A Statistical Analysis of the Colorado Works Caseload Trend

Prepared for:
The Colorado Department of Human Services

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Executive Summary

Since July 1997, Colorado Works has been the State of Colorado's welfare program for families with children, providing cash assistance and services to needy families in the state. The Colorado Works one-parent caseload has changed significantly in recent years. In July 1998, the caseload included nearly 14,000 cases, and it declined rapidly until the end of 2000, when it was about 7,000 cases. The state then experienced a recession, and the caseload increased to over 10,000 cases in mid-2004, and then began declining, reaching about 5,000 cases by the end of 2007. The two-parent caseload experienced a similar trend on a smaller scale, while in contrast, the child-only caseload has remained generally stable over the period analyzed. This report summarizes the statistical models The Lewin Group has developed to explain the determinants of caseload trends from July 1998 through December 2007.

Using a statistical procedure called regression analysis, equations were developed to estimate the size of the Colorado Works monthly caseload based on the Colorado economy, Colorado Works program characteristics, and other factors. Separate models of caseload size were developed for one-parent families, two-parent families, and child-only cases. In addition, models were also developed of monthly entries and exits for one-parent cases, and county-level models of the one-parent caseload for the five largest counties. Models were estimated using data from July 1999 through December 2007. The models estimated did a good job of estimating the caseloads in the period analyzed, as the size of the caseload predicted by the models was close to the actual caseload.

The key finding from the analysis is that the unemployment rate is the key factor affecting the size of the one-parent and two-parent caseloads. The caseload in a month is affected by the unemployment rate up to 24 months earlier. Several Colorado Works and federal policy variables also had a statistically significant effect on the size of the caseload. For the one-parent caseload, the proportion of cases that were sanctioned had a negative effect on the size of the caseload, so that if the sanction rate increased, the size of the caseload would decrease, holding all other factors the same. On the other hand, the number of diversions, cases eligible for Colorado Works but who received a lump sum payment instead of enrollment in the program, did not appear to affect the size of the caseload. Finally, we found that issuance of the interim final rule for the Deficit Reduction Act is associated with a decline in the one-parent and two-parent caseloads. For the child-only caseload, the estimated effects of changes in the program and economy were very small and usually not statistically significant.

As an alternative to estimating the total size of the one-parent caseload, separate models of entries and exits to the caseload were estimated. These models produced estimates that are consistent with the results from the caseload size model, and the entry and exit models would be useful to officials interested more in the flow of cases on and off the caseload than the overall size of the caseload.

Modeling the caseload at the county-level is a difficult endeavor. It is hard to identify all of the relevant changes on a monthly basis over the course of the decade at the county level, and ballpark estimates of when changes occurred have less utility. Also, when examining counties with smaller populations, it is possible to run into measurement error with some of our

independent variables such as the unemployment rate, which makes results difficult to interpret.

Simulations using the models indicate that if unemployment rates rise to the levels experienced in the last recession, the one-parent caseload would likely increase by 1,700 to 1,800 cases. On the other hand, if the unemployment rate drops to the levels experienced in the late 1990s, the one-parent caseload would fall by 1,500 to 1,800 cases.

Colorado did not change the maximum benefits over the period analyzed, so we were unable to determine what impact a change in the benefit would have on the size of the Colorado Works caseload. We did find some evidence that the stricter sanction and closure for administrative reasons reduced the one-parent caseload.

The statistical models developed for this project should be useful to state and county officials in projecting how the caseload might be expected to change if we observe benefits and unemployment rates similar to what the state has experienced in the past, and the state can make estimates of how the caseload might be affected by a change in the unemployment rate.

I. Introduction

This report was prepared as part of The Lewin Group's research on the Colorado Works program. In this report, we present and interpret statistical models of the Colorado Works caseload. Models of this nature have a substantial history and can be used for a number of purposes, including:

- Developing a general understanding of the impact that changes in various factors have on the size of the caseload;
- Determining the impact that specific changes in program law or policy have had on the caseload;
- Simulating the effects of potential changes in the program, population served, or economic environment on the size of the caseload; and
- Projecting the size and cost of the program in the future.

The current project corresponds most with the first category listed above—developing a general understanding of the impact that changes in various factors have on the size of the caseload. As consistent data on Colorado's welfare program do not extend back for a significant period prior to enactment of the federal Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA) of 1996 and the implementation of Colorado's TANF program, Colorado Works, this analysis focuses on changes since TANF became effective. Such changes include shifts in the economy; modifications in TANF policy including sanction rates, diversions, and adherence to work participation requirements; and other state factors such as the Colorado minimum wage and population size. In addition to understanding the impacts that changes in various factors have on the caseload, we also conduct simulations to explore what effects changes in the unemployment rate in the next three years might have on the size of the caseload.

The next section of this report provides a brief description of the Colorado Works program. Section 3 provides a graphical presentation of how the Colorado Works caseload has changed in recent years. Section 4 describes how regression analysis is used to understand factors associated with the trend in size of the caseload. The data used for the analyses and descriptive statistics are presented in Section 5. The results of our state-level regression analyses are presented in Section 6, including models for entries and exits onto the one-parent family caseload. Section 7 provides simulations of what our model predicts will happen to the one-parent caseload if the unemployment rate changes. Section 8 provides our analyses for the five largest counties in Colorado. Our conclusions are presented in Section 9.

II. The Colorado Works Program

Colorado Works was implemented in July 1997, following enactment of the 1996 federal statute the Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA), which abolished the Aid to Families with Dependent Children (AFDC) welfare program and replaced it with the Temporary Assistance for Needy Families (TANF) program. PRWORA and its implementing regulations emphasize moving welfare clients quickly into work. This diverges from the emphasis of the AFDC program on skill development through participation in

education and training activities in lieu of immediate employment. In addition, the four stated purposes of TANF focus on family stability as well as employment:

- Assisting needy families so that children can be cared for in their own homes,
- Promoting work and marriage to end dependency,
- Preventing out-of-wedlock pregnancies, and
- Encouraging two-parent families.

However, in Colorado, counties make many of the important decisions regarding how to operate their programs, including how much emphasis to place on employment versus skill development or education, and how to address the four purposes of TANF.

The Colorado Works program is characterized by three features. First, as mentioned above, the state has a long history of local control of programs, and the 64 counties, therefore, have considerable autonomy and discretion in the design and implementation of their Colorado Works programs. This level of county control ensures that local policies reflect the specific needs of residents. Counties also contribute financially to the program. Second, counties have established an extensive network of agencies and organizations that are involved in the delivery of services to clients. The counties use this network to expand the range and quality of services available to participants. Third, counties have used the flexibility allowed under TANF to implement a number of promising initiatives that support the broader purposes of TANF. For example, several counties have implemented youth initiatives (including nonmarital pregnancy prevention programs), fatherhood programs, strategies to keep families from entering the child welfare system, and a broad range of strategies to help individuals with special challenges to employment (e.g., health or substance abuse problems, mental health issues, domestic violence issues, and homelessness).

The strong role of the counties in Colorado makes the development of statistical models more challenging than in states where state government determines policies. Counties may vary in how and when they implement policies that affect the caseload, so it may not be adequate to use data at the state level. In addition, the diverse policies among counties may mean that the effect of economic conditions may not be the same for all counties, again making accurate state models difficult to construct.

Description of recent changes:

As part of this study, we interviewed Colorado Works program administrators from both state and county offices. Interviews with state personnel were conducted to understand the broader context affecting the Colorado Works program. Interviews with county staff from Adams, Arapahoe, Denver, El Paso, and Jefferson counties were conducted to discern factors affecting the caseloads in the counties with the largest caseload levels. Several statewide policy changes were particularly important to understanding caseload trends.

First, state personnel indicated that the policy environment was generally stable during the beginning of our analysis period. The first major change came in 2001, when the state increased

the income disregard policy to a two-thirds disregard for the first 12 cumulative months of assistance. Previously, the disregard was $90 per month for work expenses plus $30 per month (limited to 12 months) and one-third of the remainder (for a maximum of four consecutive months.)

Second, in the summer of 2004, Colorado Works transitioned to a new administrative system known as the Colorado Benefits Management System (CBMS). Leading up to the change, case managers were instructed to process as many applicants as possible so that the program could go into the transition with no backlog of applications. Following the implementation of the new system in August 2004, staff had great difficulty adjusting to the new administrative environment. Case managers had difficulty processing applications, approving benefits, and administering sanctions, among other regular aspects of their duties. Noticeable difficulty in using the system lasted several months for many counties.

The next set of changes came with enactment of the Deficit Reduction Act of 2005 (DRA). Due to the increased focus on work participation rates that arose following enactment of DRA and the possibility of facing penalties to Colorado's TANF block grant, state and county officials began to focus more on engaging clients in work activities. This encouraged more interaction between clients and case managers and increased the participation expectations case managers had for their clients.

Several other statewide changes also have occurred in recent years. In 2006, the General Assembly passed legislation that clarified that unlawful aliens could not receive Colorado Works assistance, and they required counties to implement more stringent documentation and verification procedures. In the same year, the General Assembly also passed legislation increasing the resource limits from $2,000 to $15,000, with additional types of assets exempted from the resource limit determination.[1] Finally in 2007, the state began to actively promote family stabilization diversion payments, which aim to divert families away from ongoing assistance through immediate lump sum payments for short-term needs.

As Colorado Works is a county-administered program, a great amount of discretion has been given to county officials, and changes occurred at different points in the counties. At the county level, it is difficult to discern any consistent trend in policy changes. Several county administrators discussed how they have had to reorient their programs to meet the work participation requirements set forth by DRA. Most of these changes, including additional focus on diversion, case closures for demonstrable evidence, specialized case management, and greater emphasis on work activities, have occurred following 2006. However, staff in Adams County, which has always had a strong work-first program, indicated that they did not feel they needed to make major changes in response to DRA as they were already adequately engaging their caseload.

Other important changes that were noted by county staff included modifications to case management strategies, relocation of local offices, implementation of incentive programs, changes to sanction processes, and expansion of community partnerships and outreach.

[1] The resource limits are the maximum value of assets that TANF families can own without being made ineligible for benefits.

III. Trends in the Colorado Works Caseload in Recent Years

This section presents the actual caseload levels in Colorado over the period from July 1998 through December 2007. There are three types of Colorado Works cases based on the number of adults in the unit receiving benefits—one-parent cases, two-parent cases, and child-only cases. Exhibit 1 shows the trend in the three types of cases from July 1998, approximately one year after Colorado Works replaced the prior program, through December 2007. Several interesting patterns can be seen from the exhibit. First, for most of the period, the one-parent family caseload was significantly larger than the other two types of cases—over three times as large as the child-only caseload in July 1998. By the end of 2007, however, the one-parent caseload was smaller than the child-only caseload. Second, the one-parent caseload was fairly volatile, dropping by nearly 50 percent in the first four years, then increasing substantially, and finally dropping to about one-third of the initial level. It is this caseload volatility that makes caseload modeling of interest—can we explain the volatility in the caseload as a function of changes in the program, characteristics of the population, or the economy? Third, in contrast to the one-parent caseload, the child-only and two-parent caseloads are relatively flat in the analysis period. Fourth, although the caseload changes smoothly over most of the period, there are some unusual movements around July 2004. This corresponds to the period when CBMS was being implemented, and as was described above, may reflect temporary changes in behavior in enrolling and terminating people rather than a permanent change in program behavior.

Exhibit 1: Recent Trend in the Colorado Works One-Parent, Two-Parent and Child-Only Caseloads

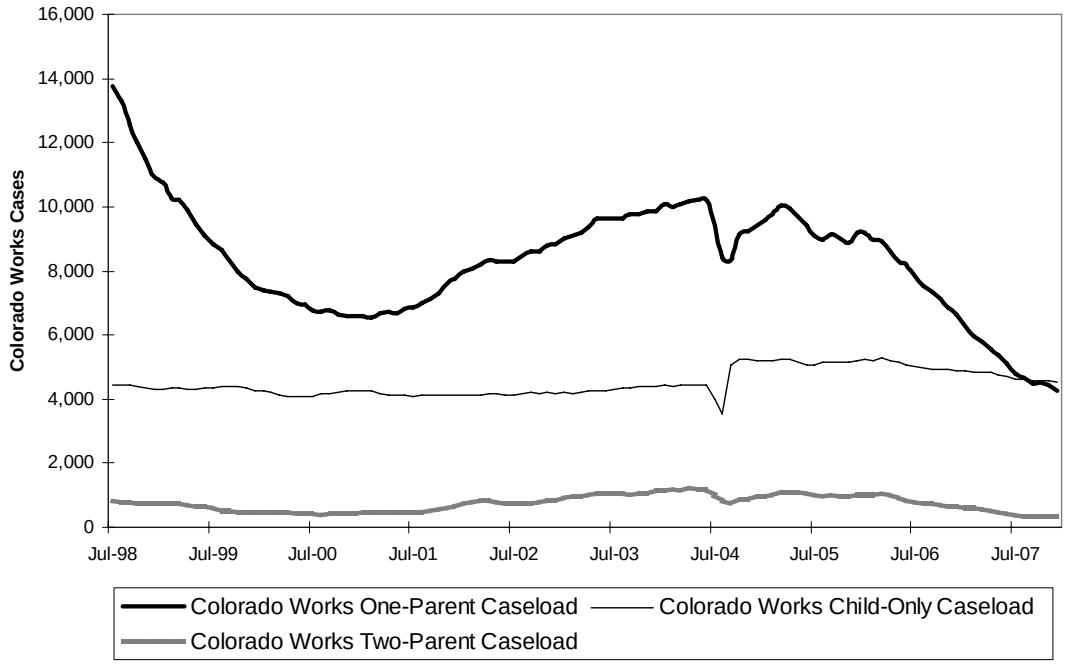
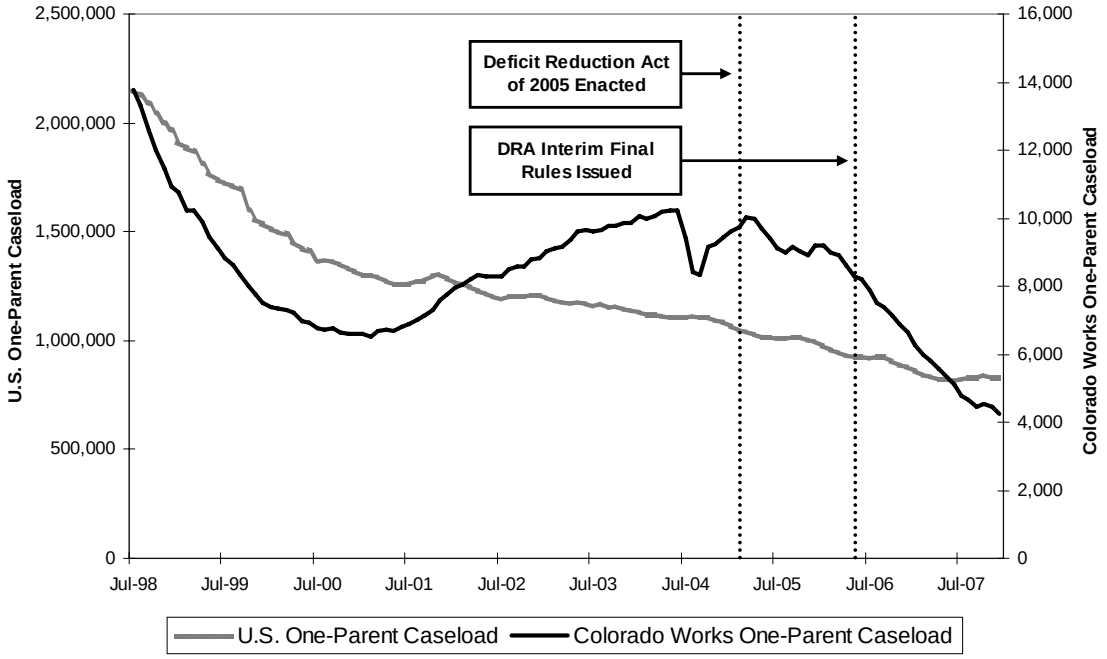


Exhibit 2 shows how the Colorado Works and U.S. one-parent caseloads changed over the period analyzed. For both the nation as a whole and for Colorado, the size of the one-parent caseload fell substantially over the period analyzed. The patterns over the period are quite different, however. For the nation as a whole, the decline in the size of the caseload was almost continuous, but for Colorado, after an initial drop that was proportionately larger than for the

nation as a whole, the size of the caseload increased significantly, and then dropped more steeply than occurred for the nation as a whole. We were concerned that the major changes in Colorado Works that were implemented as a result of the enactment of PRWORA may have required a number of months for the system to stabilize. We therefore omitted the first 18 months of experience after PRWORA became effective, and our models begin with June 1999 data.

The exhibit also shows when DRA was enacted (2005) and when the federal interim final rule was promulgated (2006). This legislation generally tightened the requirements for states to keep welfare recipients actively engaged in the labor market, and failure to meet the participation rates leads to financial penalties to the states. In our empirical work, the statistical model permits the predicted caseload to drop after DRA implementation. We use the date that the interim final rule was issued to mark the change in periods (rather than the date the DRA was enacted) because state and county officials indicated that it was only after the rule was issued that they changed their strategies.

Exhibit 2: Colorado Works and U.S. One-Parent Caseloads in Relation to Federal Policy Changes



As discussed in the following section, our statistical modeling controls for a number of factors that we expect are related to the caseload trends. Before presenting the results of the modeling, the next few exhibits here show how some of those factors we hypothesize affect the caseload changed over the period analyzed. These graphs simply show whether the time trends for these factors are similar to what happened to the caseload just described, but they do not offer evidence about the importance of each variable—that information is presented in the following sections. Exhibit 3 shows the trends for the unemployment rate and the one-parent caseload for the period studied. The exhibit shows that Colorado experienced a sharp increase in the unemployment rate in the first half of 2001, with a gradual decline in the following months. Movements in the caseload appear to lag the unemployment rate, and as data analysis in the

next section shows, we confirm that the unemployment rate from as long ago as three years can influence the size of the one-parent caseload.

Exhibit 3: Colorado Works One-Parent Caseload and the Colorado Unemployment Rate

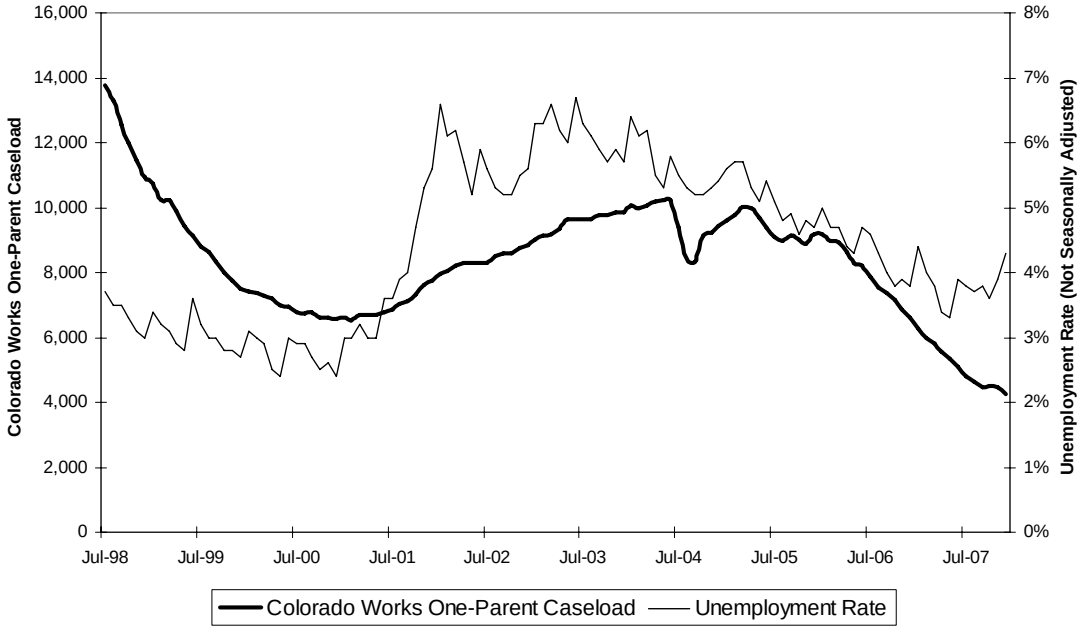


Exhibit 4 shows the trend in the proportion of cases that are formally sanctioned or closed for demonstrable evidence of noncompliance and the trend in the one-parent caseload. As one might expect, there is a negative association between the size of the caseload and the proportion of cases that are sanctioned or closed for evidence of noncompliance. In Colorado, counties can make one-time payments to families eligible for Colorado Works in a form known as diversion assistance, but such benefits are only available to those who the county believes can avoid being on Colorado Works if a cash payment is made. One would expect that as diversions increase, the size of the caseload would decline, and this is the pattern seen in Exhibit 5.

Exhibit 4: Rates of Formal Sanctioning and Administrative Case Closures for Demonstrable Evidence in the Colorado Works One-Parent Caseload

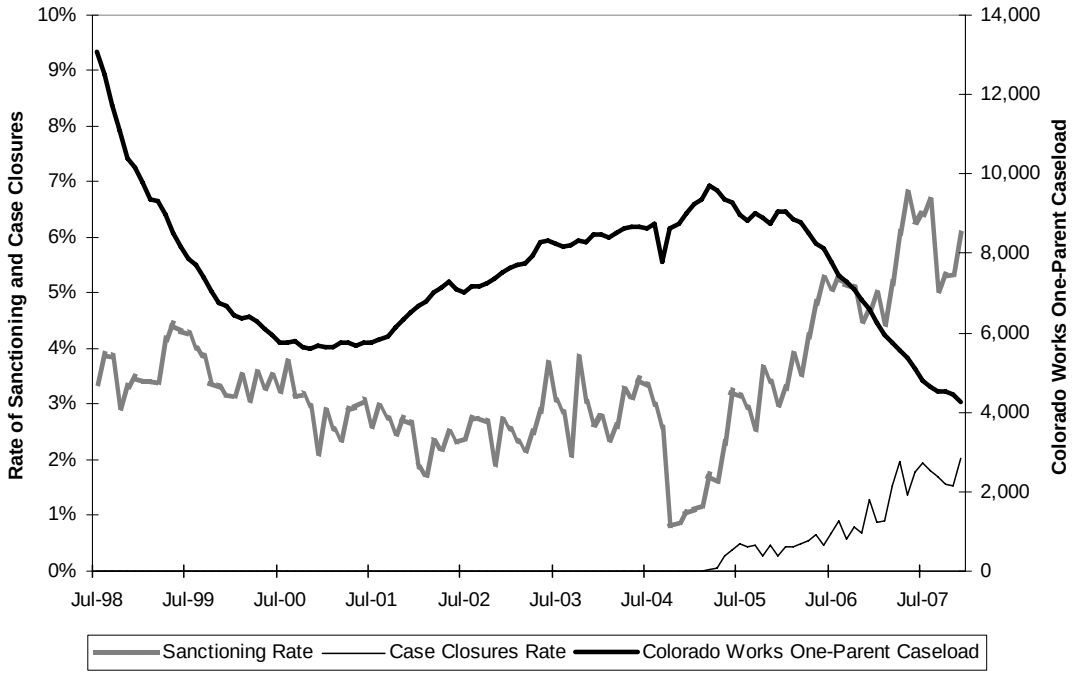
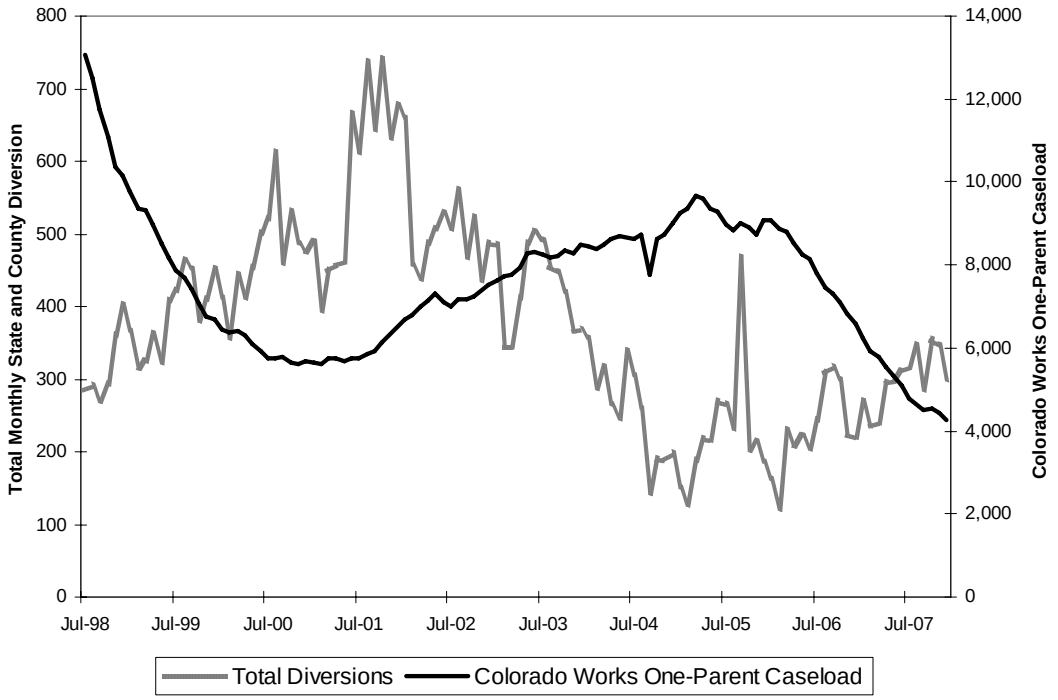


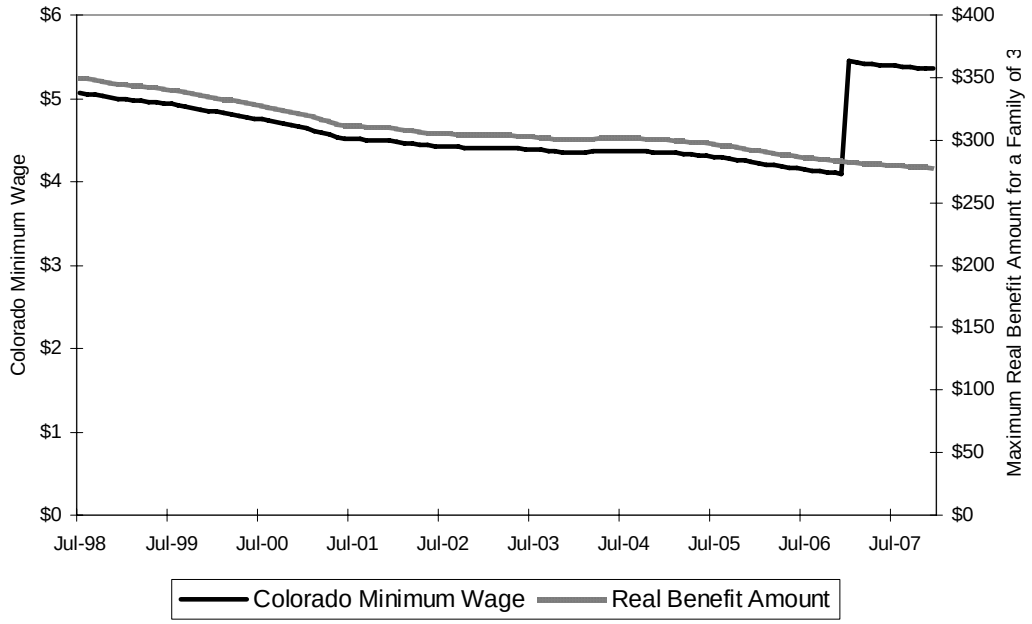
Exhibit 5: Total Diversions Paid in Colorado Works



Finally, Exhibit 6 shows the trends in the inflation-adjusted maximum Colorado Works cash benefit for a family of three and the trend in the inflation-adjusted Colorado minimum wage over the period analyzed. The maximum benefit was not changed during the period analyzed,

so the steady decline in the line on the chart indicates the extent to which the purchasing power of the maximum benefit declined as a result of inflation. The minimum wage was increased once toward the end of the period analyzed. Because these two factors moved together, we expected that it may be difficult in the statistical analysis to disentangle the separate effects of each of the two factors on the size of the caseload. Also, because the variables changed gradually due to inflation, rather than abruptly due to a policy change, we expected that it might be difficult to discern the impact of a jump in the maximum benefit or the minimum wage on the caseload.

Exhibit 6: Colorado Works Maximum Benefit for a Family of Three and Colorado Minimum Wage (Inflation Adjust to 1998 Dollars)



IV. Use of Regression Analysis to Analyze the Colorado Works Caseload

This section presents the results of the statistical modeling that was conducted to determine which factors best explain the trends in the caseload just described. Ordinary least squares (OLS) regression analysis is a statistical technique that is used to estimate the relationship between one or more explanatory variables and an outcome variable, referred to as the dependent variable. OLS is used to determine the best linear equation that describes the relationship between the dependent variable and the explanatory variables.[2] The statistical programs used to perform regression analysis estimate the regression coefficients, which are the estimated impact that a one unit change in the explanatory variable will have on the dependent variable. In addition, the programs estimate the standard error of the regression coefficient, which provides a measure of the statistical reliability of the regression coefficient. To interpret the regression coefficients and the standard errors, researchers generally rely only on findings that are statistically significant at the 5 percent or 10 percent level. An estimate that is

[2] In this context, the term "best" means the equation that minimizes the squares of the deviations of the actual data points from the values predicted by the equation.

statistically significant at the .05 level means that the probability we would obtain an estimated regression coefficient as large as we did if the true effect were zero is .05 or less.

In estimating the Colorado Works caseload, there are several alternative approaches that can be used, depending upon the purpose of the analyses, data available, and the time and resources available. First, one can estimate models at the state, regional, or county levels. Because Colorado Works is largely a county-administered program with significant financial resources provided by the counties, it is useful and appropriate to estimate models at the county level. There are, however, 64 counties in Colorado, and many of them have very small caseloads, so the data for some of the variables of interest may not be accurate enough to estimate reasonable models. We have therefore estimated models only for the state as a whole and for the five largest counties—Adams, Arapahoe, Denver, El Paso, and Jefferson Counties. A second issue is the choice of the dependent variable. We have developed models using the number of cases that received benefits each month—referred to as a *stock* model. A common alternative is to estimate the flow of cases each month by estimating the number of entries and exits. We have estimated stock, entry, and exit models at the state level, but we have only estimated stock models for the five counties analyzed individually.

One problem that sometimes arises in time series analyses is "serial correlation" or autocorrelation of the error terms. Serial correlation of the error terms means that the error terms are not independent over time. The Durbin-Watson statistic provides a statistical test for the absence of serial correlation, with a coefficient close to 2.0 indicating that serial correlation is not present. The Durbin-Watson statistics from our regressions are presented with the regression results. Although ordinary least squares does not produce biased estimates of the regression coefficients in the presence of serial correlation, the standard errors estimated by OLS are generally smaller than they should be, and the models tend to overstate the statistical significance of the regression coefficients. We have used the Prais-Winsten adjustment to deal with the serial correlation. In all but two of the county models estimated, the Prais procedure has corrected for the serial correlation.

Before proceeding, it is worth briefly considering the utility of the caseload modeling approach. A recent National Academy of Sciences panel considered the utility of caseload modeling along with other evaluation approaches that have been used to evaluate welfare reform.[3] Several of the panel's conclusions are worth noting. First, the panel concludes:

> Experimental methods [approaches where people are randomly assigned to alternative welfare programs] could not have been used for evaluating the overall effects of PRWORA, and are, in general, not appropriate for evaluating the overall effects of large-scale, system-wide changes in social programs." With regard to caseload modeling, the panel concludes that such studies have produced "a mixed set of results, partly because of data limitations and partly because of an inherent lack of policy variability. They have done somewhat better at producing ballpark estimates of the overall effect of

[3] Robert A. Moffitt and Michele Ver Ploeg, editors (2001). *Evaluating Welfare Reform in an Era of Transition*. Washington, DC: National Academy Press.

> welfare reform [on caseload trends] than at producing estimates of individual broad components.

It should also be noted that caseload models have several advantages over alternative evaluation strategies. As the NAS panel notes, caseload modeling studies are the only evaluations that have sought to control for economic conditions and isolate the effect of welfare reform from the economy. Barnow, Kaplan, and Moffitt note that caseload modeling evaluations are often less expensive than alternative strategies, and they can be used to detect "entry effects," which is something that experimental designs generally cannot do.[4]

A recent comprehensive review of the literature by Rebecca Blank reaches similar conclusions.[5] Blank (2002, p. 1126) concludes that "Ultimately, econometric models—however limited—will probably provide the best evidence we are likely to have available on the overall effects of welfare reform. Such models are almost surely less reliable in providing evidence on individual program components; when available, experimental evidence on specific program changes is probably more believable."

This report should provide general guidance on the determinants of the Colorado Works caseload and why the caseload has changed over the period analyzed, but for several reasons, caution should be exercised in interpreting the findings:

- **Some variables are not available for the analysis**. From our review of the caseload modeling literature, we identified a number of variables we would have liked to include in the analysis but could not or did not include for several reasons. Some variables were not available for the early and/or later months of the period analyzed. This group includes the number of divorces, the number of out-of-wedlock births, variables on the racial/ethnic composition of the population, the median retail sector wage rate, the Colorado family poverty rate, and the median family income of the population. When we included these variables in the analysis, the number of observations dropped by nearly half, from 96 months of data to only 49. In addition, the model estimated with the additional variables produced models that did not fit the data well, and few of the regression coefficients were statistically significant.

- **Some important variables do not vary much over the period of interest**. For example, the maximum monthly benefit for a family of three did not change in dollar terms over the period analyzed, so the only variation observed is for the inflation-adjusted or "real" benefit. Thus, although we can explore the implications of a gradual erosion of the real

[4] Entry effects refer to changes in the caseload that result from decisions by households to apply for welfare because of changes in the rules or benefits of the program. Experimental designs usually cannot capture these changes as the experiment only includes those who have already made the decision to apply. See Burt S. Barnow, Thomas Kaplan, and Robert Moffitt, editors. "Introduction" in *Evaluating Comprehensive State Welfare Reform: The Wisconsin Works Program*. Albany, NY: Rockefeller Institute Press, 2000.

[5] See Rebecca M. Blank (2002). "Evaluating Welfare Reform in the United States." *Journal of Economic Literature*. XL (4): 1105-1166.

value of the Colorado Works benefit, we believe that it would not be prudent to estimate the impact of a major change in the benefit.

- **For time series data, factors that influence the caseload are likely to follow similar patterns**. When two variables tend to move together, the data are said to exhibit "multicollinearity." The presence of multicollinearity does not lead to biased estimates of the estimated regression coefficients, but it does generally reduce the possibility of obtaining statistically significant effects, i.e., estimates that we can be reasonably confident are not zero.

V. Data in the Caseload Models

The variables used in the regression analyses are described in Exhibit 7, and descriptive statistics at the state level are provided in Exhibit 8. The statistical models are based on data between July 1999 and December 2007. The start point of the data series was selected to avoid having other factors that were changing pick up the impact of the transition to TANF. There are six months (June 2004 to November 2004) that are left out of the analysis because the computer transition at the beginning of August 2004 distorts the data immediately before and after the transition.

Three types of variables can be expected to affect the Colorado Works caseload: economic factors, population characteristics, and program characteristics. The variables used in the analysis are available for the state and for the counties. Most variables are available on a monthly basis. For variables that are available less frequently, such as the consumer price index for the Denver region, we linearly interpolated to obtain the values. Most of the variables have a clear rationale and expected impact.

The unemployment rate is expected to have a significant effect on the caseload, and past analyses of welfare caseloads find that an increase in the unemployment rate leads to an increase in the caseload. Klerman and Haider (2004) show that it is important to include past levels of the unemployment rate in caseload models as well as the current unemployment rate.[6] We use the unemployment rate for the state without seasonal adjustment.

Other environmental variables in the model are the inflation-adjusted minimum wage, the inflation-adjusted Colorado Works maximum benefit for a family of three, the size of the state population in thousands, and a set of three binary variables to control for unmeasured seasonal factors that may affect the caseload. The minimum wage variable has no clear direction of impact. On the one hand, an increase in the minimum wage makes low-wage jobs more attractive relative to welfare and could reduce the caseload. On the other hand, some economists believe that an increase in the minimum wage reduces employment, which could increase the caseload; thus, the sign of the regression coefficient for the minimum wage variable could be positive or negative. The size of the population is expected to have a positive coefficient; as the population increases, more people are likely to receive benefits. Finally, we include binary variables for the first three quarters of the year to control for seasonal factors.

[6] See Jacob Alex Klerman and Stephen J. Haider (2004). "A Stock-Flow Analysis of the Welfare Caseload." *The Journal of Human Resources* 39(4): 865-886.

Exhibit 7: Variables Used in the Statewide Stock Models

Variable	Description
Stock Caseload Size	Total cases receiving a payment for the analysis month. The caseloads are also separated by one-parent families, two-parent families and child-only families.
Unemployment Rates	Not-seasonally adjusted, Colorado State unemployment rate. Lags of one month, three months, six months, 12 months, 24 months and 36 months are included in the models in addition to the current unemployment rate.
Deficit Reduction Act - Interim Final Rule	This is a binary variable that has a value of 0 from the beginning of the dataset through May 2006, and a value of 1 from June 2006 forward.
Total State and County Diversions	Total count of cases receiving state diversion or county diversion payments.
Maximum Benefit for a Family of Three	Maximum benefit that a family of three can qualify for under Colorado Works. This was adjusted for inflation on a monthly basis using interpolated, biannual data from the Consumer Price Index for All Urban Consumers (CPI-U) for the Denver metropolitan area.
Combined Sanction and Administrative Closure Rate	This is the percent of cases that have grant reductions due to case sanctions or administative closures for non-participation. It was calculated by taking the total number of cases facing grant reductions in a month and dividing by the total caseload for the month.
CBMS Computer System	This is a binary variable marking the transition between computer benefits systems. It is 0 from the beginning of the analysis period through July 2004, and then 1 from August 2004 through the end of the period analyzed.
State Population Size	Total population in thousands for Colorado
Colorado Minimum Wage (Inflation Adjusted)	Colorado minimum wage. This was adjusted for inflation on a monthly basis using interpolated, biannual data from the Consumer Price Index for All Urban Consumers (CPI-U) for the Denver metropolitan area.
Quarters 1, 2, and 3	Binary variables for seasonal variation. Quarter 4 was left as the excluded category.

Program-related variables in the models include the inflation-adjusted value of the maximum benefit for a family of three, the number of cases receiving state or county diversion payments in the month, the combined sanction and administrative closure rate, a dummy variable equal to one for months when the interim final rule for the Deficit Reduction Act was in effect, and a dummy variable for when the new computer management system was in effect. The maximum cash benefit for a family of three is expected to have a positive coefficient—as the benefit increases, welfare becomes more attractive relative to work, and Colorado Works participants who work are more likely to still qualify for benefits. Diversions are expected to have a negative impact on the caseload because as diversions increase, potential eligible families do not receive cash benefits. The sanction rate is also expected to have a negative impact on the size of the caseload. Not only is there a direct reduction in the caseload for each case sanctioned, increased sanctioning is likely to increase incentives for recipients to search work as they know that the rules will be strictly enforced. We include administrative closures with the sanctions because they are similar in nature. The DRA was passed in 2005, but the interim final rules were not issued until June 2006. We included a binary (or "dummy") variable to permit the caseload to shift after the interim final rule was issued because our discussions with state and county Colorado Works officials indicated that the new law was unlikely to have affected the

caseload until the interim final rule was issued.[7] Finally, we include a binary variable equal to one when the Computer Benefit Management System (CBMS) was in effect, from August 2004 through the end of the analysis period. It should be noted, however, that this variable will also pick up effects from any other variable that triggered on in this period.

Exhibit 8: Descriptive Statistics of Variables from Statewide Stock Models

Independent Variables	Mean	Std Dev	Minimum	Maximum
Diversions	387	143	120	741
Real Maximum Benefit	304	17	278	341
Real Minimum Wage	4.57	0.37	4.10	5.44
Current Unemployment Rate	4.51	1.24	2.4	6.7
1 Month Lag	4.50	1.25	2.4	6.7
3 Month Lag	4.47	1.25	2.4	6.7
6 Month Lag	4.44	1.25	2.4	6.7
12 Month Lag	4.39	1.25	2.4	6.6
24 Month Lag	4.31	1.34	2.4	6.7
36 Month Lag	4.23	1.34	2.4	6.7
State Population (Thousands)	4554	207	4056	4901
Sanction and Case Closure Rate (One Parent Families)	3.4	1.9	1.0	8.4
Sanction and Case Closure Rate (Child Only Families)	0.5	0.3	0.0	1.2
Sanction and Case Closure Rate (Two Parent Families)	5.1	1.9	1.2	11.4

There were also several variables that we considered including in the models but decided not to include in the end. In most instances, the variables were excluded because data for at least 12 months were unavailable, and we would have not been able to include most of the period after the interim final rule for the DRA was issued.[8] Variables eliminated for this reason include number of divorces, number of out-of-wedlock births, racial/ethnic composition of the Colorado population, average retail wage, and median income of the Colorado population. In addition, we tried using monthly binary variables to capture seasonality, but this change in specification did not add significant explanatory power to the model.

VI. Modeling to Explain State-Level Caseload Trends

This section provides major results from the state-level modeling analyses. We first present the models of the one-parent, two-parent, and child-only caseloads. We then present the analyses where instead of modeling the caseload level, we model entries and exits separately.

[7] We recognize that this is not an ideal way to deal with the DRA because the DRA tightened participation requirements for the states, and the state initiated several new policies after the DRA interim final rules were promulgated. However, there is no good way to model a series of changes that were rapidly introduced after the DRA rule was issued.

[8] To see if including the variables missing the last 12 months would add to our understanding of the caseload, we conducted analyses with these variables using the shorter period of time. In most instances, the variables either were statistically insignificant or had the wrong sign.

A. One-Parent Caseload Stock Models

The one-parent caseload model results are presented in Exhibit 9. Not surprisingly, the unemployment rate is a key factor in determining the Colorado Works one-parent caseload. Although the regression coefficient for the current unemployment rate and the 36-month lagged rate were not statistically significant, the coefficients for the unemployment rate lagged by one month, three months, 12 months, and 24 months were all positive, indicating that an increase in the unemployment rate leads to an increase in the one-parent caseload. To help interpret the findings, note that an increase in the unemployment rate by one percentage point would lead to an increase in the caseload by 398 cases one month later, 401 cases 12 months later, and 325 cases 24 months later, holding other factors constant. The estimates for the impacts of the current rate, the rate lagged 6 months, and the rate lagged 36 months were not statistically significant so we cannot be reasonably confident that the true impact is not zero.

Several of the policy variables have a statistically significant effect on the one-parent caseload. During the period when the interim final rule for the DRA is in effect, the monthly caseload is 643 cases smaller than it otherwise would be. The coefficient for the inflation-adjusted maximum cash benefit for a family of three had a statistically significant regression coefficient, but the sign was negative, contrary to what we had expected. This unusual result may have occurred because the cash benefit was not changed over the period analyzed, so the observed change was due to inflation.[9] The number of diversions did not have a statistically significant effect on the caseload, but the coefficient for the sanction and administrative closure rate had the expected negative sign and was statistically significant. Finally the coefficient for use of the CBMS computer system did not have a statistically significant impact.

Among the other variables in the model, the caseload was found to be lower in the second and third quarters relative to the fourth quarter, but there was no statistically significant difference between the second and fourth quarters. The regression coefficient for the state inflation-adjusted minimum wage was negative and significant. Contrary to expectations, population size had a statistically significant negative coefficient.

Overall, it appears that the unemployment rate has been a major factor in determining the size of the one-parent caseload. The caseload has fallen since 2005, but it is difficult to isolate the extent to which specific changes made in response to the DRA have driven the decline.

[9] In caseload models developed for New Jersey, the real benefit also had a negative statistically significant regression coefficient. See Steven Garasky and Burt S. Barnow (1992). "Cost neutrality: Using Caseload Models to Determine the Federal Cost Neutrality of New Jersey's REACH Demonstration/" *Journal of Policy Analysis and Management* 11(4): 624-636.

Exhibit 9: Regression Results from Statewide One-Parent Stock Model

	One-Parent Caseload
Unemployment Rates (Not Seasonally Adjusted):	
Current	-89.042
	(87.600)
1 Month Lag	398.403
	(99.965)***
3 Month Lag	211.720
	(80.385)**
6 Month Lag	89.593
	(67.939)
12 Month Lag	401.008
	(51.917)***
24 Month Lag	325.399
	(35.790)***
36 Month Lag	50.410
	(119.582)
Policy Issues and Changes:	
DRA - Interim Final Rule	-642.655
	(139.437)***
Total State and County Diversions	0.511
	(0.516)
Maximum Benefit for a Family of 3 (Inflation Adjusted)	-56.230
	(18.974)***
Combined Sanction and Administrative Closure Rate	-71.503
	(34.655)**
CBMS Computer System	322.053
	(456.621)
Other Factors:	
State Population Size	-9.056
	(1.658)***
Colorado Minimum Wage (Inflation Adjusted)	-855.264
	(120.871)***
Quarter 1	-211.196
	(102.702)**
Quarter 2	40.447
	(71.425)
Quarter 3	-130.831
	(75.434)*
Constant	64,202.917
	(13,458.328)***
Observations	96
R-squared	0.98
Durbin-Watson Statistic	1.34

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

B. Two-Parent Caseload Stock Models

The regression model used to estimate the level of the two-parent family caseload is shown in Exhibit 10. The explanatory variables in this model are the same as in the model for one-parent

families. Once again, the lagged unemployment rate is an important determinant of the caseload, with the one-month, three-month, 12-month, and 24-month lagged unemployment rates having statistically significant effects on the caseload.

Exhibit 10: Regression Results from State-Wide Two-Parent Stock Model

	Two-Parent Caseload
Unemployment Rates (Not Seasonally Adjusted):	
Current	-31.938
	(16.978)*
1 Month Lag	101.995
	(17.887)***
3 Month Lag	34.170
	(13.372)**
6 Month Lag	4.830
	(12.453)
12 Month Lag	60.205
	(9.220)***
24 Month Lag	63.772
	(6.394)***
36 Month Lag	-5.322
	(25.207)
Policy Issues and Changes:	
DRA - Interim Final Rule	-147.236
	(23.026)***
Total State and County Diversions	0.095
	(0.099)
Maximum Benefit for a Family of 3 (Inflation Adjusted)	-8.041
	(3.423)**
Combined Sanction and Administrative Closure Rate	6.741
	(3.463)*
CBMS Computer System	29.397
	(90.014)
Other Factors:	
State Population Size	-0.775
	(0.310)**
Colorado Minimum Wage (Inflation Adjusted)	-140.943
	(18.722)***
Quarter 1	8.404
	(19.717)
Quarter 2	23.472
	(13.010)*
Quarter 3	-39.384
	(12.314)***
Constant	6,320.801
	(2,506.273)**
Observations	96
R-squared	0.98
Durbin-Watson Statistic	1.29

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

As with the model for the one-parent caseload, the policy variables have a mixed record. The coefficient for the period when the DRA interim final rule was in effect was again negative

indicating that the caseload was smaller after the rule was issued. As before, the coefficient for the real maximum benefit for a family of three was negative and statistically significant, and the coefficients for total state and county diversions and the period of the CBMS were small and insignificant. Unlike the model for the one-parent caseload, the coefficient for the combined sanction and administrative closure rate is positive and significant in the two-parent caseload model.

The Colorado population size coefficient is again unexpectedly negative, and the inflation-adjusted minimum wage coefficient is negative and statistically significant. For the calendar quarter variables, the coefficient for the third quarter is negative and the only quarter whose coefficient is statistically significant.

C. Child-Only Stock Models

The child-only caseload differs from the one-parent and two-parent caseload in several important ways.[10] In some instances there are no adults in the unit because the children do not live with their parents but with a relative or other adult caretaker whose income and assets are not considered in determining TANF eligibility; in others, the parent(s) may not be eligible for TANF because of factors such as receipt of supplemental security income (SSI) or alien status. Because there are no work requirements for the parents or choices between work and welfare to be made, we would not anticipate the statistical models to perform as well in explaining the size of the Colorado Works child only caseload as they do for the one-parent and two-parent caseloads. For example, the size of the maximum benefit might still be a factor in whether the custodian applies for benefits for the child, but the diversion and sanctioning policies are no longer relevant. The unemployment rate might still have an effect because the custodian might be more likely to apply for the benefits when economic conditions are harsher, but such effects are not likely to be as strong as we found for the cases where one or both parents are present. Exhibit 11 shows the regression coefficients for the child-only caseload model and, as expected, few of the coefficients are statistically significant. Among the unemployment rate variables, the current unemployment rate coefficient is statistically significant, but the coefficient is negative, which is contrary to what we would expect.[11] The only other unemployment rate that has a statistically significant coefficient is the rate lagged three months. Because the coefficients for these two unemployment rate variables are close in magnitude but opposite in sign, they virtually cancel each other out in their effect on the child-only caseload. The only other variables with statistically significant regression coefficients are the binary variable for the period when the DRA interim final rule was in effect, which reduced the caseload by 57 cases, and the binary variable for the period when the CBMS was operating, which has a positive coefficient of 929 cases. (The variable for first quarter caseload is statistically significant, but the magnitude is so small, a reduction in the caseload of 1.1 cases, that the impact on the caseload is inconsequential.)

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[10] For a review of issues surrounding the TANF child-only caseload, see Mary Farrell, Michael Fishman, Stephanie Laud, and Vincena Allen (2000). *Understanding the AFDC/TANF Child-Only Caseload: Policies, Composition, and Characteristics in Three States*. Falls Church, VA: The Lewin Group.

[11] One hypothesis is that relative caretakers can choose between receiving TANF payments and foster care payments. Foster care pays higher benefits but requires more state oversight, and it is possible that when unemployment is high the higher payments become more important.

Exhibit 11: Regression Results from State-Wide Child-Only Stock Model[1]

	Child-Only Caseload
Unemployment Rates (Not Seasonally Adjusted):	
Current	-27.697
	(16.637)*
1 Month Lag	-0.642
	(14.297)
3 Month Lag	18.885
	(11.222)*
6 Month Lag	-7.099
	(13.742)
12 Month Lag	16.362
	(19.455)
24 Month Lag	18.011
	(19.824)
36 Month Lag	-6.137
	(23.572)
Policy Issues and Changes:	
DRA - Interim Final Rule	-56.659
	(18.378)***
Total State and County Diversions	0.064
	(0.060)
Maximum Benefit for a Family of 3 (Inflation Adjusted)	-3.512
	(8.667)
Combined Sanction and Administrative Closure Rate	12.221
	(27.062)
CBMS Computer System	928.536
	(289.996)***
Other Factors:	
State Population Size	-1.089
	(0.601)*
Colorado Minimum Wage (Inflation Adjusted)	10.918
	(10.630)
Quarter 1	9.205
	(16.603)
Quarter 2	-4.162
	(15.005)
Quarter 3	-12.155
	(11.550)
Constant	10,079.310
	(5,243.264)*
Observations	96
R-squared	0.91
Durbin-Watson Statistic	1.56

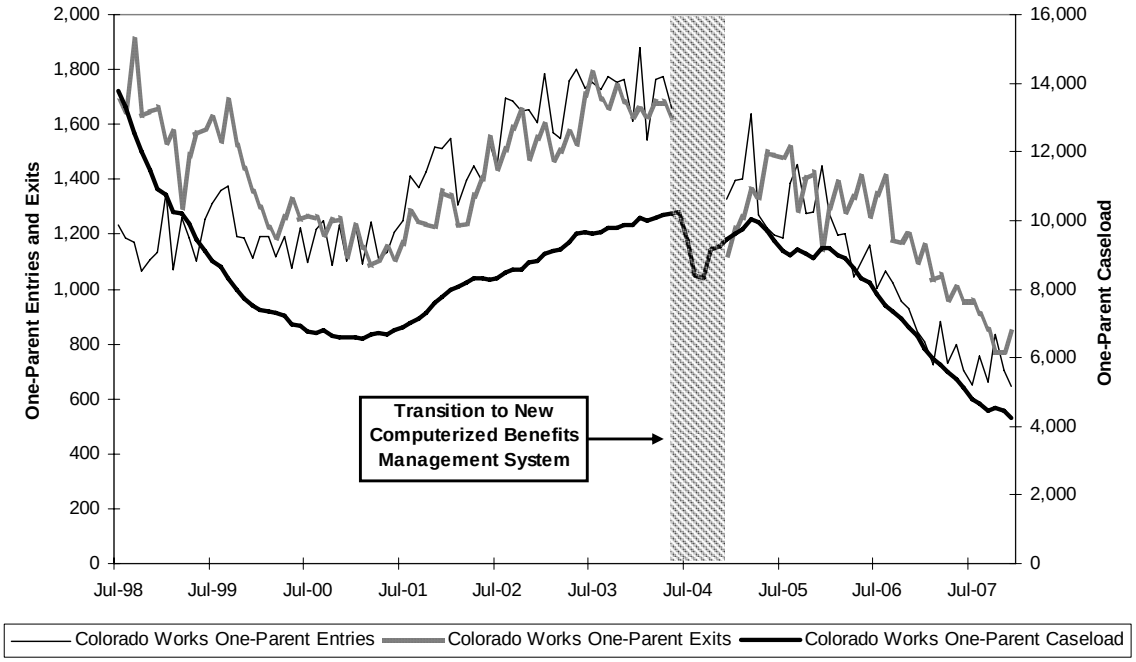
Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
[1]Adjusted for Autocorrelation utilizing the Prais-Winsten Method

D. One-Parent Caseload Entry and Exit Models

The analyses presented to this point all model the level of the caseload. A more sophisticated way to look at the caseload is that the caseload in month *t* is the caseload in the prior month plus new entries minus exits: $Cases_t = Cases_{t-1} + Entries_t - Exits_t$. In this approach, the factors that affect entries can differ from those that affect exits, and common variables can have different impacts on entries than they do on exits.

Interestingly, entries and exits to the caseload tend to move together. Exhibit 12 tracks the total one-parent caseload, entries, and exits over the period analyzed. As one would expect, entries are generally greater than exits during periods when the caseload is growing, and exits are greater than entries when the caseload is shrinking. Also, both entries and exits tend follow the general pattern of caseload change—in periods when the caseload is growing, entries and exits tend to grow as well.

Exhibit 12: Colorado Works One-Parent Caseload and Associated Entries and Exits



Models for caseload entries and exits were developed only for the one-parent caseload. The entry model is presented in Exhibit 13, and the exit model is in Exhibit 14. One notable difference between the entry-exit models and the caseload stock model is that fewer variables in the entry-exit regressions tend to be statistically significant. These models do, however, provide evidence on whether the caseload changes are due to changes in entries, exits, or both. For example, two of the unemployment rate variables are statistically significant in the entry regression (the unemployment rate lagged three months and lagged 12 months), but none of the unemployment rate variables are statistically significant in the exit model. This leads to the inference that when the economy deteriorates, one can expect an increase in entries with no offsetting increase in exits. The coefficient for the inflation-adjusted maximum benefit for a family of three is not significant in either the entry or the exit model. The coefficients for the

combined exit and sanction rates in the two models are of interest. The coefficient is statistically significant in both regressions, indicating that when the sanctioning/administrative closure rate increases, both entries and exits are affected. Thus, in addition to sanctions directly increasing exits, there appears to also be a deterrent effect as entries also decline. As would be expected, the effect of a change in the sanctioning and administrative closure rate is much larger for exits than it is for entries.

Exhibit 13: Regression Results from Statewide One-Parent Entries Model

	One-Parent Entries
Unemployment Rates (Not Seasonally Adjusted):	
Current	54.582
	(40.605)
1 Month Lag	-35.728
	(42.788)
3 Month Lag	72.981
	(32.969)**
6 Month Lag	-3.632
	(28.922)
12 Month Lag	92.973
	(19.412)***
24 Month Lag	22.260
	(18.471)
36 Month Lag	-9.242
	(44.932)
Policy Issues and Changes:	
DRA - Interim Final Rule	-151.174
	(55.544)***
Total State and County Diversions	0.474
	(0.180)**
Maximum Benefit for a Family of 3 (Inflation Adjusted)	-6.950
	(7.036)
Combined Sanction and Administrative Closure Rate	-21.163
	(11.522)*
CBMS Computer System	-186.373
	(143.023)
Other Factors:	
State Population Size	-0.765
	(0.582)
Colorado Minimum Wage (Inflation Adjusted)	-82.551
	(34.472)**
Quarter 1	-34.728
	(38.152)
Quarter 2	-55.963
	(31.312)*
Quarter 3	13.406
	(32.570)
Constant	6,413.961
	(4,895.534)
Observations	96
R-squared	0.93
Durbin-Watson Statistic	1.91

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

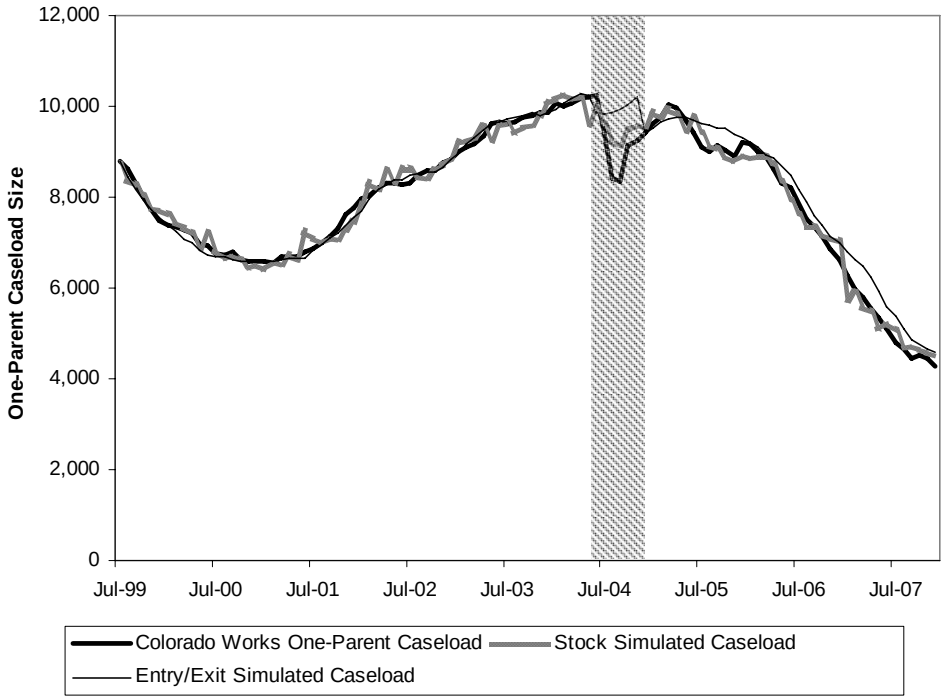
Exhibit 14: Regression Results from Statewide One-Parent Exits Model

	One-Parent Exits
Unemployment Rates (Not Seasonally Adjusted):	
Current	7.258
	(33.251)
1 Month Lag	-53.637
	(35.401)
3 Month Lag	45.507
	(31.302)
6 Month Lag	29.306
	(18.638)
12 Month Lag	14.288
	(18.416)
24 Month Lag	-14.951
	(12.346)
36 Month Lag	9.028
	(36.493)
Policy Issues and Changes:	
DRA - Interim Final Rule	-4.498
	(59.038)
Total State and County Diversions	0.149
	(0.189)
Maximum Benefit for a Family of 3 (Inflation Adjusted)	2.806
	(2.110)
Combined Sanction and Administrative Closure Rate	66.005
	(13.000)***
CBMS Computer System	-216.291
	(125.953)*
Other Factors:	
One-Parent Caseload Size	0.142
	(0.034)***
Colorado Minimum Wage (Inflation Adjusted)	-20.047
	(50.291)
Quarter 1	-5.114
	(40.314)
Quarter 2	-32.452
	(26.300)
Quarter 3	30.739
	(26.745)
Constant	-916.833
	(570.003)
Observations	96
R-squared	0.92
Durbin-Watson Statistic	1.78

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

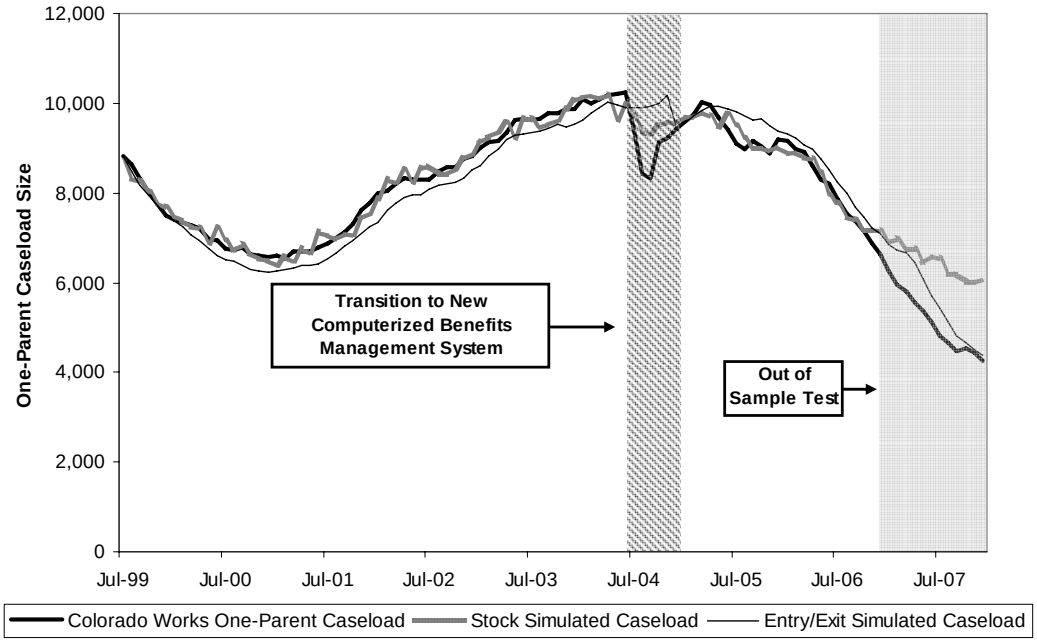
We conducted several analyses to compare the stock model to the entry/exit approach. First, we plotted the actual one-parent caseload against the caseload levels predicted by the stock model and the entry and exit models; the three plots are shown in Exhibit 15. Both approaches did reasonably well at predicting the caseload for the overall period. It is well known, however, that models that do a good job of fitting the data for the period analyzed may not do as well for another period of time; thus, analysts sometimes withhold some periods of data from the estimation and then use the out-of-sample period to compare alternative specifications. Because we only have 96 months of data for the analysis, we decided against withholding some of the observations for estimating our main models. However, we did rerun the numbers using this technique to compare the stock model to the entry/exit approach. To perform this test, we re-estimated the stock, entry, and exit models for the one-parent caseload, excluding the 12 observations from 2007. We then used the resulting equations to predict the size of the one-parent caseload each month in 2007. The results are shown in Exhibit 16. This simulation indicates that for the out-of-sample period selected, the entry/exit approach performed considerably better in the second half of the year.

Exhibit 15: Actual Versus Simulated Colorado Works One-Parent Caseloads[1]



[1] June 2004 to November 2004 were excluded from the regression because of the transition to the CBMS system.

Exhibit 16: Out-of-sample Test of Regression Simulation Caseloads[1]



[1] June 2004 to November 2004 were excluded from the regression because of the transition to the CBMS system.

VII. Simulation of Changes in the Unemployment Rate

Caseload models can be used to conduct simulations that indicate what might happen to the caseload when there is a change in one or more of the explanatory variables. We elected to vary the unemployment rate, the factor that had the greatest influence in explaining the trends in the size of the one-parent caseload.[12] Specifically, we used the one-parent stock caseload model to explore what would happen over the next three years if the unemployment rate increased as it did during the 2001-2003 recession and, conversely, if the unemployment were to fall and remain at an historically low level.

For the first simulation, we set the unemployment rate at the levels seen between 2001 and 2003, between 5 and 7 percent, for the 2008-2010 period. We compared this scenario to one where unemployment rate was fixed at 4.3 percent. This caseload simulation is shown in Exhibits 17a and 17b. In December 2010, the one-parent caseload when the unemployment rate was fixed at 4.3 percent would be 3,007 cases using the stock model and 2,830 using the entry/exit models, but under the recession scenario, the caseload would be 4,748 using the stock model and 4,651 using the entry/exit models. Thus, both approaches indicate that a recession would add 1,740-1,820 cases to the monthly one-parent caseload.

[12] We would have liked to conduct simulations of the effect of varying the maximum benefit for a family of three. However, the only variation we observed in the inflation-adjusted maximum benefit for the period analyzed was due to inflation rather than to an actual benefit increase. We believed that the simulations of benefit changes would not accurately reflect what would happen to the caseload if the inflation-adjusted maximum benefit changed because of a benefit increase rather than inflation.

Exhibit 17a: Simulated One-Parent Caseload in 2008, 2009, 2010 Assuming 2001-2003 Recession Level Unemployment Using Stock Model

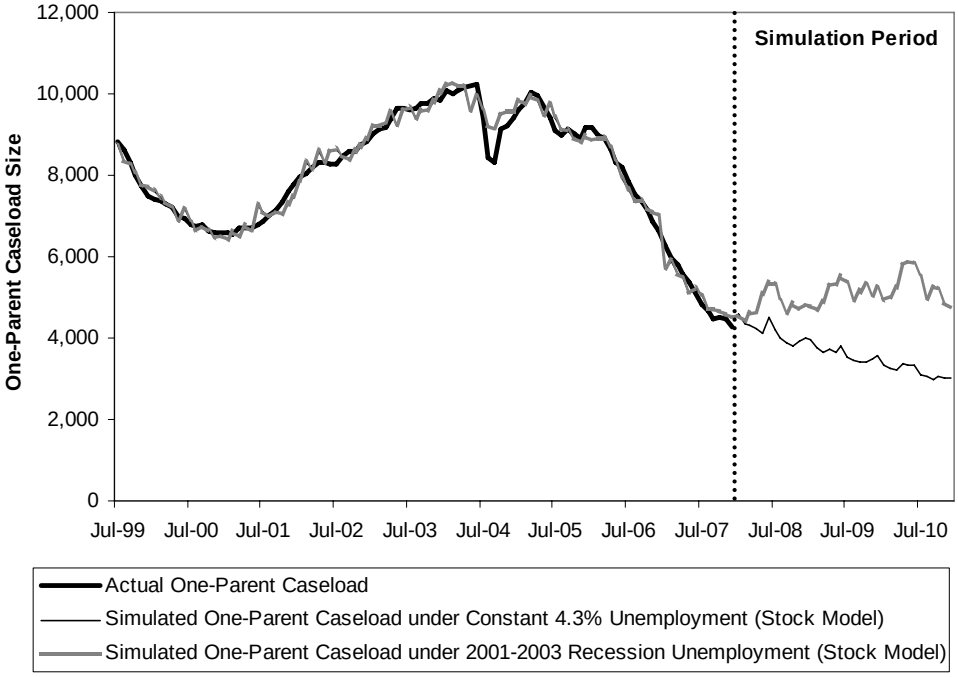
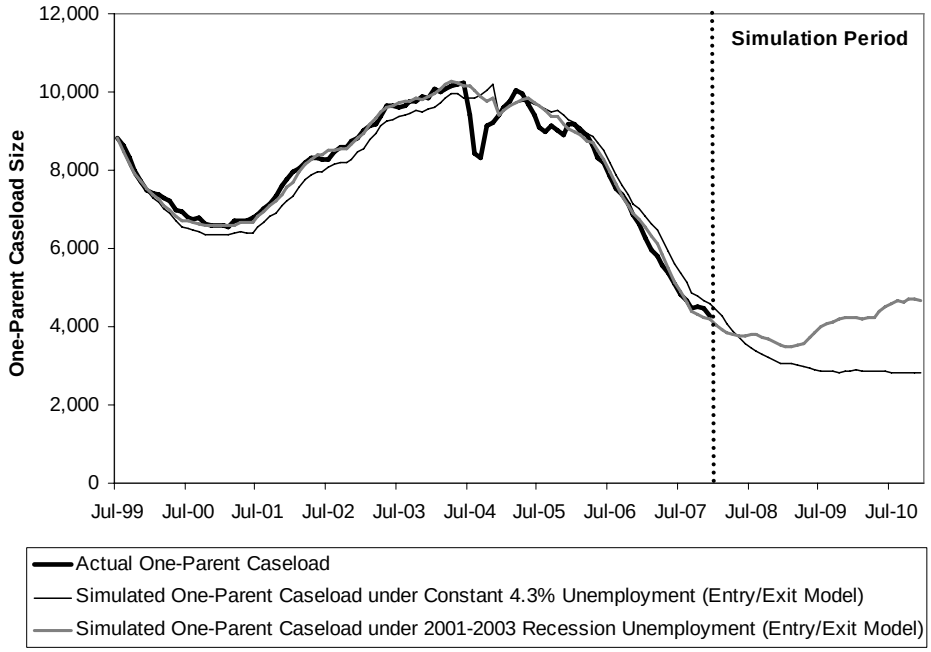


Exhibit 17b: Simulated One-Parent Caseload in 2008, 2009, 2010 Assuming 2001-2003 Recession Level Unemployment Using Entry/Exit Models



In the second simulation, we looked at what would happen to the one-parent caseload if the unemployment rate dropped from the 4.3 percent rate observed in December 2007 to 3.0 percent in January 2008 and remained at that level through December 2010; we selected 3.0 percent

because the state has experienced periods where the unemployment rate was 3 percent or slightly lower. The results of this simulation are presented in Exhibits 18a and 18b. Once again the two types of models produce similar findings. Using the stock model, the drop in the unemployment rate would lead to a decrease in the caseload from 3,007 cases to 1,269 cases, and the entry/exit models indicate that the drop in the unemployment rate would lead to a decline in the caseload from 2,830 cases to 1,307 cases. Thus, the models we have developed indicate that a sustained period of low unemployment could reduce the caseload by 1,500 to 1,800 cases, which would cut the one-parent caseload to less than one-half what it was in December 2007.

Exhibit 18a: Simulated One-Parent Caseload in 2008, 2009, 2010 Assuming Unemployment Rates of 3 Percent Using Stock Model

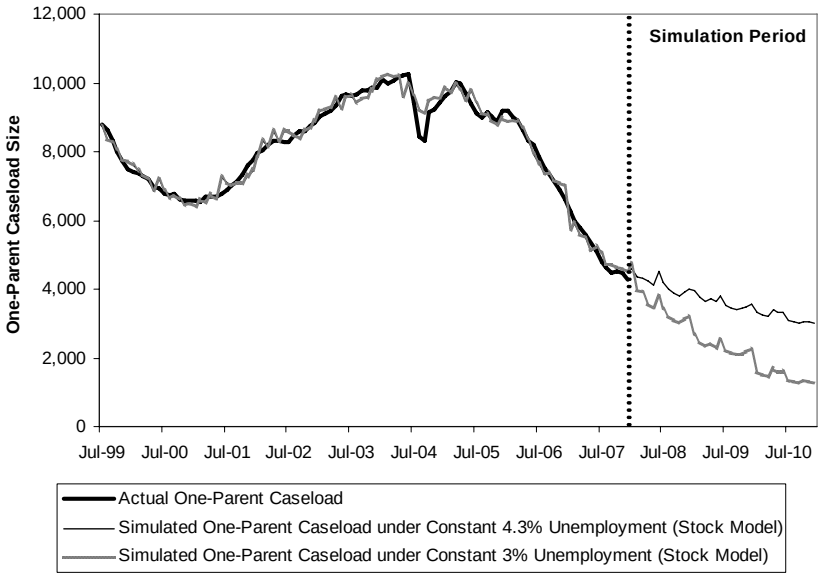
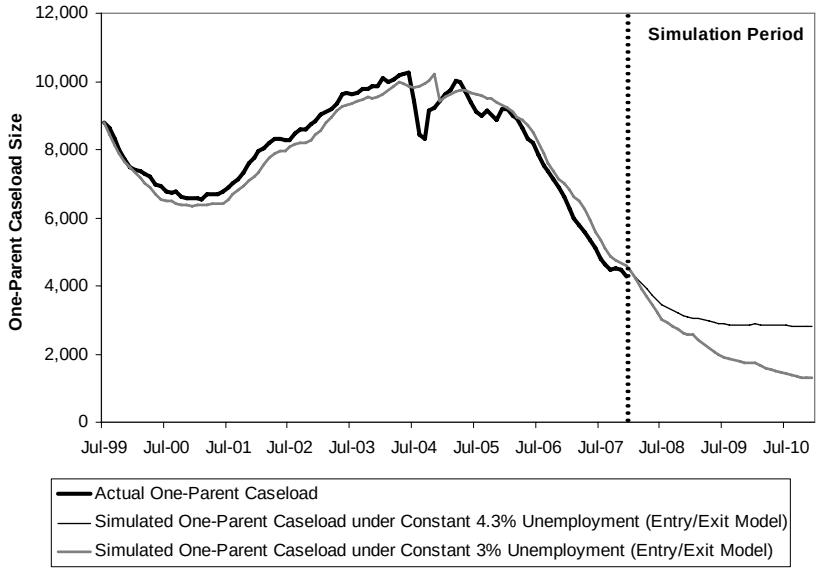


Exhibit 18b: Simulated One-Parent Caseload in 2008, 2009, 2010 Assuming Unemployment Rates of 3 Percent Using Entry/Exit Models



The models indicate that if the unemployment rate stays within the range experienced in the past decade and no other important changes occur, the one-parent caseload is predicted to be between 1,500 and 4,800 cases compared to roughly 4,000 cases at the end of 2007.

VIII. Caseload Models for the Five Largest Counties

County-level models were developed for the one-parent caseloads in the five largest counties in Colorado to better understand caseload dynamics at a local level.[13] The county-level analyses are of interest for several reasons. First, because the counties pay for a significant share of the TANF program, county officials may wish to understand the determinants and sensitivity of their caseload so that they can plan better. Second, the counties have somewhat different policies and economies; it is interesting to see if caseload trends differ among the counties. This section presents the findings from our county-level analyses. The counties analyzed are Adams, Arapahoe, Denver, El Paso, and Jefferson Counties. For each of these counties, we present the model results and how well the model predicts each county's caseload trends.

A. Adams County

Adams County is the smallest of the five counties examined. It is located directly east of Denver County, and it has had a one-parent caseload varying between 200 and 650 cases over the analysis period. While Adams' caseload started close to 500 cases per month in 1999, it dropped to about 300 cases per month during the early 2000s. Over the course of 2002, 2003, and 2004, the caseload steadily climbed back up to a peak of 650 cases by July 2004. However, following this peak, and coinciding with the implementation of CBMS, the caseload dropped considerably. In 2007, the county's one-parent caseload was about 200 cases a month.

While in the state-level analysis, we found many policy and contextual variables statistically significant, for the Adams model, only the unemployment rate, lagged six months, was statistically significant. This measure of the economy was positively associated with the caseload size, as was found in the state-level analysis—about six months after the unemployment rate rises, so does the caseload.

Adams County was somewhat "ahead-of-the-curve," having adopted a strong work-first strategy before 2005. Discussions with county staff indicated that the county administrator did not feel there needed to be any major changes to their system following DRA in order to meet their participation requirements. Because of this, we are not surprised that the regression coefficient for our dummy variable for the DRA interim final rule was not statistically significant. The unemployment rate was the only significant factor.

[13] We did not attempt to model the child-only caseloads nor the two-parent caseloads in these counties due to resource constraints and the small size of the caseloads. For the same reasons, we did not model any caseloads from the smaller Colorado counties.

Exhibit 19a: Regression Results from Adams County One-Parent Caseload Model[1]

	Adams One-Parent Caseload
Unemployment Rates (Not Seasonally Adjusted):	
Current	-3.286
	(6.067)
1 Month Lag	2.596
	(4.878)
3 Month Lag	5.842
	(4.574)
6 Month Lag	9.925
	(4.569)**
12 Month Lag	11.985
	(8.705)
24 Month Lag	11.494
	(7.693)
36 Month Lag	-14.523
	(9.496)
Policy Issues and Changes:	
DRA - Interim Final Rule	14.683
	(9.276)
Total State and County Diversions	0.379
	(0.742)
Maximum Benefit for a Family of 3 (Inflation Adjusted)	6.157
	(4.373)
Combined Sanction and Administrative Closure Rate	0.568
	(1.976)
CBMS Computer System	-49.839
	(151.078)
Other Factors:	
County Population Size	0.486
	(3.888)
Colorado Minimum Wage (Inflation Adjusted)	-5.855
	(6.928)
Quarter 1	-1.324
	(9.728)
Quarter 2	10.302
	(9.518)
Quarter 3	-0.605
	(6.027)
Constant	-1,820.792
	(2,733.735)
Observations	96
R-squared	0.40
Durbin-Watson Statistic	2.09

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
[1]Adjusted for Autocorrelation utilizing the Prais-Winsten Method

Of all of the county models developed, the Adams County model does the poorest job of predicting the caseload levels. For 2001 and 2002, the model predicts the caseload to be about 100 cases higher than it should be, and for 2003, it fails to predict the sharp spike in the caseload. This may be due to the fact that Adams was the smallest of the counties we studied, and the smaller caseload may reduce the precision of the statistical estimates.

Exhibit 19b: Actual Versus Simulated Adams County One-Parent Caseloads

B. Arapahoe County

Arapahoe County, Adams County's neighboring county directly to the south, has a larger one-parent caseload than Adams County, ranging from 500 cases to 2,000 cases over the analysis period. Arapahoe County's caseload was low in July 1999 and remained flat until 2001. At this point, the caseload began to rise until late 2005. Ever since, the caseload has been in decline.

The results from the Arapahoe County model were generally consistent with the findings from the state-level analysis, meaning that the same factors that explained the state caseload trends also explained the Arapahoe caseload trends. Many of the unemployment rate lags were statistically significant and positively related to the caseload size. The DRA Interim Final Rule coefficient was statistically significant and negatively associated with the caseload level, as was also observed in the state-level analyses. The Colorado minimum wage and county population size were both statistically significant and negative. The same seasonal patterns were also observed in Arapahoe as was seen in Colorado as a whole. In Arapahoe, however, the combined sanction and administrative closure rate was not statistically significant, and the maximum benefit for a family of three was not significant.

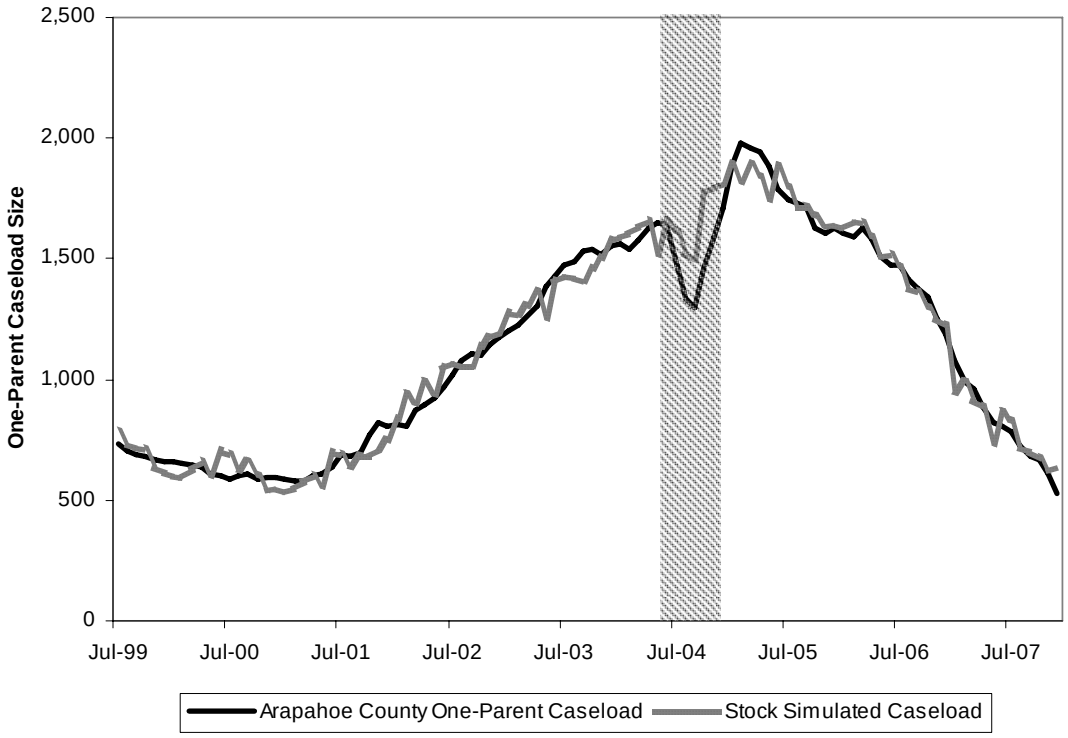
Exhibit 20a: Regression Results from Arapahoe County One-Parent Caseload Model[1]

	Arapahoe One-Parent Caseload
Unemployment Rates (Not Seasonally Adjusted):	
Current	-38.984
	(23.358)*
1 Month Lag	114.433
	(30.109)***
3 Month Lag	24.018
	(29.030)
6 Month Lag	17.636
	(19.531)
12 Month Lag	118.356
	(15.253)***
24 Month Lag	93.027
	(11.482)***
36 Month Lag	47.485
	(34.018)
Policy Issues and Changes:	
DRA - Interim Final Rule	-92.839
	(35.721)**
Total State and County Diversions	0.118
	(0.183)
Maximum Benefit for a Family of 3 (Inflation Adjusted)	-3.818
	(7.105)
Combined Sanction and Administrative Closure Rate	-6.728
	(5.157)
CBMS Computer System	226.592
	(167.222)
Other Factors:	
County Population Size	-15.634
	(9.290)*
Colorado Minimum Wage (Inflation Adjusted)	-178.793
	(41.956)***
Quarter 1	-68.531
	(26.914)**
Quarter 2	1.483
	(27.310)
Quarter 3	-44.765
	(23.480)*
Constant	9,672.958
	(6,788.401)
Observations	96
R-squared	0.98
Durbin-Watson Statistic	1.23

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
[1]Results suffer from autocorrelation. Correction techiniques were unsuccessful. Standard errors may be underestimated.

The Arapahoe County model predicts the one-parent caseload with a reasonable level of accuracy. The values predicted by the model track the actual observed caseload levels over the entire analysis period with close accuracy.

Exhibit 20b: Actual Versus Simulated Arapahoe County One-Parent Caseloads



C. Denver County

Denver County is the largest in the state and has the largest one-parent caseload size over the course of the analysis period. Between July 1999 and December 2007, the one-parent caseload ranged between 1,250 and 2,250 cases. The one-parent caseload follows a similar pattern as was observed at the state-level. Initially the caseload declined during the late 1990s, which was followed by caseload growth for several years. Beginning in 2004, there have been caseload declines, which continue today.

The regression model for Denver County is somewhat different from the state model. While many of the coefficients for our explanatory variables are consistent with the findings from the state-level modeling, many are not statistically significant. It does appear that the economy is the most important factor related to the caseload trend, with the current and six month lagged unemployment rates positively associated with the caseload level.

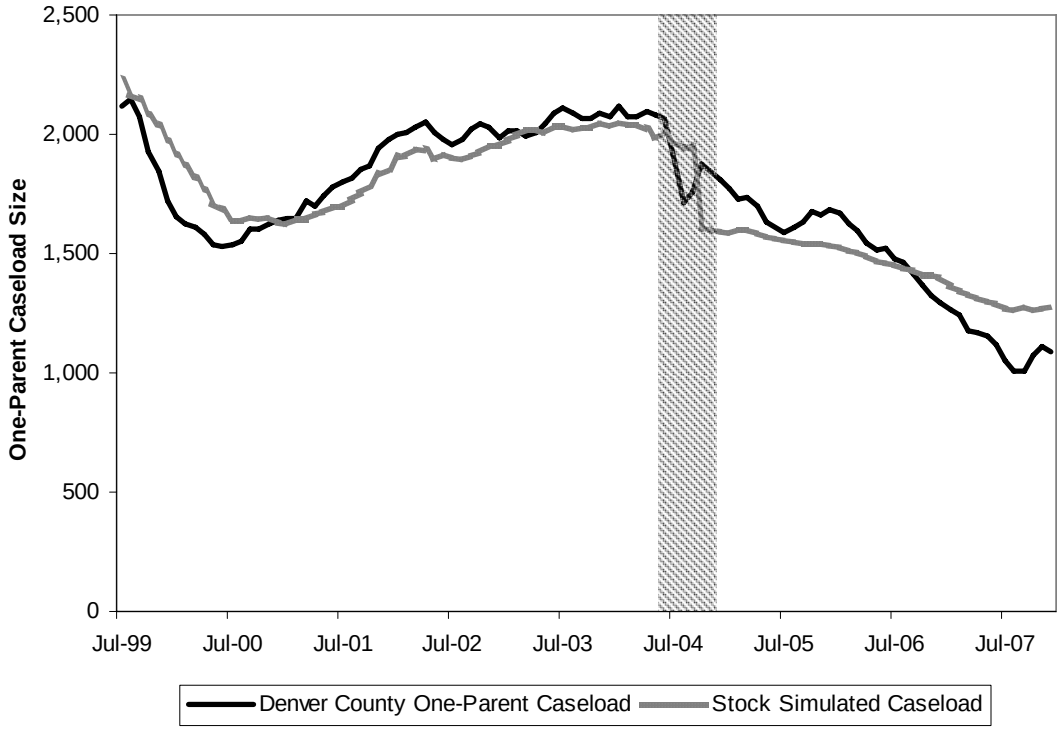
Exhibit 21a: Regression Results from Denver County One-Parent Caseload Model[1]

	Denver One-Parent Caseload
Unemployment Rates (Not Seasonally Adjusted):	
Current	36.380
	(11.312)***
1 Month Lag	3.284
	(9.817)
3 Month Lag	25.467
	(14.333)*
6 Month Lag	-17.633
	(14.799)
12 Month Lag	7.883
	(13.013)
24 Month Lag	6.934
	(13.644)
36 Month Lag	-12.344
	(16.080)
Policy Issues and Changes:	
DRA - Interim Final Rule	-18.630
	(21.856)
Total State and County Diversions	-0.707
	(0.630)
Maximum Benefit for a Family of 3 (Inflation Adjusted)	-7.468
	(6.342)
Combined Sanction and Administrative Closure Rate	0.426
	(9.541)
CBMS Computer System	-333.056
	(236.212)
Other Factors:	
County Population Size	-12.251
	(3.338)***
Colorado Minimum Wage (Inflation Adjusted)	-20.515
	(12.010)*
Quarter 1	-24.057
	(15.820)
Quarter 2	-25.252
	(16.323)
Quarter 3	-1.705
	(16.144)
Constant	10,981.738
	(3,731.279)***
Observations	96
R-squared	0.85
Durbin-Watson Statistic	1.56

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
[1]Adjusted for Autocorrelation utilizing the Prais-Winsten Method

Despite the somewhat different results in Denver compared to the state model, we find that the caseload size predicted by our analysis fits the actual Denver caseload well.

Exhibit 21b: Actual Versus Simulated Denver County One-Parent Caseloads



D. El Paso County

El Paso County's one-parent caseload has hovered between 1,100 and 1,400 cases between July 1999 and May 2004. Following the implementation of CBMS, the caseload level rose much higher to over 1,650, but these increases were counteracted by declines during 2006 and 2007.

The results from the El Paso model were inconsistent with the findings from the state-level analysis, perhaps because of the noticeable increase in the caseload at the time of CBMS implementation. Two of the measures of the economy, the current unemployment rate as well as the unemployment rate lagged 24 months, were found to be negatively associated with the caseload level. This means that when the unemployment rate declines and the economy improves, the caseload level increases. The sanction/case closure rate was also found to be positively associated with the caseload level.

Several variables, however, did follow the same trend as we found in the state as a whole. The DRA interim final rules as well as the Colorado minimum wage were both found to be negatively associated with the caseload size and the unemployment rate lagged by one month was positively associated with the caseload size.

Exhibit 22a: Regression Results from El Paso County One-Parent Caseload Model[1]

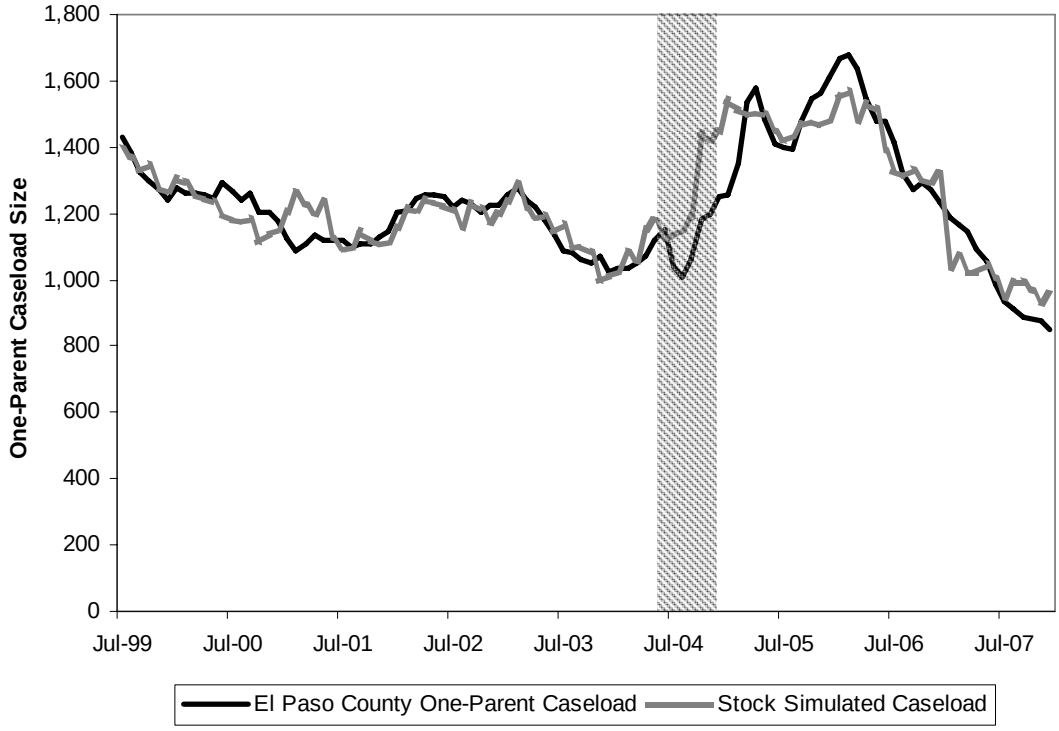
	El Paso One-Parent Caseload
Unemployment Rates (Not Seasonally Adjusted):	
Current	-53.100
	(27.214)*
1 Month Lag	42.806
	(25.659)*
3 Month Lag	11.046
	(22.507)
6 Month Lag	22.491
	(16.047)
12 Month Lag	7.302
	(10.492)
24 Month Lag	-42.528
	(10.506)***
36 Month Lag	22.472
	(37.223)
Policy Issues and Changes:	
DRA - Interim Final Rule	-104.070
	(45.731)**
Total State and County Diversions	-1.231
	(0.681)*
Maximum Benefit for a Family of 3 (Inflation Adjusted)	5.924
	(9.927)
Combined Sanction and Administrative Closure Rate	27.358
	(15.608)*
CBMS Computer System	308.866
	(139.253)**
Other Factors:	
County Population Size	0.401
	(8.217)
Colorado Minimum Wage (Inflation Adjusted)	-226.312
	(46.234)***
Quarter 1	87.301
	(39.462)**
Quarter 2	70.205
	(29.856)**
Quarter 3	18.417
	(30.731)
Constant	83.968
	(7,752.854)
Observations	96
R-squared	0.83
Durbin-Watson Statistic	0.66

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
[1]Results suffer from autocorrelation. Correction techiniques were unsuccessful. Standard errors may be underestimated.

The predicted one-parent caseload for El Paso County is closely in-line with the actual caseload.

The model has some difficulty predicting the caseload peak towards the end of 2005, but accurately depicts the caseload trends for the rest of the analysis period.

Exhibit 22b: Actual Versus Simulated El Paso County One-Parent Caseloads



E. Jefferson County

Jefferson County's one-parent caseload follows a trend similar to the trend in Arapahoe County. It starts low, rises to a plateau between 2003 and 2005, and then begins to decline rapidly in the most recent years. Overall, the one-parent caseload ranges between 400 and 1,200 cases.

In Jefferson many economic and programmatic variables were statistically and significantly related to the caseload trend. The unemployment rate lagged by one, three, 12, and 24 months were all statistically significant and positively associated with the caseload. The same was true of the maximum benefit level and the number of diversions. The sanction/administrative closure rate, the DRA interim final rule, the population size, and the inflation-adjusted Colorado minimum wage were all negatively associated with the caseload size and statistically significant.

Exhibit 23a: Regression Results from Jefferson County One-Parent Caseload Model

	Jefferson One-Parent Caseload
Unemployment Rates (Not Seasonally Adjusted):	
Current	-0.074
	(10.308)
1 Month Lag	35.795
	(13.726)**
3 Month Lag	28.464
	(14.419)*
6 Month Lag	10.051
	(10.717)
12 Month Lag	52.934
	(6.873)***
24 Month Lag	34.994
	(5.638)***
36 Month Lag	0.218
	(17.376)
Policy Issues and Changes:	
DRA - Interim Final Rule	-55.349
	(19.983)***
Total State and County Diversions	2.365
	(0.548)***
Maximum Benefit for a Family of 3 (Inflation Adjusted)	2.846
	(0.869)***
Combined Sanction and Administrative Closure Rate	-14.561
	(7.191)**
CBMS Computer System	-27.343
	(54.204)
Other Factors:	
County Population Size	-8.336
	(1.791)***
Colorado Minimum Wage (Inflation Adjusted)	-155.018
	(20.327)***
Quarter 1	-19.225
	(12.165)
Quarter 2	7.300
	(11.600)
Quarter 3	-9.929
	(11.019)
Constant	4,354.141
	(1,252.177)***
Observations	96
R-squared	0.99
Durbin-Watson Statistic	1.62

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

The results from this county's model were closely in line with the findings from the state-level analysis, and the predicted caseload based on the model's results fits the actual caseload with

close accuracy. Excluding the transition to the CBMS system, the model predicts a caseload that is always within 60 cases of the actual caseload.

Exhibit 23b: Actual Versus Simulated Jefferson County One-Parent Caseloads

IX. Conclusions

This report has presented the results of our efforts to develop statistical models of the Colorado Works caseload trends from 1998 through 2008. We estimated models of the size of the Colorado Works caseload (stock models) for one-parent, two-parent, and child only cases, and for the one-parent caseload we also estimated models of monthly entries and exits. We found that both types of models fit the data reasonably well, meaning that we are able to identify factors that are most closely associated with the caseload trends (increases and decreases), and the caseload levels predicted by the models are reasonably close to the actual caseload for the period analyzed. But to be more confident that the findings over the past 10 years will apply to future periods, we would have preferred to have more data observations to better test the out-of-sample properties of our models.

The most important factor determining the size of the one-parent and two-parent caseloads is the unemployment rate, and the unemployment rate from as early as 24 months earlier is a statistically significant factor in determining the size of the current caseload. Our efforts were less successful in determining the factors that influence the size of the child-only caseload, which is not surprising because the factors determining the size of the child-only caseload are not as well understood as those affecting the adult caseload.

The more recent decline in the one-parent caseload beginning in 2005, though, is difficult to explain statistically. Actions taken by the state and counties in response to the federal Deficit

Reduction Act (DRA) are likely to be important, because after the interim final rule for the DRA was issued, the state and most counties made a number of policy changes that together could account for a substantial portion of the decline. However, because the actions were taken within a short period of time, it is not possible to statistically isolate the impact of any one specific change.

Simulations using the models developed indicate that if unemployment rates were to rise over the next three years to the levels experienced in the last recession, the state level one-parent caseload would likely rise by 1,700 to 1,800 cases in 2010. On the other hand, if the unemployment rate drops to the levels experienced in the late 1990s, the one-parent caseload would fall by 1,500 to 1,800 cases.

Administrative and regulatory changes can also affect caseloads. Colorado did not change the maximum benefits over the period analyzed, so we were unable to determine what impact a change in the benefit would have on the size of the Colorado Works caseload. We did find some evidence that stricter policies regarding sanctions and closure for administrative reasons was associated with a reduction in the one-parent caseload.

Modeling the caseload at the county level is a challenging endeavor. It is hard to identify all the relevant changes over the course of the decade, and often difficult to pinpoint exactly when a policy change occurred. Also, when examining smaller counties, measurement errors and random events may arise for some of independent variables such as the unemployment rate, which makes results difficult to interpret.

Nonetheless, the statistical models developed for this project should be useful to state and county officials in understanding how economic and some policy factors affect the caseload, and in projecting how the caseload might be expected to change if benefit amounts and unemployment rates change in certain ways. In short, the analysis provides further insight into the caseload trends for the state as a whole and how counties vary in the terms of factors that are important explanatory factors at that level.

Appendix A

Exhibit A1: Descriptive Statistics of Variables from Adams One-Parent Stock Models

Independent Variables	Mean	Std Dev	Minimum	Maximum
Diversions	5	3	0	16
Real Maximum Benefit	318	17	291	356
Real Minimum Wage	4.78	0.39	4.28	5.69
Current Unemployment Rate	5.03	1.59	2.4	7.8
1 Month Lag	5.01	1.60	2.4	7.8
3 Month Lag	4.95	1.61	2.4	7.8
6 Month Lag	4.89	1.61	2.4	7.8
12 Month Lag	4.79	1.64	2.4	7.8
24 Month Lag	4.65	1.80	2.4	7.8
36 Month Lag	4.49	1.80	2.4	7.8
County Population (Thousands)	382	27	331	427
Sanction and Case Closure Rate (One Parent Families)	2.6	1.7	0.0	7.1

Exhibit A2: Descriptive Statistics of Variables from Arapahoe One-Parent Stock Model

Independent Variables	Mean	Std Dev	Minimum	Maximum
Diversions	8	22	0	212
Real Maximum Benefit	318	17	291	356
Real Minimum Wage	4.78	0.39	4.28	5.69
Current Unemployment Rate	4.44	1.42	2.0	7.0
1 Month Lag	4.42	1.43	2.0	7.0
3 Month Lag	4.38	1.46	2.0	7.0
6 Month Lag	4.31	1.48	2.0	7.0
12 Month Lag	4.19	1.51	2.0	6.5
24 Month Lag	4.00	1.68	2.0	7.0
36 Month Lag	3.80	1.71	2.0	7.0
County Population (Thousands)	516	18	482	550
Sanction and Case Closure Rate (One Parent Families)	5.0	2.1	0.6	14.3

Exhibit A3: Descriptive Statistics of Variables from Denver One-Parent Stock Model

Independent Variables	Mean	Std Dev	Minimum	Maximum
Diversions	11	8	0	46
Real Maximum Benefit	318	17	291	356
Real Minimum Wage	4.78	0.39	4.28	5.69
Current Unemployment Rate	5.18	1.57	2.6	7.8
1 Month Lag	5.16	1.58	2.6	7.8
3 Month Lag	5.12	1.58	2.6	7.8
6 Month Lag	5.07	1.56	2.6	7.8
12 Month Lag	5.01	1.58	2.6	7.8
24 Month Lag	4.93	1.68	2.6	7.8
36 Month Lag	4.87	1.70	2.6	7.8
County Population (Thousands)	563	18	500	594
Sanction and Case Closure Rate (One Parent Families)	1.3	0.9	0.2	3.6

Exhibit A4: Descriptive Statistics of Variables from El Paso One-Parent Stock Model

Independent Variables	Mean	Std Dev	Minimum	Maximum
Diversions	87	28	20	143
Real Maximum Benefit	318	17	291	356
Real Minimum Wage	4.78	0.39	4.28	5.69
Current Unemployment Rate	4.81	1.25	2.5	7.2
1 Month Lag	4.81	1.25	2.5	7.2
3 Month Lag	4.78	1.26	2.5	7.2
6 Month Lag	4.75	1.26	2.5	7.2
12 Month Lag	4.71	1.25	2.5	7.2
24 Month Lag	4.64	1.31	2.5	7.2
36 Month Lag	4.57	1.32	2.5	7.2
County Population (Thousands)	552	25	500	590
Sanction and Case Closure Rate (One Parent Families)	1.4	1.1	0.0	5.5

Exhibit A5: Descriptive Statistics of Variables from Jefferson One-Parent Stock Model

Independent Variables	Mean	Std Dev	Minimum	Maximum
Diversions	14	9	1	52
Real Maximum Benefit	318	17	291	356
Real Minimum Wage	4.78	0.39	4.28	5.69
Current Unemployment Rate	4.25	1.32	2.0	6.6
1 Month Lag	4.24	1.33	2.0	6.6
3 Month Lag	4.19	1.35	2.0	6.6
6 Month Lag	4.13	1.37	2.0	6.6
12 Month Lag	4.04	1.40	2.0	6.3
24 Month Lag	3.87	1.53	2.0	6.6
36 Month Lag	3.70	1.54	2.0	6.6
County Population (Thousands)	526	4	509	531
Sanction and Case Closure Rate (One Parent Families)	1.5	1.0	0.2	4.3