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by

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Abstract

Anti-poverty policy in the U.S. has emphasized labor supply policies, such as welfare reform or job training. Anti-poverty policy in the U.S. has not emphasized policies to increase labor demand for the poor, such as public employment or subsidizing private employers to hire the poor. What are the aggregate effects of such policies on wages and unemployment of different groups? This paper estimates and simulates a model with several types of labor, using data from the Current Population Survey on state labor markets. The simulations suggest that forcing more disadvantaged persons into the labor market can displace many other persons from employment in the short-run and medium-run, and increased public employment of the poor may be offset by reduced private employment of the poor in the long run. Wage subsidies to either the poor or the poor's employers have little effect on the poor's employment or market wages, although paying wage subsidies to the poor increases take-home pay. Finally education policies not only directly help those educated, but also increase average earnings of less-educated groups and reduce average earnings of more-educated groups.

> "We suspect that macro effects [of a social policy change] are often substantial, and that, correspondingly, the policy impacts determined by micro-experimental evaluations are often seriously biased . . . [T]he only way to determine the magnitude of macro effects is to measure them, something that has not been done."

Irwin Garfinkel, Charles F. Manski, and Charles Michalopoulos, "Micro Experiments and Macro Effects" (p.254), in *Evaluating Welfare and Training Programs* (Eds., Charles F. Manski and Irwin Garfinkel), Harvard University Press, 1992.

1. Introduction

How can policymakers best increase employment or wages of the poor? In the U.S., anti-poverty policies devote more resources to "labor supply" policies than "labor demand" policies. Labor supply policies, which increase the quantity or quality of the poor's labor supply, include welfare-to-work programs, job training, and education. Labor demand policies, which increase demand for the poor's labor, include public employment and wage subsidies. The relative merits of labor supply vs. demand policies depend in part on their aggregate labor market effects. For example, job training for the poor is less attractive if every job gained by a trainee displaces someone else from a job.

As noted by Garfinkel et al. in the above quotation, almost no studies have estimated these "aggregate" or "macro" effects. The present paper provides estimates of the aggregate effects of both labor supply and demand policies.

These estimates of aggregate effects use a structural model of the labor market, which describes the labor supply and demand of different groups and their relationship to labor market outcomes. The structural model allows for involuntary unemployment. The model is estimated using pooled time-series cross-section data, with annual observations on average values of different labor market variables for 50 states and the District of Columbia, from 1979 to 1997. The model's data are derived from the Current Population Survey–Outgoing Rotation Group (CPS-ORG). The model considers five groups: men and women, each divided into a less- and a more-educated group, and with less-educated women divided into a less-educated single mother group and the remainder of less-educated women.

Preliminary simulations examine the behavior of different parts of the model, including elasticities of labor supply and labor demand. Other simulations examine how wages, employment, and other labor market variables respond to labor supply and demand shocks. The shocks considered include “quantity” shocks to the labor supply or demand of each group and “wage subsidy” shocks to the demand or supply of each group. I also consider education shocks that switch labor supply from one group to another, and demand-shift shocks that switch labor demand towards more-educated groups.

The most important implication of these simulations is that the aggregate effects of labor market policies are large. A labor market policy targeted on one group often has “spillover” effects on other groups of comparable magnitude to the direct effects of the policy on the targeted group.

2. Theory of Wage and Displacement Effects of Labor Supply and Demand Shocks

Figure 1 illustrates the wage and displacement effects of shocks to labor supply and demand. The diagrams show a labor market, which could be the entire labor market or the market for some type of labor. Shocks will affect wages for all workers, not just workers who participate in some program. Market wages decrease due to supply shocks and increase due to demand shocks. For shocks to the quantity supplied or demanded, the increase in employment is less than the number of workers added to the market or employed by the policy, because some workers are displaced by program participants. For wage subsidies, the wage received by workers goes up by less than the amount of the subsidy.

Figure 1A. Effects of a Labor Supply Shock

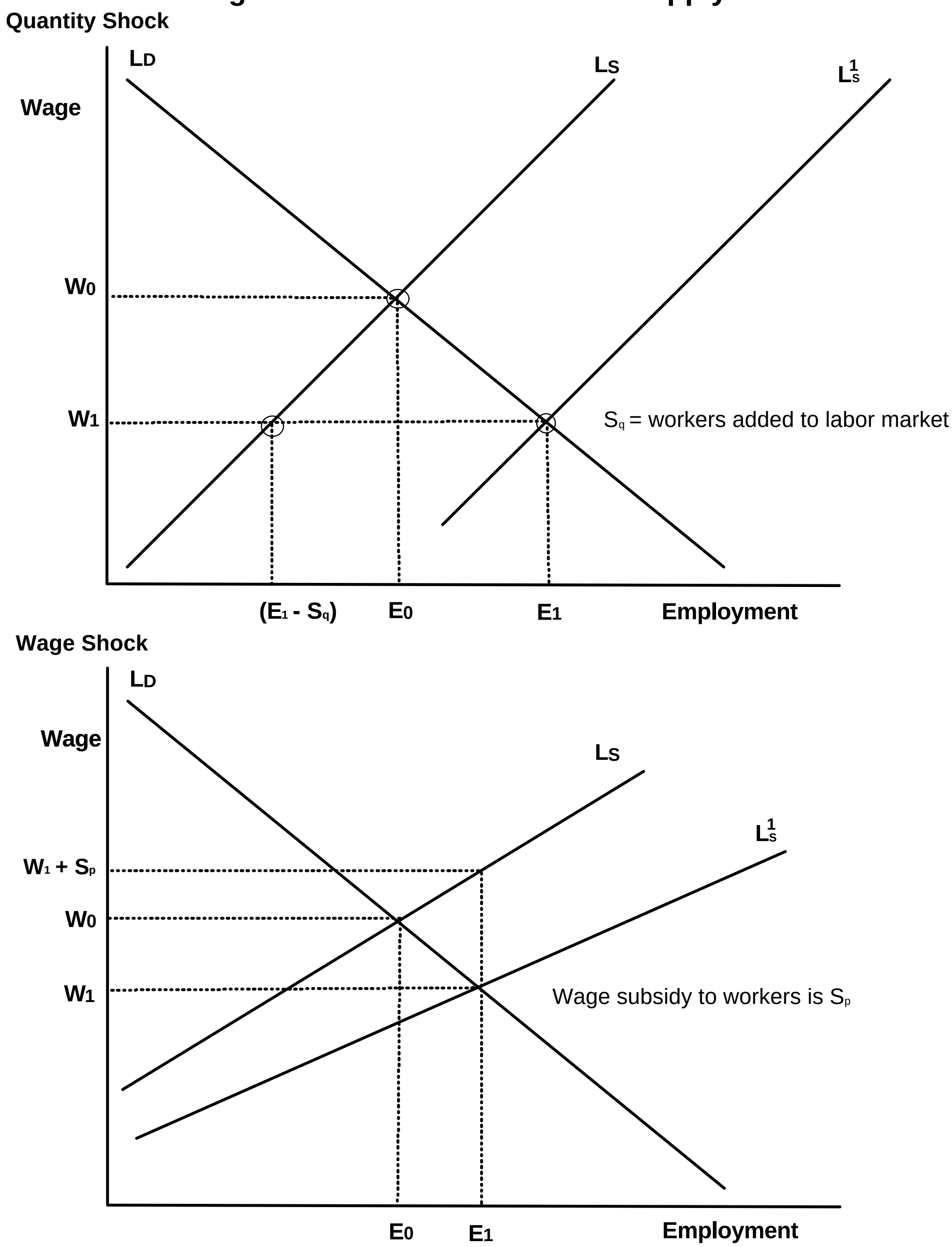
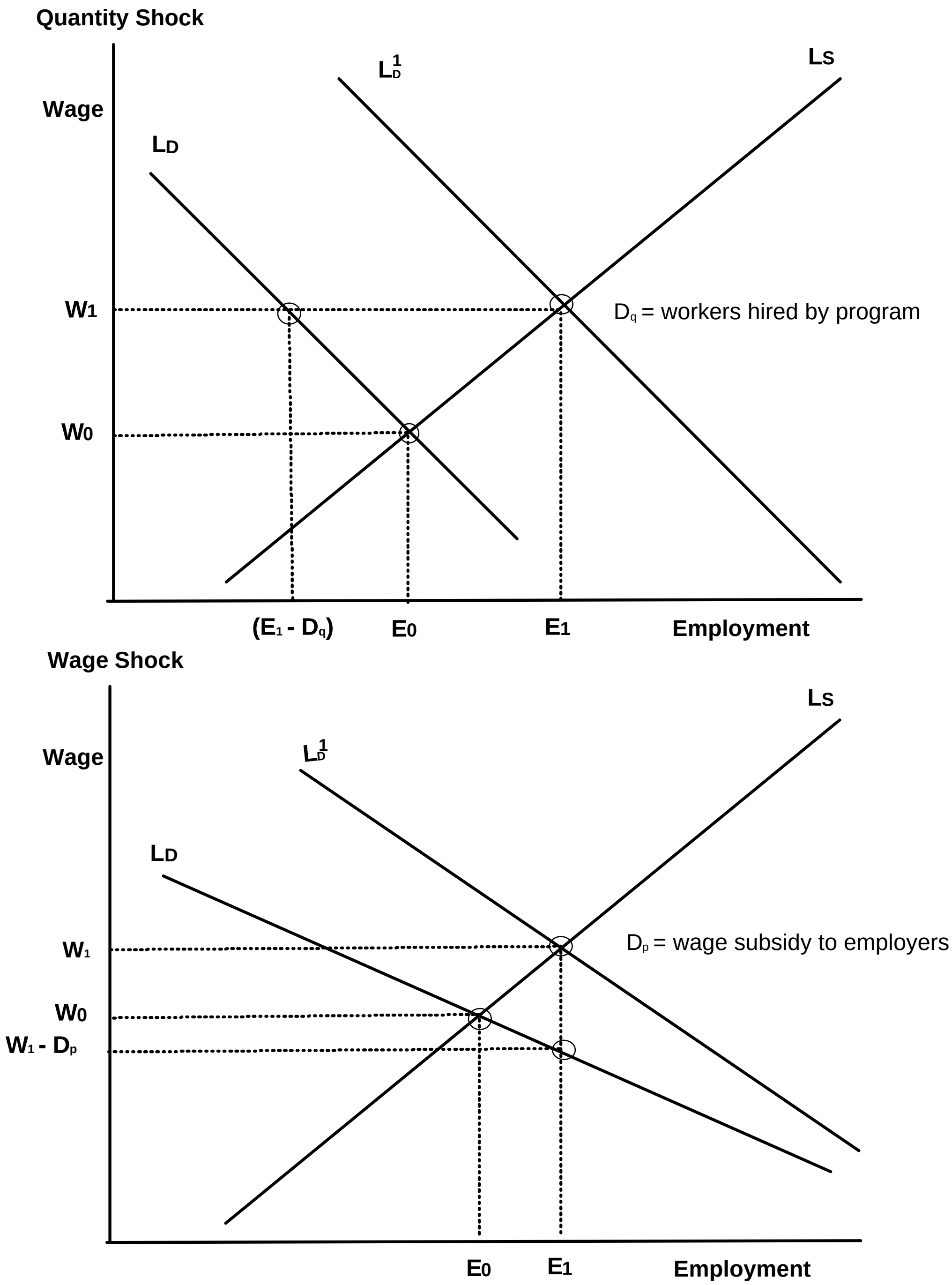


Figure 1B. Effects of a Labor Demand Shock



It is apparent from Figure 1 that wage and displacement effects depend on the slopes of supply and demand curves. One can derive the following formulas[1] for the wage and employment effects of demand and supply shocks:

(1) $$\%\Delta W = [d_q + \eta d_p - s_q - \epsilon s_p] \,/\, (\epsilon + \eta)$$

(2) $$\%\Delta E = [(\epsilon(d_q + \eta d_p) + \eta\,(s_q + \epsilon s_p)] \,/\, (\epsilon + \eta)$$

where $\%\Delta W$ is the percentage change in wages in the relevant labor market, d_q is the quantity shock to labor demand as a percentage of employment, d_p is a wage subsidy given to employers as a percentage of the market wage, s_q is the quantity shock to labor supply as a percentage of employment, s_p is a wage subsidy given to workers as a percentage of the market wage, ϵ is the elasticity of labor supply with respect to wages, η is -1 times the elasticity of labor demand with respect to wages (and hence is positive), and $\%\Delta E$ is the percentage change in employment in the relevant labor market.

In addition, changes in wages and employment in the shocked labor market would shift demand and supply in other labor markets. These shifts would change wages and employment in still other labor markets, leading to further shifts in supply and demand in all markets, until we reach a new general equilibrium.

What do we know about labor demand and supply elasticities? We know a lot about aggregate labor demand elasticities, which will be relevant to the effects of shocks on overall wages and employment. Research suggests that in the short run, the elasticity of labor demand with respect to wages will be high, probably greater in absolute value than -3.[2] In the long run, the overall labor demand elasticity will be even greater, perhaps even infinite.[3]

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[1]These are standard results in economics; see Freeman (1977) or Katz (1998). These equations can be derived by differentiating and rearranging the equilibrium condition $L(W(1 + S_p))\,(1 + S_q) = E(W(1- D_p))\,(1 + D_q)$. $L(\ )$ is the labor supply function and $E(\ )$ is the employment demand function. The wage subsidies and quantity shocks are expressed as proportions of wages and employment.

[2]Hamermesh’s (1993) review says that the “output-constant” elasticity of labor demand is -0.3, but the relevant elasticity for analyzing effects of supply and demand shocks should allow output to vary. In this short run, this elasticity is 1 divided by the “factor price elasticity for overall labor”: how the wage employers are willing to pay varies with labor, holding capital constant. Hamermesh concludes that this factor price elasticity is -0.3, so the short-run demand elasticity for overall labor, allowing output to vary, is 1/(-0.3) = -3.33.

In contrast, we know little about the elasticity of demand for types of labor.[4] Regressions that use relative employment of labor types as a dependent variable find modest effects of relative wages on relative employment (Grant, 1979). Regressions that use relative wages of labor types as a dependent variable find modest effects of relative employment on relative wages, which suggests large elasticities of relative labor demand with respect to relative wages (Berger, 1983; Borjas, Freeman, and Katz, 1997). Either approach is unconvincing because both relative wages and relative employment are endogenous, biasing estimation. The most convincing evidence—convincing because the right-hand-side variable is plausibly exogenous—is from the minimum wage literature, which finds that minimum wages have modest effects, if any, on the relative employment of minimum wage workers such as teenagers.

Traditionally, economists have believed that labor supply is unresponsive to wages. More recent estimates suggest larger labor supply elasticities for low-skilled groups, as high as 0.4 (Juhn, Murphy, and Topel, 1991). The effective labor supply elasticity will be even larger in models with involuntary unemployment. Unemployment can be included in models by assuming that wages are a function of unemployment (a "wage curve"). Conditional on labor supply, the wage curve acts as an effective labor supply curve. Most estimates of wage curves suggest large labor supply elasticities, perhaps greater than 1.[5]

Involuntary unemployment also complicates the wage and displacement effects of supply and demand shocks. The unemployment rate could affect labor supply or demand; labor market

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[3]An infinite labor demand elasticity is implied if production is constant returns to scale in labor and capital, and long-run capital supply is perfectly elastic. Suppose a supply shock lowers the wage. This increases profits, which increases capital supply, thus increasing output and labor demand and forcing the wage back up. If the profit rate is set by a long-run horizontal capital supply curve, then equilibrium will be restored at the original wage, implying a long-run horizontal labor demand curve. With constant returns, the wage and profit rate are functions of the capital labor ratio, so if the profit rate is the same, so must be the wage.

[4]This agrees with Hamermesh (1993): "Knowledge of the extent of substitution among various groups of workers is not well developed" (p. 136).

[5]Blanchflower and Oswald (1994) suggest the effect of ln(unemp. rate) on ln(wage) is -0.1. If unemployment is 6 percent, a 1 percent decrease in unemployment would increase wages by 1.6 percent. Cross-section studies suggest that a 1 percent decease in unemployment increases labor force participation by half a percent (Bowen and Finegan, 1969). Combining these relationships, a 1.5 percent increase in employment is associated with a 1.6 percent increase in wages.

conditions cannot be characterized solely by the wage rate. The direct effects of supply shocks on demand curves, or of demand shocks on supply curves, should be included in models.

Therefore, we have little conclusive evidence on the magnitude of wage and displacement effects of supply or demand shocks. This paper's model provides a structure for thinking about these issues and presents new empirical evidence.

3. Description of Structural Model and Data

The model is estimated using pooled time-series cross-section data. The model's observations are means or aggregates of labor market variables for a state/year cell. The data encompass all 50 states and the District of Columbia and all years from 1979 to 1997. The data come from the Outgoing Rotation Group of the Current Population Survey (CPS-ORG). The model's 23 equations are estimated using weighted least squares, with 1979 state population for weights. Fixed effects for state and year are included in all equations to reflect omitted characteristics of states or time periods. The model includes equations for five groups: female heads of household who are not college graduates and who have other relatives present in the household;[6] other women who are not college graduates; female college graduates; males who are not college graduates; and male college graduates. The model can be divided into five different sectors: six labor demand equations, one for each group and one overall; six wage equations; five labor force participation rate equations, one for each group; five population equations; and one equation explaining state personal income. The model's estimates are used to simulate the effects of labor supply shocks and demand shocks.

The model includes unemployment, which makes it more realistic: we observe unemployment, and unemployment varies greatly over time, across different groups, and across different local markets. Empirical evidence shows that unemployment predicts wages.[7]

[6]This is the closest one can come to consistently defining single mothers using CPS-ORG data.

[7]Unemployment predicts wages better than employment/population ratios, which would fit a market-clearing model (Blanchflower and Oswald, 1994).

The model is estimated using local data, not national data. Using local data provides more observations, allowing more precise estimates. In addition, empirical evidence suggests that labor market outcomes are more influenced by local variables than national variables (Blanchflower and Oswald, 1994; Bartik, 1994). State data are used rather than metropolitan data, even though metropolitan areas are closer to true local labor markets. States are chosen for data reasons. Metropolitan area boundaries change greatly over time, making it difficult to define consistent variables. In addition, sampling for the CPS is designed to produce reliable estimates at the state level (for example, by oversampling smaller states) but is not designed for reliable estimates for smaller metropolitan areas.

The model identifies cause and effect relationships by lagging right-hand-side variables and including lagged dependent variables as controls. We would like to allow right-hand-side variables to have immediate effects. However, almost all the right-hand-side variables are endogenous, and it is difficult to find good instruments for so many endogenous variables. The identifying assumption that labor market behavior responds to other variables with a lag seems plausible. Including lagged dependent variables allows the dynamic behavior of the model to be more complex. Lagged dependent variables also control for recent state trends. Controlling for such unobserved trends, the estimated effects of other variables on the dependent variable is more likely to represent a true causal influence.

Table 1 summarizes the model. The demand equations impose the restrictions that overall labor demand depends on average wages and that relative demand for each type of labor depends on each type's relative wage. This specification can be derived from a production function in which labor enters in aggregate form, with that labor aggregate produced by a sub-production function that is constant-elasticity-of-substitution in the five labor types. Less restrictive specifications, in which demand for each labor type depends on all five wages, resulted in estimates that were too imprecise.

Table 1. Summary of a Wage Curve Model of State Labor Markets

Type of Equation	Dependent Variable	Independent Variables (in addition to year and state dummies, and two lags of dependent variable). All dependent variables are included with two lags and no current values unless otherwise noted.
Overall labor demand (1 equation)	ln(state employment)	ln(wage) ln(personal income)
Employment share demand (5 equations)	ln(share of employment in group)	ln(wage of group/overall wage) current value of ln(labor force share of group) [endogenous, lagged labor force share used as instrument]
Overall wage curve (1 equation)	ln(wage)	ln(unemployment rate)
Relative wage curves (5 equations)	ln(wage of group/overall wage)	Some function of relative unemployment of group, with functional form chosen for each group after preliminary testing
Labor force participation rate (5 equations)	ln(labor force participation rate of group)	ln(wage of group) unemployment rate of group ln(AFDC benefits for female head group)
Migration (5 equations)	ln(population of group)	Same as for labor force participation
Income (1 equation)	ln(state personal income)	ln(wage) ln(employment) ln(population) Includes current as well as lagged values of these variables

Notes: All estimates based on pooled annual time-series cross-section data for all states, 1979-97. All estimates are weighted by 1979 state population. All estimates use weighted least squares except employment share demand, which is weighted 2SLS.

Employers with a job opening may base hiring in part on who is in the labor queue, not just on wages. To allow for this, the equations for the relative labor demand for each group also include the labor force share of each group. The current values of labor force share are included, because hiring should depend on the current labor queue. Because measurement error in labor force share will be correlated with measurement error in employment share (both variables are measured using the CPS-ORG data), lagged labor force share is used as an instrument for current labor force share.

The overall wage curve in the model is standard, but it implicitly assumes that overall wages depend on overall unemployment and not on relative unemployment of different groups. The relative wage equations assume the relative wage is affected by relative unemployment. Less restrictive specifications, in which each group's wage rate depends on all the group's unemployment, were too imprecise.

Some experimentation was done with the functional form by which unemployment affects wages. For each wage curve, four different specifications were estimated, each with a different functional form for unemployment: linear; unemployment and unemployment squared; the natural logarithm of the unemployment rate; and one over the unemployment rate. The specification that minimizes the Akaike Information Criterion was chosen for use in simulations.

The labor force participation equations and "migration" (or population) equations are standard. An income equation is included, and income is included in the labor demand equation, to allow for multiplier effects. As state employment increases, income increases, increasing local output demand, which will further increase local labor demand. The income equation includes current right-hand-side variables because income will increase immediately if wages, employment, and population in the state increase. The system is still identified because income enters with a lag in the overall labor demand equation.

The equation system seems sparse because only a few continuous variables are included in each equation. Including state and year dummies means that the model does control for many variables. The state dummies control for variables that vary among states but not much over time. The year dummies control for variables that change over time in a similar manner for different states.

The model is estimated using weighted least squares, with 1979 state population as weights. Using state population as weights increases the precision of estimates, because CPS-ORG samples are larger for the larger states. State population weights also mean that the estimates describe the behavior of the "average" state, where "average" reflects the relative population in each state. State population from 1979 is used as weights, rather than population for each state/year cell, to ensure that the weighting variable is not endogenous.[8]

These estimated equations are used to simulate the impact of various shocks to the labor supply or demand of different groups. Appendix 1 gives an example of the simulation program.

The wage curve equations are nonlinear, and so the model requires assumptions about the baseline unemployment rate. With lower unemployment, wages respond more to shocks, which affects other variables. The simulations consider both low-unemployment and high-unemployment baselines. For the low-unemployment baseline, unemployment rates for each group are taken from national averages for the lowest unemployment year (1997) in the sample; for the high-unemployment baseline, unemployment rates are from the highest unemployment sample year (1982).

This paper focuses on "national effects" of labor supply or demand shocks, that is, the average effects in all states of labor supply or demand shocks that take place in all states. Such an analysis should incorporate spillover effects across states. I explored modeling spillover by adding national variables to the equations, which requires changing from fixed to random year effects, but in most cases the national variables had counter-intuitive signs. This may reflect the limited number of available national observations (18 years).

To estimate national effects, most simulations suppress the migration effects of supply or demand shocks. This approach will approximate national effects of a shock if migration is the main spillover effect across states. The assumption is that if a shock takes place in all states, the resulting adjustments should not involve significant migration. All simulations also were done with migration effects allowed. The difference in estimations with and without migration are slight, reflecting the modest effects of wages and unemployment on migration.

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[8]Because all equations include a state fixed effect, state population from any year can be used as a weight without bias, as long as the weight does not vary across years for a state.

Table 2. 1997 National Means of Labor Market Outcomes for Five Demographic Groups and Overall Population Ages 16-64

	Female			Male		
	Household Heads; Ages 16-44; Other relatives present, Less than college ed.	Ages 16-64; Less than college ed.; except for first group	College graduates; Ages 16-64	Less than college ed.; Ages 16-64	College graduates; Ages 16-64	Overall Population; Ages 16-64
Proportion of population	0.0399	0.3569	0.1091	0.3782	0.1159	1.0000
Wage rate	$8.49	$8.80	$15.19	$10.85	$18.85	$11.29
Unemployment rate (1982 rate in parentheses)	11.0 (15.4)	5.4 (10.2)	2.2 (4.2)	6.0 (12.0)	1.9 (3.1)	5.0 (9.9)
Labor force participation rate	75.7	66.5	82.8	81.5	93.1	77.4

Notes: All data are taken from 1997 Merged Outgoing Rotation Group data tape of the Current Population Survey, with the exception of the unemployment rate data for 1982. All means are weighted national means using appropriate weights from tape. Mean wage rate is actually exp(mean ln(hourly wage)). Over sample period of 1979-97, 1997 is year with lowest national unemployment rate for 16-64 year olds, and 1982 is year with highest national unemployment rate. In this paper, the patterns of unemployment in these two years are used as alternative baselines in simulating the effects of supply and demand shocks.

Table 2 summarizes the means of some variables for the five groups. The means have the pattern one would expect, with less-educated groups having lower wages, lower labor force participation, and higher unemployment rates than more-educated groups, and women having lower wages and labor force participation rates than men.

4. Estimation Results: Elasticities Implied by the Model

In this section, I present the implications of the model's estimates for the elasticities of labor demand, supply, and other labor market behavior.[9]

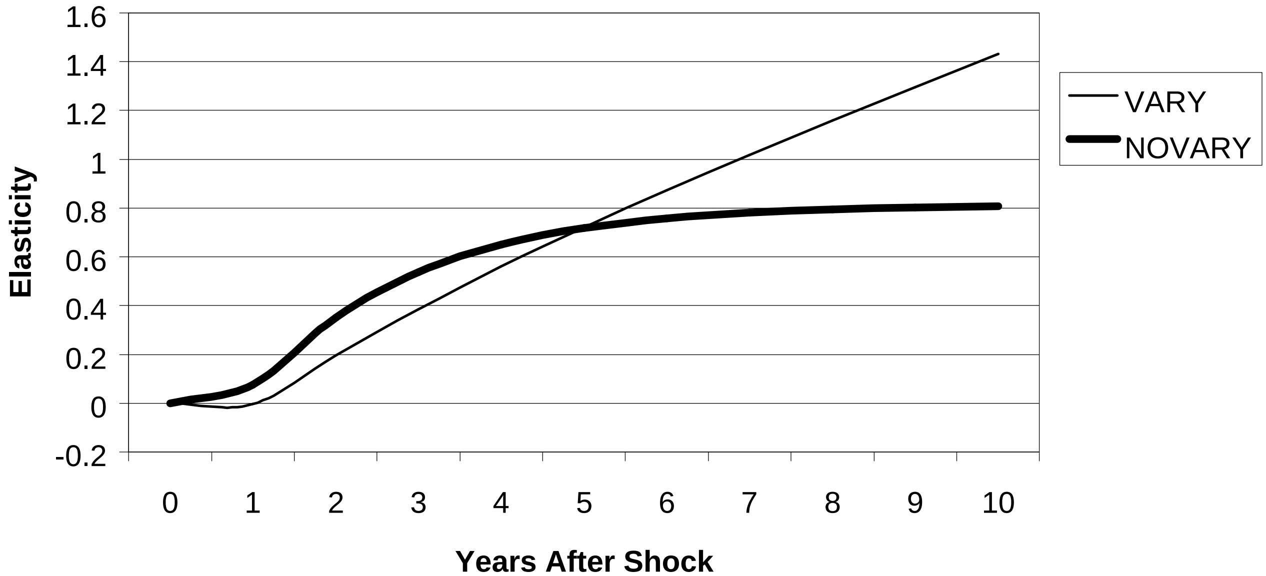
The model's elasticity of overall labor demand with respect to wages is summarized in Figure 2.[10] The figure shows the elasticity both with income held fixed and with income allowed to vary. The estimates here of income-constant elasticities (of -0.2 or -0.4 in the short run, and -0.8 after eight years or so) are consistent with estimates of output-constant labor demand elasticities in the literature (Hamermesh, 1993). When personal income is allowed to vary, the model implies that labor demand elasticities with respect to wages head off towards infinity in the very long run, which is consistent with the theory of section 2. A wage decrease increases employment, which increases income, which further increases employment, and the process continues. As explored in sections 2 and 5, a flat long-run demand curve implies that supply shocks have small long-run displacement effects on the overall labor market, while demand shocks have large long-run displacement effects on the overall labor market.

Estimates of relative labor demand elasticities for labor types with respect to relative wages are shown in Figure 3. Estimates of relative demand elasticities are modest, about 0.1 in

[9] Appendix 2 presents parameter estimates for the 23 model equations. The parameter estimates are relegated to the appendix because they are not readily interpretable.

[10] Estimates in figures and tables are based on 1000 Monte Carlo repeated simulations of the model, with each simulation based on one random draw from the distribution of parameter estimates for the 23 estimated equations. These 1000 Monte Carlo repetitions are used to generate "average" elasticities and effects, "standard errors" of such effects (the standard deviation of the effect in the 1000 repetitions), and "pseudo t-statistics" for the effects (the ratio of the average effects to the standard deviation of the effects. This approach is used because of the difficulty in generating analytical standard errors in this complicated non-linear model.

Figure 2. (-1) Times Elasticity of Overall Employment Demand With Respect to Overall Wages, With and Without Income Varying



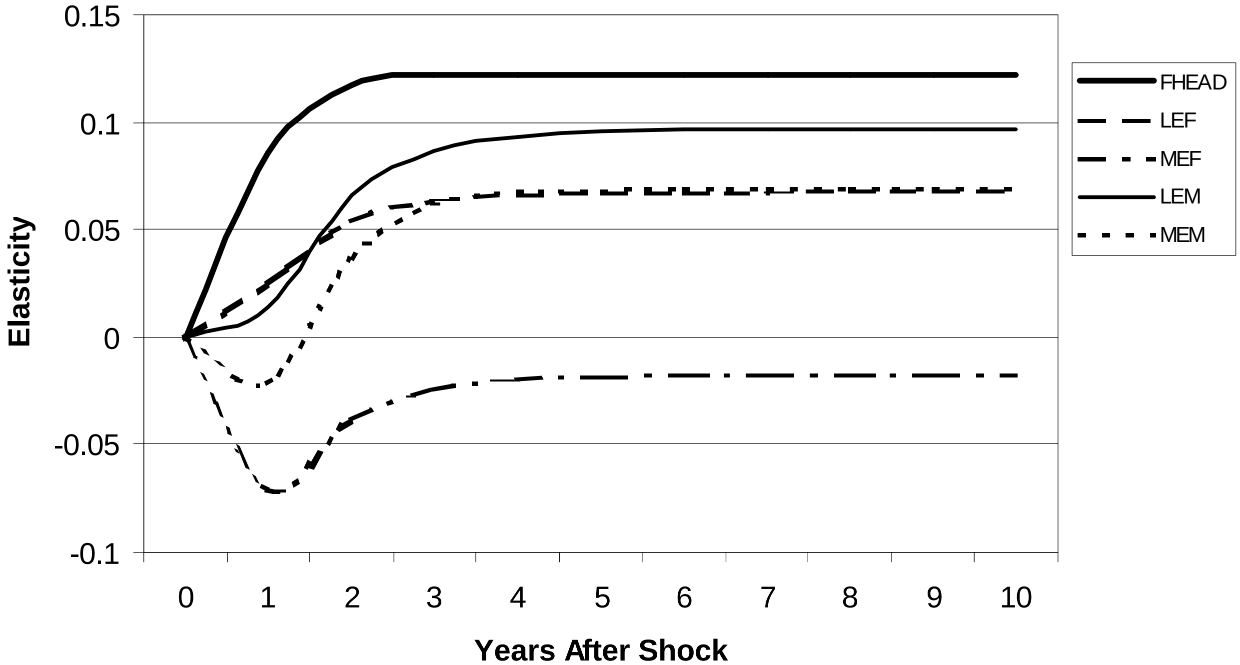
	Income not allowed to vary	Income allowed to vary
5 years	0.717 (11.22)	0.722 (5.84)
10 years	0.808 (12.43)	1.431 (4.48)

Notes: Pseudo *t*-statistics, derived from 1000 Monte Carlo repetitions of simulations, are in parentheses. Elasticities derived from decreasing overall wages by 10 percent. Simulation with income varying also allows income equation in model to become operational, with feedback between labor demand and income equations.

absolute value after five years for most groups. These estimates are consistent with the minimum-wage literature (Katz, 1998).

Estimates of how relative labor demand responds to relative labor supply, holding relative wages constant, are presented in Table 3. These effects of relative labor supply are large, consistent with the argument in section 3 that who employers hire depends on who is in the queue.

Figure 3. Elasticity of Group-Specific Labor Demand Relative To Overall Labor Demand Where Income is Not Allowed to Adjust



	Group	Female Heads of Household	Other Less-Educated Females	More-Educated Females	More-Educated Males
5-year elasticity	0.122 (1.29)	0.067 (4.24)	-0.019 (0.26)	0.096 (3.58)	0.068 (1.79)

Notes: Pseudo *t*-statistics are in parentheses, derived from 1000 Monte Carlo repetitions of effects of shock. Effects are –1(elasticity of ln(employment in group/employment overall)) with respect to ln(wage of group/overall wage). Elasticities are derived from decreasing wage of group by 0.10, with resulting effects multiplied by 10 to generate the table and figure.

Table 3. Estimates of Sensitivity of Relative Labor Demand to Relative Labor Supply, Holding Relative Wages Constant

Group	Short-Run (Immediate) Elasticity	Implied Long-Run Elasticity
Female heads of household	0.375 (1.56)	0.486
Other less-educated females	0.850 (14.00)	0.919
More-educated females	0.301 (1.96)	0.451
Less-educated males	0.428 (3.44)	0.680
More-educated males	0.401 (3.98)	0.588

Notes: Effects are derived directly from parameter estimates in relative labor demand elasticities. See Appendix 2 for complete set of estimates. Short-run effect is from equation explaining ln(employment share of group) and is coefficient on ln(labor force share of group). *t*-statistic is in parentheses. Long-run effect is this short-run effect divided by (1 minus (sum of coefficients on two lagged dependent variables in equation)).

Estimates of elasticities of labor supply of different groups with respect to wages or unemployment are presented in Table 4. Wages are estimated to have little effect on labor supply, with the exception of modest effects on the migration of male and female college graduates. This is consistent with most previous research. Unemployment rates have large effects on both labor force participation and migration. The effects on labor force participation and population migration are consistent with previous research (Bowen and Finegan, 1969; Herzog and Schlottmann, 1993).

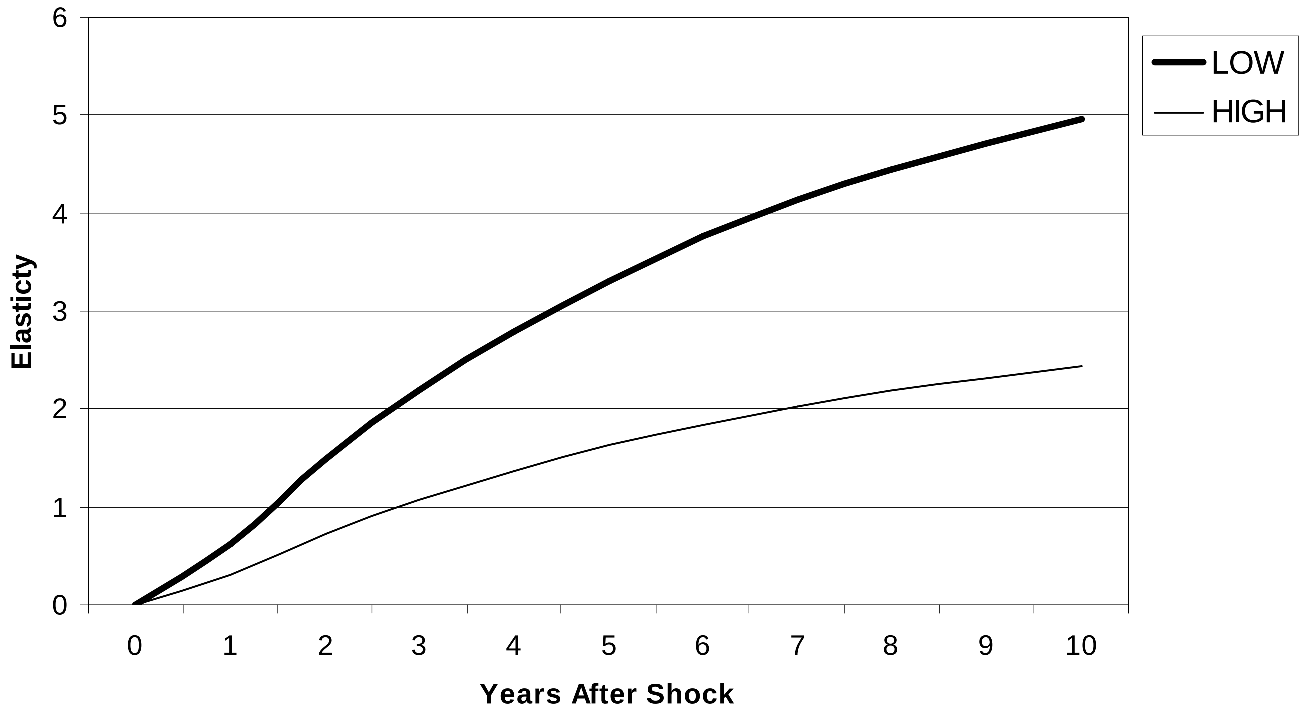
Table 4. Summary of Medium Run Elasticities of Labor Supply With Respect to Wages and Unemployment

	Females			Males		
	Heads of Household	Other Less-educated	More-educated	Less-educated	More-educated	All Five Groups
Wage elasticities after 5 years						
Labor Force Participation Rate	0.098 (1.38)	-0.025 (0.51)	-0.057 (1.89)	0.030 (1.64)	0.024 (1.58)	0.021 (1.05)
Population	-0.140 (1.06)	-0.039 (0.45)	0.236 (2.24)	0.012 (0.15)	0.397 (3.29)	0.048 (0.98)
Total Labor Force	-0.042 (0.28)	-0.064 (0.66)	0.178 (1.63)	0.042 (0.49)	0.421 (3.44)	0.069 (1.33)
-1 times Unemployment Elasticities after 5 years						
Labor Force Participation Rate	0.298 (3.18)	0.661 (5.15)	0.149 (1.07)	0.374 (8.02)	0.173 (2.04)	0.492 (8.92)
Population	0.121 (0.66)	0.262 (1.17)	0.447 (0.89)	0.508 (2.60)	2.769 (3.83)	0.632 (4.25)
Total Labor Force	0.420 (1.98)	0.923 (3.60)	0.596 (1.14)	0.882 (4.33)	2.943 (4.05)	1.124 (6.93)

Notes: Estimates are derived from 1000 Monte Carlo repetitions of two different simulations: one where all ln(wages) are increased by 0.10, the other where all unemployment rates are reduced by 0.01. Elasticities are change in natural logarithm of the three labor force variables, divided by change in the wage or unemployment rate variable, and, for unemployment, multiplied by -1. Absolute values of pseudo *t*-statistics are in parentheses below elasticity estimates, and is equal to absolute value of mean elasticity from 1000 repetitions divided by standard deviation of elasticity in 1000 repetitions. Estimates are elasticities after five years; elasticities only slowly change after five years. For example, elasticity of total overall labor force after 10 years with respect to wages is 0.039 (0.52=*t*), from 0.069 (*t*=1.33) after 5 years. Elasticity of overall total labor force after 10 years with respect to unemployment is 1.408 (*t*=6.15), compared to 1.124 (*t*=6.93) after 5 years.

As Figure 4 shows, reductions in unemployment have large effects on wages. These effects on wages gradually unfold, so that the wage inflation rate is higher for a while after an unemployment reduction, resulting in a short-run Phillips curve. The nonlinearity of the wage curve implies that if unemployment is initially lower, a reduction in unemployment has effects on wages that are greater.

Figure 4. Elasticity of Overall Wages With Respect to Unemployment Under Conditions of High and Low Initial Unemployment

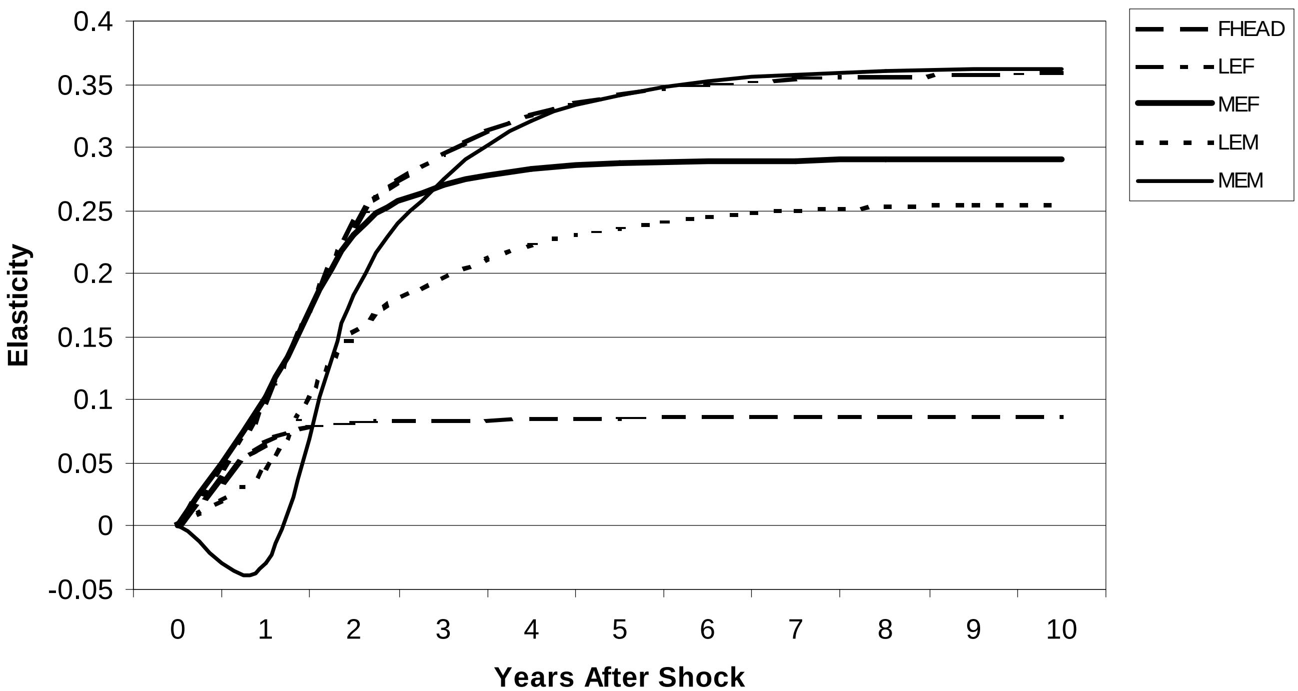


Elasticity of Wages With Respect to 1% Reduction in Unemployment	**Low Unemployment at Baseline**	**High Unemployment at Baseline**
After 5 years	3.317 (15.13)	1.629 (15.13)
After 10 years	4.959 (12.40)	2.435 (12.40)

Notes: Results are change in ln(wage) multiplied by 100, for 1% reduction in unemployment of all five groups. Base unemployment rates in low-unemployment baseline are actual national unemployment rates for five groups in 1997. For high-unemployment baseline, actual national unemployment rates for five groups as of 1982 were used. 1982 and 1997 were highest and lowest unemployment years in nation from 1979-97. See Table 2 for actual values of unemployment rates for each group in 1982 and 1997.

Figure 5 shows that a change in unemployment of one group has effects on relative wages that are small, regardless of the initial unemployment rate. A 1 percent unemployment reduction for a group increases the group's relative wage by less than one-third of 1 percent after

Figure 5. Group-Specific Elasticity With Respect to Unemployment for Group-Specific Wages Relative to Overall Wages Under Conditions of Low Initial Unemployment



	Female Heads of Household	Other Less-educated Females	More-educated Females	Less-educated Males	More-educated Males
Low-Unemployment Baseline	0.085 (3.70)	0.341 (3.02)	0.287 (2.97)	0.236 (3.70)	0.342 (2.27)
High-Unemployment Baseline	0.047 (3.84)	0.142 (3.86)	0.273 (2.83)	0.173 (3.18)	0.322 (2.15)

Notes: Pseudo *t*-statistics are in parentheses, derived from 1000 Monte Carlo repetitions of simulation. Simulation shows effect on 100 times ln(wage of group/average overall wage) of reduction of 1% in unemployment of that group, with unemployment rates for other groups staying unchanged.

five years. Effects of overall unemployment on overall wages are five to ten times as great. The estimates are consistent with labor market institutions and customs that resist changes in relative wages.

The estimated wage curves, and the effects of unemployment on labor force participation and migration, imply that the model's effective labor supply elasticity with respect to wages is much greater than Table 4's tiny wage elasticities of labor supply. An effective labor supply elasticity can be calculated by estimating the effect of a demand-induced change in unemployment on employment and wages. The ratio of the percentage change in employment to the percentage change in wages from this exercise is an effective labor supply elasticity.

Effective labor supply elasticities are shown in Figure 6. These supply elasticities are large, particularly in the short run. In a wage curve model, short-run elasticities are large because employment adjusts faster than wages. Elasticities decline over time as wages adjust, although long-run elasticities are still higher than the conventional wisdom in economics. Effective supply elasticities are higher if population as well as labor force participation is allowed to adjust. Effective supply elasticities are also higher if initial unemployment is higher, because wages are less sensitive to increased demand when unemployment is high.

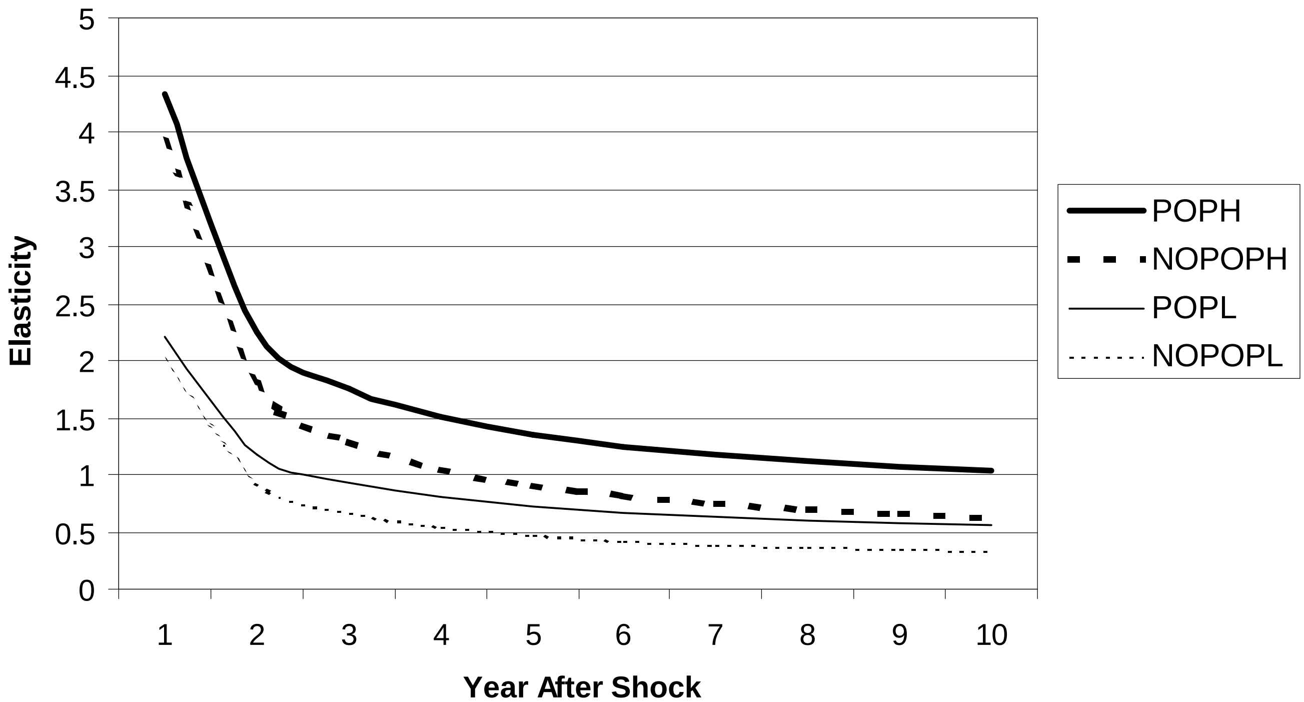
5. Empirical Estimates: The Effects of Demand and Supply Shocks

In this section, I present simulations of the effects of shocks to the quantity supplied or demanded of some labor type.

I first consider shocks to the quantity of labor supplied of some type of labor. Such shocks could be brought about by welfare-to-work programs.

Figure 7A shows the effects on the overall labor market of an increase in the labor supply of female household heads. As shown in the table below the figure, a given percentage change in overall labor supply results in effects on overall employment and wages of virtually the same magnitude, regardless of which group's labor supply is shocked. An increase in labor supply results in some initial displacement, as wages and employment only gradually adjust to the labor supply shock. Even in the medium run (five years), the supply shock results in displacement and wage declines. Eventually, employment adjusts upwards to the expanded labor supply, and

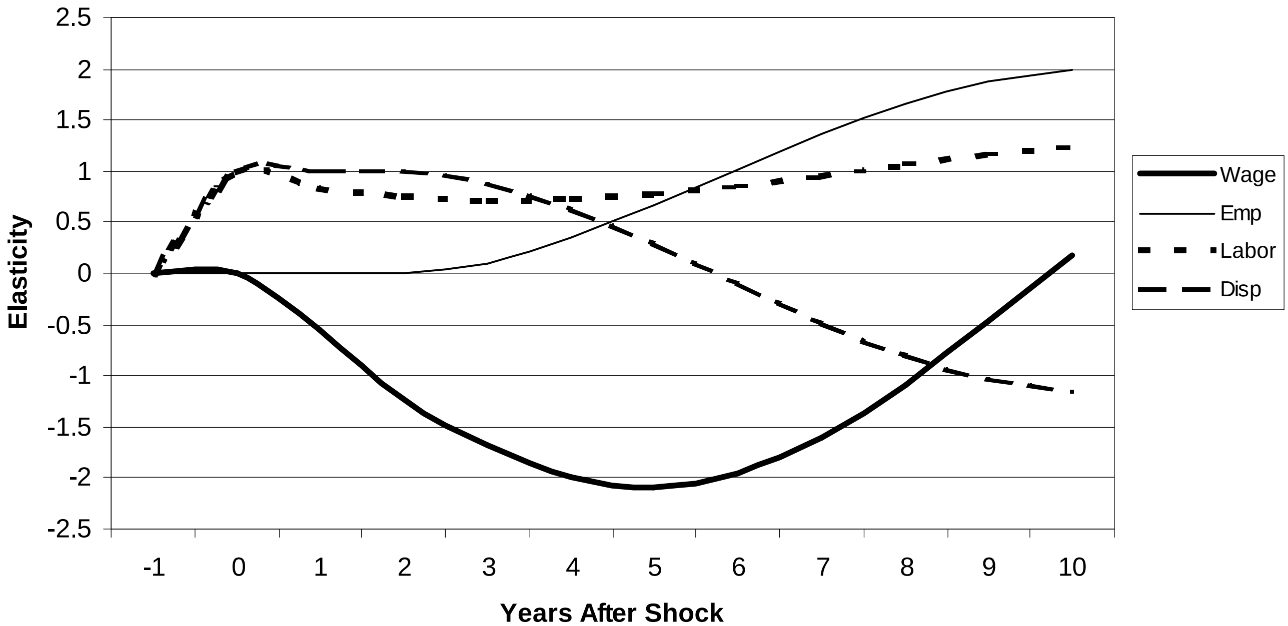
Figure 6. Complete Labor Supply Elasticities With and Without Population Adjustment Under Conditions of High (Bold Lines) and Low (Regular Lines) Initial Unemployment



	Low Initial UR, No Population Adjustment Allowed	Low Initial UR, With Population Adjustment	High Initial UR, No Population Adjustment Allowed	High Initial UR, With Population Adjustment
Effective Labor Supply Elasticity After 5 Years	0.473 (12.71)	0.725 (10.14)	0.912 (12.94)	1.351 (10.12)

Notes: These numbers are derived from simulation that specified exogenous 1% reduction in unemployment rate for all groups, and used wage curve equations, labor force participation rate equations, and population migration equations to simulate effects of this change on wages and the labor force. The effective labor supply elasticity is the ratio of the change in the natural logarithm of the overall labor force to the change in the average log wage. Pseudo *t*-statistics from 1000 Monte Carlo repetitions of simulation are in parentheses. Low initial unemployment rates are national unemployment rates of 1997 (overall average = 5.0%), high initial unemployment rates are national unemployment rates of 1982 (overall average = 9.9%).

Figure 7A. Overall Elasticity of Wages, Employment and Total Labor Supply and the Displacement Rate from a Supply Shock to Female Heads With Low Initial Unemployment



Elasticities after five years:

	Labor Supply	Employment	Wage	Displacement
Elasticity	**0.788**	**0.660**	**-2.086**	**0.284**
(pseudo *t*-statistic)	**(15.87)**	**(4.11)**	**(10.97)**	**(1.63)**

Notes: Elasticities come from supply shock to female heads that is equal to 0.001 of overall population. Elasticities calculated by dividing change after five years in ln of overall labor supply, employment, or wage, by original change in ln of overall labor supply. Displacement is equal to 1-(change in overall employment divided by change in employment of those added to labor force by labor supply shock). Pseudo *t*-statistics are derived by 1000 Monte Carlo repetitions of simulation. Labor supply elasticities in figure are significant from year 0 to year 10, employment elasticities are significant from year 4 on, wage elasticities are significant from year 1 through year 8, and displacement elasticities are significant from year 0 through year 5, and again in years 8 through 10. Numbers for elasticities are quite similar if do other four groups, which give rise to following estimates:

	Labor Supply	Employment	Wage	Displacement
Less-educated	0.723	0.648	-1.966	0.350
Females	(17.10)	(4.15)	(11.22)	(2.23)
More-educated	0.852	0.654	-2.185	0.361
Females	(10.58)	(4.04)	(9.40)	(2.28)
Less-educated	0.748	0.660	-2.018	0.333
Males	(20.73)	(4.14)	(11.89)	(2.07)
More-educated	0.803	0.665	-2.128	0.354
Males	(17.09)	(4.07)	(11.37)	(2.23)

Numbers are also not much different if allow population to adjust. Same overall elasticities, calculated based on shock to female heads, in case where population adjusts, are given by

	Labor Supply	Employment	Wage	Displacement
5-year Elasticity When Population is Allowed to Adjust	0.711 (7.24)	0.683 (4.76)	-1.702 (6.47)	0.260 (1.67)

As can be seen in this table, with population migration, there is some reduction in the labor supply effects of the shock due to out-migration, which moderates the wage effects of the shock somewhat.

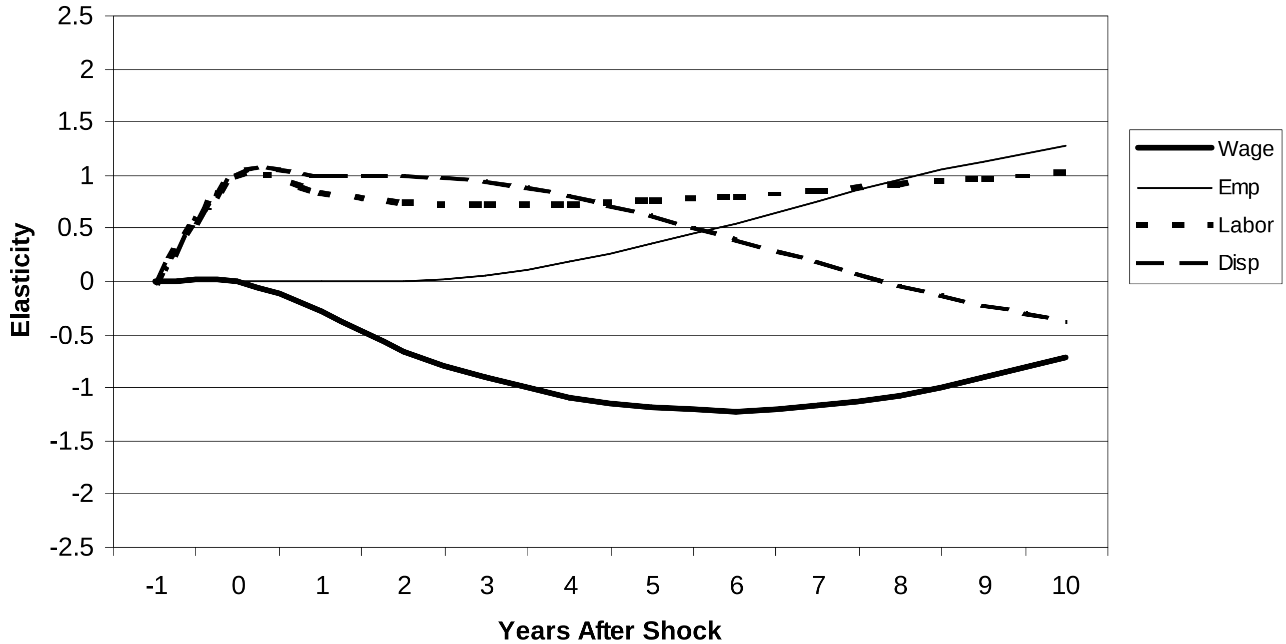
In the above tables, pseudo *t*-statistics are calculated based on 1000 Monte Carlo repetitions. Calculated *t*-statistics for displacement assume denominator of ratio used in calculation is nonstochastic; checks in a few cases indicate that changing this assumption makes no difference in calculated *t*-statistic, as employment change in group added to labor supply is largely non-stochastic, with very small variance because most of change is assumed.

supply shock. Even in the medium run (five years), the supply shock results in displacement and wage declines. Eventually, employment adjusts upwards to the expanded labor supply, and wages come back to their original level. However, this adjustment to the shock takes at least seven to ten years. If the initial unemployment level is high, this adjustment to the labor supply increase is even more protracted. With high unemployment (Figure 7B), wages initially respond less to the supply shock, which thereby delays the employment response to the supply shock.

How does a shock to some group's labor supply affect that group's labor market?[11] As Figure 8 and the accompanying table show, the effects on the group's relative wages are slight, reflecting the resistence of relative wages to change in this model. But as Figure 9 and the accompanying table show, the effects on the group's relative employment are large. However, effects on the group's employment are still not large enough to avoid unemployment and displacement effects on the group that are sizable and persistent. For example, after five years the percentage increase in employment in usually only about half the percentage shock to labor supply, which implies that about half the shock results in displacement and unemployment. For some of the smaller groups, unemployment and displacement persist even after ten years. The

[11] Groups other than those shocked all have similar percentage wage effects and employment effects, which are quite similar to the effects on overall wages and employment.

Figure 7B. Overall Elasticity of Wages, Employment and Total Labor Supply and the Displacement Rate from a Supply Shock to Female Heads With High Initial Unemployment



Elasticities after five years:

	Labor Supply	Employment	Wage	Displacement
Elasticity	0.763	0.356	-1.190	0.614
(pseudo t-statistic)	(17.82)	(4.07)	(12.61)	(6.48)

Notes: Elasticities come from supply shock to female heads that is equal to 0.001 of overall population. Elasticities calculated by dividing change after five years in ln of overall labor supply, employment, or wage, by original change in ln of overall labor supply. Displacement is equal to 1-(change in overall employment divided by change in employment of those added to labor force by labor supply shock). Pseudo *t*-statistics are derived by 1000 Monte Carlo repetitions of simulation. Labor supply elasticities in figure are significant from year 0 to year 10, employment elasticities are significant from year 4 on, wage elasticities are significant from year 1 through year 10, and displacement elasticities are significant from year 0 through year 6. Elasticities are quite similar for shocks to other four groups, which give rise to following estimates:

	Labor Supply	Employment	Wage	Displacement
Less-educated females	0.696 (20.00)	0.349 (4.12)	-1.124 (13.01)	0.648 (7.57)
More-educated females	0.822 (10.55)	0.353 (4.01)	-1.238 (10.30)	0.665 (7.96)
Less-educated males	0.724 (28.13)	0.356 (4.11)	-1.155 (13.96)	0.634 (7.11)
More educated males	0.770 (19.38)	0.358 (4.04)	-1.205 (12.76)	0.665 (8.01)

Numbers are also not much different if allow population to adjust. Same overall elasticities, calculated based on shock to female heads, in case where population adjusts, are given by:

	Labor Supply	**Employment**	**Wages**	**Displacement**
5-year Elasticity When Population is Allowed to Adjust	0.679 (7.94)	0.389 (4.62)	-1.010 (7.36)	0.578 (6.33)

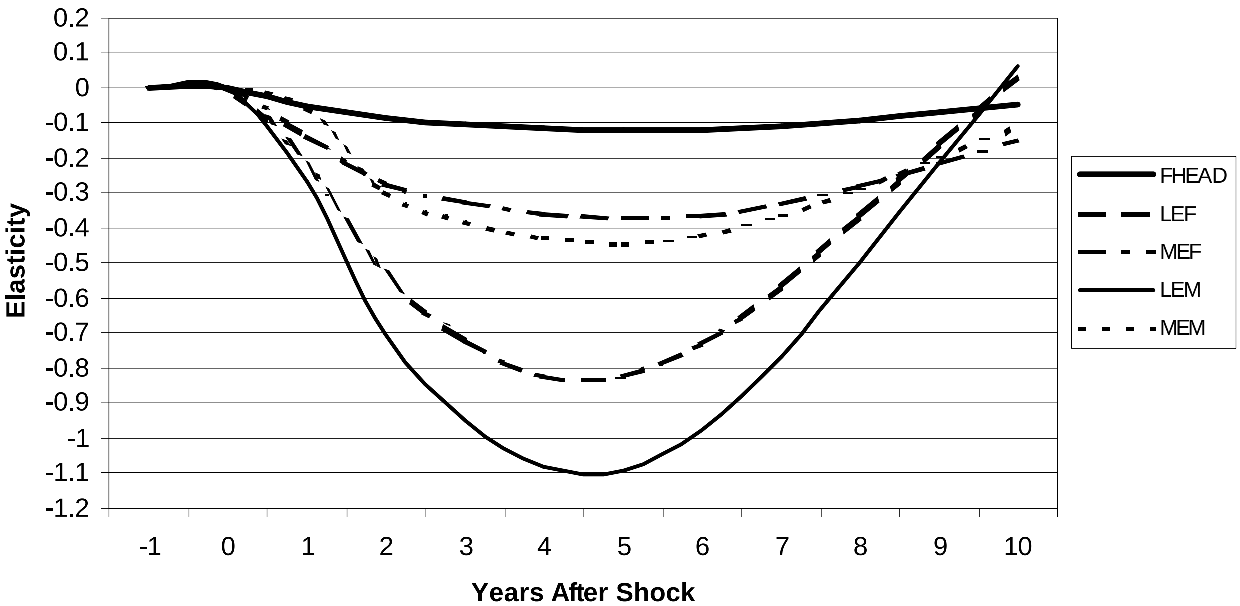
As can be seen in this table, with population migration, there is some reduction in the labor supply effects of the shock due to out-migration, which moderates the wage effects of the labor supply shock somewhat.

In above tables, pseudo *t*-statistics are calculated based on 1000 Monte Carlo repetitions. Calculated *t*-statistics for displacement assume denominator of ratio used in calculation is nonstochastic; checks in a few cases indicate that changing this assumption makes no different in calculated *t*-statistic, as employment change in group added to labor supply is largely non-stochastic, with very small variance because most of change is assumed.

two largest groups (less educated men and other less-educated women) show full employment adjustment to a supply shock to that group after ten years. A shock to a group's labor supply expands the entire local economy, and groups that are a larger proportion of the labor force naturally share more of the expanded employment that results.

To dramatize how labor supply shocks differentially affect various groups, consider the employment effects after 10 years of an increased labor supply of female household heads. As shown in Table 5, with initially low unemployment, for every 100 persons added to the labor force by this shock, roughly 88 are expected to be employed at the end of 10 years. These 88 displace some female heads from employment, reducing employment by about 46 among other female heads. Net employment of female heads goes up by about 42 (88-46). But as a result of the expansion of the economy brought about by adding more female heads to the labor supply, more individuals in the long run are employed in all other groups. Overall, about 189 additional individuals are employed, which implies that about 147 non female heads are employed because of the shock (147 = 189 - 88 + 46). The net employment effects on female heads are considerably greater in *percentage* terms, however, as female heads are only 4 percent of the working-age population.

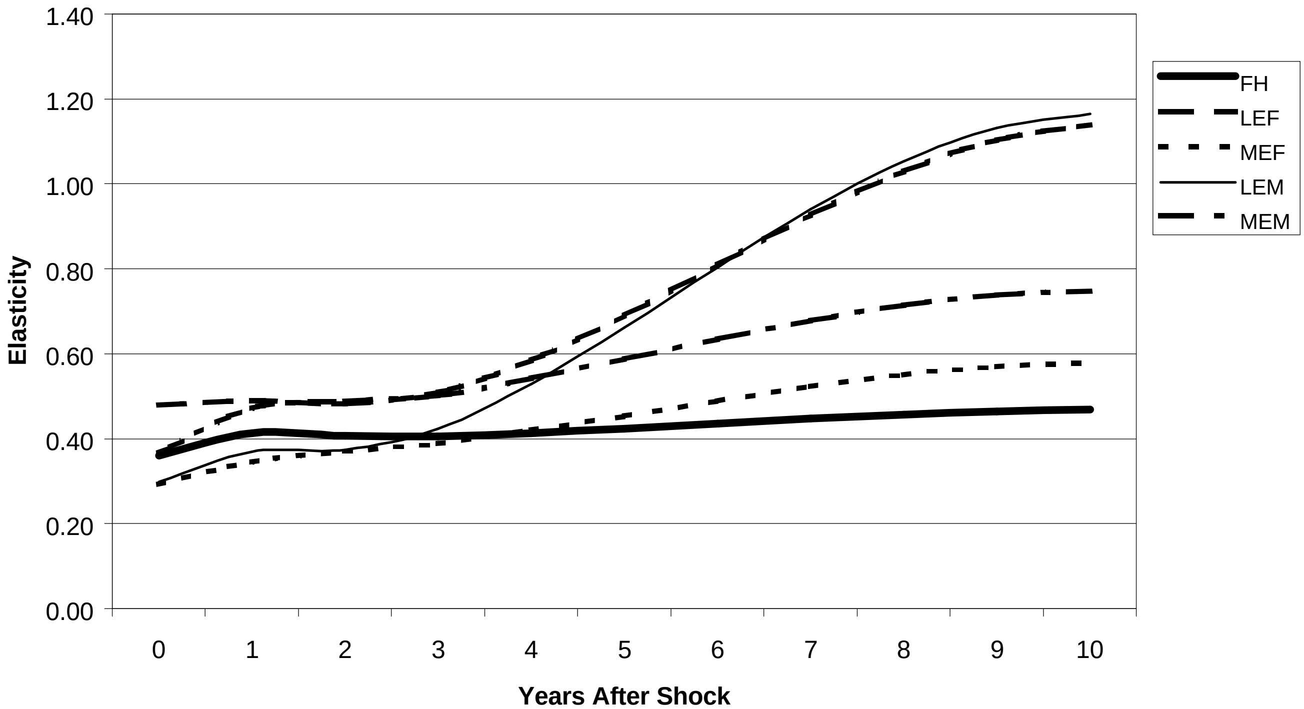
Figure 8. Elasticity of Group-Specific Wages With Respect to Initial Labor Force Shock to That Group With Low Initial Unemployment



	Elasticity With Low Initial Unemployment	Elasticity With High Initial Unemployment
Female Heads of Household	-0.105 [-3.003] {-2.086} (5.61)	-0.061 [-1.748] {-1.190} (5.69)
Less-educated Females	-0.672 [-2.089] {-1.966} (11.72)	-0.381 [-1.184] {-1.124} (13.40)
More-educated Females	-0.354 [-3.780] {-2.185} (4.40)	-0.260 [-2.782] {-1.238} (3.50)
Less-educated Males	-0.914 [-2.166] {-2.018} (12.16)	-0.540 [-1.279] {-1.155} (13.49)
More-educated Males	-0.410 [-3.143] {-2.128} (5.67)	-0.286 [-2.193] {-1.205} (4.15)

Notes: First number in each box are elasticities after five years, calculated as estimated change after five years in ln(wage of group) divided by initial change in ln(labor force of same group). Number in brackets [ ] below is elasticity calculated by dividing change after five years in ln(wage of group), divided by initial change in ln(overall labor force). Number in braces { } to right is elasticity of overall wages, calculated relative to initial change in overall labor force. These overall elasticities are the same ones reported in tables below Figures 7A and 7B. Elasticities are calculated from simulations of labor supply shock of 1% of overall population. Simulations are for model with migration suppressed. Pseudo *t*-statistics from 1000 Monte Carlo repetitions of simulation are reported in parentheses. Figure presents effects with low base unemployment rates. Wage effects with low unemployment rate are statistically significant from 1-9 years after shock for female heads, more-educated females, and more-educated males, and from 1-8 years after shock for less-educated females and less-educated males. With high unemployment, all wage effects are statistically significant from 1-10 years after shock.

Figure 9. Own Group Employment Elasticity for a Supply Shock With Low Base Unemployment and No Population Adjustment



	Elasticity With Low Initial Unemployment	Elasticity With High Initial Unemployment
Female Heads	0.424 [12.128] {0.660} (1.75) (4.11)	0.413 [11.817] {0.356} (1.69) (4.07)
Less-educated Females	0.690 [2.144] {0.648} (10.56) (4.15)	0.585 [1.818] {0.349} (12.65) (4.12)
More-educated Females	0.454 [4.847] {0.654} (2.77) (4.04)	0.424 [4.527] {0.353} (2.62) (4.01)
Less-educated Males	0.661 [1.568] {0.660} (8.04) (4.14)	0.539 [1.276] {0.356} (8.75) (4.11)
More-educated Males	0.588 [4.504] {0.665} (6.72) (4.07)	0.547 [4.192] {0.358} (6.37) (4.04)

Notes: First number in each cell is employment elasticity for the group after five years, defined as estimated change after five years in ln(employment) of group, divided by initial change in ln(labor force of same group). Number in brackets [ ] below is elasticity relative to initial change in ln(overall labor force). Number in braces { } to right is elasticity of overall employment with respect to initial change in ln(overall labor force). This is included to allow for examination of effects of shocks on relative employment. Numbers in parentheses below are pseudo *t*-statistics, derived by dividing estimate by standard deviation of estimates in 1000 Monte Carlo repetitions of simulation. Elasticities are calculated from simulations of labor supply shock of 0.1% of overall population. Ten different simulations are reported in table, with five different shocks considered (one for each group), under two initial unemployment conditions, low and high unemployment. Simulations are for models with migration suppressed. Employment elasticities are significant at 95% confidence level for all groups except female heads, for whom pseudo *t*-statistics tend to be in 1.6-2.0 range for all 10 years after the shock.

Table 5. Illustrative Effects of Labor Supply Shock to Female Heads on Employment of Different Groups, Effects After Ten Years

	Low-unemployment baseline: Employment Effects As Proportion of Original Supply Shock	High-unemployment baseline: Employment Effects as Proportion of Original Supply Shock
Female heads added to labor force	0.876 (140.9)	0.833 (138.5)
All other female heads	-0.462 (2.24)	-0.461 (2.32)
Less-educated females	0.476 (3.40)	0.217 (1.90)
More-educated females	0.165 (4.63)	0.103 (3.54)
Less-educated males	0.630 (4.19)	0.337 (2.91)
More-educated males	0.205 (4.27)	0.121 (3.13)
Overall	1.890 (6.53)	1.149 (5.64)

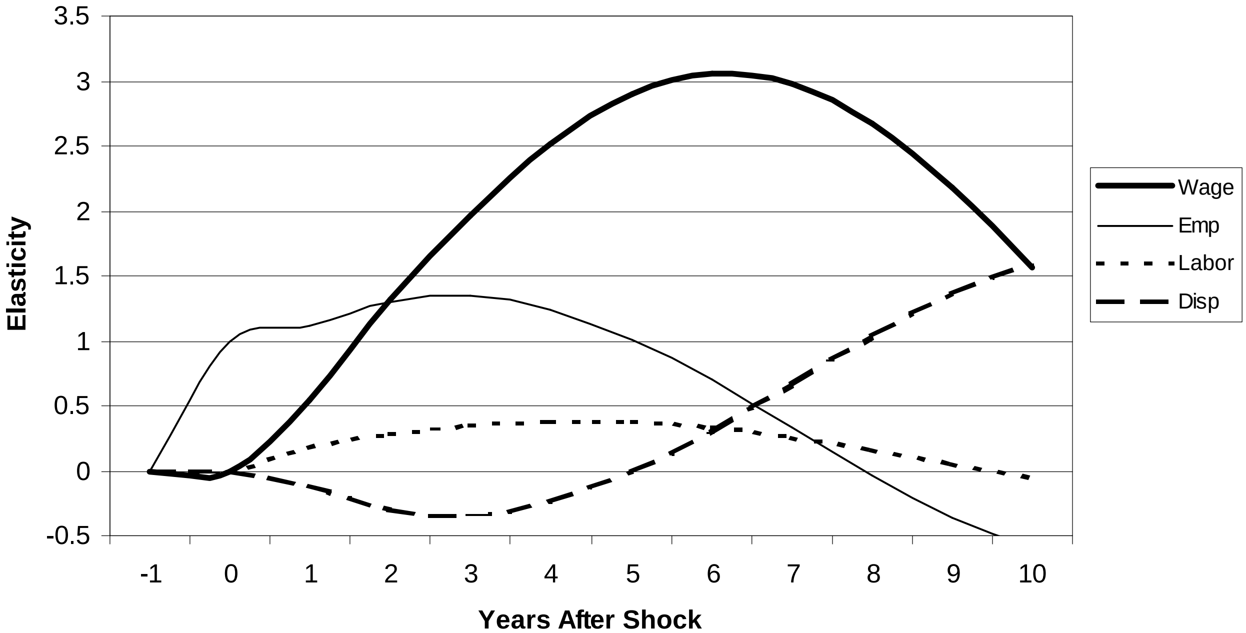
Notes: Effects are calculated by simulating effects of shock of 1/10th of 1% of overall population to labor force of female heads. Pseudo *t*-statistics are in parentheses. Derived from 1000 Monte Carlo repetitions.

The net effect is that the overall economy is in some sense fully supply determined in the long run. The overall labor market adjusts fully to the supply shock in the long run, and it is overall employment that adjusts to supply rather than the reverse. However, in the medium run a supply shock increases overall unemployment and reduces wages. And even in the long run, in many of the simulations there are some adverse unemployment and displacement effects among some of the group being shocked. Finally, if unemployment is initially higher, the results are qualitatively the same, but the positive employment effects upon other groups are smaller.

What about shocks to the quantity of labor demanded of various groups? Such shocks could be brought about through macroeconomic policy, economic development policy, or public employment.

Figure 10 shows the effects on the overall labor market of an increase in the labor demand for female household heads. As shown in the table below Figure 10, a given percentage

Figure 10A. Overall Elasticity of Wages, Employment and Total Labor Supply and the Displacement Rate from a Demand Shock to Female Heads With Low Initial Unemployment



Elasticities after five years:

	Labor Supply	Employment	Wage	Displacement
Elasticity	0.378	1.010	2.900	-0.012
(pseudo *t*-statistic	(6.31)	(5.48)	(11.36)	(0.06)

Notes: The three elasticities (labor supply, employment, wage) and displacement numbers are derived from simulation of effects of demand shock to employment of female heads that is equal to 0.001 of overall population. Elasticities calculated by dividing change after five years in ln of overall labor supply, employment, or wage, by original change in ln of overall employment supply. Displacement is equal to 1-(change in overall employment divided by direct change in employment due to demand shock/supply shock). Pseudo *t*-statistics are derived by 1000 Monte Carlo repetitions of simulation. Labor supply elasticities in figure are significant from year 1 to year 7, employment elasticities are significant from year 0 to year 6, wage elasticities are significant from year 1-10, and displacement proportion numbers are significant from year 0 through year 3 and year 7 through year 10. Numbers for elasticities are quite similar if do other four groups, which give rise to following estimates:

	Labor Supply	Employment	Wage	Displacement
Less-educated Females	0.435 (7.55)	1.018 (5.63)	2.793 (11.54)	-0.020 (0.11)
More-educated Females	0.291 (3.30)	1.007 (5.38)	3.050 (10.55)	-0.009 (0.05)
Less educated Males	0.403 (8.32)	1.004 (5.46)	2.858 (12.08)	-0.006 (0.03)
More-educated Males	0.338 (5.90)	0.996 (5.29)	2.994 (11.80)	0.002 (0.01)

Numbers are also not much different if allow population to adjust. Same overall elasticities, calculated based on shock to female heads, in case where population adjusts, are given by:

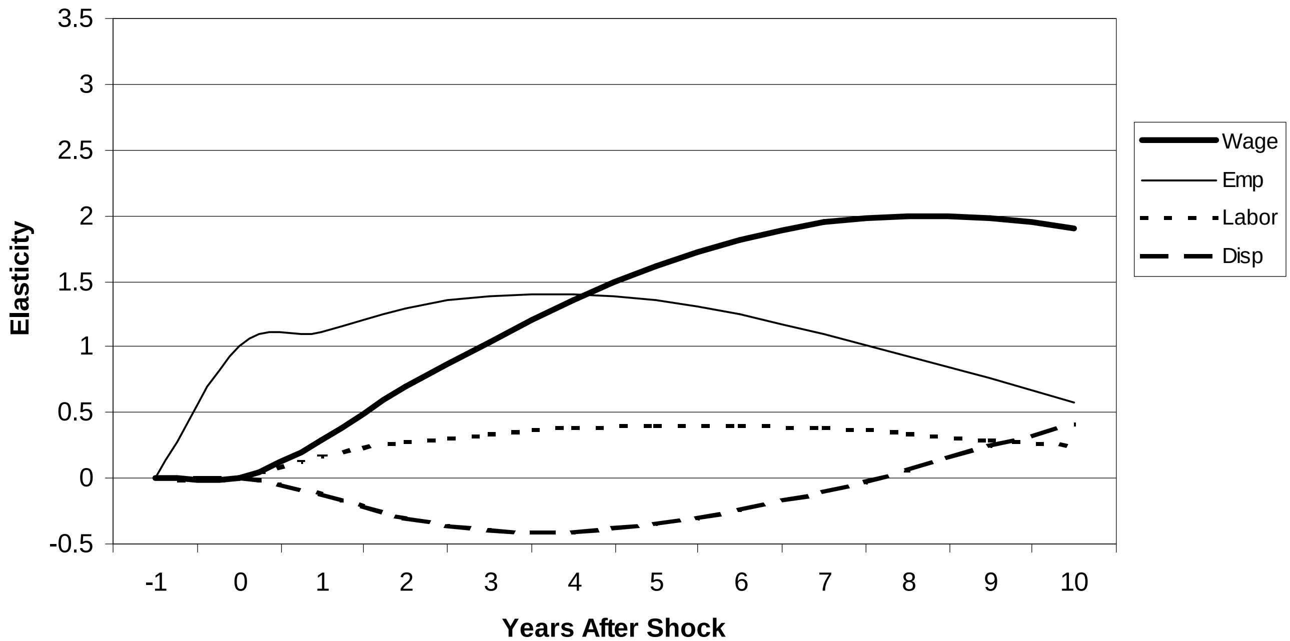
	Labor Supply	Employment	Wage	Displacement
5-year Elasticity When Population is Allowed to Adjust	0.605 (5.46)	0.980 (5.92)	2.381 (7.58)	0.019 (0.11)

As can be seen in this table, with population migration, there is some increase in the labor supply effects of the demand shock due to in-migration, which moderates the wage effects of the labor supply shock somewhat.

In the above tables, pseudo *t*-statistics are calculated based on 1000 Monte Carlo repetitions.

change in overall labor demand results in effects on overall employment and wages of virtually the same magnitude, regardless of which group's labor demand is shocked. In the short run and medium run, an increase in labor demand results in some multiplier effects, with overall employment increasing by more than the shock. Labor supply responds sluggishly to the increased labor demand. As unemployment falls in the short run and medium run, overall wages increase significantly. Eventually, these wage increases bring employment back down to its original level. As employment declines from its peak, wages begin to decline. The adjustments to the labor demand shock are quite protracted. When initial unemployment is low, employment does not return to its original level until after eight years, and wages are still above their initial

Figure 10B. Overall Elasticity of Wages, Employment and Total Labor Supply and the Displacement Rate from a Demand Shock to Female Heads With High Initial Unemployment



Elasticities after five years:

	Labor Supply	Employment	Wage	Displacement
Elasticity	0.401	1.350	1.621	-0.379
(pseudo *t*-statistic)	(7.28)	(10.08)	(11.96)	(2.83)

Notes: The three elasticities (labor supply, employment, wage) and displacement numbers are derived from simulation of effects of demand shock to employment of female heads that is equal to 0.001 of overall population. Elasticities calculated by dividing change after five years in ln of overall labor supply, employment, or wage, by original change in ln of overall employment supply. Displacement is equal to 1-(change in overall employment divided by direct change in employment due to demand shock). Pseudo *t*-statistics are derived by 1000 Monte Carlo repetitions of simulation. Labor supply elasticities in figure are significant from year 1 to year 10, employment elasticities are significant from year 0 to year 10, wage elasticities are significant from year 1 through year 10, and displacement proportion numbers are significant from year 1 through year 5. Numbers for elasticities are quite similar if do other four groups, which give rise to following estimates:

	Labor Supply	Employment	Wage	Displacement
Less-educated Females	0.472 (8.68)	1.356 (10.19)	1.556 (12.04)	-0.356 (2.67)
More-educated Females	0.314 (3.73)	1.349 (9.98)	1.705 (11.11)	-0.348 (2.57)
Less-educated Males	0.431 (10.50)	1.348 (10.07)	1.597 (12.72)	-0.348 (2.60)
More-educated Males	0.362 (7.18)	1.343 (9.92)	1.677 (12.35)	-0.343 (2.53)

Numbers are also not much different if allow population to adjust. Same overall elasticities, calculated based on shock to female heads, in case where population adjusts, are given by:

	Labor Supply	Employment	Wages	Displacement
5-year Elasticity When Population is Allowed to Adjust	0.622 (6.25)	1.308 (10.42)	1.376 (8.25)	-0.307 (2.44)

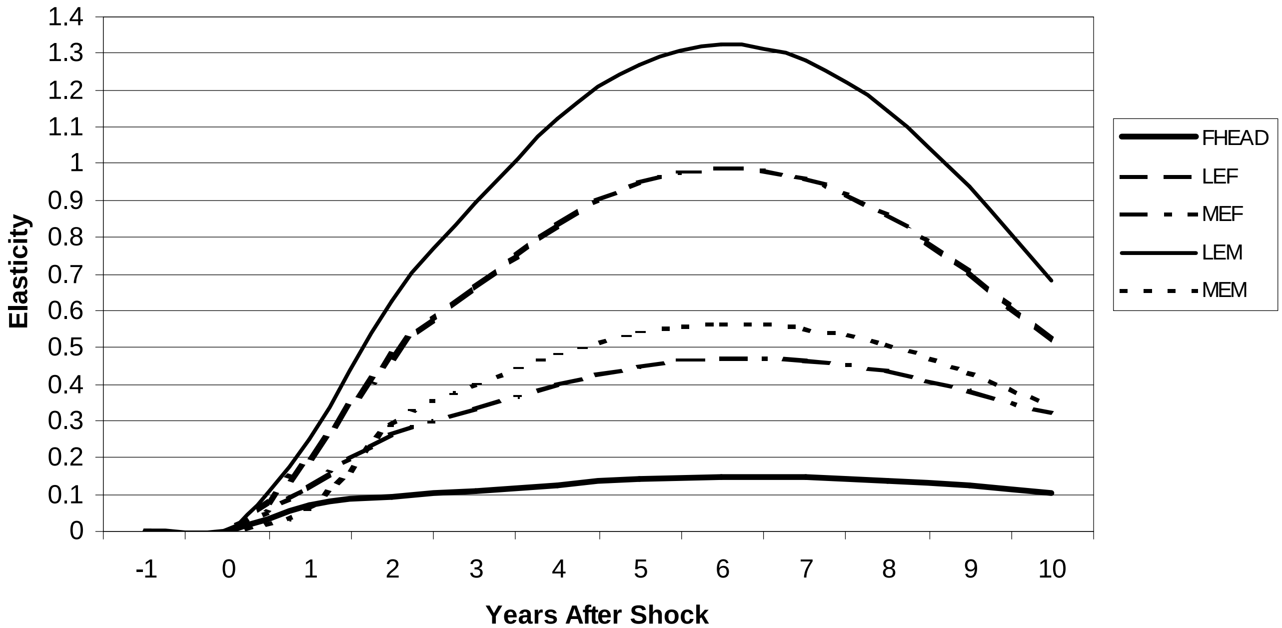
As can be seen in this table, with population migration, there is some increase in the labor supply effects of the demand shock due to in-migration, which moderates the wage effects of the labor supply shock somewhat.

In above tables, pseudo *t*-statistics are calculated based on 1000 Monte Carlo repetitions.

level after ten years (Figure 10A). Adjustment is even more protracted when unemployment is initially high (Figure 10B), because wages adjust less with high unemployment.

How does a shock to some group's labor demand affect that group's labor market? As Figure 11 shows, quantity shocks to a group's labor demand only have modest positive effects on the relative wages of that group. But as shown in Figure 12, shocks to a group's labor demand have large and persistent effects on relative employment. However, the relevant elasticities are significantly less than 1, that is the employment of the group being shocked goes up by less than the amount of the demand shock, implying some displacement within the group. What happens is that some of those hired due to the demand shock (the public employment program?) would have worked anyway. The vacancies they leave in many cases go to others in the same group,

Figure 11. Elasticity of Group-Specific Wages With Respect to Initial Labor Demand Shock to that Group With Low Initial Unemployment

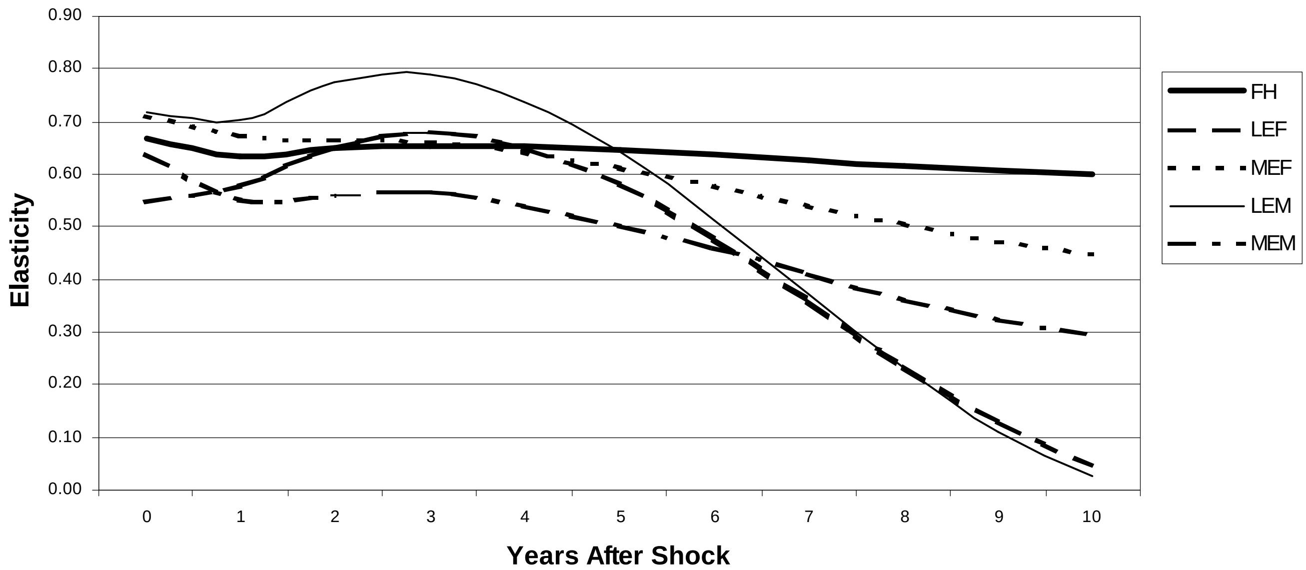


Wage elasticity after five years:

	Elasticity With Low Initial Unemployment	Elasticity With High Initial Unemployment
Female Heads	0.141 [4.297] {2.900} (4.89)	0.079 [2.430] {1.621} (5.67)
Less-educated Females	0.946 [2.955] {2.793} (11.97)	0.525 [1.643] {1.556} (12.47)
More-educated Females	0.446 [4.648] {3.050} (5.43)	0.317 [3.210] {1.705} (4.25)
Less-educated Males	1.271 [3.044] {2.858} (12.44)	0.722 [1.759] {1.597} (12.81)
More-educated Males	0.850 [4.021] {2.994} (7.11)	0.367 [2.631] {1.677} (5.21)

Notes: First number in each cell are elasticities after five years, calculated as estimated change after five years in ln(wage of group) divided by initial change in ln(labor force of same group). Number in brackets [ ] below is elasticity calculated by dividing change after five years in ln(wage of group), divided by initial change in ln(overall labor force). Number in braces { } to right is elasticity of overall wages, calculated relative to initial change in overall labor force. These overall elasticities are the same ones reported in tables below Figures 10A and 10B. Elasticities are calculated from simulations of labor demand shock of 0.1% of overall population. Simulations are for model with migration suppressed. Pseudo *t*-statistics from 1000 Monte Carlo repetitions of simulation are reported in parentheses. Figure presents effects with low base unemployment rates. All wage effects are statistically significant up to 10 years after labor demand shock.

Figure 12. Own Group Employment Elasticity for a Demand Shock With Low Base Unemployment and No Population Adjustment



Employment elasticity after 5 years:

	Elasticity With Low Initial Unemployment	**Elasticity With High Initial Unemployment**
Female Heads	0.647 [19.969] {1.010} (3.21)	0.681 [21.062] {1.350} (3.56)
Less-educated Females	0.581 [1.813] {1.020} (7.84)	0.735 [2.302] {1.356} (12.33)
More-educated Females	0.612 [6.378] {1.009} (3.81)	0.656 [6.638] {1.349} (4.22)
Less-educated Males	0.641 [1.535] {1.006} (7.28)	0.808 [1.966] {1.348} (11.82)
More-educated Males	0.503 [3.745] {0.998} (5.74)	0.558 [4.001] {1.343} (6.53)

Notes: First number in each cell are elasticities after five years, calculated as estimated change after five years in ln(employment of group) divided by initial change in ln(employment of same group). Number in brackets [ ] below is elasticity calculated by dividing change after five years in ln(employment of group), divided by initial change in ln(overall labor force). Number in braces { } to right is elasticity of overall employment, calculated relative to initial change in overall labor force. These overall elasticities are the same ones reported in tables below Figures 10A and 10B. Note that because these overall elasticities include group being shocked, the effect on group not being shocked will be lower, particularly for cases where group being shocked is sizable proportion of working-age population. Elasticities are calculated from simulations of labor demand shock of 0.1% of overall population. Simulations are for model with migration suppressed. Pseudo *t*-statistics from 1000 Monte Carlo repetitions of simulation are reported in parentheses. Figure presents effects with low base unemployment rates. All employment effects are statistically significant up to 10 years after labor demand shock, with exception of employment effects on less-educated females and less-educated males in low-unemployment rate baseline scenarios, which are statistically significantly greater than 0 for 8 years (females) and 7 years (males).

but in some cases to other groups. Therefore, net employment of the targeted group increases by less than the demand shock.

To dramatize how different groups are affected by a demand shock, Table 6 shows the long-run employment effects on different groups of a demand shock to female household heads. As the table shows, whether the initial unemployment rate is low or high, in the long run there are some positive effects on female heads of the demand shock. For every 100 female heads directly employed due to the policy, 60 (low unemployment) to 67 (high unemployment) additional female heads will be employed in the long run. Thus, there is some displacement of other female heads due to the policy, ranging from 33 (high unemployment) to 40 (low unemployment). In addition, there is more displacement of other groups, which occurs because the demand shock pushes overall wages up, which in the long run has dramatic effects on overall labor demand. These displacement effects are larger when the initial unemployment rate is low,

Table 6. Illustrative Effects of Labor Demand Shock to Female Heads on Employment of Different Groups, Baseline Low Unemployment Rate, Effects After Ten Years

	Low-Unemployment Baseline: Employment Effects As Proportion of Original Demand Shock	High-Unemployment Baseline: Employment effects as Proportion of Original Demand Shock
Female Heads	0.605 (2.97)	0.665 (3.41)
Less-educated Females	-0.370 (2.40)	0.040 (0.30)
More-educated Females	-0.146 (3.87)	-0.040 (1.24)
Less-educated Males	-0.508 (3.07)	-0.047 (0.34)
More-educated Males	-0.172 (3.30)	-0.031 (0.69)
Overall	-0.590 (1.72)	0.585 (2.07)

Notes: Effects are calculated by simulating effects of shock of 1/10th of 1% of overall population to employment of female heads. Pseudo *t*-statistics are in parentheses. Derived from 1000 Monte Carlo repetitions.

as overall wages go up from a demand shock if unemployment is already low. As shown in Table 6, if unemployment is low, for every 100 female heads directly employed by the demand shock, on net there are 59 fewer persons employed, and 119 fewer persons in groups other than female heads employed (-119 = -59 -60). When unemployment is high, these displacement effects on other groups are much lower, with only 8 fewer persons employed among groups other than female heads. Public employment “crowds out” less of total private employment if unemployment is currently high.

Therefore, in the aggregate the model suggests that attempts to artificially boost employment will not boost overall employment absent some shift in overall labor supply. The overall labor market is supply-determined in the long run. But in the medium run, labor demand shocks can significantly increase employment and wages. Even in the long run, labor demand shocks to some groups have sizable effects upon the distribution of employment among different groups.

6. Empirical Estimates: The Effects of Wage Subsidies to Supply and to Demand

In this section, I present the estimated effects of wage subsidies. These wage subsidies may be provided on the supply side (that is, to workers) or provided on the demand side (that is, to employers).

As shown in Table 7, supply-side wage subsidies are estimated to have small effects on overall employment and on the employment of the group of workers receiving the wage subsidy. In addition, supply-side wage subsidies have little effect on wages paid in the market. This implies that net wages received by a group of workers go up by about that group’s wage subsidy. However, the supply-side wage subsidy does raise the net earnings of the subsidized group, which may be an important policy goal.

Table 7. Elasticities Five Years After Shock in Response to Supply-Side Wage Subsidy

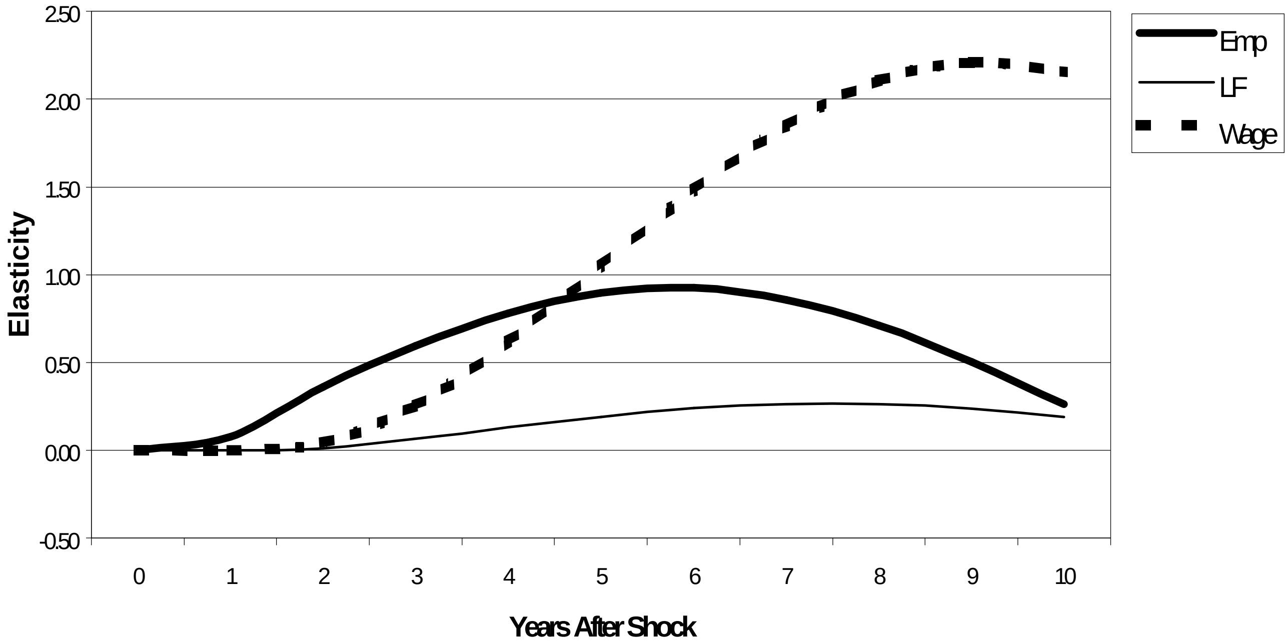
Wage subsidy to group below	Own employment elasticity	Overall employment elasticity	Own wage elasticity	Overall wage elasticity
Female Heads	0.041 (0.99)	0.013 (0.71)	-0.009 (1.32)	-0.167 (1.35)
Less-educated Females	-0.011 (0.46)	0.004 (0.29)	0.007 (0.27)	0.018 (0.26)
More-educated Females	-0.021 (1.36)	0.000 (0.02)	0.015 (1.51)	0.078 (1.46)
Less-educated Males	0.010 (1.14)	-0.003 (0.42)	-0.015 (1.07)	-0.032 (1.03)
More-educated Males	0.012 (1.52)	0.006 (1.38)	-0.009 (1.55)	-0.045 (1.65)

Notes: Results are for low-unemployment baseline, no migration. All elasticities are calculated based on shock to each group's labor supply of 10 percent subsidy to group's wage. Own elasticities are equal to change in ln(employment) or ln(market wage) of group (that is, wage before subsidy is added on), divided by difference in ln(group's wage) with and without the subsidy. Overall elasticities are equal to change in ln(overall employment) or ln(overall market wage average) divided by difference in ln(overall average wage) with and without the subsidy. Elasticities can be converted to use same denominator if remember that wage index uses weights on each group of 0.0322 (female heads), 0.3198 (less-educated females) 0.0968 (more-educated females), 0.4155 (less-educated males), and 0.1357 (more-educated males). Pseudo *t*-statistics are in parentheses, based on ratio of estimated elasticity to standard deviation of this estimation from 1000 Monte Carlo repetitions of model with different parameters.

An important assumption in this simulation is that a supply-side wage subsidy does not shift the wage curve. If a supply-side wage subsidy led to a downward shift in the wage curve, the effects of a supply-side wage subsidy would be greater. I assume the wage curve stays put because I interpret the wage curve as arising from social standards of fairness, which would not necessarily shift because of wage subsidies.

What about demand-side wage subsidies? As shown in Figure 13, demand-side wage subsidies can have substantial long-run effects. Even after ten years, average market wages have still been driven up by more than the employer subsidy. With a long-run demand curve for aggregate labor that is flat, an employer subsidy should eventually raise market wages by the amount of the subsidy, but the economy is still "overshooting" this long-run equilibrium after ten years (Figure 13A). Overall employment and labor supply are still significantly greater as a result of the employer wage subsidy, although they seem to be slowly moving back toward their original level, albeit slowly given the lagged adjustment of labor demand and supply in this

Figure 13A. Overall Employment, Labor Force and Wage Rate Elasticities for a 10 Percent Demand-Side Wage Subsidy for Female Heads Under Low Base Unemployment With No Population Adjustment



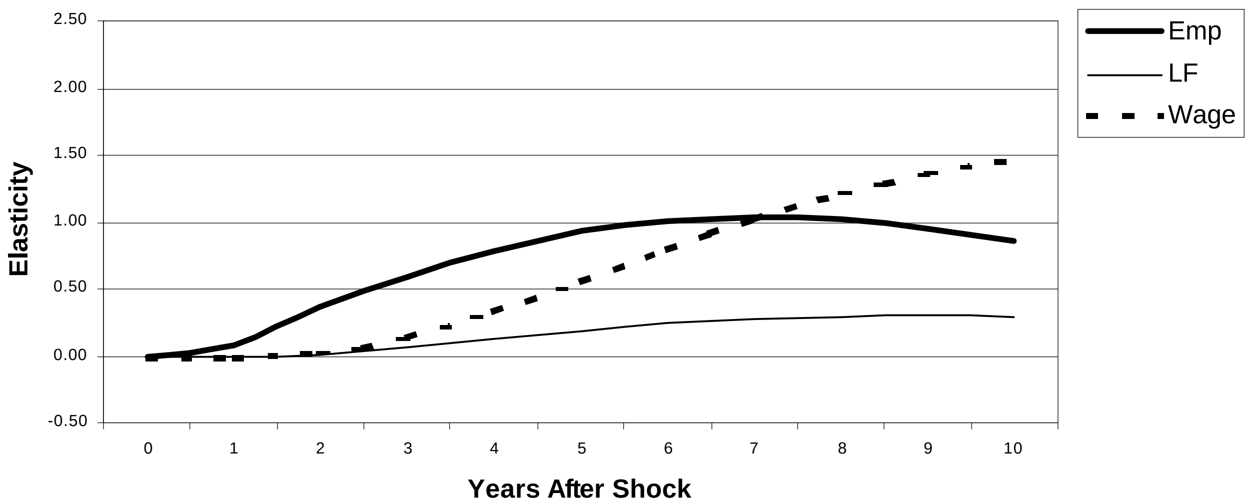
Elasticities after five years:

Group Below Whose Wage Is Subsidized	Elasticity of Overall Labor Supply	Elasticity of Overall Employment	Elasticity of Overall Average Wages
Female Heads	0.193 (6.31)	0.898 (11.04)	1.050 (6.87)
Less-educated Females	0.209 (6.58)	0.893 (11.17)	1.214 (6.09)
More-educated Females	0.210 (6.37)	0.896 (11.06)	1.062 (6.59)
Less-educated Males	0.196 (6.97)	0.890 (11.23)	1.339 (5.84)
More-educated Males	0.191 (6.16)	0.896 (11.09)	1.103 (6.62)

Notes: Elasticities are calculated with by dividing difference in overall ln of variable listed (labor force, employment, wages), by difference in ln(overall wages paid by employer) due to wage subsidy. Pseudo *t*-statistics are in parentheses, and are derived by 1000 Monte Carlo repetitions of simulation. No migration is allowed in deriving these estimates.

model. If the original unemployment level is higher (Figure 13B), wage effects are somewhat less, and employment effects are somewhat more.

Figure 13B. Overall Employment, Labor Force and Wage Rate Elasticities for a 10 Percent Demand-Side Wage Subsidy for Female Heads Under High Base Unemployment With No Population Adjustment



Elasticities after five years:

Group Below Whose Wage Is Subsidized	Elasticity of Overall Labor Supply	Elasticity of Overall Employment	Elasticity of Overall Average Wages
Female Heads	0.191 (6.18)	0.926 (10.25)	0.561 (6.77)
Less-educated Females	0.209 (6.48)	0.925 (10.31)	0.597 (6.35)
More-educated Females	0.210 (6.24)	0.925 (10.26)	0.558 (6.55)
Less-educated Males	0.196 (6.91)	0.924 (10.35)	0.629 (6.32)
More-educated Males	0.190 (6.04)	0.925 (10.27)	0.574 (6.63)

Notes: Elasticities are calculated with by dividing difference in overall ln of variable listed (labor force, employment, wages), by difference in ln(overall wages paid by employer) due to wage subsidy. Pseudo *t*-statistics are in parentheses, and are derived from 1000 Monte Carlo repetitions of simulations. No migration is allowed in deriving these estimates.

Table 8 shows the effects of wage subsidies to employers for employing some group on that group's wages and employment. These wage subsidies only have quite modest effects on relative wages and relative employment. This reflects the model's estimates that relative labor

Table 8. Elasticities of Own Wages and Own Employment With Respect to Demand-Side Wage Subsidies, Compared to Overall Wages and Overall Employment

Effect of Demand-Side Wage Subsidies to Group Given Below	Own Wages, Low UR [Overall Wage] (*t*-stat on own wage coefficient)	Own Wages, High UR	Own Employment, Low UR [Overall Employment] (t-stat on own employment coefficient)	Own Employment, High UR
Female Heads	0.039	0.022	0.160	0.162
	[0.034]	[0.018]	[0.029]	[0.030]
	(3.60)	(4.00)	(1.57)	(1.57)
Less-educated Females	0.425	0.201	0.395	0.405
	[0.388]	[0.191]	[0.286]	[.295]
	(6.15)	(6.56)	(11.12)	(10.48)
More-educated Females	0.095	0.046	0.056	0.059
	[0.103]	[0.054]	[0.087]	[0.089]
	(3.57)	(2.11)	(0.70)	(0.74)
Less-educated Males	0.608	0.283	0.470	0.488
	[0.556]	[0.261]	[0.370]	[0.384]
	(5.88)	(6.53)	(10.93)	(10.39)
More-educated Males	0.167	0.093	0.189	0.192
	[0.150]	[0.078]	[0.122]	[0.126]
	(6.03)	(4.91)	(4.41)	(4.47)

Notes: Elasticities are the difference in ln of dependent variable due to the policy (own or overall market wage or employment) divided by difference in ln(wage paid by employer) of subsidized group due to the demand-side wage subsidy. Elasticities are derived from 10 simulations showing effects on labor market of 10 percent wage subsidy to each of five groups under two different initial unemployment rates. Pseudo *t*-statistics, derived from 1000 Monte Carlo repetitions of simulation are in parentheses. *t*-statistics are for effect on own variables; *t*-statistics for overall variables are in previous tables. Estimated elasticities for overall variables differ from previous tables because here we are dividing difference in overall variables by difference in own group wages paid by employers due to the wage subsidy, whereas before division was by difference between net wages after subsidy of overall wages, and net wage before subsidy of overall wages.

demand conditions have modest effects on relative wages, and relative wages have modest effects on relative labor demand.

7. Empirical Estimates: Applying the Model to Supply Shifts and Demand Shifts

In this section, I consider two shifts in labor supply and demand: education policies that shift some of the population from a less-educated group to a more-educated groups, and technological change that shifts labor demand from less-educated to more-educated groups.

Figure 14 and its accompanying tables show the effects of education on the earnings of various groups. Moving some persons from a less-educated to a more-educated group would increase employment rates and wages among those remaining in the less-educated group, and reduce wages and employment rates among those originally in the more-educated group. Because the more-educated groups have greater labor force participation, overall labor supply will go up, which should initially depress wages before the economy adjusts and employment increases to match the added labor supply.

As can be seen in the figure and table, the "spillover effects" of education policy are substantial. Effects on other groups are often commensurate with the effects on the group being educated. In all the simulations, negative effects on the average earnings of the more-educated group, and positive effects on the average earnings of the less-educated group, are large and persistent. Total earnings initially decline before finally increasing, with the adjustment taking place more quickly if unemployment is initially lower.

I now consider the effects of shifts in labor demand, specifically shifts of demand away from less-educated groups and towards more-educated groups. During the 1980s and 1990s, the wages of less-educated workers declined dramatically relative to those of more-educated workers. Most economists believe that these relative wage trends are best explained by technological change, which has decreased demand for less-educated workers and increased demand for more-educated workers (Katz and Murphy, 1992). Other economists suggest that declining wages for less-educated workers might be explained by "institutional factors": a declining real value of the minimum wage, declines in high-wage industries, and declining unionization.

Figure 15 and its accompanying table show this model's estimates of the effects of shifts in demand towards more-educated workers on relative wages. The estimated effects might be large enough that demand shifts in the U.S. could explain observed shifts in relative wages, although a more definitive answer requires more detailed modeling.

Figure 14A. Education Shock Increasing Education of Female Heads Under Low Initial Unemployment: Ratio of Effect on Earnings of Indicated Group to Effect on Earnings of Group Being Educated

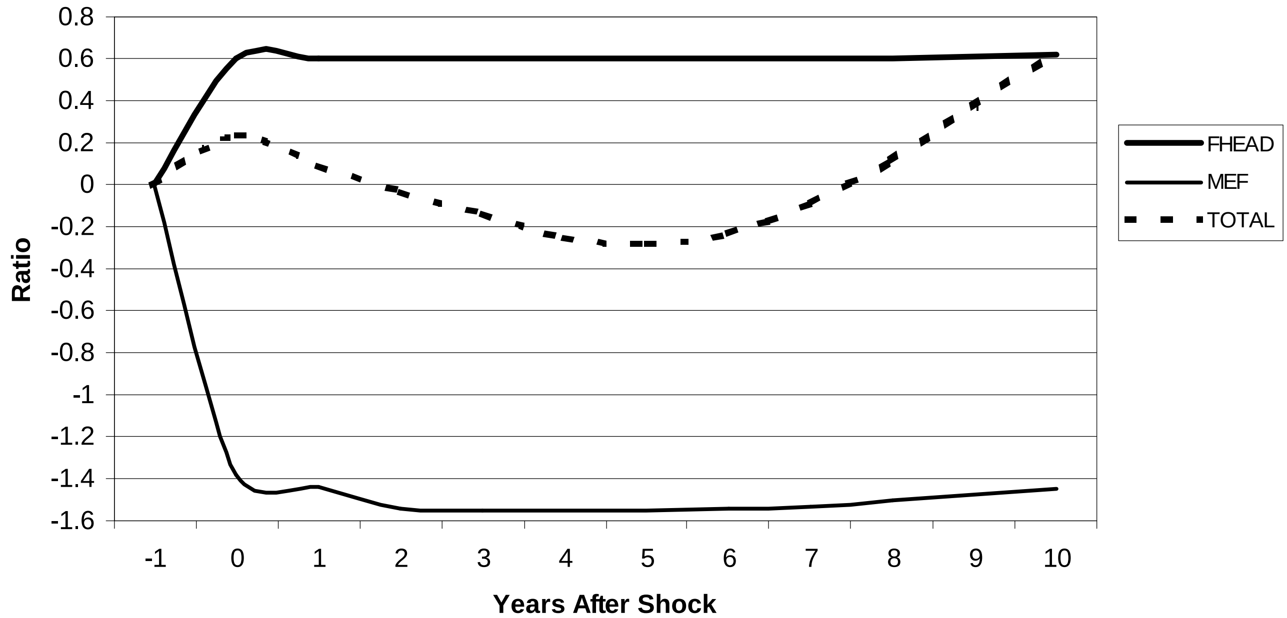


Figure 14B. Education Shock Increasing Education of Female Heads Under High Initial Unemployment: Ratio of Effect on Earnings of Indicated Group to Effect on Earnings of Group Being Educated

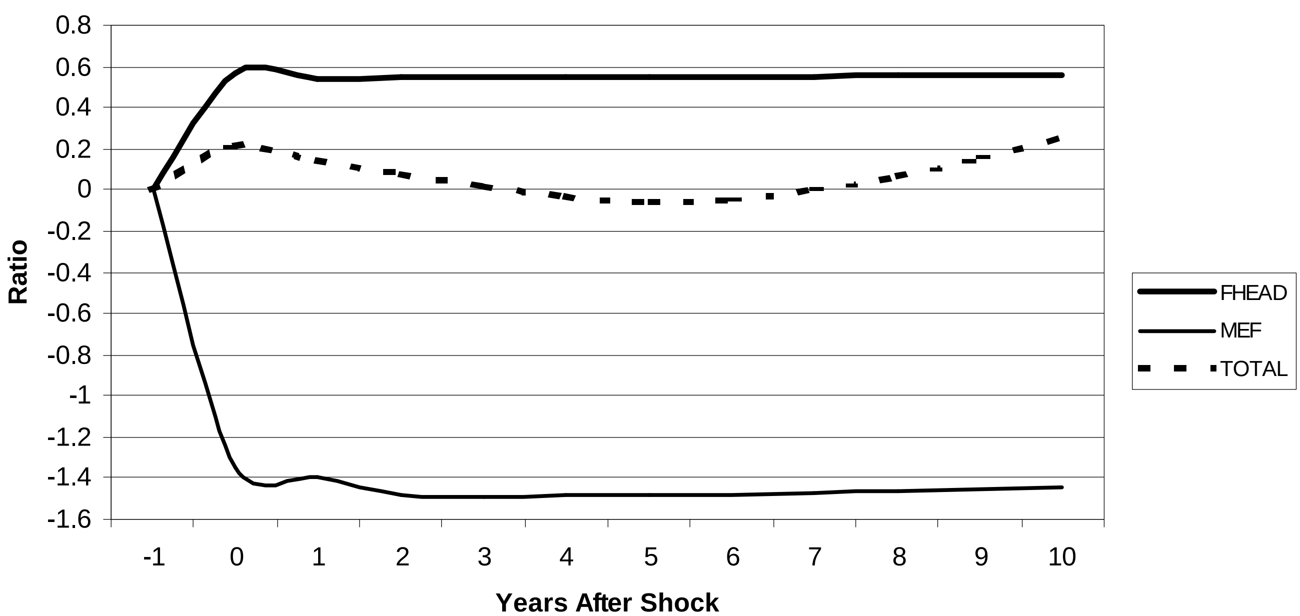


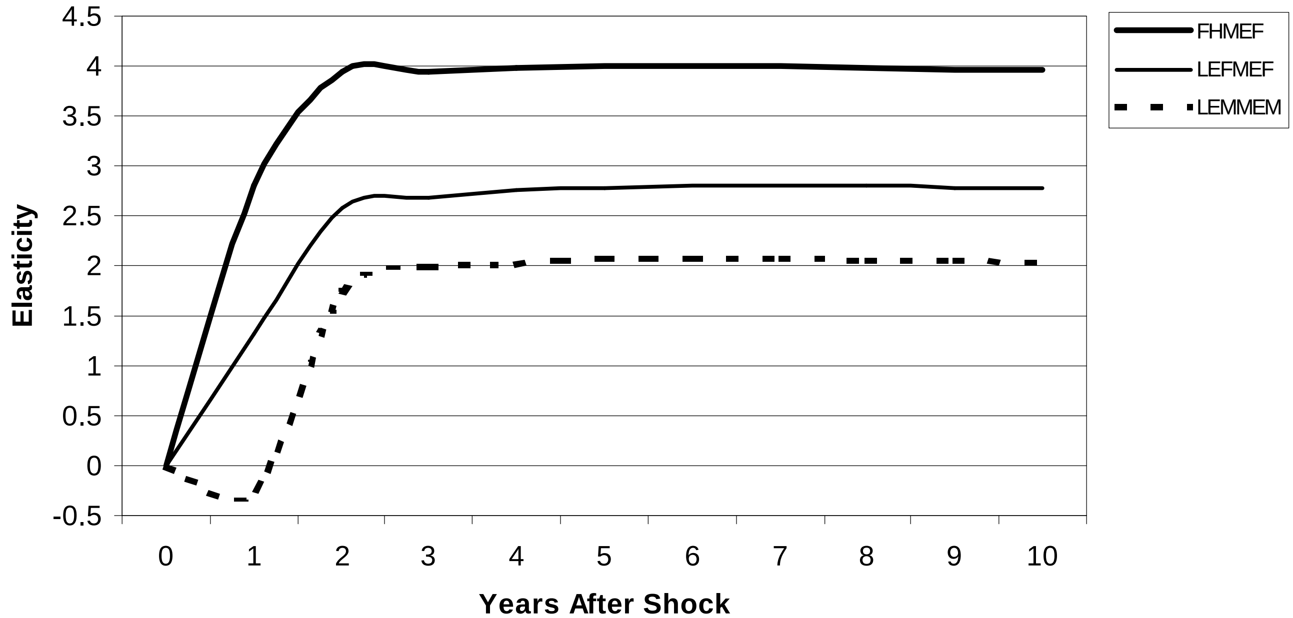
Figure 14 A. (Continued)

Effects of education on earnings:

	Low Unemployment Rate		High Unemployment Rate	
	Effects after 5 years	Effects after 10 years	Effects after 5 years	Effects after 10 years
Group educated: Female heads				
Ratio: (earnings effects on group left)/ (earnings gains for group educated)	0.596 (2.28)	0.615 (2.35)	0.550 (2.30)	0.557 (2.33)
Ratio: (earnings effects on group joined)/ (earnings gains for group educated)	-1.555 (3.30)	-1.445 (3.09)	-1.486 (3.31)	-1.445 (3.21)
Ratio: (total earnings effects for population)/ (earnings gains for group educated)	-0.280 (0.91)	0.635 (1.90)	-0.051 (0.27)	0.259 (1.38)
Group educated: Other less-educated females				
Ratio: (earnings effects on group left)/ (earnings gains for group educated)	0.113 (0.98)	0.481 (3.19)	0.133 (1.42)	0.265 (2.62)
Ratio: (earnings effects on group joined)/ (earnings gains for group educated)	-1.443 (3.31)	-1.275 (2.95)	-1.355 (3.27)	-1.295 (3.13)
Ratio: (total earnings effects for population)/ (earnings gains for group educated)	-0.438 (1.53)	1.001 (2.37)	-0.072 (0.43)	0.413 (1.96)
Group educated: Less-educated males				
Ratio: (earnings effects on group left)/ (earnings gains for group educated)	0.420 (3.02)	0.673 (4.57)	0.424 (3.46)	0.496 (4.16)
Ratio: (earnings effects on group joined)/ (earnings gains for group educated)	-1.320 (4.55)	-1.165 (4.17)	-1.224 (4.54)	-1.163 (4.44)
Ratio: (total earnings effects for population)/ (earnings gains for group educated)	-0.007 (0.04)	0.668 (3.07)	0.139 (0.99)	0.365 (2.58)

Notes: Table presents ratios of effects on "earnings" (dollar effects effects on earnings, defined as change in product of wage times employment rate) of different groups to effects on earnings of individuals who are "educated" by leaving a low-education group and joining a higher education group. Absolute values of pseudo *t*-statistics, derived from 1000 Monte Carlo repetitions of simulations. The earnings effects analyzed are for the low-education group that loses some population, the high-education group that gains some population, and for everyone. The earnings effects calculated for the group receiving education assumes this group before and after being switched from one population to another has wages and employment rate similar to whatever group it is in at the moment. Three different education switches are considered: switching some female heads to college educated female group; switching some less-educated females to more-educated female group; switching some less-educated male group to more educated female group. Simulations are all for switch of 1/10th of percent of overall population. Generally, the group that is educated approximately doubles their average earnings, mostly due to gaining wages from switching to college-educated group.

Figure 15. Elasticity of Relative Wages for Demand Shift Simulations Under Low Initial Unemployment: Female Heads to More Educated Females (FHMEF), Less Educated Females to More Educated Females (LEFMEF), and Less Educated Males to More Educated Males (LEMMEM)



Effect of demand shifts on relative wages:

Demand Shift	Elasticity of Relative Wages After Five Years, Initially Low Unemployment	Elasticity of Relative Wages After Five Years, Initially High Unemployment
From Female Heads to More Educated Females	3.999 (2.76)	3.400 (2.57)
From Less Educated Females to More Educated Females	2.784 (2.27)	2.522 (2.12)
From Less Educated Males to More Educated Males	2.087 (2.18)	2.205 (2.24)

Notes: Elasticities look at difference in ln(wage of more educated group/wage of less educated group), divided by demand shift as proportion of total adult population. Elasticities are based on simulation of demand shift in each case of 0.001 of total population. Pseudo *t*-statistics in parentheses, based on 1000 repetitions of Monte Carlo simulations. No migration is allowed in these simulations.

For example, consider the relative wages and employment of less- and more-educated men. The data compiled in estimating this model suggests that the relative ln(wage) of college-educated vs. less-than-college-educated men increased by 0.160 (17.4%) from 1979 to 1997.

The elasticities reported in the table and figure suggest that for this relative wage shift to be explained solely by labor demand shifts, a labor demand shift of about 7.7 percent of the working age population would be required.[12] As a percentage of the average employment of the two groups, this would be equivalent to a combination of a 13 percent decline in employment demand for less-educated males and a 40 percent increase in employment demand for more-educated males. From 1979-97, the actual share of employment of less-educated males declined by around 15 percent and the actual share of employment of more-educated males increased by around 20 percent. Thus, the actual employment shifts seem of the rough order of magnitude to be consistent with the observed relative wage shifts. A more detailed analysis would need to take account of many other factors, including the demand shifts among all five groups, supply shifts, and the model's lagged adjustment.

8. Conclusion

What do we learn from complex simulation models? Such models cannot focus on any particular equation, and so the individual equation estimates are unlikely to be compelling. What a complex simulation model can suggest is how individual equation estimates fit together to determine the overall economy.

This paper's model suggests that wage or quantity shocks to labor supply or demand will have spillover effects on the overall economy that are large and of a particular character. Particular features of how the economy reacts to labor demand and supply shocks follow from particular features of the economy. Table 9 summarizes the links between the behavior of different economic sectors and how the economy responds to different shocks. While one may quarrel with some of the behavior assumed or estimated in the model, these behavioral patterns are defensible views of the way the world works. It is plausible that labor demand responds a

[12]This is derived by dividing the relative wage shift by 2.087, the elasticity with low initial unemployment reported in the table.

Table 9. Implications of the Model

Features of Model to Right, Implications Below	D Responds to Wages More in LR	Wage Curve Flat in SR, Not as Flat in LR	Supply Not Responsive to Wages	Relative Demand Not Very Sensitive to Wages	Relative Wages Not Very Sensitive to Relative Unemployment
Q demand shocks cause little displacement in SR, more in LR.	X	X			
Q demand shocks affect relative employment more than relative wage					X
Q supply shocks affect relative employment more than relative wage					X
Wage subsidies for labor supply have little effect except to raise net wages of targeted group			X		
Wage subsidies for labor demand raise overall wages some in LR, have little effect on relative demand and relative wages	X			X	
Education has sizable spillover effects on affected groups				X	
Relative wages adjust modestly to fairly large shifts in relative labor demand					X

great deal to wages in the long run, wage curves exist, labor force participation is insensitive to wages, relative labor demand responds modestly to wages, and relative wages resist change. From these reasonable, although not unassailable, beliefs there follow important conclusions on how the economy is affected by labor supply and demand shocks.

These conclusions can be summarized by what they imply for some policymaker who wants to improve the earnings of some disadvantaged group. This policymaker presumably would like to improve the employment and wages of this disadvantaged group without too much adverse displacement or wage effects, especially on other disadvantaged groups.

To improve employment of some disadvantaged group, policies that increase the quantity of labor demanded or supplied of this disadvantaged group will work, at least in the medium run. However, either policy has drawbacks. Increasing the quantity of labor demanded of the disadvantaged has labor market benefits that decline over time, and displacement effects that increase over time. Increasing the quantity of labor supplied by the disadvantaged has employment benefits that are slow to develop, and causes considerable wage decreases and displacement in the short run and medium run.

The weakness of each policy, when used separately, suggest the possibility of combining the two: a policy mix that increases both the labor quantity supplied and demanded of the targeted group. For example, welfare-to-work programs might be combined with public employment programs for ex-welfare recipients. This would offset some of the negative effects of supply-side quantity shocks in the medium run and avoid some of the displacement effects of demand-side quantity shocks in the long run.

The appropriate mix of supply-side quantity shocks and demand-side quantity shocks might depend on the strength of the economy. More emphasis on demand-side policies would be appropriate where or when unemployment is high, and more emphasis on supply-side policy where or when unemployment is low.

Wage subsidies to disadvantaged workers or their employers do not seem particularly effective in increasing their employment. However, wage subsidies to disadvantaged workers are likely to be effective in increasing the net wage received by disadvantaged workers.

The perennial favor of American social policy, education, has much to recommend it as an anti-poverty policy. Educating disadvantaged groups will increase the earnings of those educated, while also increasing the earnings of other disadvantaged individuals who are not educated. Education policy may have the adverse effect of reducing the earnings of some of the currently more-educated individuals. However, from a distributional perspective, this improves the distribution of the nation's income. The declining earnings of the more-educated will only be a political problem for education policy if such a decline is perceived by the more-educated as occurring due to the education policy. This seems unlikely if education policy is implemented in an economy in which demand shifts to the more-educated are increasing the earnings of the more-educated. Education policy may be a necessary policy to ensure that the benefits of new technology are broadly shared among all groups in the population, and particularly the disadvantaged.

Appendix A

Example of Sims

Group 2 = FHEAD
Group 3 = LEF
Group 4 = MEF
Group 5 = LEM
Group 6 = MEM
No group suffix = Overall average or aggregate

All variables are initialized to zero. Sim is simulating difference between world with shock and world without shock. Program is written in SAS. Program is in regular typeface; comments in bold.

```
%reg;

%macro sims;
 %do k=2 %to 6;
  %do j=1 %to 3;
   data dummy&j;
    do x=1 to 13;                    x is time periods of simulation
     ur2=0;                          Unemployment Rate of educated group
     ur3=0;
     ur4=0;
     ur5=0;
     ur6=0;
     ur=0;
     urbase2=0;                      Baseline & new levels of unemployment
     urbase3=0;
     urbase4=0;
     urbase5=0;
     urbase6=0;
     urbase=0;
     urnew2=0;
     urnew3=0;
     urnew4=0;
     urnew5=0;
     urnew6=0;
     urnew=0;
     urnew2x=0;
     urnew3x=0;
     urnew4x=0;
     urnew5x=0;
     urnew6x=0;
     urnewx=0;
     lnlftot2=0;                     ln(labor force)
     lnlftot3=0;
     lnlftot4=0;
     lnlftot5=0;
     lnlftot6=0;
     lne2=0;                         ln(employment)
     lne3=0;
     lne4=0;
     lne5=0;
```

```
lne6=0;
lne=0;
lwr2=0;                                   ln(wage rates)
lwr3=0;
lwr4=0;
lwr5=0;
lwr6=0;
lwr=0;
rw2=0;                                    ln(relative wage of each group)
rw3=0;
rw4=0;
rw5=0;
rw6=0;
lnpop2=0;                                 ln(population)
lnpop3=0;
lnpop4=0;
lnpop5=0;
lnpop6=0;
lnpop=0;
lnlfp2=0;                                 ln(labor force participation rate)
lnlfp3=0;
lnlfp4=0;
lnlfp5=0;
lnlfp6=0;
lnlfp=0;
logben3=0;
lnafdc=0;
lnpi=0;                                   ln(personal income)
shock2=0;
shock3=0;
shock4=0;
shock5=0;
shock6=0;
empwgt2=0;
empwgt3=0;
empwgt4=0;
empwgt5=0;
empwgt6=0;
lfwgt2=0.0343;                            Share of labor force in each group
lfwgt3=0.3213;
lfwgt4=0.0930;
lfwgt5=0.4215;
lfwgt6=0.1299;
empsh2=0;
empsh3=0;
empsh4=0;
empsh5=0;
empsh6=0;
lfsh2=0;
lfsh3=0;
lfsh4=0;
lfsh5=0;
lfsh6=0;
shsum1=1.0;
shsum2=1.0;
if x > 2 then do;
```

j = 1, 2, 3. Three scenarios, each differing in baseline unemployment rates and hence, employment shares/weights at baseline

```
%if &j=1 %then %do;
  ** Average base unemployment rates **;
  urbase=0.0700;
  urbase2=0.1317;
  urbase3=0.0750;
  urbase4=0.0313;
  urbase5=0.0842;
  urbase6=0.0255;

  empwgt2=0.0322;
  empwgt3=0.3197;
  empwgt4=0.0967;
  empwgt5=0.4156;
  empwgt6=0.1358;
  empwgt2x=empwgt2; empwgt2y=empwgt2;
  empwgt3x=empwgt3; empwgt3y=empwgt3;
  empwgt4x=empwgt4; empwgt4y=empwgt4;
  empwgt5x=empwgt5; empwgt5y=empwgt5;
  empwgt6x=empwgt6; empwgt6y=empwgt6;
%end;
%else %if &j=2 %then %do;
  ** High unemployment base **;
  urbase=0.1015;
  urbase2=0.1670;
  urbase3=0.1078;
  urbase4=0.0424;
  urbase5=0.1275;
  urbase6=0.0317;

  empwgt2=0.0321;
  empwgt3=0.3193;
  empwgt4=0.0986;
  empwgt5=0.4107;
  empwgt6=0.1393;
  empwgt2x=empwgt2; empwgt2y=empwgt2;
  empwgt3x=empwgt3; empwgt3y=empwgt3;
  empwgt4x=empwgt4; empwgt4y=empwgt4;
  empwgt5x=empwgt5; empwgt5y=empwgt5;
  empwgt6x=empwgt6; empwgt6y=empwgt6;
%end;
%else %if &j=3 %then %do;
  ** Low unemployment base **;
  urbase=0.0521;
  urbase2=0.1170;
  urbase3=0.0550;
  urbase4=0.0222;
  urbase5=0.0618;
  urbase6=0.0192;

  empwgt2=0.0322;
  empwgt3=0.3204;
  empwgt4=0.0958;
  empwgt5=0.4174;
  empwgt6=0.1342;
  empwgt2x=empwgt2; empwgt2y=empwgt2;
  empwgt3x=empwgt3; empwgt3y=empwgt3;
```

```
      empwgt4x=empwgt4; empwgt4y=empwgt4;
      empwgt5x=empwgt5; empwgt5y=empwgt5;
      empwgt6x=empwgt6; empwgt6y=empwgt6;
      %end;
      shock&k=0.001*(1/0.7532)*(1/lfwgt&k);
      end;
      output dummy&j;
      end;
```

Shock is 0.001 of overall population which is converted to proportion of group=s labor force. 0.7532 is overall average LFPR.

```
  %if &j=1 %then %let t3=Average Base Unemployment Rate;
 %else %if &j=2 %then %let t3=High Base Unemployment Rate;
 %else %if &j=3 %then %let t3=Low Base Unemployment Rate;
 %if &k=2 %then %let x=Female Heads;
 %else %if &k=3 %then %let x=Other Less Educated Females;
 %else %if &k=4 %then %let x=More Educated Females;
 %else %if &k=5 %then %let x=Less Educated Males;
 %else %if &k=6 %then %let x=More Educated Males;

proc model data=dummy&j;
 title1 "Monte Carlo Simulation of 0.001 Shock to Labor Supply of &x";
 title2 "Population is NOT Allowed to Adjust";
 title3 "Revised Labor Demand and Wage Equations";
 title4 &t3;
 parms e1sh2l1-e1sh2l2 e1rw2l1-e1rw2l2 e1lf2
      e2sh3l1-e2sh3l2 e2rw3l1-e2rw3l2 e2lf3
      e3sh4l1-e3sh4l2 e3rw4l1-e3rw4l2 e3lf4
      e4sh5l1-e4sh5l2 e4rw5l1-e4rw5l2 e4lf5
      e5sh6l1-e5sh6l2 e5rw6l1-e5rw6l2 e5lf6
      e6rw2l1-e6rw2l2 e6u32l1-e6u32l2
      e7rw3l1-e7rw3l2 e7u33l1-e7u33l2
      e8rw4l1-e8rw4l2 e8u14l1-e8u14l2
      e9rw5l1-e9rw5l2 e9u15l1-e9u15l2
      e10rw6l1-e10rw6l2 e10u16l1-e10u16l2
      e11lf2l1-e11lf2l2 e11wr2l1-e11wr2l2 e11ur2l1-e11ur2l2 e11bnl1 e11bnl2
      e12lf3l1-e12lf3l2 e12wr3l1-e12wr3l2 e12ur3l1-e12ur3l2
      e13lf4l1-e13lf4l2 e13wr4l1-e13wr4l2 e13ur4l1-e13ur4l2
      e14lf5l1-e14lf5l2 e14wr5l1-e14wr5l2 e14ur5l1-e14ur5l2
      e15lf6l1-e15lf6l2 e15wr6l1-e15wr6l2 e15ur6l1-e15ur6l2
      e21wr2l1-e21wr2l2 e21wr3l1-e21wr3l2 e21wr4l1-e21wr4l2 e21wr5l1-e21wr5l2 e21wr6l1-e21wr6l2
      e21ur2l1-e21ur2l2 e21ur3l1-e21ur3l2 e21ur4l1-e21ur4l2 e21ur5l1-e21ur5l2 e21ur6l1-e21ur6l2
      e21dcl1 e21dcl2 e21bnl1 e21bnl2
      e22pil1-e22pil2
      e22wr e22wrl1-e22wrl2 e22e e22el1-e22el2 e22p e22pl1-e22pl2
      e23el1-e23el2 e23wrl1-e23wrl2 e23pil1-e23pil2
      e24wrl1-e24wrl2 e24lnl1-e24lnl2;
 exogenous urbase urbase2-urbase6;
 outvars urbase urbase2-urbase6 shock&k;

 lnlftot2 = log(exp(lnlf2) + shock2);
 lnlftot3 = log(exp(lnlf3) + shock3);
 lnlftot4 = log(exp(lnlf4) + shock4);
 lnlftot5 = log(exp(lnlf5) + shock5);
 lnlftot6 = log(exp(lnlf6) + shock6);
```

Adds shock to labor supply

```
 lnlftot = log(0.0343*exp(lnlftot2) + 0.3213*exp(lnlftot3) +
           0.0930*exp(lnlftot4) + 0.4215*exp(lnlftot5) +
           0.1299*exp(lnlftot6));
```

Definition: Dln(labor force total) = weighted average of D in each group

```
lfprtot2 = lnlftot2 - lnpop2;
lfprtot3 = lnlftot3 - lnpop3;
lfprtot4 = lnlftot4 - lnpop4;
lfprtot5 = lnlftot5 - lnpop5;
lfprtot6 = lnlftot6 - lnpop6;
lfprtot = lnlftot - lnpop;
```

Definition of labor force participation changes

This re-expresses all changes in employment as proportion of baseline population.

```
epopadd&k = 0.001*exp(-1*ur&k-1*urbase&k);
epopoth2 = exp(-1*urbase2)*lfwgt2*0.7532*(exp(-1*ur2)*exp(lnlf2)-1);
epopoth3 = exp(-1*urbase3)*lfwgt3*0.7532*(exp(-1*ur3)*exp(lnlf3)-1);
epopoth4 = exp(-1*urbase4)*lfwgt4*0.7532*(exp(-1*ur4)*exp(lnlf4)-1);
epopoth5 = exp(-1*urbase5)*lfwgt5*0.7532*(exp(-1*ur5)*exp(lnlf5)-1);
epopoth6 = exp(-1*urbase6)*lfwgt6*0.7532*(exp(-1*ur6)*exp(lnlf6)-1);
epopover = exp(-1*urbase)*0.7532*(exp(lne)-1);
```

Definition

```
lfsh2 = lnlftot2-lnlftot;
lfsh3 = lnlftot3-lnlftot;
lfsh4 = lnlftot4-lnlftot;
lfsh5 = lnlftot5-lnlftot;
lfsh6 = lnlftot6-lnlftot;
```

Overall labor demand equation

```
lne = e23el1*lag1(lne) + e23el2*lag2(lne) +
    e23wrl1*lag1(lwr) + e23wrl2*lag2(lwr) +
    e23pil1*lag1(lnpi) + e23pil2*lag2(lnpi);
```

Relative labor demand equations

```
empsh2 = e1sh2l1*lag1(empsh2) + e1sh2l2*lag2(empsh2) +
        e1rw2l1*(lag1(lwr2)-lag1(lwr)) +
        e1rw2l2*(lag2(lwr2)-lag2(lwr)) +
        e1lf2*lfsh2;

empsh3 = e2sh3l1*lag1(empsh3) + e2sh3l2*lag2(empsh3) +
        e2rw3l1*(lag1(lwr3)-lag1(lwr)) +
        e2rw3l2*(lag2(lwr3)-lag2(lwr)) +
        e2lf3*lfsh3;

empsh4 = e3sh4l1*lag1(empsh4) + e3sh4l2*lag2(empsh4) +
        e3rw4l1*(lag1(lwr4)-lag1(lwr)) +
        e3rw4l2*(lag2(lwr4)-lag2(lwr)) +
        e3lf4*lfsh4;

empsh5 = e4sh5l1*lag1(empsh5) + e4sh5l2*lag2(empsh5) +
        e4rw5l1*(lag1(lwr5)-lag1(lwr)) +
        e4rw5l2*(lag2(lwr5)-lag2(lwr)) +
        e4lf5*lfsh5;

empsh6 = e5sh6l1*lag1(empsh6) + e5sh6l2*lag2(empsh6) +
        e5rw6l1*(lag1(lwr6)-lag1(lwr)) +
        e5rw6l2*(lag2(lwr6)-lag2(lwr)) +
        e5lf6*lfsh6;
```

Forces shares to sum to exactly 1

```
empsh2x = exp(empsh2)*empwgt2;
empsh3x = exp(empsh3)*empwgt3;
empsh4x = exp(empsh4)*empwgt4;
empsh5x = exp(empsh5)*empwgt5;
```

```
empsh6x = exp(empsh6)*empwgt6;
shsum1 = empsh2x + empsh3x + empsh4x + empsh5x + empsh6x;

empsh2y = empsh2x/shsum1;
empsh3y = empsh3x/shsum1;
empsh4y = empsh4x/shsum1;
empsh5y = empsh5x/shsum1;
empsh6y = empsh6x/shsum1;
shsum2 = empsh2y + empsh3y + empsh4y + empsh5y + empsh6y;
```

Definition of demand for each group

```
lne2 = log(empsh2y/empwgt2) + lne;
lne3 = log(empsh3y/empwgt3) + lne;
lne4 = log(empsh4y/empwgt4) + lne;
lne5 = log(empsh5y/empwgt5) + lne;
lne6 = log(empsh6y/empwgt6) + lne;
```

Defines new levels of unemployment rates

```
urnew2x = urbase2 + ur2;
urnew3x = urbase3 + ur3;
urnew4x = urbase4 + ur4;
urnew5x = urbase5 + ur5;
urnew6x = urbase6 + ur6;
urnewx = urbase + ur;
```

Makes sure no negative unemployment rates

```
urnew2 = if urnew2x < 0 then 0 else urnew2x;
urnew3 = if urnew3x < 0 then 0 else urnew3x;
urnew4 = if urnew4x < 0 then 0 else urnew4x;
urnew5 = if urnew5x < 0 then 0 else urnew5x;
urnew6 = if urnew6x < 0 then 0 else urnew6x;
urnew = if urnewx < 0 then 0 else urnewx;
```

Relative wage curves

```
rw2 = e6rw2l1*lag1(rw2) + e6rw2l2*lag2(rw2) +
    e6u32l1*(((1/(lag1(urnew2)+0.005))-(1/(lag1(urnew)+0.005))) -
         ((1/(lag1(urbase2)+0.005))-(1/(lag1(urbase)+0.005)))) +
    e6u32l2*(((1/(lag2(urnew2)+0.005))-(1/(lag2(urnew)+0.005))) -
         ((1/(lag2(urbase2)+0.005))-(1/(lag2(urbase)+0.005))));

rw3 = e7rw3l1*lag1(rw3) + e7rw3l2*lag2(rw3) +
    e7u33l1*(((1/(lag1(urnew3)+0.005))-(1/(lag1(urnew)+0.005))) -
         ((1/(lag1(urbase3)+0.005))-(1/(lag1(urbase)+0.005)))) +
    e7u33l2*(((1/(lag2(urnew3)+0.005))-(1/(lag2(urnew)+0.005))) -
         ((1/(lag2(urbase3)+0.005))-(1/(lag2(urbase)+0.005))));

rw4 = e8rw4l1*lag1(rw4) + e8rw4l2*lag2(rw4) +
    e8u14l1*((lag1(urnew4)-lag1(urnew))-(lag1(urbase4)-lag1(urbase))) +
    e8u14l2*((lag2(urnew4)-lag2(urnew))-(lag2(urbase4)-lag2(urbase)));

rw5 = e9rw5l1*lag1(rw5) + e9rw5l2*lag2(rw5) +
    e9u15l1*((lag1(urnew5)-lag1(urnew))-(lag1(urbase5)-lag1(urbase))) +
    e9u15l2*((lag2(urnew5)-lag2(urnew))-(lag2(urbase5)-lag2(urbase)));

rw6 = e10rw6l1*lag1(rw6) + e10rw6l2*lag2(rw6) +
    e10u16l1*((lag1(urnew6)-lag1(urnew))-(lag1(urbase6)-lag1(urbase))) +
    e10u16l2*((lag2(urnew6)-lag2(urnew))-(lag2(urbase6)-lag2(urbase)));

rwsum = 0.0322*rw2 + 0.3198*rw3 + 0.0968*rw4 + 0.4155*rw5 + 0.1357*rw6;
```

```
lwr = e24wrl1*lag1(lwr) + e24wrl2*lag2(lwr) +
     e24lnl1*(log(lag1(urnew)+0.005)-log(lag1(urbase)+0.005)) +
     e24lnl2*(log(lag2(urnew)+0.005)-log(lag2(urbase)+0.005));
```

Wage curve

```
lwr2 = rw2 + lwr - rwsum;
lwr3 = rw3 + lwr - rwsum;
lwr4 = rw4 + lwr - rwsum;
lwr5 = rw5 + lwr - rwsum;
lwr6 = rw6 + lwr - rwsum;
```

Forces relative wages to sum to 0

```
lwrcheck = (0.0322*lwr2 + 0.3198*lwr3 + 0.0968*lwr4 +
           0.4155*lwr5 + 0.1357*lwr6)-lwr;
```

```
ur2 = lnlftot2 - lne2;
ur3 = lnlftot3 - lne3;
ur4 = lnlftot4 - lne4;
ur5 = lnlftot5 - lne5;
ur6 = lnlftot6 - lne6;
ur = lnlftot - lne;
```

Definition of unemployment rate (not exactly conventional one!)

```
lnlfp2 = e11lf2l1*lag1(lnlfp2) + e11lf2l2*lag2(lnlfp2) +
        e11wr2l1*lag1(lwr2) + e11wr2l2*lag2(lwr2) +
        e11ur2l1*lag1(ur2) + e11ur2l2*lag2(ur2) +
        e11bnl1*lag1(logben3) + e11bnl2*lag2(logben3);

lnlfp3 = e12lf3l1*lag1(lnlfp3) + e12lf3l2*lag2(lnlfp3) +
        e12wr3l1*lag1(lwr3) + e12wr3l2*lag2(lwr3) +
        e12ur3l1*lag1(ur3) + e12ur3l2*lag2(ur3);

lnlfp4 = e13lf4l1*lag1(lnlfp4) + e13lf4l2*lag2(lnlfp4) +
        e13wr4l1*lag1(lwr4) + e13wr4l2*lag2(lwr4) +
        e13ur4l1*lag1(ur4) + e13ur4l2*lag2(ur4);

lnlfp5 = e14lf5l1*lag1(lnlfp5) + e14lf5l2*lag2(lnlfp5) +
        e14wr5l1*lag1(lwr5) + e14wr5l2*lag2(lwr5) +
        e14ur5l1*lag1(ur5) + e14ur5l2*lag2(ur5);

lnlfp6 = e15lf6l1*lag1(lnlfp6) + e15lf6l2*lag2(lnlfp6) +
        e15wr6l1*lag1(lwr6) + e15wr6l2*lag2(lwr6) +
        e15ur6l1*lag1(ur6) + e15ur6l2*lag2(ur6);
```

Labor force participation rate equations

```
lnlf2 = lnlfp2 + lnpop2;
lnlf3 = lnlfp3 + lnpop3;
lnlf4 = lnlfp4 + lnpop4;
lnlf5 = lnlfp5 + lnpop5;
lnlf6 = lnlfp6 + lnpop6;
lnlf = log(0.0343*exp(lnlf2) + 0.3213*exp(lnlf3) +
          0.0930*exp(lnlf4) + 0.4215*exp(lnlf5) + 0.1299*exp(lnlf6));
```

Labor force equation definitions

```
lnlfp = lnlf - lnpop;
```

```
er2 = lne2 - lnpop2;
er3 = lne3 - lnpop3;
er4 = lne4 - lnpop4;
er5 = lne5 - lnpop5;
er6 = lne6 - lnpop6;
```

Employment rate definitions

```
  er = lne - lnpop;

  lnpi = e22pil1*lag1(lnpi) + e22pil2*lag2(lnpi) +
        e22wr*lwr + e22wrl1*lag1(lwr) + e22wrl2*lag2(lwr) +
        e22e*lne + e22el1*lag1(lne) + e22el2*lag2(lne) +
        e22p*lnpop + e22pl1*lag1(lnpop) + e22pl2*lag2(lnpop);

  %if &k=2 %then %do;
    disp = 1-(epopover/epopadd&k);
  %end;
  %else %do;
    disp = -1*epopoth&k/epopadd&k;
  %end;
solve empsh2 empsh3 empsh4 empsh5 empsh6 shsum1 shsum2
      empsh2x empsh3x empsh4x empsh5x empsh6x
      empsh2y empsh3y empsh4y empsh5y empsh6y
      lfsh2 lfsh3 lfsh4 lfsh5 lfsh6
      urnew2 urnew3 urnew4 urnew5 urnew6 urnew
      urnew2x urnew3x urnew4x urnew5x urnew6x urnewx
      lnlftot2 lnlftot3 lnlftot4 lnlftot5 lnlftot6 lnlftot
      lfprtot2 lfprtot3 lfprtot4 lfprtot5 lfprtot6 lfprtot
      epopadd&k epopoth2 epopoth3 epopoth4 epopoth5 epopoth6 epopover
      lne2 lne3 lne4 lne5 lne6 lne
      rw2 rw3 rw4 rw5 rw6 rwsum
      lwr2 lwr3 lwr4 lwr5 lwr6 lwr lwrcheck
      ur2 ur3 ur4 ur5 ur6 ur
      er2 er3 er4 er5 er6 er
      lnlfp2 lnlfp3 lnlfp4 lnlfp5 lnlfp6 lnlfp
      lnlf2 lnlf3 lnlf4 lnlf5 lnlf6 lnlf
      lnafdc
      lnpi disp /out=sim estdata=beta random=1000 seed=1212;
```

Equation explaining state personal income

1000 repetitions to generate standard errors

Appendix B

Parameter Estimates

All equations also include complete vector of year dummies and state dummies, to control for fixed time effects and fixed state effects.

Table A-1. Overall Labor Demand Equation (Dependent variable: ln(employment))

Independent variable	Coefficient (t-stat)
Lag ln(employment)	0.6900 (19.49)
2nd lag	-0.0567 (-1.72)
Lag ln(wage)	-0.0779 (-1.74)
2nd lag	-0.2210 (-4.85)
Lag ln(personal income)	0.4377 (9.50)
2nd lag	-0.1524 (-3.12)

Table A-2. Relative Labor Demand Equations (Dependent variables are ln(employment of group/total employment))

Independent variable	Female Heads	Other Less-educated Females	More-educated Females	Less-educated Males	More-educated Males
Lag ln(employment share of group)	0.2713 (2.66)	0.0719 (2.34)	0.3549 (4.40)	0.3999 (5.15)	0.3864 (5.62)
2nd lag	-0.0434 (-1.64)	0.0032 (0.25)	-0.0227 (-0.92)	-0.0291 (-1.27)	-0.0685 (-2.83)
Lag ln(relative wage of group)	-0.0915 (-1.41)	-0.0502 (-2.50)	0.0923 (1.93)	-0.0333 (-0.99)	0.0340 (1.03)
2nd lag	0.0015 (0.02)	-0.0124 (-0.65)	-0.0647 (-1.26)	-0.1170 (-3.29)	-0.0810 (-2.52)
Current ln(labor force share of group)	0.3752 (1.56)	0.8503 (14.00)	0.3008 (1.96)	0.4277 (3.44)	0.4009 (3.98)

Note: For these equations only, estimated by 2SLS, with current labor force share treated as endogenous, and lagged labor force share used as instrument.

Table A-3. Overall Wage Equation (Dependent Variable : ln(wage))

Independent variable	Coefficient (t-statistic)
Lag ln(wage)	0.7318 (20.29)
2^{nd} lag	0.1030 (2.96)
Lag ln(unemployment rate plus .005)	-0.0314 (-6.71)
2^{nd} lag	-0.0217 (-4.52)

Note: Unemployment rate defined as ln(labor force) - ln(employment). Specification then takes logarithm of this UR definition. 0.005 added to avoid problems with occasional Azeros@ for some smaller groups. This specification was chosen by Akaike Information Criterion over linear specification, specification with 1/unemployment rate, and specification with unemployment rate and unemployment rate squared.

Table A-4. Relative Wage Curves (Dependent Variables are ln(wage of group/average wages overall))

Independent variable	Female Heads	Other Less-educated Females	More-educated Females	Less-educated Males	More-educated Males
Lag ln(relative wages)	0.2332 (6.47)	0.3227 (9.05)	0.3090 (8.81)	0.3592 (10.31)	0.4426 (12.67)
2^{nd} lag	-0.0463 (-1.28)	0.0862 (2.44)	-0.0139 (-0.39)	0.1555 (4.48)	0.0146 (0.42)
lag (relative unemployment variable)	0.001035 (4.35)	0.000567 (1.75)	-0.1150 (-1.54)	-0.0419 (-0.61)	0.0539 (0.49)
2^{nd} lag	-0.000045 (-0.22)	0.000496 (1.51)	-0.1021 (-1.37)	-0.1422 (-2.06)	-0.2779 (-2.51)

Note: Relative unemployment variable specification was chosen for each group based on AIC tests among following specifications: linear (URg - UR); log-linear (ln(URg) - ln(UR)); 1 over UR specification (1/URg - 1/UR); and quadratic. Optimal specification was 1/UR for female heads and less-educated females, linear for all others.

Table A-5. Labor Force Participation Rate Equations (Dependent Variables: ln(labor force participation rate for that group))

Independent Variable	Female Heads	Other Less-educated Females	More-educated Females	Less-educated Males	More-educated Males
lag ln(lfpr for group)	0.4140	0.4923	0.3246	0.4324	0.2730
	(11.62)	(13.88)	(9.53)	(12.14)	(7.58)
2nd lag	-0.0227	0.1331	-0.0808	-0.0044	-0.0802
	(-0.63)	(3.80)	(-2.39)	(-0.12)	(-2.24)
lag ln(wage rate for group)	0.0169	0.0188	0.0160	-0.0149	0.0177
	(0.39)	(0.48)	(0.64)	(-0.77)	(1.45)
2nd lag	0.0448	-0.0323	-0.0595	0.0332	0.0013
	(1.05)	(-0.83)	(-2.40)	(1.76)	(0.11)
lag (unemployment rate for group)	-0.1482	-0.2527	-0.1990	-0.1124	-0.1136
	(-3.04)	(-3.85)	(-2.47)	(-3.46)	(-2.20)
2nd lag	-0.0351	-0.0387	0.0876	-0.1068	-0.0270
	(-0.72)	(-0.58)	(1.10)	(-3.18)	(-0.52)
lag ln(AFDC benefit level)	-0.1201	--	--	--	--
	(-2.17)				
2nd lag	0.0153	--	--	--	B
	(0.30)				

Note: AFDC benefits only allowed to affect lfpr of female head group.

Table A-6. AMigration@ Equations (Dependent Variables: ln(population for that group))

Independent variable	Female Heads	Other Less-educated Females	More-educated Females	Less-educated Males	More-educated Males
lag ln(pop for group)	0.5839	0.7782	0.6112	0.8547	0.7084
	(16.40)	(22.13)	(17.54)	(23.95)	(20.06)
2nd lag	-0.0935	0.0872	-0.0348	0.0400	-0.0604
	(-2.61)	(2.56)	(-1.03)	(1.14)	(-1.77)
lag ln(wage rate for group)	-0.1098	0.0427	0.1628	0.0651	0.1664
	(-1.63)	(1.02)	(3.01)	(1.72)	(3.39)
2nd lag	0.0379	-0.0629	-0.0595	-0.0739	-0.0147
	(0.56)	(-1.53)	(-1.10)	(-2.00)	(-0.29)
lag (unemployment rate for group)	-0.0509	-0.0153	-0.1422	-0.0583	-0.7644
	(-0.66)	(-0.22)	(-0.81)	(-0.89)	(-3.64)
2nd lag	-0.0104	-0.0664	-0.0624	-0.0842	-0.3288
	(-0.14)	(-0.94)	(-0.36)	(-1.30)	(-1.56)
lag ln(AFDC benefit level)	0.0255	--	--	--	B
	(0.30)				
2nd lag	0.0989	--	--	B	B
	(1.24)				

Note: AFDC benefits only allowed to affect population of female head group.

Table A-7. Personal Income Equation: (Dependent Variable: ln(state personal income))

Independent Variable	Coefficient (*t*-statistic)
ln(wage rate)	0.1862 (5.30)
lag	-0.0903 (-2.12)
2nd lag	-0.1126 (-3.37)
ln(employment)	0.2670 (7.31)
lag	-0.0053 (-0.12)
2nd lag	-0.1350 (-3.62)
ln (population)	-0.1539 (-3.18)
lag	-0.0600 (-1.01)
2nd lag	0.1492 (3.28)
lag ln(personal income)	1.0651 (28.72)
2nd lag	-0.1688 (-4.20)

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