PVE. Productivity has increased. In addition, there appears to be greater satisfaction among employees at NUMMI compared to the period before 1982, as indicated by a great reduction in the number of grievances, and enthusiastic statements quoted in newspaper and magazine articles. It is not certain whether the ETP-supported OJT at NUMMI has contributed to increasing access for under-represented groups, though it is evident from visiting the plant that the NUMMI workforce includes substantial proportions of women and racial minorities.

Since OJT normally is related to the work at hand, there is some danger that subsidizing OJT will focus training on very specific skills, yielding only a short-term payoff. However, in

the case of NUMMI this danger seems to have been avoided. Classes in problem solving, quality control and kaizen develop capabilities that are useful in other work and even outside of work. NUMMI employees will be more productive as a result of this training, even if they go to work elsewhere. The importance of continued training in general skills was brought home to the workers and their union after General Motors closed the plant in 1982 and most of the laid-off employees found themselves unable to get jobs that paid as much as they had been earning. The UAW has participated in design and implementation of training at NUMMI and has helped ensure its general, as well as specific, content.

Who Should Pay for PVE?

In this paper the word "public" refers to society as a whole, including trainees and employers, not just taxpayers. For instance, if a million dollars of government spending on PVE resulted in a two million dollar increase in GNP, this would pass the benefit-cost test for society as a whole, even if less than a million dollars were returned to the taxpayers. However, it may be appropriate for trainees and employers themselves to pay for the benefits they receive from PVE. What determines the distribution of benefits among PVE participants, employers, and taxpayers?

Consider first the benefits that occur in the form of increased output. Since national product equals national income, the value of increased output from PVE equals an increase in real income that accrues as higher wages, bigger profits, and lower prices. Taxpayers are also consumers and therefore benefit from lower prices. How much of the increase in national income occurs through changes in wages, profits, and prices depends, first, on a division between producers and buyers of goods and services, and, second, on a division between employees and owners of firms. The first division is determined by how much the relative prices of goods and services fall when PVE reduces the cost of production by increasing labor supply and factor productivity. A given increase in labor supply or productivity will cause a bigger decrease in cost of production if payments to labor are a large share of value added in production. A given decrease in cost of production results in a bigger price reduction if demand for the product or service is relatively inelastic.

If some of the reduced cost of production is not passed on to consumers in the form of price reductions, then it is paid either in higher wages to workers or higher profits to owners of firms. This division depends on the relative importance of increased labor supply versus increased factor productivity in reducing the cost of production. It also depends on the substitutability of PVE-trained workers for other factors of production, which affects the

elasticity of demand for that kind of labor. A diagrammatic explanation of these statements is in Grubb (1988).

Taxpayers, as consumers, benefit from PVE to the extent that it results in lower prices for goods and services. In addition, taxpayers benefit from taxes paid on additional earnings of PVE participants and taxes paid on additional profits or capital gains for owners of firms. If taxpayers were to break even from every PVE program, it would be necessary to measure these effects for all PVE programs. Given the kind of data presently available, this is not feasible. However, it should be possible to estimate these effects for PVE as a whole, and to levy user fees on PVE participants and taxes on employers that would, on average, let taxpayers break even on the output-increasing effect of PVE.

In addition to the benefit they receive from increased output, taxpayers also have the satisfaction of knowing that PVE improves access of under-represented groups to occupations from which they have previously been excluded. This is a public good in the strict economic sense (if it is available to anyone, it is available to everyone); its monetary value is determined by the political process, not by market exchange. On the other hand, the remaining benefit of PVE—increased non-monetary rewards at work—accrues only to PVE participants, not to taxpayers.

Only a limited amount of taxpayers' money is available for PVE. How should it be spent in a way that maximizes achievement of aggregate purposes? One approach to this question is to break it into two parts: what should be taught, and who should teach it?

The answer to the question of what should be taught presumably varies from place to place and time to time. Administratively, there should be some decision-making entity that can allocate governmental resources for an appropriate geographical area. That agency should maintain updated estimates of the social rate of return to education for particular occupations or occupational clusters. It should also keep track of whether demand is growing faster than supply in each occupation. If the number of people employed in a given occupation is growing at a faster rate than total employment in the region, ***and*** the average wage in that occupation is growing faster than the average for all occupations, then demand must be growing faster than supply. The regional agency could use this information, along with rate-of-return estimates, to decide how much money should be made available within its jurisdiction for training in particular occupations. These allocations should change from year to year, but yearly changes should be based on multi-year moving averages so that change is not too abrupt.

Given the allocation of money for PVE in each occupation or occupational cluster, individual programs should compete on the basis of measured cost-effectiveness in achieving positive labor market outcomes as well as developing participants' knowledge and skill. Using DEA, or some better technique if it can be found, an index of cost-effectiveness should eventually be computed for each program. Inefficient providers should be given some technical assistance. If they remain inefficient year after year, they should lose their governmental subsidy. Given the still-experimental nature of DEA, it will take time to make this procedure operational. The first task is to develop common measures of skill and knowledge that could be used to judge PVE programs in each occupational area. It is crucial that these measures be considered legitimate by administrators and instructors in PVE programs. Otherwise they will comply only with the letter, not the spirit, of the performance-based system, as past experience with performance-based education has shown (Gramlich and Koshel, 1975; Stern, 1986; Spaeth, 1988). The process of developing "youth competencies" for JTPA illustrates the kind of technical work combined with political consensus-building that has to occur before a performance-based system can be faithfully implemented.

By separating the question what to teach from the question who should teach it, the ambitious task of implementing performance-based policy is made somewhat more manageable. However, one limitation of the guidelines suggested here is that they ignore the degree to which benefits from PVE accrue to taxpayers/consumers, rather than to PVE participants or employers. It seems appropriate that the rate of governmental subsidy should be higher for programs yielding bigger benefits to taxpayers. Unfortunately, as explained above, it does not appear feasible to adjust subsidy rates for different PVE programs according to this criterion. Further inquiry into the proportion of benefit from PVE that accrues to taxpayers/consumers would be warranted.

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