# Would Active Labor Market Policies Help Combat High U.S. Unemployment?

*By Jun Nie and Ethan Struby*

Two years after the end of the 2007-09 recession, the unemployment rate in the United States remains above 9 percent—roughly double its pre-recession level.

This elevated level of unemployment has a cyclical and a structural component. The cyclical component reflects weakness in the demand for goods and services, which makes employers reluctant to expand their payrolls. By contrast, the structural component reflects potential mismatches in the labor market. These mismatches may include the types of jobs being created versus the skills of unemployed workers, and locations of new jobs relative to unemployed workers. Because their causes are different, addressing structural problems in the labor market requires strategies that are different from those that address cyclical problems.

U.S. labor market policies historically have focused on providing unemployment insurance during downturns. These programs have provided financial support for unemployed workers on the premise that the cyclical downturns would prove to be temporary. Because these programs do not directly help workers find jobs, they are called *passive* labor market policies.

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By contrast, *active* labor market policies seek to increase the probability that unemployed workers will find jobs through more direct approaches, such as training and job-search assistance for unemployed workers, and incentives to employers for expanding their workforces. In a number of foreign countries, these policies have been used extensively to combat structural unemployment. Would active labor market policies be an effective tool to help combat high unemployment in the United States?

This article examines the experiences of a sample of countries in the Organization for Economic Cooperation and Development (OECD) that have a history of using active labor market policies. The analysis finds that two types of active programs can be particularly effective: training programs that equip unemployed workers with skills in demand and job-search assistance that matches unemployed workers with employers. Beyond these two program types, there is little evidence that other active programs (such as employment incentives and direct job creation) reduce unemployment significantly. These findings—together with evidence that the U.S. labor market currently suffers from a certain amount of structural unemployment—suggest that the United States could benefit from more training programs and job-search assistance.

The first section describes the passive and active labor market policies used in OECD countries. The second section uses cross-country data to estimate the ability of active labor market policies to reduce unemployment. The third section discusses the implications for the United States.

## I. LABOR MARKET POLICIES IN OECD COUNTRIES

Many OECD countries previously have confronted stubbornly high unemployment, even during periods of economic growth. In Europe, the phenomenon was so prevalent that it was called "eurosclerosis." Partly as a result of these historical experiences, OECD countries have instituted different labor market policies to help deal with persistent unemployment.

Economists typically divide labor market policies into passive and active policies. The policies differ in their approach to supporting unemployed workers and the conditions under which they are likely to be

most effective. This section reviews the various passive and active labor market policies and describes some of their benefits and drawbacks.

### *Passive labor market policies*

Unemployment benefits and early retirement benefits comprise the bulk of passive labor market policies (PLMP) in use across OECD countries (Chart 1). *Unemployment benefits* are intended to provide income support for workers who are experiencing a period of joblessness or involuntary work reduction. The most common unemployment benefit is unemployment insurance (UI), which is payable to unemployed workers with some kind of work history and who satisfy other criteria. A second type of unemployment benefit is unemployment assistance (UA). UA applies to workers who, for some reason, do not meet the criteria for UI or have exceeded the maximum duration of UI benefits. UA tends to be less generous than UI and normally is means tested.[1] Unemployment benefits also may take the form of partial or part-time benefits, which apply to workers who have had their working hours reduced.

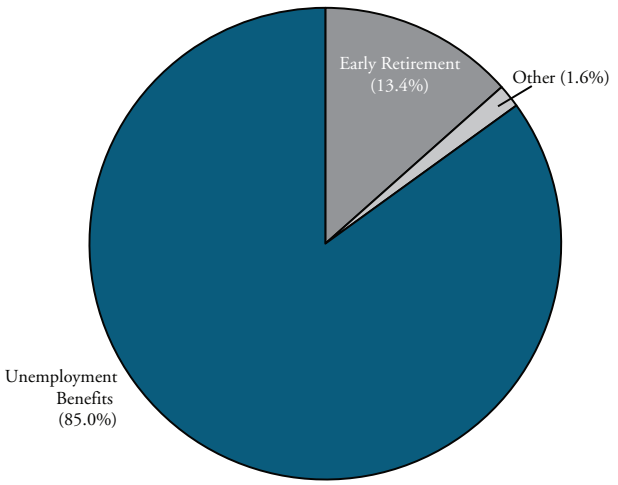
*Early retirement programs* assist workers near retirement age who are out of work and unlikely to find new work. These programs provide assistance until the workers reach the normal retirement age. They are distinct from other retirement programs, including pensions and Social Security or its equivalent, for which many older workers are eligible.[2] One example is the Finnish unemployment pension system. Unemployed workers in Finland who were born before 1950 and are between the ages of 60 and 64 are eligible for an "unemployment pension." They must have worked for at least five years during the previous 15 years and reached the maximum duration of unemployment allowance of 500 days before age 60. These unemployment pensions are automatically converted to a universal social insurance benefit once the worker reaches the official retirement age of 65.

Other types of passive policies are designed to help maintain workers' income after a change or disruption in their employers' activities, but these expenditures are less than 2 percent of the total spending on passive policies.[3]

The ability of passive policies to combat high unemployment rates is unclear. The goal of passive policies is to provide temporary financial

*Chart 1*

## PASSIVE LABOR MARKET POLICY SPENDING BY CATEGORY, OECD AVERAGE. 2004-2008




Source: OECD

support for unemployed workers and their families. Because workers who receive unemployment benefits may not have many other income sources, economists believe recipients spend most of these benefits. In this sense, unemployment benefits are a stabilizer for the economy, as they provide automatic countercyclical fiscal policy in downturns and cushion declines in aggregate demand (Blinder). In addition, generous unemployment benefits may improve the quality of matches among unemployed workers and employers. Such benefits enable workers to take more time in their job search rather than accept the first position they can find (Acemoglu and Shimer). Aside from increasing workers' productivity, better matches potentially reduce the possibility that workers will be terminated and rejoin the unemployed.

On the negative side, generous unemployment benefits may discourage the unemployed from actively looking for jobs, therefore potentially increasing unemployment durations (Summers; Ljungqvist and Sargent). In turn, workers who suffer long unemployment periods may have a lower probability of returning to employment (Meyer; Hornstein and Lubik). Although the negative effects of unemployment benefits on job seeking exist whether the economy is expanding or

contracting, they are mitigated when the economy is booming: When jobs are readily available, the disincentive effects from unemployment benefits will be offset by strong labor demand.

### *Active labor market policies*

In contrast to passive policies, the focus of active labor market policies (ALMP) is to increase the employability of unemployed workers. Generally, ALMP fall into six categories: training programs, job-search assistance, employment incentives, supported employment, direct job creation, and other policies (Chart 2).

*Training programs* primarily focus on vocational training for the unemployed or those who are at risk of losing their jobs. Training programs provide workers with specific skills that are in demand to smooth the transition to new employment. For example, the German government operates extensive training programs that include several types of interventions. These include so-called "further training," aimed at technical development and advancing the careers of trainees, as well as retraining programs that support up to two years of education toward a new vocational education degree or certification. Training may also include grants to firms for general staff training and incentives to employers to recruit apprentices or train workers from targeted groups. Training programs make up the largest share of ALMP spending.

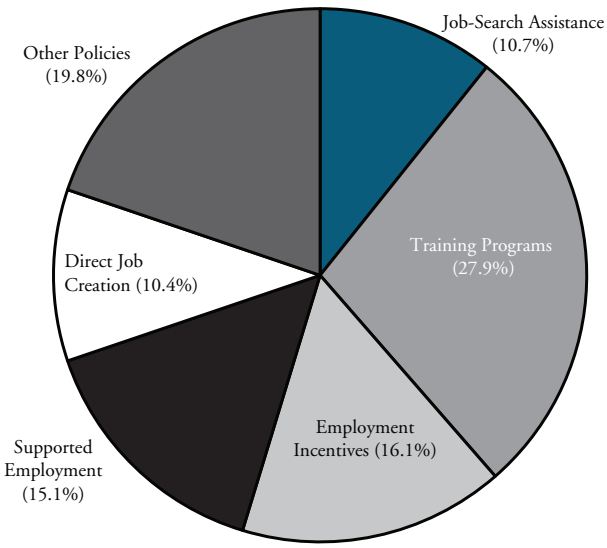
*Job-search assistance* includes programs intended to connect employers to the unemployed more efficiently than they might have matched up otherwise. It includes referrals to available jobs or training, job brokerage services for employers, and financial assistance to help pay for the costs of a job search or relocation to take a job.

*Employment incentives* are temporary payments to facilitate the transition of the unemployed into jobs. These include employer subsidies to hire new employees, as well as targeted bonuses paid to individuals for taking a job. Employment incentives also may include payments to employers to facilitate continued employment during restructuring.

*Supported employment* includes subsidies for employing workers with a reduced capacity to work, as well as vocational rehabilitation or training for workers to prepare them to move to nonsupported work.

*Chart 2*

## ACTIVE LABOR MARKET POLICY SPENDING BY CATEGORY, OECD AVERAGE, 2004-2008




Source: OECD

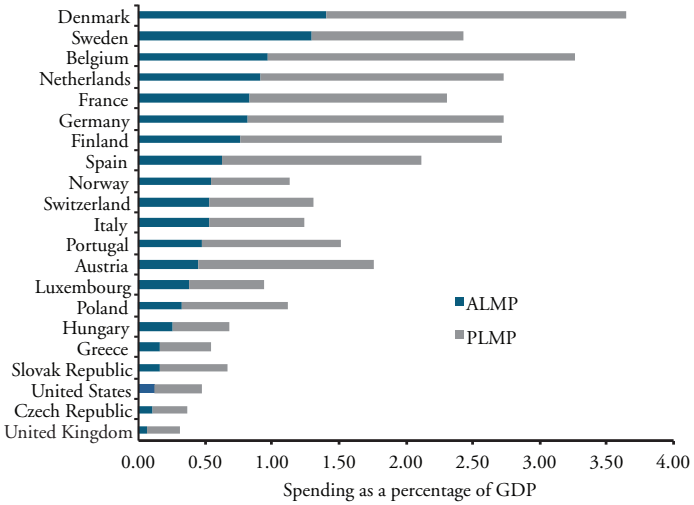
*Direct job creation* includes programs that create temporary, nonmarket jobs that would not have existed without the policy. These jobs often are in the public or nonprofit sector and are targeted at long-term unemployed or groups that are difficult to place in other types of jobs. An example is France's "Jobs for Young People" program, which subsidizes fixed-term contracts for young people in government, nonprofit civil organizations, and private organizations that manage public services.

*Other policies* are quite diverse. They include start-up incentives to encourage entrepreneurship among the unemployed, which were introduced in 2003 in Germany as part of the Hartz reforms.[4] They also include a variety of other spending, such as administration expenses associated with labor market programs that are included in other categories.

By design, active labor market policies aim to increase the employability of jobless workers and reduce unemployment, regardless of whether the economy is in an upturn or a downturn. In practice, however, the effectiveness of active policies may vary with the business

*Chart 3*

## RELATIVE LABOR MARKET POLICY SPENDING, 1998-2008




Note: The bars represent the average annual labor market policy spending as a percentage of GDP between 1998 and 2008, divided into active and passive policy spending, for the 20 OECD countries studied in this article plus the United States.
Source: OECD

cycle. This variation occurs because the largest categories of active policies—such as training and job-search assistance—are meant to improve the quality and efficiency of matching the unemployed (labor supply) with employers (labor demand). Therefore, if labor demand is weak and few jobs are available, active policies may be less effective.[5]

### *The use of passive and active policies in different countries*

The level of spending on labor market policies differs widely across OECD countries. Between 1998 and 2008 in 21 OECD countries, total expenditures on passive and active labor market policies as a fraction of GDP ranged from about 4 percent in Denmark to 0.25 percent in the United Kingdom (Chart 3). The United States is near the bottom of this list, spending slightly less than 0.5 percent of GDP on labor market policies during this time.

In addition, the fraction of spending on active versus passive policies differs across countries. Outside the United States, the average country in Chart 3 devoted 59 percent of labor market policy expenditures to PLMP and 41 percent to ALMP. In the United States, how-

ever, 70 percent of expenditures went to PLMP and 30 percent went to ALMP.

Another common method to measure spending on labor market policies is to consider expenditures per unemployed worker as a percentage of GDP per capita.[6] This measure adjusts for differences across countries in unemployment rates and the size of the economy. Between 1998 and 2008, average expenditures on PLMP in the United States on each unemployed worker were about 12 percent of GDP per capita, while the average level for the 20 other OECD countries in Chart 3 was about 25 percent of GDP per capita. The U.S. expenditures on ALMP were even less: Over the same period, expenditures on ALMP per unemployed worker in the United States were about 5 percent of GDP per capita, while the average spending per unemployed worker for the 20 other OECD countries was approximately 19 percent of GDP per capita. How large were the effects of these different uses of ALMP on unemployment? Does the form of ALMP spending matter in terms of its effect on the unemployment rate? The next section provides a more formal analysis to answer these questions.

## II. HOW EFFECTIVE ARE ACTIVE LABOR MARKET POLICIES IN REDUCING UNEMPLOYMENT?

The effectiveness of active labor market policies in reducing the unemployment rate can be quantified by examining the experiences of different OECD countries that have used a variety of labor market policies over multiple years. In particular, panel regressions can uncover the relationship between the key variable of interest—the unemployment rate—and the factors that may influence this variable, such as different labor market policies and other relevant variables. This exercise provides estimates of the overall effectiveness of ALMP in reducing unemployment and the effectiveness of individual ALMP categories, such as training programs, job-search assistance, employment incentives, and others.

A nation's unemployment rate is influenced by many factors, and labor market policies comprise only one such factor. Properly measuring the impact of these policies on unemployment rates requires carefully controlling for other factors. For example, in addition to active and passive labor market policies, countries may have varied unemploy-

ment rates because they differ in certain institutional features, such as the degree of employment protection or the extent of unionization. Tax policies also influence unemployment rates through the so-called "labor tax wedge" between the employer's labor cost and the corresponding net take-home pay of the employee.[7]

The business cycle plays an important role in determining the unemployment rate. When the economy is booming, the unemployment rate tends to be low even if few resources are devoted to labor market policies. In a recession, the unemployment rate usually will be high even if labor market policies are used more intensively. Models that ignore changes in aggregate conditions will inaccurately estimate the effects of labor market policies. Thus, the output gap—the difference between the actual level of output and the level of output associated with a stable inflation rate—is included as an explanatory variable to summarize conditions in the aggregate economy.[8]

Although all the factors mentioned above usually vary over time, time-invariant and country-specific factors (such as culture, geography, and political systems) also may cause unemployment rates to differ across countries. Thus, the models also include a "fixed-effect" component.[9]

The ideal data for estimating the effect of labor market policies on unemployment would be a series of observations of different unemployment rates associated with different policies and institutional measures. Unfortunately, policies and institutional features do not change frequently within a given country. Therefore, this article explores the annual cross-country experiences in a sample of 20 OECD countries that engaged in ALMP over the period 1998-2008.[10]

Overall, active labor market policies tend to reduce the unemployment rate (Table 1, column 1). The regression results show that an increase in spending on active labor market policies of 1 percent typically reduces the unemployment rate by 0.11 percentage point. To put this statistic in perspective, the average level of ALMP expenditures per unemployed worker is 19 percent of GDP per capita across OECD countries in the sample. Increasing this spending to 20 percent of GDP per capita—which would require an additional $274 of spending per unemployed person in 2011 dollars—would reduce unemployment by 0.11 percentage point.[11]

*Table 1*

## EFFECTS OF LABOR MARKET POLICIES ON UNEMPLOYMENT

| Explanatory Variable | Specifications | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| Labor Force Participation Rate | 0.15* | 0.20** | 0.26** |
| | (0.09) | (0.90) | (0.10) |
| Union Density | 0.30** | 0.35** | 0.31** |
| | (0.05) | (0.07) | (0.09) |
| Employment Protection | -0.92 | -1.44 | 0.88 |
| | (0.99) | (1.12) | (1.67) |
| Tax Wedge | 0.20* | 0.15 | 0.49** |
| | (0.11) | (0.12) | (0.16) |
| Output Gap | -0.42** | -0.42** | -0.42** |
| | (0.07) | (0.08) | (0.08) |
| PLMP | 0.01 | | |
| | (0.03) | | |
| Initial Unemployment Benefit Replacement Ratio | | 0.01 | -0.04 |
| | | (0.04) | (0.04) |
| Unemployment Benefit Duration | | 4.82** | 7.59** |
| | | (1.85) | (3.24) |
| ALMP | -0.11** | -0.11** | |
| | (0.03) | (0.02) | |
| Job-Search Assistance | | | -0.31* |
| | | | (0.17) |
| Employment Incentives | | | -0.15 |
| | | | (0.13) |
| Supported Employment | | | -0.05 |
| | | | (0.11) |
| Training | | | -0.20** |
| | | | (0.07) |
| Direct Job Creation | | | 0.27* |
| | | | (0.14) |
| Other Policies | | | -0.30** |
| | | | (0.13) |
| Observations (N) | 157 | 119 | 119 |
| Overall R-squared | 0.01 | 0.04 | 0.03 |

Notes: Standard errors indicated in parentheses. * Indicates significant at 90 percent level. ** Indicates significant at 95 percent level. Labor market policies are defined as spending per unemployed worker as a percentage of GDP per capita. This table reports the regression results for the three different specifications considered in this article. Specification 1 examines the aggregate effects of ALMP and PLMP on the unemployment rate. Specification 2 examines the effects of unemployment benefits on the unemployment rate. Specification 3 breaks down ALMP into six categories as defined in Section I. See the text and Appendix B for more details of different model specifications.

By contrast, passive labor market policies typically do not reduce the unemployment rate. The empirical results suggest that if PLMP expenditures per unemployed worker increase by 1 percent of GDP per capita, from the OECD average of 25 percent to 26 percent, the unemployment rate would *increase* by 0.01 percentage point. This result suggests that more PLMP spending may not help reduce unemployment and may even increase the unemployment rate, though the point estimate is not statistically different from zero. As the literature studying UI benefits suggests, when provided with more generous benefits, unemployed workers will have less incentive to look for jobs and will be more reluctant to accept lower income jobs (Ljungqvist and Sargent). Both of these factors may lead to an increase in the unemployment rate.

To pursue this idea further, column 2 of Table 1 separates PLMP expenditures into two common measures: the duration of unemployment benefits and the ratio of unemployment benefits to the past wage, also called the replacement ratio. The estimates show that, if the maximum unemployment-benefit duration increases by one year, the unemployment rate increases by about 0.29 percent.[12] Similarly, increasing the replacement ratio also increases the unemployment rate, but again the associated effect is economically small and not statistically significant.

Several other variables have significant effects on the unemployment rate. For example, an increase in the labor force participation rate typically increases the unemployment rate. Wider union coverage is associated with a higher unemployment rate, possibly because unionization pushes up labor costs. Similarly, a larger labor tax wedge increases the unemployment rate because it raises labor costs for employers and thus reduces the demand for labor. Finally, the output gap is always negatively correlated with the unemployment rate.

Although active policies are effective overall in reducing unemployment rates, certain policies may be better than others. To assess this possibility, the model is rerun after breaking down spending among active policies into the commonly defined categories (Table 1, column 3).

The regression results suggest that two ALMP categories appear to be especially helpful in reducing unemployment rates: training

and job-search assistance.[13] Increasing the expenditures per unemployed worker on these two active policies by 1 percent of GDP per capita is estimated to reduce the unemployment rate by 0.20 percentage point and 0.31 percentage point, respectively.[14] However, the mechanisms through which these two policies help reduce the unemployment rate are very different. Training is designed to improve the employability of unemployed workers by enhancing their skills, while job-search assistance tries to make it easier to match the unemployed with employers.

The results for other types of active programs are mixed. Although the regression results suggest that the *other policies* category can reduce the unemployment rate, it is difficult to understand the mechanism through which this category works because the expenditures for this group mainly are devoted to benefits administration, which is not considered to be a typical tool of ALMP.[15] Although programs such as employment incentives and supported employment appear to reduce the unemployment rate as well, their effects are not statistically significant.

Finally, the regressions suggest one counterintuitive finding. In the sample of OECD countries, higher spending on direct job-creation programs tends to be associated with a higher rate of unemployment. How can increased spending on direct job creation result in fewer jobs and hence higher unemployment?

The answer lies in the discrepancy between spending on direct job-creation programs and the number of jobs actually created by that spending—also known as the stock of participants in direct job-creation programs. Direct job-creation programs typically target certain unemployed workers who have specific difficulties in acquiring jobs. As such, increased spending on these programs often reflects higher costs of putting participants to work, rather than more jobs being created by that spending.[16]

### *The cost-effectiveness of active labor market policies*

Although some types of active policies appear to be more effective than others in reducing unemployment rates, there is concern about whether these policies are cost-effective. Between the costs associated with supporting aging populations and the fiscal ramifications of the

recent financial crisis, many OECD countries face high levels of government debt. As a result, ensuring that active policies are an effective use of government spending is crucial. To address these concerns, this section considers the cost-effectiveness of ALMP.

The cost-effectiveness analysis focuses on added economic value from ALMP, measured by increased GDP. In the simplest setting, if spending one extra dollar on active policies tends to increase GDP by more than one dollar, the policy passes the cost-effectiveness test.[17] Following this spirit, the cost-effectiveness analysis compares the total cost of increasing ALMP expenditures per unemployed worker by 1 percent of GDP per capita with the increased GDP that is attributable to that policy. If the benefit of a particular type of active policy is greater than the cost, it is considered cost-effective.

To provide a comprehensive comparison, the cost-effectiveness analysis considers both active policies that have a significant association with reduced unemployment rates (overall ALMP, training, and job-search assistance) as well as the categories that tend to reduce the unemployment rate but whose effects are not statistically significant (employment incentives and supported employment programs).

To calculate the change in GDP from increased use of ALMP, three estimates are needed. The first is the effect of the active policy on the unemployment rate. The regression in the previous subsection provides this estimate: it measures the change in the unemployment rate from a 1 percent change in ALMP spending. For example, column 1 of Table 1 shows that increasing overall ALMP spending by 1 percent is associated with a 0.11 percentage point decline in the unemployment rate.

The second translates the change in ALMP spending into GDP terms, which is necessary because the regression uses spending per unemployed worker as a fraction of GDP per capita. Continuing the example, increasing ALMP spending per unemployed by 1 percent of GDP per capita cost 0.04 percent of GDP on average for the countries in the sample, or about $230 million (in 2011 dollars).[18]

The third estimate needed for the analysis is the effect of the change in the unemployment rate on GDP.[19] Two different ways to measure the impact of a change in unemployment on GDP are considered, giving rise to two cost-effectiveness approaches. The first approach uses Okun's law to determine the extent to which GDP varies with the change in

*Table 2*
## COST-EFFECTIVENESS ANALYSIS, OKUN'S LAW

| Row | Policy | Change in unemployment, percentage points | Cost, as a percentage of GDP | Increase in GDP, percent | Cost-Effective? |
|---|---|---|---|---|---|
| 1. | ALMP | -0.11 | 0.04 | 0.09 | Yes |
| 2. | Training | -0.20 | 0.12 | 0.16 | Yes |
| 3. | Job-Search Assistance | -0.31 | 0.01 | 0.25 | Yes |
| 4. | Employment Incentives | -0.15 | 0.04 | 0.12 | Yes |
| 5. | Supported Employment | -0.05 | 0.04 | 0.04 | Yes |

Notes: As explained in Approach 1, the estimate of Okun's law is used in calculating the change in GDP. The Okun's law relationship is estimated for all countries over the sample period. The explanation of ALMP categories is found in Section I. The cost in terms of GDP represents the cost of increasing expenditures per unemployed worker on each policy by 1 percent of GDP per capita.

the unemployment rate.[20] The second approach directly calculates the change in GDP after making certain assumptions about changes in the labor force and workers' productivity.[21]

Despite their differences, both approaches find that active labor market policies are overall cost-effective in reducing the unemployment rate. Table 2 presents the results based on Okun's law. A 1 percent increase in total ALMP spending reduces the unemployment rate by 0.11 percentage point (row 1). The cost of increasing ALMP spending is 0.04 percent. However, the decrease in unemployment associated with increasing total ALMP spending results in a 0.09 percent increase in GDP. Because the increase in GDP is larger than the cost, the policy is cost-effective.

In general, the Okun's law approach finds that most active policies are cost-effective. This includes the two policies that were found to have a significant association with reduced unemployment rates—training and job-search assistance—as well as employment incentives and supported employment.

Table 3 presents the results from varying the productivity of the newly employed. Once again, overall ALMP spending is cost-effective

*Table 3*

## COST-EFFECTIVENESS ANALYSIS, VARYING LABOR FORCE AND PRODUCTIVITY

| | | | | Assumptions: no change in the labor force, newly employed workers are as productive as previously employed workers | | Assumptions: no change in the labor force, newly employed workers are half as productive as previously employed workers | |
|---|---|---|---|---|---|---|---|
| Row | Policy | Change in unemployment, percentage points | Cost, as a percentage of GDP | Increase in GDP, percent | Cost-Effective? | Increase in GDP, percent | Cost-Effective? |
| 1. | ALMP | -0.11 | 0.04 | 0.12 | Yes | 0.06 | Yes |
| 2. | Training | -0.20 | 0.12 | 0.22 | Yes | 0.11 | No |
| 3. | Job-Search Assistance | -0.31 | 0.01 | 0.33 | Yes | 0.17 | Yes |
| 4. | Employment Incentives | -0.15 | 0.04 | 0.16 | Yes | 0.08 | Yes |
| 5. | Supported Employment | -0.05 | 0.04 | 0.05 | Yes | 0.02 | No |

Notes: The change in unemployment is based on Approach 2 as explained in Appendix C. The cost in terms of GDP represents the cost of increasing expenditures per unemployed worker on each policy by 1 percent of GDP per capita.

(row 1). This is true whether the newly employed workers are equally productive relative to previously employed workers (in which case GDP increases by 0.12 percent) or half as productive (in which case GDP increases by 0.06 percent).

Notably, the results from Table 3 show the importance of productivity in assessing the cost-effectiveness of various types of active policies. Intuitively, adding less-productive workers to the ranks of the employed contributes less to GDP. Whether a program can pass the cost-effectiveness test thus depends both on how much it increases employment and the productivity of those workers. If the newly employed are unskilled relative to existing workers or their skills do not match their new jobs, the program may reduce the unemployment rate, but the increased value in terms of GDP cannot cover the expenditures associated with the program.[22] If the productivity of newly employed workers is low, the active labor market policies studied in this article could fail the cost-effectiveness test. From this point of view, programs that either can improve the productivity of unemployed workers or

can better match the skills of unemployed workers with related jobs are more likely to be cost-effective.[23]

Training programs and supported employment programs are most affected by the productivity of the hires they create. If newly employed workers are just as productive as previously employed workers, then training and supported employment programs are cost-effective (Table 3, rows 2 and 5, respectively). However, the programs are not cost-effective if the newly employed are only half as productive as the previously employed.

## III. WOULD ACTIVE LABOR MARKET POLICIES HELP REDUCE UNEMPLOYMENT IN THE UNITED STATES?

The U.S. unemployment rate rose dramatically during the 2007-09 recession. After peaking at 10.1 percent in October 2009, the unemployment rate has remained about 9 percent two years after the official end of the recession (Chart 4). Further illustrating the weakness in the labor market, more than 40 percent of the unemployed have been out of work for at least 27 weeks.

A number of factors have contributed to this persistently elevated unemployment in the United States.

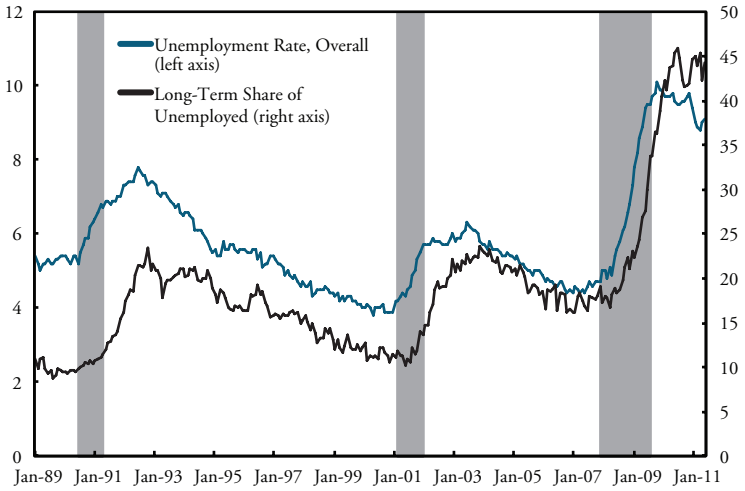
First and most importantly, weak demand in the U.S. economy has contributed to high unemployment (for example, Kocherlakota). Firms facing little growth in demand for their goods and services have no need to expand production and hire more workers, or they may be able to expand production slightly through productivity gains. This lack of demand leads to few job openings, slow hiring, and high unemployment.

Second, mismatch in the labor market also may be contributing to the weak job market. One estimate suggests that mismatch across industries and occupations accounts for 0.8 percentage point to 1.4 percentage points of the recent rise in the unemployment rate (Şahin and others).[24] This mismatch occurs because the recession affected different sectors of the economy differently. For example, many workers in the construction sector lost their jobs during the recession. However, in the recovery, more jobs have been created in education and health services than in construction. Therefore, one problem for construction workers who lost their jobs is that their skills may not match the skills demanded by industries adding new jobs.

Third, the depressed housing market may contribute to the high unemployment rate because it reduces the mobility of the unemployed.

*Chart 4*

## UNEMPLOYMENT STATISTICS IN THE UNITED STATES




Notes: Shading indicates a recession as determined by the National Bureau of Economic Research. The long-term share of unemployed measures the percentage of unemployed workers who have been out of work for at least 27 weeks.
Source: BLS

Unemployed workers may be unable to sell their houses and move to an area with more promising employment prospects—a situation economists have termed "house lock" (Estevão and Tsounta). Because the recession and recovery have affected various regions of the country unevenly, reduced household mobility may be an impediment to unemployed workers being able to take advantage of relatively stronger growth in other areas of the country.[25]

Fourth, extensions of UI benefits in the last few years also may have increased the unemployment rate. As discussed earlier, extended UI benefits may reduce the incentives for unemployed workers to search actively for jobs or to take low-wage jobs they might have taken without the extended benefits. The extensions of UI benefits during and following the recession appear to have increased the U.S. unemployment rate by 0.8 percentage point to 1.7 percentage points (Fujita; Valletta and Kuang).[26]

Solving these problems in the U.S. labor market requires diverse strategies, and clearly there are no simple solutions. Nevertheless, active labor market policies—especially training and job-search assistance—may hold some promise for helping reduce skill and geographic

mismatch in the labor market. The previous section found that these policies have been a cost-effective way to help combat unemployment in other OECD countries. Moreover, the United States has spent much less on ALMP than most other OECD countries, suggesting that there is scope for further programs. Thus, it is useful to apply the analysis of ALMP to the U.S. economy to provide some preliminary evidence on how active policies could help reduce the U.S. unemployment rate.

For example, one interesting question is: "How much would the United States have to spend on active labor market policies to reduce the unemployment rate by 1 percentage point, say, from 9 percent to 8 percent?" To answer this question, Table 4 provides the estimated costs associated with using different programs to achieve this goal. The estimated amount the United States would have to spend using overall ALMP to help reduce the unemployment rate by 1 percentage point is about $79.5 billion (in 2011 dollars).[27] If the United States were to focus only on training programs, the costs would be $43.7 billion. On the other hand, it would cost $28.7 billion if the government only used job-search assistance to reduce the unemployment rate by the same amount. Based on the results in the previous section, such spending should also be cost-effective if the productivity of the newly employed workers is high enough.

Reducing unemployment by 1 percentage point using employment incentives or supported employment would cost more—$56.8 billion and $191.8 billion, respectively. This significantly larger spending mainly reflects the much smaller estimates of the effects of these types of spending on unemployment (Table 1, column 3).[28]

These results should be read cautiously for several reasons. First, the spending amounts reported are not sufficient to reduce the unemployment rate on their own. In particular, as discussed in previous sections, training programs and job-search assistance mainly help the unemployed gain needed skills for new jobs or help them find new jobs more efficiently. In this sense, spending on these programs can *help* reduce the unemployment rate *if* sufficient jobs already exist in the economy. If there are not enough jobs available, however, the effects of increasing spending on training programs and job-search assistance may be much smaller.

Second, the statistical analysis in this article is based on estimates from 20 OECD countries excluding the United States. The U.S. la-

*Table 4*

## ESTIMATED COSTS OF REDUCING U.S. UNEMPLOYMENT

| Policy | Cost of reducing U.S. unemployment rate from 9 percent to 8 percent, billions of 2011 dollars |
|---|---|
| ALMP | 79.5 |
| Training | 43.7 |
| Job-Search Assistance | 28.7 |
| Employment Incentives | 56.8 |
| Supported Employment | 191.8 |

Note: Costs in 2011 dollars, adjusted using the GDP deflator for the 2011 Q1 third release.

bor market differs from other OECD countries in many respects. For example, economists have noted important differences between the United States and other OECD countries in terms of the degree of employment protection, unionization, tax wedges, the labor force participation rate, the generosity of unemployment benefits, and other labor market institutions. Although many of these differences have been taken into account in the analysis, no model can perfectly capture all differences. It is possible there are factors not taken into account that limit the applicability of the results of Section II for the United States.

Third, the models in this article are relatively simple. They characterize linear relationships between unemployment and labor market policies. They are also static, focusing on the effects of labor market policies on unemployment within the same period. Although these techniques are common in policy evaluation and are relatively easy to understand and interpret, they may not capture the dynamic and nonlinear effects of ALMP on unemployment.

Fourth, properly designing ALMP for the United States may be challenging. Although certain active policies can reduce the aggregate unemployment rate on average, particular labor market policies may have a wide range of effects on the employment probabilities and earning prospects of individuals (Heckman and others). In addition, effective ALMP must be designed to fit the specific structure of a country's labor market. Thus, directly copying from the models of other countries may not be appropriate or helpful.

Finally, the impact of the use of ALMP on the government budget also should be taken into account because these policies mainly rely on

public funds. In the long run, ALMP may help reduce unemployment, increase GDP, and thus potentially increase tax revenues. However, it takes time for active policies to reduce unemployment, and thus the spending on these programs may increase the government's fiscal deficit in the short run. In considering whether to implement ALMP, it also is wise to compare the trade-offs of spending on ALMP with other policies that have the potential to reduce unemployment by boosting weak demand.

Nevertheless, the results in this article suggest that the United States may benefit from investing more in ALMP—or by combining passive and active labor market policies as other countries have—to hasten a decline in the unemployment rate as the economic recovery proceeds.

## IV. CONCLUSIONS

This article uses data from 20 OECD countries during 1998-2008 to study the effects of active labor market policies on unemployment and whether these policies also are cost-effective. The analysis finds that overall active labor market policies are cost-effective in reducing unemployment. Within major categories of active policies, training programs that help the unemployed gain the skills needed in the labor market and job-search assistance that improves the efficiency with which workers are matched with employers are especially useful in reducing unemployment rates.

These findings, together with the evidence from some recent studies that the level of structural unemployment has risen in the United States, suggest that using more training programs and job-search assistance may be helpful in reducing the high unemployment rate in the United States.

# APPENDIX A

## DATA DESCRIPTION

The regression analysis uses annual data from 1998–2008 on 20 OECD countries. The countries analyzed were selected on the basis of data availability over the duration of the sample. Except for the data on replacement ratios, all data were taken from various components of the OECD.Stat database.

Data on the unemployment rate and labor force participation come from the OECD Annual Labor Force Survey. The Survey includes data from the European Union's Eurostat database. The measure of trade union density generally is collected by the OECD from national survey and administrative data and occasionally based on estimates.

The OECD's measure of employment protection is constructed by weighting 21 different indicators of strictness of regulations for dismissing workers (for example, notification requirements and severance pay) and for hiring temporary or fixed-contract workers.

Data on ALMP and PLMP come from OECD's labor market programs data. OECD breaks ALMP spending as a percentage of GDP into seven groups: (1) Public Employment Services (PES) and Administration, (2) Training, (3) Job Rotation and Sharing, (4) Employment Incentives, (5) Supported Employment and Rehabilitation, (6) Direct Job Creation, and (7) Start-up incentives. The first group also includes benefits administration. Groups (3) and (7) are small relative to other categories. Thus, this article aggregates ALMP along the categories in Section I.

Data on replacement ratios come from the OECD's Tax-Benefit Indicator statistics. The initial unemployment benefit replacement ratio is the percentage of wages replaced net of taxes during the initial period of unemployment. The replacement ratio is averaged over eight different types of households, reflecting two different wage levels (either 67 percent or 100 percent of the national average wage), marital status (either single or married with only one person earning), and the presence of dependent children (either no children or two children). Following the literature, the measure for the duration of unemployment benefits is calculated as the replacement ratio in the first year of unemployment divided by the replacement ratio over the first five years of unemployment.

Data on the output gap—the deviation of actual GDP from potential GDP—is taken from the OECD's annual *Economic Outlook*.

The tax wedge is measured as the average difference between total labor compensation and net take-home pay as a ratio of total labor compensation, and is taken from the OECD's Taxes and Wages database.

# APPENDIX B

## MODEL DESCRIPTION

This appendix describes the models estimated in Section II of this paper. The analysis in Section II starts by looking at aggregate measures of expenditures on both active and passive labor market policies.[29] A model is estimated using a fixed-effects panel regression for the unemployment rate in country *i* in year *t* based on the following equation:

$$\begin{aligned} &\textit{Unemployment Rate}_{it} \\ &= \beta_i + \beta_1 (\textit{Labor Force Participation Rate})_{it} + \beta_2 (\textit{Union Density})_{it} \\ &+ \beta_3 (\textit{Employment Protection})_{it} + \beta_4 (\textit{Tax Wedge})_{it} + \beta_5 (\textit{Output Gap})_{it} \\ &+ \beta_6 (\textit{ALMP})_{it} + \beta_7 (\textit{PLMP})_{it} + \varepsilon_{it} \end{aligned}$$

The $\beta_i$ represents country *i's* fixed effect and $\varepsilon_{it}$ is an error term. Union density is the ratio of wage earners who are members of a trade union to the total number of wage/salary workers. ALMP and PLMP represent expenditures on active and passive labor market policies per unemployed worker as a percentage of GDP per capita, respectively. The $\beta_j$ are estimated and represent the effects of a one unit increase of each variable on the unemployment rate.

The second specification breaks down PLMP into the replacement ratio and duration of unemployment benefits:

$$\begin{aligned} &\textit{Unemployment Rate}_{it} \\ &= \beta_i + \beta_1 (\textit{Labor Force Participation Rate})_{it} + \beta_2 (\textit{Union Density})_{it} \\ &+ \beta_3 (\textit{Employment Protection})_{it} + \beta_4 (\textit{Tax Wedge})_{it} + \beta_5 (\textit{Output Gap})_{it} \\ &+ \beta_6 (\textit{ALMP})_{it} + \beta_7 (\textit{Initial Unemployment Benefit Replacement Ratio})_{it} \\ &+ \beta_8 (\textit{Unemployment Benefit Duration})_{it} + \varepsilon_{it} \end{aligned}$$

The third specification breaks down ALMP into major categories, as follows:

$$
\begin{aligned}
&\textit{Unemployment Rate}_{it} \\
&\quad = \beta_i + \beta_1 (\textit{Labor Force Participation Rate})_{it} + \beta_2 (\textit{Union Density})_{it} \\
&\quad + \beta_3 (\textit{Employment Protection})_{it} + \beta_4 (\textit{Tax Wedge})_{it} + \beta_5 (\textit{Output Gap})_{it} \\
&\quad + \beta_6 (\textit{Initial Unemployment Benefit Replacement Ratio})_{it} \\
&\quad + \beta_7 (\textit{Unemployment Benefit Duration})_{it} + \beta_8 (\textit{Job-Search Assistance})_{it} \\
&\quad + \beta_9 (\textit{Employment Incentives})_{it} + \beta_{10} (\textit{Supported Employment})_{it} \\
&\quad + \beta_{11} (\textit{Training})_{it} + \beta_{12} (\textit{Direct Job Creation})_{it} + \beta_{13} (\textit{Other Policies})_{it} \\
&\quad + \varepsilon_{it}
\end{aligned}
$$

# APPENDIX C

## TWO APPROACHES FOR THE COST-EFFECTIVENESS ANALYSIS

This section describes the two approaches used to conduct the cost-effectiveness analysis.

**Approach 1**

The first approach uses Okun's law to determine the extent to which GDP changes with changes in the unemployment rate.

**Step 1.** For a given type of ALMP, suppose the current expenditures per unemployed as a percentage of GDP per capita are increased by 1 percentage point. The total cost (as a percentage of GDP) of doing so can be computed from the current total expenditures of this type of ALMP as a percentage of GDP and the current expenditures per unemployed worker as a percentage of GDP per capita. Call this number $x$. *Example*. Suppose the current expenditures on training programs per unemployed worker are 5 percent of GDP per capita and the total expenditures of training are 0.2 percent of GDP. Then, the cost (as a percentage of GDP) of increasing the expenditures per unemployed on training from 5 percent to 6 percent of GDP per capita is equal to $0.2\times(6-5)/5=0.04$ percent of GDP.[30]

**Step 2.** Estimate the relationship between the change in the unemployment rate and GDP growth (Okun's law) using the data from the same set of OECD countries over the same period used in the previous section. This provides an estimate of the amount $y$ that GDP growth will increase if the unemployment rate falls by 1 percentage point. In addition, the model presented in Section II provides an estimate of the change in the unemployment rate resulting from this 1 percentage point increase in expenditures per unemployed worker as a percentage of GDP per capita. Call this amount $z$.

**Step 3.** Given the GDP level in the previous year, a 1 percentage point increase in the GDP growth rate in this year means that the GDP level increases by 1 percent in this year. In this way, the change in GDP growth can be linked to the change of the level of GDP. Thus, using the estimates in Step 2, if the expenditures per unemployed of this type

of ALMP increase by 1 percent of GDP per capita, it will increase the level of GDP level by percent.

**Step 4.** If, $yz \geq x$ the total added GDP exceeds the total expenditures on this type of ALMP, thus, it is cost-effective; otherwise, the policy is not cost-effective.

**Approach 2**

The second approach directly calculates the change in GDP after making certain assumptions about changes in the labor force and the productivity of workers.

**Step 1.** For a given type of ALMP, suppose the current expenditures per unemployed as a percentage of GDP per capita will be increased by 1 percentage point. The total cost (as a percentage of GDP) of doing this can be calculated from the current expenditures on this type of ALMP as a percentage of GDP and the current expenditures per unemployed as a percentage of GDP per capita. Call this number $x$. In addition, the model presented in Section II provides an estimate of the change in the unemployment rate resulting from this 1 percentage point increase in expenditures per unemployed as a percentage of GDP per capita on this type of ALMP. Call this amount $y$.

**Step 2.** To calculate the GDP change due to a 1 percentage point change in the unemployment rate, two assumptions are needed: the change in the labor force and the relative productivity of newly employed workers. A decrease in the unemployment rate will increase GDP by an amount that depends on the size of the labor force, average productivity of new workers, and the current unemployment rate. Specifically, a $y$-percentage-point decrease in the unemployment rate will increase GDP by $[a+(100+a)\times y/(100+u)]\times b$ percent, where $a$ is the change in the labor force, $b$ is the average productivity of newly employed workers compared with all employed workers, and $u$ is the current unemployment rate (in percentage points).[31] Basically, this formula says that, holding other things unchanged, an increase in the size of the labor force will increase GDP, because more workers are employed. Similarly, the more productive newly employed workers are, the greater the increase in GDP.

**Step 3.** If the change in GDP (as calculated above) is greater than $x$, the total added GDP exceeds the total expenditures on this type of ALMP and thus it is cost-effective; otherwise, the policy is not cost-effective.

## ENDNOTES

[1]Financing systems for UI and UA differ across countries. Most countries considered in this article pay UI benefits out of a government-established fund, which primarily is financed by payroll contributions from employers and workers but may be supplemented by public funds. Some Nordic countries have a more complex system. In Finland, for example, there are three sources of funds: a basic UI benefit that is paid by the government out of public funds, a system of 32 unemployment funds (divided by profession) that receive contributions from their member employees, and a government-established Unemployment Insurance Fund that is funded by contributions from workers and employers. In most countries, UA is funded through central or municipal governments.

[2]Disability benefits, such as those offered by Social Security Disability Insurance in the United States, typically fall outside the scope of labor market policies considered in this article.

[3]For instance, some countries compensate workers for wages not paid due to employer insolvency. In Sweden, the employees of a firm that is in bankruptcy proceedings and has insufficient assets to cover employees' wages may receive compensation from the state under the terms of the Wage Guarantee Act. A few countries compensate or provide assistance to employees who have been made redundant. Prior to 2004, Finland compensated workers over age 45 who became unemployed due to "financial or production-related problems for the employer." However, compensation was contingent on seeking retraining or a new job.

[4]Other types of start-up subsidies, such as those focusing on the unemployed during the early employment period, already existed in Germany from 1986.

[5]However, other categories of ALMP, such as employment incentives, supported employment, and direct job creation, are intended to help boost the demand for workers.

[6]For example, see Layard and others, Bassanini and Duval, and Schmitt.

[7]For example, see OECD Employment Outlook 2006.

[8]Appendix A provides a detailed description of the data sources and the definition of each variable used in the regressions.

[9] Appendix B provides more details on the regression models considered in this article. Although the model estimated in this article is similar to that used by Layard and others, there are several important differences. First, this article includes more explanatory variables. In particular, the current model includes major categories of ALMP, which are the focus of this article. Second, this article uses more recent data to estimate the model. Third, the article estimates a panel regression with fixed effects while Layard and others apply OLS regression to the countries' averages over sample years. As in Bassanini and Duval, the model in this article includes the tax wedge and the output gap, which are found to have significant effects on the unemployment rate.

[10]The sample does not cover all OECD countries because some do not have complete (or near-complete) data over 1998-2008. The 20 countries—Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, and the United Kingdom. In one robustness check, the analysis also included data for the United States, Canada, Japan, and South Korea. These four countries had very little spending on ALMP during the sample period. Including them in the regression does not change the main findings of this article.

[11]As shown in Table 1 (specifications 1 and 2), the estimates are significant at the 95 percent level and are robust to the inclusion of different measures of PLMP. Qualitatively speaking, these findings also are robust to various lag choices, or measuring spending as a fraction of GDP. The OECD average level refers to the average level of the 20 OECD countries studied in this article.

[12]The effect of increasing unemployment benefit duration on the unemployment rate is calculated based on the empirical findings in Table 1, model specification 2. Because countries have different institutional frameworks, finding a consistent measure of unemployment benefit duration can be problematic. Instead, the literature uses a measure of how quickly unemployment benefits decline as a measure of the actual unemployment benefit duration. That is, a more rapid decline in unemployment benefits corresponds to a shorter duration of benefits and vice versa. Thus, following the approach used in the *OECD Employment Outlook*, the measure used in this article is defined as how much total unemployment benefits have declined from the average level in the first year to the average level in the first five years. For example, the average level of this measure in the 20 OECD countries studied in this article over 1998-2008 is about 0.6, which means that the average level of the unemployment benefits in the first five years is about 60 percent of the average level of the unemployment benefits in the first year. Assuming benefits decline at a constant rate, the unemployment benefits will decline 40 percent in (5–1)/2=2 years, or 20 percent per year. In other words, the benefits last approximately five years. Following the same logic, if the benefits last for one more year, to six years, the rate of decline is about 17 percent per year. At this speed, the average level of the unemployment benefits in the first five years is 66 percent of the average level in the first year. Using the estimated model coefficient for unemployment benefit duration, 4.82, increasing the unemployment benefit duration by one year will increase the unemployment rate by (0.66–0.60)×4.82=0.29 percentage point.

[13]These findings are consistent with several recent studies. For example, see Kluve and Schmidt, and Card and others.

[14]The estimates also differ in their statistical significance. The estimate for job-search assistance is significant at the 90 percent level, while the estimate for training is significant at the 95 percent level.

[15]According to the OECD classification, benefit administration expenditures include those used to manage the unemployment and early retirement benefits and labor market programs, which cannot be separated from the expenditures in PLMP and other ALMP. In addition to benefit administration, this group contains two other small programs: start-up incentives, and job rotation and job sharing. However, the expenditures on these two programs are usually very small (for example, for job rotation and job sharing, the average expenditures as a percent of GDP over OECD countries is less than 0.01 for most of the years in 1998-2008). Thus, this article does not study them separately.

[16]Using OECD data between 1985 and 2002, Bassanini and Duval also found that increasing ALMP spending on youth and disabled unemployed workers does not lead to a reduction in the unemployment rate. Although the results are not reported in the table, conducting the analysis again to include participant stocks in direct job-creation programs finds that the unemployment rate decreases when the participant stocks in direct job-creation programs increase. This finding and the results in the table suggest that the allocation of spending and the efficiency of that allocation are crucial in determining the effects of ALMP on the unemployment rate. Of course, an alternative possibility is that by spending more money per job created, the government is creating higher-wage jobs and therefore improving the welfare of the participants in these direct job-creation programs.

[17]Although the basic idea of a cost-effectiveness analysis is straightforward, it is challenging to precisely measure the associated benefits in practice for several reasons. First, by definition, the benefits are computed under the assumption that all other factors are fixed. In other words, any models that try to uncover the "unobservable" benefits have to control for all the factors that might affect the outcomes. This is challenging because no model can account for *all* factors, and data are not always available for some factors. Second, the benefits of some programs may vary over time. This raises the question of what time frame should be used to measure the benefits. For example, Nie shows that training programs exhibit a trade-off between short-term and long-term effects. Because it takes time to improve workers' skills, in the short term these programs will hold workers in them, which reduces the workers' employment probabilities. This is called the "lock-in" effect in the empirical literature. However, over a relatively longer period, training programs may improve employability by giving workers the necessary skills to match with jobs.

[18]See note 12 for more information on how the cost is calculated. Note that earlier the cost was expressed as $274 *per unemployed worker*, whereas the cost is now expressed as the total amount ($230 million).

[19]The regression model contains the output gap as an explanatory variable. Thus, the cost-effectiveness analysis assumes *ex ante* that output and the output gap are fixed when calculating the effect of ALMP on the unemployment rate, even though in the second step output is allowed to vary. This endogeneity be-

tween unemployment and output may bias the cost-effectiveness analysis: The results presented may actually be too conservative, because a dollar of ALMP spending may reduce the unemployment rate and lead to faster GDP growth and a smaller output gap, which in turn reduces unemployment further, and so on. Developing a general equilibrium model to address this endogeneity is beyond the scope of this article.

[20]Okun's law posits a negative relationship between GDP growth and changes in the unemployment rate: Rapid GDP growth is associated with declines in unemployment, and slow or negative GDP growth is associated with increases in unemployment. See Knotek.

[21]The main idea of this approach is that if the change in the labor force is known, the change in unemployment can be directly translated to a change in employment. Furthermore, the change in employment can be translated to a change in GDP if the relative productivity of newly employed workers is known. Appendix C provides more details on these two approaches.

[22]There also is a trade-off between the short-term effects and the long-term effects. Because workers can still accumulate human capital during the employment period, their productivity may increase as they become employed for a longer time.

[23]To illustrate the main idea, the analysis considers a static scenario. Ideally, the benefits associated with a certain program may accumulate over a longer time.

[24]These estimates do not include workers who already have left the labor force.

[25]Although the phenomenon of "house lock" has been discussed quite extensively, it is not easy to measure its effects on the unemployment rate due to limits on data availability. Several recent studies using U.S. state-level data show that the impact of "house lock" on workers' state-to-state mobility is limited (Aaronson and Davis, Şahin and others).

[26]Knotek and Terry discuss several aspects of the nature of recoveries from financial crises that also may be contributing to sustained high unemployment.

[27]These estimates assume that expenditures on ALMP in the United States as a percentage of GDP increase proportionally with increases in the U.S. unemployment rate. For example, average expenditures on active labor market policies in the United States were approximately 0.16 percent of GDP during the period 1998-2008. However, the average U.S. unemployment rate in the first half of 2011 was 1.8 times the average over the sample period. Thus, this article assumes that the U.S. expenditures on ALMP as a percentage of GDP rose to 0.16×1.8=0.29 percent of GDP. Based on the estimates from Section II, total expenditures would have to be increased by approximately 181 percent in order to use ALMP to reduce the unemployment rate by 1 percentage point, which is about 0.29×181%=0.52 percent of GDP. Using a projection for the level of U.S. GDP in 2011, the estimated costs would be approximately $79.5 billion (in 2011 dollars).

[28]In addition to their small size, Table 1 shows that these types of active spending policies do not reduce unemployment in a statistically significant way.

[29]Following the literature, the spending on labor market policies is measured by the expenditures per unemployed worker as a percentage of GDP per capita (as also explained in Section I). By construction, the expenditures per unemployed worker are correlated with the unemployment rate in the same time period. To mitigate the endogeneity problem caused by this definition, this article uses the one-period lagged unemployment rate and GDP per capita to construct the expenditures variables that will be on the right hand side in the regressions. In one robustness check, this article also used expenditures on ALMP as a percentage of one-period lagged GDP to replace the above definition and found the results are robust to this alternative specification.

[30]In this calculation, the total number of unemployed workers is fixed. So, increasing expenditures per unemployed worker from 5 percent of GDP per capita to 6 percent implies that the total expenditures (as a percentage of GDP) increase by 20 percent (that is, 100×(6–5)/5=20. In the model presented in Section II, the lagged unemployment rate is used to calculate the expenditures per unemployed, which is consistent with the assumption of fixing the number of unemployed used in this calculation.

[31]Let $L$ be the size of the labor force (in levels), $E$ be the amount of employed (in levels), $U$ be the amount of unemployed (in levels), and $u$ be the unemployment rate. By definition:

$$L = E + U, U = \frac{(L \bullet u)}{100}, E = \frac{L(100-u)}{100}$$

Assume that $L$ increases by $a$ percent (if $a<0$, $L$ decreases):

$$L' = \frac{L(100+a)}{100}$$

and $u$ declines by y percentage points, $u'=u$-y.Then, the number of unemployed becomes

$$U' = \frac{(100+a)}{100} \bullet L \bullet \frac{u'}{100} = \frac{(100+\mathrm{a})}{100} \frac{L}{100} \left( \frac{100u}{L} - y \right)$$

$$= \frac{(100+a)}{100} \bullet \frac{1}{100} (100U - Ly)$$

$$= \frac{100+a}{100} \left( U - \frac{Ly}{100} \right).$$

Accordingly, the number of employed becomes

$$E' = L' - U'$$
$$= \frac{(100+a)}{100} \bullet L \bullet \frac{100+y-u}{100}.$$

Thus, combined with $E=L(100-u)/100$, it implies that the employment change (in percent) is

$$\Delta E = \frac{E'-E}{E} x100 = a + \frac{(100+a) \bullet y}{100-u}$$

Let $b$ be the productivity of newly employed workers relative to those already employed. Then, the change in GDP will be

$$\Delta GDP = \Delta E \cdot b = \left[ a + \frac{(100+a)y}{100-u} \right] \bullet b.$$

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