

Dynamic Economic Returns to Workforce Investments

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Abstract

A dynamic economic simulation model is used to assess the potential for job readiness programs (which bring the unemployed into the labor force) and job training programs (which upgrade the skills of low-wage workers) to reduce household poverty at the state level in Oregon. For individuals, participation in these programs tends to increase their earnings, but when the programs are administered to large numbers of persons under welfare-for-work programs, we find that the aggregate effect in the labor market is to increase the supply of labor and lower wages slightly. While wage decline is not good for the currently employed, lower wages reduce the cost of production and stimulate exports to the rest of the nation and the rest of the world, an effect which increases the demand for labor and leads to an increase in wages. The simulation model is used to assess the strength of these competing influences on the poverty rate at the state level. The net effect on poverty depends on the number of new workers brought into the labor force, the responsiveness of exports to changes in the cost of production, and the responsiveness of the poverty rate to changes in the wage rate. Under the assumptions built into the model, job readiness programs are projected to lower the poverty rate more than job training programs over a ten-year period.

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Poverty in Oregon, as elsewhere, has proven remarkably resistant to policy fixes. After rising from 10.7 percent in 1979 to 12.4 percent in 1989, the state's poverty rate averaged around 11.5 percent during the 1990's. The state's policy innovations in welfare reform, passed by the Oregon Legislature and approved by the federal government before the passage of the Personal Responsibility and Work Opportunity Reconciliation Act of 1996, were designed to move the heads of low-income families off welfare and into the work force, and to provide a set of "social supports" in the form of child care and health care subsidies and earned income tax credits.

Policymakers in Oregon have set ambitious social economic and environmental goals and tracked them through a state agency known as the Oregon Progress Board. The Oregon Benchmarks are reviewed regularly and evaluated to see how well the state is doing in meeting the targets for the one hundred benchmarks set by the appointed Board. One of the critical benchmarks against which the state evaluates its social health is the poverty rate. In 1999, the Progress Board issued a "report card" grading the state on its progress toward the benchmark targets, thus identifying issues that citizens of the state should attempt to address through a combination of social policy and collaborative action. The most recent report card gave Oregon a "C" in its progress toward meeting its target on poverty incidence. The state has also not been able to reduce its poverty rate below 10 percent and many wonder whether the state will be able to meet its target of nine percent by the year 2010.

Can state policy have an impact on poverty incidence? What types of policies ought the state to implement if it wishes to reduce poverty within its boundaries? What effort would it take for the state to achieve its benchmark target of a nine percent poverty rate by 2010? Answering these questions requires an understanding of poverty and workforce dynamics and the impact of

state policy on poverty. In order to better understand how state policy or other collective action can affect the incidence of poverty, the Progress Board supported the development of a dynamic simulation model of poverty incidence in Oregon that links policy actions to poverty outcomes.

This paper begins with a discussion of poverty dynamics and dynamic simulation models. It then outlines Oregon's workforce development policies, stressing the role of education and training in increasing worker productivity. The third section of the paper outlines the structure of the Oregon Poverty Dynamics Simulation model and the construction of the baseline. A fourth section presents a simulation of the impact of the expansion of two workforce development policies on poverty. A concluding section discusses the results and the use of results in policy design.

Modeling Poverty Dynamics

Contrary to popular stereotypes of long-term poverty and welfare dependence, poverty is actually quite dynamic. Using national longitudinal survey data, Gottschalk et al. (1994) find that nearly 60 percent of poverty spells last only one year. Many households, of course, experience repeated poverty spells. Nevertheless, Blank (1997) found that 50 percent of Americans who were poor between 1979 and 1991 were poor for three years or less out of the 13 year time period.

Poverty can change because of changes in family composition (marriage, divorce, or birth of a new child) or because of changes in income (getting or losing a job or changes in wages or hours worked). Blank (1997) found that more than 40 percent of poverty spells begin when the earnings of the household head decrease, usually due to unemployment. Similarly, more than 50 percent of the exits from poverty are associated with increases in the household's earned income. Changes in poverty status are clearly related to workforce dynamics.

Economists have attempted to model poverty and income distribution dynamics and the factors that affect poverty status in a number of ways. Bartik (1993), for example, uses panel data from the Panel Survey of Income Dynamics to develop econometric models of the impact of local labor demand on poverty. One set of probit models for both males and females estimates the probability that individuals who are initially poor will escape from poverty. Another set of probit models estimates the probability that individuals who are initially not poor will enter poverty. His results suggest that local economic growth helps both males and females escape poverty and helps prevent their falling into poverty.

Another approach is microsimulation. Golladay and Haveman (1977), for example, use a microsimulation model to examine the income distribution effects of two income transfer proposals considered during the late 1970s (a negative income tax and a more complex income transfer proposal, the Family Assistance Program, developed by the Nixon Administration). They model the direct and indirect impact of the policy-induced change in net income (transfer minus taxes to finance the transfer) on the distribution of income to four “earnings classes”. They conclude that, because the indirect effects of the policy-induced changes in consumption tend to favor high-income families, the redistributive impacts of these policies toward low income families are not as great as one would expect from an examination of only the direct impacts of the tax-transfer programs.

In this paper, we use yet another approach to the modeling of poverty changes and the impacts of policy on poverty outcomes: a dynamic simulation model. We are not aware of any other use of this approach to model state-level poverty dynamics. Dynamic simulation models of the sort used here simulate behavior based on a relatively small number of representative agents rather than the large number of individual agents in microsimulation models. The advantages of

dynamic simulation models over econometric models is that they capture feedback effects of behavioral responses in a more explicit manner, and the advantages over microsimulation models are that they require less individual and institutional data and that they are somewhat more transparent because economic agents are less disaggregated.

Dynamic simulation models are systems of equations that describe change over time. Given a set of initial conditions and assumed behavioral parameters, these models trace changes in key variables over time and allow analysis of the dynamic implications of changes in external conditions. The process of building a model involves specifying functional relationships, and initial conditions and parameters. The model is then validated by comparing model predictions with historical data. Changes are made in parameters and input variables to yield better “predictions” of historical values of key variables (Ruth and Hannon, 1997). A model that “predicts” historical outcomes satisfactorily can be used as a baseline against which to compare scenarios based on alternative inputs and parameters.

While a comprehensive poverty dynamics model should be able to explain both family changes and earnings changes, the earnings impact is clearly more important. Davis and Weber develop a dynamic simulation model that emphasizes changes in family composition. In contrast, this paper develops an economic model of earnings change that emphasizes the dynamics of the labor market.

Oregon’s Workforce Development Strategy

Investments in education, workforce development and social supports make up a large share of Oregon’s state budget and have been the focus of intensive policy discussions during the

late 1990's as Oregon worked to revamp its "human investment policy" to meet state goals and to address changes in federal welfare and workforce legislation.

Oregon's strategic plan, as articulated in *Oregon Shines* and *Oregon Shines II*, has as its "most important element" that "Oregon's workforce will be the best educated and trained in America by the year 2000 and equal to any in the world by 2010" (Oregon Economic Development Department; Oregon Progress Board and Governor's Oregon Shines Task Force). Oregon's 1997 legislature passed SB 917, which provided the institutional infrastructure for building a workforce system: the Governor's Office of Education and Workforce Policy, the Workforce Policy Cabinet, and Regional Workforce Committees. As the state is reconfiguring to meet the requirements of the federal Workforce Investment Act (WIA) of 1998, it is developing a strategy "to upgrade the existing workforce, to prepare and inspire those trapped in costly systems of welfare and corrections and to educate and excite young people entering the workforce for the first time (p. 2, *Workforce Investment Act Transition Plan in Oregon*, 1999). Goals for the "transitional workforce" ("the unemployed, underemployed or workers in transition to new jobs") are "to provide the skills necessary to obtain and maintain employment; and to prepare workers for high skill, high wage jobs in current demand."

Education and training services for the "transitional workforce" are provided by a number of public and private institutions. Community colleges constitute the largest technical education training system, and are the largest provider of literacy and adult basic skills instruction in Oregon. There are also private for-profit and not-for-profit service providers offering programs and courses of study "designed to prepare persons with the skills and knowledge to enter employment in a specific occupation or group of occupations." These vary in length "depending on the current knowledge of the individual participant and the skills necessary for employment in

the particular field” (Department of Community Colleges and Workforce Development). WIA specifies the process of certifying eligible training providers so that they can provide services under the Act. Eligible training is provided for skills varying from accounting to welding.

The Oregon Poverty Dynamics Simulation Model

Oregon's poverty alleviation policies are aimed primarily at increasing labor force participation and raising workers' wages. To simulate the effects of these policies, we develop a four-module model that links individuals, households, labor markets, and industries.

The overall structure of the model is shown in Figure 1.¹ Final demand (export sales to purchasers outside the state of Oregon, household consumption, government purchases, and investment) drives production in the industry module. Industry hires workers from the labor module based on wages determined by the interaction of the supply of labor in the household module and industry demand for labor. The demographic module supplies people to the household module through natural growth in population (births minus deaths) and through net migration, which depends in part on wages in Oregon relative to wages elsewhere. The household module in turn supplies workers to high-skill and low-skill labor markets in the labor market module. Increases in labor supply from the household module lower wages, reducing the costs of production (and product prices), which boosts exports. This increases further the demand for labor, which puts upward pressure on wages and makes Oregon more attractive as a migration destination but less attractive as a business location. The poverty rate is also sensitive to wages; increases in the low-skill wage reduce the probability of being poor and reduce the poverty rate.

There are a number of ways that policies to reduce poverty could be introduced into the model. For example, policies aimed at reducing industry costs and thus increasing demand for

workers could be built into the industry module, or policies to increase the minimum wage could be entered into the labor market module. In this paper, we introduce policies aimed at increasing the productivity and availability of workers (through job-readiness preparation and job training) in the household module. By increasing worker productivity, and thus wages, and by increasing the probability that currently unemployed persons will successfully enter the labor market, labor force policies can affect the poverty rate of the state.

Demographic module. As shown in Figure 2, there are seven age cohorts in the demographic module: under age 1, ages 1-4, ages 5-17, ages 18-24, ages 25-44, ages 45-64, and age 65 and over. A fertility rate based on Oregon data is multiplied by the number of women of ages 18 to 44 to determine the number of births each year. Historical death rates are applied to determine the number of persons exiting each cohort annually through death. Net migration (not shown in Figure 2) is also calculated for each cohort. The demographic module was constructed using data from the 1996 Oregon Population Survey² and from population forecasts by the State of Oregon (Oregon Progress Board; Oregon Department of Administrative Services; Vaidya, 1997).

Household module. Since poverty is defined for households and not individuals, it is necessary to group individuals into households to model poverty dynamics. There are nine household groups, as shown in Figure 3. These household groups receive people from the demographic module when they reach their 25th year and are grouped into households that supply adult workers to the labor market module. When household heads turn 65, the household module retires household members from the labor market, except for a small percentage of households in which retirement is delayed.

Households are classified into nine types depending on whether there are one (single) or two (couple) adult householders and on the workforce status of the respondent and (in couple households) the respondent's spouse or partner. The household module was constructed using data from the 1996 Oregon Population Survey. The Oregon Population Survey has 13 occupational categories that we classified as either high-income occupations or low-income occupations based on whether median annual earnings were above or below \$22,500:

- High-income occupations: managerial, owner (classified as high-income even though median earning was \$22,000 because the family poverty rate for owners was very low), professional, craftsman, machine operator, fishing and forestry, and protective service.
- Low-income occupations: wholesale/retail, clerical, laborer, agriculture, personal services, household services.

Using this categorization of occupations, nine household types were created³:

Single adult household (40% of households)

- N: adult does not report being employed or self-employed (17% of households);
- L: adult is employed in a low-income occupation (11% of households);
- H: adult is employed in a high-income occupation (12% of households).

Couple households (60% of households)

- NN: neither adult reports being employed or self-employed (12% of households);
- LN: one adult is employed in a low-income occupation and the other does not report being employed or self-employed (7% of households);
- HN: one adult is employed in a high-income occupation and the other does not report being employed or self-employed (10% of households);
- LL: both adults are employed in low-income occupations (5% of households);

- HL: one adult is employed in a high-income occupation and the other is employed in a low-income occupation (17% of households);
- HH: both adults are employed in high-income occupations (10% of households).

Households in the model are conduits through which workers are supplied to the labor force module. In order for households to supply the proper number of workers, it is necessary to take into account two realities.⁴ First, many households have more workers than the respondent or spouse/partner. The Oregon Population Survey defines a household the same way as the U.S. Census defines it: a group of people who live and sleep in the same housing unit. Thus, there are many more workers than the one or two adults who are the heads of households. Indeed, 12 percent of the employed workforce consists of nonspouse adult relatives living in households and four percent of the employed workforce is nonrelatives (boarders, roommates, housemates) living in households. The total number of employed persons in our household groups is 1,485,000.⁵

Second many workers hold more than one job. There are more “job-holders” than “workers” (one person holding two jobs is considered to be “two job-holders”). In 1996, 15 percent of the respondents in the Oregon Population Survey reported holding more than one job. The average multiple job-holding respondent held 1.18 jobs. For high-income workers, 13 percent held more than one job; each multiple-job-holder held an average of 1.16 jobs. For low-income workers, 17 percent held more than one job, each multiple-job-holder held an average of 1.20 jobs. Our labor (“job-holder”) supply estimate in the model of 1,742,799 is based on the assumption that multiple job holding occurred at these rates.

Labor market module. As shown in Figure 4, wages are determined by the interaction of supply and demand for labor. Separate labor markets are specified for low-skill and high-skill labor⁶ (though the figure shows only the high-skill market). Households supply workers to the

resident labor force and industries hire labor. The difference between the quantity supplied and the quantity demanded is unemployment. The rate of unemployment influences the regional wage rate, based on a Phillips curve relationship. Wages adjust to the unemployment rate with a one period lag. The resulting wage rate then affects the number of workers hired by firms.

Data on employment was obtained from Oregon input-output tables generated by the 1996 IMPLAN regional economic accounts generator. Employment estimates in IMPLAN are derived from REIS (Bureau of Economic Analysis, 1996). These “place of work” estimates are customarily larger than the “place of residence” estimates of the state employment statistics, in part because of the difference in basis. The IMPLAN estimate puts 1996 “place of work” employment in Oregon at 1,927,826. An upward adjustment is introduced into the model that adds eight percent (139,366 jobs) to the estimate of job holders to make the supply of Oregon resident job holders in the household module consistent with the demand for (place of work) job holders in the labor market module. This adjustment is very close to the number of households deleted from the sample for missing information on occupation and poverty status.

Inter-industry module. Production is estimated using a dynamic inter-industry model, as shown in figure 5. The foundation of the model is a material-balance equation that requires production to equal intermediate and final demand. Inventory, a component of final demand, adjusts to accommodate excess demand or excess supply in each period. The change in inventory is a stock-adjustment process that links the decisions of one period to the decisions of the next period. Following a shock to final demand, production initially lags demand but eventually catches up as the economy converges to a long-run stable growth path. Household spending is a constant share of labor income, which is determined endogenously in the labor market. Other categories of final demand are state and local government expenditures, federal government

expenditures, gross private investment expenditures, and exports. Government spending on goods and services and gross private investment grow at an exogenous rate roughly equal to Oregon's growth rate over the period 1990-1996. The model allows exports to deviate from an underlying exogenous rate of growth in response to changes in the cost of production in Oregon. If labor costs and the price of intermediate goods and services rise, the price of Oregon's output rises and the rate of export growth drops. If Oregon production costs fall, the rate of export growth rises.

In addition to purchasing goods and services, the state government also collects taxes and spends money on labor force preparation services in the model. An ad valorem industry tax instrument is used to estimate the corporate profit tax and the property tax (Oregon does not have a sales tax). A personal income tax is also calculated, using information from the Oregon Legislative Revenue Office on the effective tax rates for workers earning the average wage for each of the two labor markets.

Stock and flow responses in the model are governed by a number of elasticities and other parameters. Table 2 identifies the most important of these, indicates their values, and the rationale and source of the data used to estimate them.

Moving Out of Poverty. The poverty rate changes in the model when adults make job changes that move them from one household category to another (by getting a job, if not working; by moving from a low-wage job to a high-wage job, if already working) or when the Oregon average wage for low-wage jobs increases. If the adult in a single unemployed adult household (N) gets a low-wage job, for example, the household moves from the N household category to the L category. The probability of being poor differs among household types. Therefore, moving from one household type to another changes the probability of being poor. The

overall poverty rate in each period is calculated as the average of the poverty rates of each household type, weighted by the number of households of that type during that period. Table 1 shows the poverty rate for each of the nine household types. The poverty rate is also sensitive to changes in the average wage of low-skill workers: an increase in the low-skill wage reduces the overall poverty rate.

Baseline Scenario. The baseline ("without") scenario is established by simulating the Oregon economy over a 10-year period (1996-2005). Model parameters were adjusted to approximately reproduce the 10-year official forecast of population in Oregon. The population forecast in Table 3 is the September 2000 forecast. The model predicts a 12.1 percent increase in population, compared to the official forecast of a 12.2 percent increase over the 1996-2006 period. The model also predicts a 21.4 percent increase in employment, compared to a 21.8 percent increase in the official forecast. The baseline simulation has the poverty rate remaining steady at about 11.4 percent over this period.

The two best sources of state-level information on poverty in Oregon are not consistent in their estimates of poverty incidence during the 1996-99 period. The Oregon Population Survey, described above, estimates the poverty rate in Oregon in 1997 to be 11.8 percent, and the preliminary estimate of poverty for 1999 is 10.7 percent. The Current Population Survey (CPS), which produces rolling three-year averages of poverty for each state, estimates poverty in the 1996 base year (1995-97) to be 11.5 percent, quite close to the Oregon Population Survey estimate used to establish the model baseline. The estimates for subsequent years, however, show quite different levels of poverty and quite different trends. The 1997 (1996-98) estimate of Oregon poverty is 12.8 percent and the 1998 (1997-99) estimate is 13.1 percent. These estimates are quite imprecise, however. The 90 percent confidence interval around the 1995-97 CPS-

estimated poverty rate of 11.5 percent is 9.5 percent to 13.5 percent, a range that includes the subsequent poverty rate estimates (Center on Budget and Policy Priorities). Because the one series suggests that poverty has gone up while the other series suggests it has gone down, we feel the model baseline in which the poverty rate is relatively constant can be defended.

Workforce Policy Scenarios

Oregon has a number of policies directed to development of the transitional workforce. Policymakers often wonder how expanding these programs would affect the achievement of the state's goals, particularly the goal of reducing poverty. This section of the paper describes some workforce development policies and the scenarios developed in the poverty dynamics model to simulate the impact of expansions of these policies on the percent of households in poverty in Oregon over the period 1996-2006.

Scenario description

Workforce education and training for the “transitional workforce” is basically of two types: job-readiness activities and job training. Job-readiness services are “short-term prevocational services, including development of learning skills, communications skills, and interviewing skills, punctuality, personal maintenance skills, and professional conduct to prepare individuals for employment or training.” (Oregon Department of Community Colleges and Workforce Development). Job training includes “occupational skill training, on-the-job training, cooperative work experience, private sector training, skill upgrade and retraining and entrepreneurial training.”

There are two "with" scenarios, one that moves unemployed workers into the labor force (job readiness), and one that trains workers already in the labor force so that their skills are upgraded and their wages are higher (job training).

Scenario 1: Expanded Job Readiness Strategy. This scenario moves 30,000 unemployed workers into labor force over a two-year period but with no occupational skill upgrading. For each of years 1 and 2, nine thousand households, about ten percent of the 87,870 N households in 1996, are moved into household category L. Also, in each of years 1 and 2, six thousand households, about ten percent of the 63,839 NN households in 1996, are moved into LN and LL. Half go to LN and half go to LL.

This is a relatively large change in the existing labor force policy of the Oregon state government. In March of 2000, there were about 3,000 people in job readiness programs in Oregon. Since these are short-term enrollments, it is not unreasonable to estimate that approximately 15,000 to 20,000 people currently participate in job-readiness programs in any recent year. The policy change proposed here would roughly double the size of these programs. The average cost of these programs in Oregon has been estimated at around \$2,000 per participant.

Scenario 2: Expanded Job Training Strategy. This scenario upgrades the skills of 12,000 currently-employed low-skill workers over a two-year period. For each of years 1 and 2, the following changes occur: (1) L to H -- 1,500 single adults move from a low-skill to a high-skill job; (2) LN to HN -- 1,500 adults in couple households where only one adult is working move from a low-skill job to a high-skill job; (3) LL to HL -- 1,500 adults in couple households where two adults hold low-skill jobs move from a low-skill job to a high-skill job; and (4) HL to HH -- 1,500 adults in couple households where one adult holds a low-skill job and a second adult holds

a high-skill job move from a low-skill job to a high-skill job. This would represent a large expansion of existing programs in Oregon. In March of 2,000, there were approximately 1,000 people in job training activities in Oregon. Since these are long-term enrollments, it is reasonable to estimate that 2,000-3,000 people participate currently in training programs in any given year. This policy change would thus represent a doubling or tripling of current job-training program activity. The average cost of these programs has been estimated at around \$5,000 per participant.

Results

Expanded Job Readiness Scenario. Each of the workforce strategies reduces poverty. The Expanded Job Readiness Strategy puts 15,000 additional low-skill workers into the local low-skill labor force in each of the first two years, which lowers the low-skill wage rate slightly. This reduces production costs and hence output prices in both industry sectors and stimulates final demand, which in turn stimulates the demand for both low- and high-skill labor. The increase in demand for high-skill labor increases the high-skill wage rate, which lowers the unemployment rate and attracts immigrants. However, the increase in the low-skill labor force is larger than the increase in demand for low-skill labor, leading to more unemployment and wage declines in this sector and outmigration of low-skill workers. The net result of these interactions is that the Expanded Job Readiness Strategy reduces poverty. In year 2 (1997), poverty is reduced to 11.08 percent, a decrease of 0.26 percentage points from the baseline (see Table 4). By the 10th year, the poverty rate is reduced from 11.43 percent to 11.15 percent, a reduction of 0.28 percentage points as compared to the baseline.

The Expanded Job Readiness strategy costs \$30 million annually for two years (years 1 and 2). The net present value of these program costs, using a 7 percent discount rate, is \$56.8 million. The entry of new workers into the workforce generates additional tax revenues over the

time horizon of the model. If we assume that the worker placed in a low-skill job during year 1 will continue to earn the average wage in the low-skill labor market during the entire 10 years of the simulation, the net present value of the added personal income tax revenues from this work (at a discount rate of 7 percent) is \$334.39 million. Based on the current estimated per-participant cost of \$2,000, the revenue-cost ratio of this policy is 5.9. This ratio suggests that, even in the limited government cost-revenue calculation that ignores social benefits, this expenditure pays for itself over time. Indeed, we estimate that the state government could afford to spend up to \$11,800 per worker placed in a job and still break even from an expenditure-revenue standpoint. Another way of thinking about this policy is that the net present value of the fiscal (government) cost of reducing the poverty rate by one-tenth of a percentage point is \$20.6 million.

Expanded Job Training Scenario. The Expanded Job Training strategy has less impact on poverty than the expanded job readiness strategy under the assumptions used in the model. This is because the strategy is targeted to people who are already employed and therefore less likely to be poor. The strategy is more expensive on a per-worker basis than the expanded job readiness scenario, so fewer workers can be trained for a given dollar amount. To facilitate comparison between the two strategies, we assume that identical sums (\$30 million annually during years 1 and 2) are invested in the two programs.

By year 10, poverty declines from the baseline rate of 11.43 percent to 11.34, a drop of 0.09 percent. The net present value of the cost of the Expanded Job Training scenario is \$56.82 million – the same as for the Expanded Job Readiness strategy. The net present value of added tax revenues is only \$81.80 million. At the current per-participant cost of \$5,000, the revenue-cost ratio is 1.44. The break-even cost of implementing this policy would be \$7,200 per worker.

Under current expenditures per participant, the cost of reducing poverty by one-tenth of a percentage point is \$67.07 million.

Sensitivity Analysis

The responsiveness of poverty to policy changes is potentially affected by a number of elasticities in the dynamic simulation model. Our sensitivity analysis focused on parameters that we expected to have the largest effects on the estimated poverty rate. Three values of each of the tested parameters were used: the initial (central) value, a low value (50% of the central value), and a high value (50% more than the central value). Central values are reported in Table 2. The results of the sensitivity analysis are presented in Table 5. Sensitivity results are reported for scenario 1 only since it has a larger impact on poverty than scenario 2.

The estimated poverty rate is moderately sensitive to the price elasticity of exports, which influences the growth of the state economy and, consequently, the demand for labor. When the central value of this parameter is used, the poverty rate declines to 11.15 percent by the 10th year under scenario 1. In contrast, the low value of this elasticity generates a poverty rate estimate of 11.21 percent, while the high value generates a poverty rate estimate of 11.08 percent.

Sensitivity analysis was conducted on two other parameters. Increasing or decreasing the net migration elasticity with respect to earnings by 50 percent has no perceptible effect on the poverty rate when carried out to two decimal places. The effect of the migration elasticity on poverty is small (visible at only three or more decimal places). This is not surprising because the amount of migration that occurs in any given year represents a very small percent of population and labor force.

Varying the poverty rate elasticity with respect to earnings has a small effect on the estimated poverty rate. When the high value of the elasticity is used, the poverty rate is one-tenth of a percent lower than when the central value is used. The low value of the elasticity has no effect on the poverty rate.

Not surprisingly, the model is somewhat sensitive to some parameters. However, our basic conclusion that the job readiness strategy (scenario 1) is more cost effective than the job training strategy (scenario 2) is not altered by a wide range of values for the key parameters in the model.

Conclusion

The Oregon Poverty Dynamics Simulation model was developed to allow persons involved in the design of workforce and antipoverty policy in Oregon to understand the ways that workforce policy might affect the behavior of firms and workers and how these behavioral responses would affect the poverty rate in this state.

Under the assumptions built into this model, an expanded job readiness strategy that roughly doubles the size of the job readiness programs has more effect on poverty and is more cost effective than a strategy of expanded job training that costs the same amount of money over a ten year time horizon. Not only does the former strategy return more tax revenues to the state over the 10 year time period, but it also reduces poverty more. The expanded job readiness strategy starts with households in the most impoverished household category and moves them to a household category with much lower poverty rates, whereas the job training strategy starts with households that are better off initially.

This result does not imply, however, that the state ought to put all of its workforce money into job readiness programs. Job training and education programs tend to have a long gestation

period and to have impacts over a lifetime that are not seen in the first ten years after training. Even more importantly, increasing the size of the low-wage workforce without additional training will tend to further reduce the wages of this part of the labor market, and this could have a negative long term effect on poverty and the kind of economic activity that locates in Oregon. As noted above, one of the state's goals is to have the best-educated workforce in the country, and this goal requires substantial investment in education and training. A model that simulated the impacts of various workforce strategies over a 40-50 year time horizon would enable policymakers to better understand the short- and long-term tradeoffs in workforce policy.

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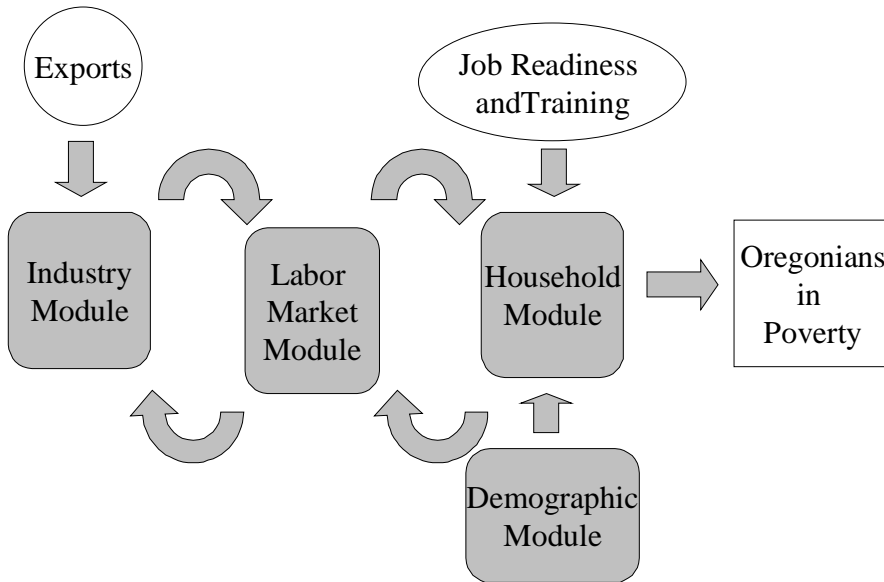
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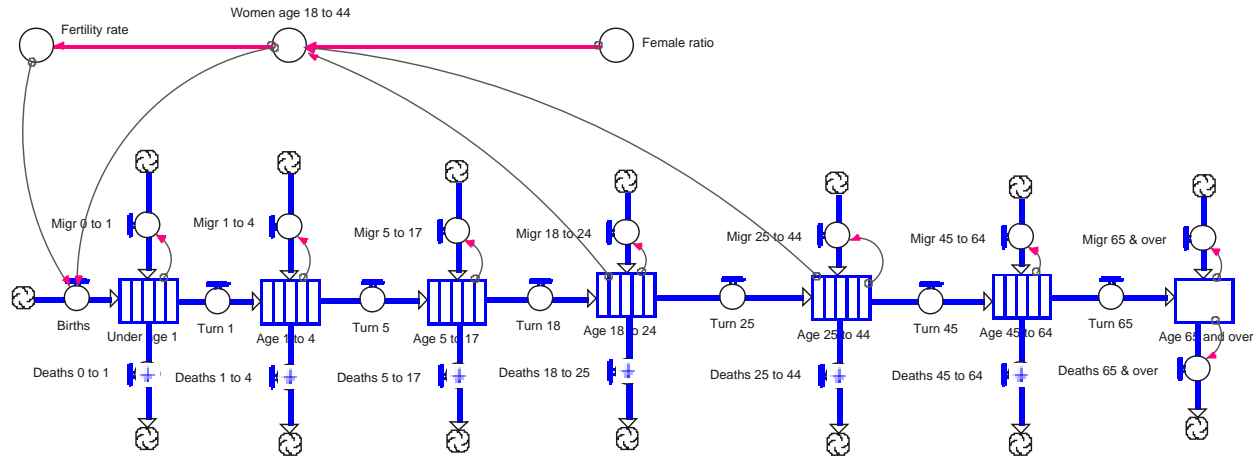
Vaidya, Kanhaiya L. "1996 Oregon Population Survey Summary. Oregon Office of Economic Analysis, Salem, Oregon, 1997.

Figure 1: Oregon Poverty Dynamics Model



The model has demographic, household, labor market, and industry modules. Individuals originate in the demographic module and are subsequently streamed into households. Households provide workers to labor markets, which provides labor services to industries. Industries, in turn, provide intermediate goods and services to Oregon industries and final goods and services to Oregon consumers; local, state, and federal governments; the investment goods sector; and the purchasers of Oregon's exports in the rest-of the United States and the rest-of-the-world. Policy instruments that alter poverty in the model are job readiness programs (which bring unemployed persons into the labor force) and training programs (which move low-wage workers into high-wage occupations). Both types of policies affect the supply of labor and, hence, the cost of production. By changing producers' costs of production through shifts in labor supply and labor productivity, these policies increase the volume of exports.

Figure 2: Demographic Module



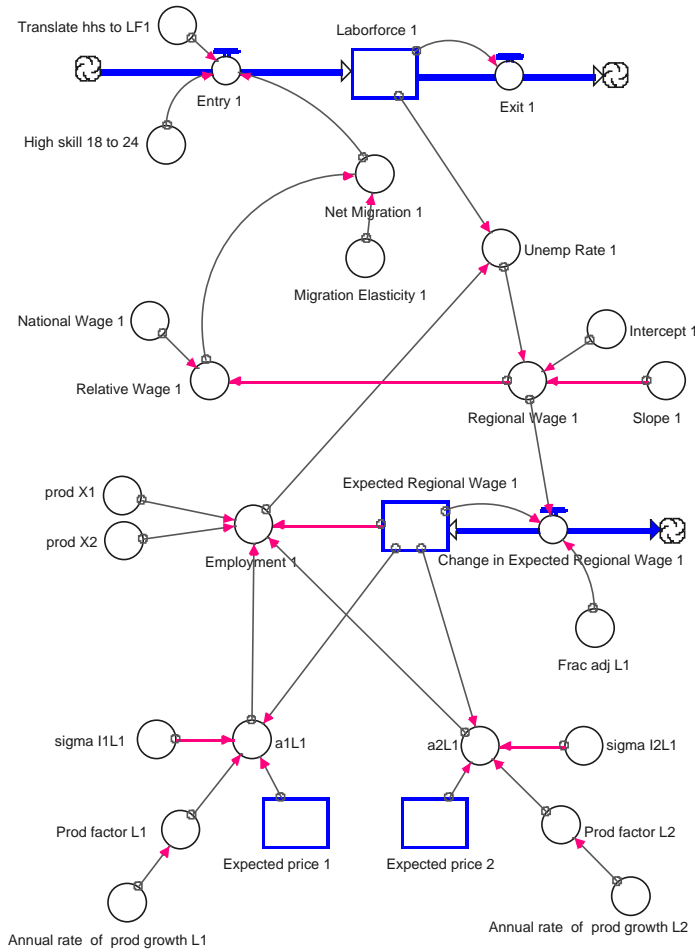
The demographic module has seven age categories: under year 1, years 1 to 4, years 5 to 17, years 18 to 24, years 25 to 44, years 45 to 64, and year 65 and over. Births are determined by the number of women age 18 to 44 and the fertility rate. Infants that survive the first year enter a "conveyor belt" that transports them to the 1-4 year category, where they remain for four years. At the end of this period, they are moved to the 5-17 year category, where they remain for 13 years. They then are moved to the next category, and the aging process continues in this manner. Within each age category, annual migration rates and death rates are applied and the stock of persons in that category is adjusted accordingly (to keep the figure simple, we have not shown migration rates).

Figure 3: Household Module



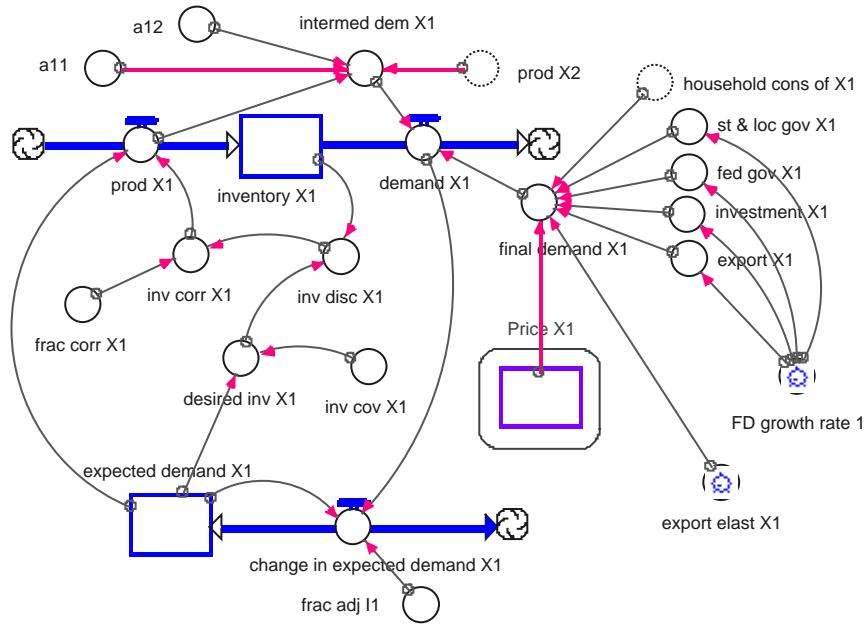
There are nine household categories, differentiated by the number of adults heading the household, and their labor force status. Individuals enter households at age 25 and are assigned to household categories according to the population proportion of each household category in the 1996 Oregon Population Survey. At age 65, most householders are assumed to retire. The current stock of householders is estimated annually, based on the previous year's stock of householders, the number of new entrants, and the number of retiring persons. Individuals are assumed to transfer from one household to another only if they participate in one of the job training programs on which this paper focuses.

Figure 4: Labor Market Module



There are two regional labor markets: high skill and low skill (only the high skill market is shown above). The labor force is updated annually by translating 18-24 years olds and householders of ages 25-65 into workers using average numbers of workers per household by household category as estimated from the 1996 Oregon population Survey. The labor force is further altered by net migration, which is responsive to the wage rate. Based on the difference between labor force and employment, an unemployment rate is calculated. A Phillips curve, estimated for Oregon using historical data, is used to determine the wage rate that corresponds to each possible unemployment rate. Labor demand (employment) is the first order condition for cost minimization, based on a CES cost function. Technical change alters the demand for labor. To reduce the simultaneity in the model, the wage rate in the labor demand function is lagged one period.

Figure 5: Interindustry Module



There are two industries: one producing traded goods (X1), the other producing nontraded goods (X2). (Only the traded goods industry is shown above). Final demand consists of household consumption, state and local government purchases, federal government purchases, investment demand, and export demand. Household consumption is driven by labor income. Exports are determined by a trend growth rate and by the cost of Oregon exports. All other categories of final demand are determined by a trend growth rate only. Total demand consists of final demand plus intermediate demand. The change in inventory is equal to current production minus total demand. Change in inventory trigger changes in production, based on a lagged adjustment process.

Table 1: Households, Jobs and Poverty Rate by Household Type

Household Type	Number of Households	Percent of Households	Number of Jobs	Percent of Jobs	Poverty Rate
N	208,887	17	37,330	2	35.4
L	135,818	11	206,242	12	21.2
H	150,943	12	230,296	13	9.8
NN	143,479	12	14,655	1	16.2
LN	81,341	7	113,936	7	16.1
HN	122,712	10	159,198	9	9.4
LL	56,961	5	148,103	9	8.3
HL	203,386	17	526,916	30	3.6
HH	118,946	10	306,124	18	2.1
Total	1,222,473	100	1,742,799	100	11.4

Table 2: Selected Parameters in the Poverty Dynamics Model

Parameter	Value of Parameter	Rationale
Growth rate of final demand for traded goods	4.7	Growth rate of US GDP during the period 1996-1998.
Price elasticity of final demand for traded goods	5.0	This is a “guesstimate.” A high value was selected because the markets for traded goods tend to be highly competitive.
Net migration elasticity with respect to high-skill annual income	0.10	Set to achieve a migration flow that corresponds in the model baseline to migration flows projected by the State of Oregon.
Net migration elasticity with respect to low-skill annual income	0.10	Same as above.
Elasticity of high-skill annual earnings with respect to unemployment rate	-0.04	Based on authors’ econometric estimates of the Oregon wage (Phillips) curve over the period 1978-97.
Elasticity of low-skill annual earnings with respect to unemployment rate	-0.04	Based on authors’ econometric estimates of the Oregon wage (Phillips) curve over the period 1978-97.
Elasticity of poverty rate with respect to income	-0.1	Blank (1997, p.52ff) has found that economic growth in the 1980s and 1990s did not produce substantial declines in poverty.

Table 3: Model Baseline and Official State Forecast

Year	Population		Total Employment, Model Baseline		Nonag. Employment, Official Forecast *		Poverty Rate
	Model Baseline	Official Forecast *	Level	Pct. Change	Level	Pct. Change	Model Baseline
1996	3,299,331	3,181,000	1,895,053	-	1,474,700	-	11.42
1997	3,338,213	3,217,000	1,956,442	3.2%	1,526,400	3.5%	11.44
1998	3,372,983	3,267,550	2,042,587	4.4%	1,551,800	1.7%	11.34
1999	3,425,197	3,300,800	2,048,352	0.3%	1,572,400	1.3%	11.38
2000	3,459,179	3,339,000	2,060,412	0.6%	1,599,900	1.7%	11.40
2001	3,495,797	3,378,000	2,088,929	1.4%	1,627,400	1.7%	11.38
2002	3,537,008	3,415,000	2,124,541	1.7%	1,654,000	1.6%	11.38
2003	3,577,141	3,453,000	2,167,529	2.0%	1,691,600	2.3%	11.39
2004	3,616,960	3,491,000	2,210,938	2.0%	1,732,900	2.4%	11.40
2005	3,658,074	3,529,000	2,253,256	1.9%	1,766,400	1.9%	11.41
2006	3,700,094	3,568,000	2,300,051	2.1%	1,796,600	1.7%	11.43
Change '96-'06	400,763 (12.1%)	387,000 (12.2%)	404,998	21.4%	321,900	21.8%	0.01%

* Oregon Department of Administrative Services, *Oregon Economic and Revenue Forecast*, September 2000.

Table 4: Simulation Results: Impacts of Workforce Policy on Poverty Rate

Year	Baseline	Strategy 1	% Difference	Strategy 2	% Difference
1996 (base)	11.42	11.42	0.00%	11.42	0.00%
1997 (Yr. 1)	11.44	11.31	-0.96%	11.39	-0.26%
1998 (Yr. 2)	11.34	11.08	-2.03%	11.24	-1.32%
1999 (Yr. 3)	11.38	11.09	0.09%	11.27	0.27%
2000 (Yr. 4)	11.40	11.09	0.00%	11.30	0.27%
2001 (Yr. 5)	11.38	11.09	0.00%	11.29	-0.09%
2002 (Yr. 6)	11.38	11.10	0.09%	11.29	0.00%
2003 (Yr. 7)	11.39	11.11	0.09%	11.29	0.00%
2004 (Yr. 8)	11.40	11.11	0.00%	11.31	0.18%
2005 (Yr. 9)	11.41	11.12	0.09%	11.32	0.09%
2006 (Yr. 10)	11.43	11.15	0.27%	11.34	0.18%
Change 1996-2006	0.01	-0.27	-	-0.08	-

Table 5: Sensitivity Analysis of Selected Model Parameters

Parameter	Poverty Rate in the 10th Year under Scenario 1		
	<i>For low parameter value</i>	<i>For central parameter value</i>	<i>For high parameter value</i>
Traded goods export elasticity	11.21	11.15	11.08
Net migration elasticity with respect to earnings	11.15	11.15	11.15
Poverty rate elasticity with respect to earnings	11.15	11.15	11.14

Endnotes

¹ The model was developed using Stella, a software package that solves systems of difference equations linked to a graphical user interface (High Performance Systems, 1997). In the development phase, we utilized the graphical user interface to demonstrate the emerging model to state agency personnel and to elicit their suggestions on the modeling of labor force policies.

² The Oregon Population Survey is a biennial survey conducted by the state of Oregon to learn about the socioeconomic characteristics of the state's population (Vaidya, 1997; Oregon Progress Board). Telephone interviews were conducted with 5,249 Oregon households by Bardsley and Neidhart Inc, a survey research firm in Portland, Oregon.

³ For 2.4 percent of households it was not possible to identify the occupation of the respondent or spouse. These households are not included in our estimates. For another approximately 6 percent, it was not possible to identify poverty status, and these observations were also deleted.

⁴ A third factor affecting the supply of workers and employment in Oregon in 1996 is commuting. The supply of job-holders in Oregon is larger than the number of job-holding Oregonians because commuters living in neighboring states commute into Oregon to hold jobs. Our model ignores commuting since there are no published estimates of net incommuters for 1996. The U.S. Bureau of Economic Analysis in its Regional Economic Information System (REIS), publishes estimates of the earnings by place of work and place of residence (but not estimates of the number of commuters). Oregon earnings by place of work are 2.6 percent higher than earnings by place of residence. If commuters were added to our Oregon household estimate of job-holding, there would be 1,788,460 "job-holders" in the Oregon resident labor module.

⁵ The Oregon Employment Department estimates that there were 1,619,400 Oregonians employed in 1996, a figure that is 9 percent larger than our estimate. As indicated in footnote 4, we excluded about 8 percent of households from our estimates because of missing information. Had we included these and assumed that their employment patterns were similar to those of the included households, our estimate would have been quite close to the Employment Department's estimate. The Employment Department estimate is for employed individuals 16 years and older by place of residence. It includes nonfarm payroll employment, the self-employed, unpaid family workers, agricultural labor and domestic service workers. Data are adjusted for multiple job-holding and commuting.

⁶ High-skill and low-skill labor markets in the model are actually "high-income occupation" and "low-income occupation" labor markets. The low-skill labor market is supplied by low-income-occupation workers from the household module and the high-skill labor market is supplied by high-income-occupation workers. We use this shorthand for convenience, recognizing that many low-income occupations require considerable skill.