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# CAPITAL IMPROVEMENT PLANNING PROJECTIONS FOR COLORADO COUNTIES AND MUNICIPALITIES: EXECUTIVE SUMMARY

**Andrew Seidl,[1] Nigel Griswold, and Erin Hicks [2]**

The demand for capital investment in public infrastructure in Colorado will continue to rise with increases in population, wealth and commercial activity. Colorado has seen a statewide population increase of over 30% between 1990 and 2000, and corresponding statewide increases in county and municipal capital outlays of 152% and 136%, respectively, controlling for inflation. However, relatively few municipalities and counties and, therefore, the state, have a good idea of how much public investment is needed. Consequently, there is a demand for technical economic information which reveals the drivers of capital investment such that local and state governments can work together to prepare for those needs and to make good public investment decisions.

The purpose of this study is to develop a methodology to identify, estimate and forecast (5, 10, and 20 years into the future) the capital needs of Colorado municipalities and counties. Three statistical models, one each for municipalities and counties and a composite model, were built using historical data that predict local government capital outlay expenditures using population, income, land use and land cover data, and regional attributes. Next, these models were used to predict future capital investment expenditures using Colorado Department of Local Affairs (DOLA) population projections for the next two decades.

This study addresses the prediction of capital improvement expenditures for the state of Colorado. We forecast total capital improvement expenditures for each municipality and county as well as for the state the Colorado for 2012, 2017, and 2027. The City/County of Denver has future capital outlay predictions derived by the traditional trend line method due to its extreme outlier properties. Estimates are expressed in 2007 dollars and are based upon econometric estimates and trend analysis that take full advantage of available secondary data. Our econometric and trend estimates are compared and contrasted with information reported by individual jurisdictions in response to a recent DOLA survey and/or as made available to the public by the jurisdictions themselves.

Three econometric models and the Denver capital outlay trend analysis are used. The first model predicts county capital improvement expenditures and the second predicts municipal expenditures. The third model aggregates all municipal capital outlays with their respective county capital outlays, as these expenditures are complementary. We reason that capital improvement expenditures will increase with increases in population, income, developable acreage, and relative dependence on tourism and/or mining as an economic driver. Regional designations provide proxies for these last three variables

[1] Corresponding author. B309 Clark Building, Department of Agricultural and Resource Economics, Colorado State University, Fort Collins, Colorado, 80523-1172. T: 970-491-7071. E: andrew.seidl@colostate.edu. F: 970-491-2067.

[2] Seidl is Associate Professor and Extension Specialist—Public Policy, Griswold is Research Associate and Hicks is Research Assistant, Department of Agricultural and Resource Economics, Colorado State University, Fort Collins, Colorado, 80523-1172.

in the municipal model, due to a lack of more detailed municipal scale data. A three year average of total capital expenditures is the dependent variable in all three cases, reasoning that a single year may be biased, but that an average over more than three years is likely to underestimate the longer term trajectory of the state.

The resultant county base model (Model 1) predicts capital outlay as shown below:

$$\ln C = \alpha + \beta_1 \ln Pop + \beta_2 \ln MI + \beta_3 PL + \beta_4 BIM + \beta_5 BIT + \beta_6 BIA + \varepsilon$$

where: 'C' equals capital outlay (a three year county average); 'α' is a constant; 'Pop' equals county population in 2006; 'MI' equals county 1999 median income in 2007 dollars; 'PL' equals the percent of public land per county; 'BIM' equals the percent of county base industry income from mining; 'BIT' represents the percent of county base industry income from tourism; 'BIA' equals the percent of county base industry income from agribusiness; and, 'E' is the error term assumed to have a conditional mean of zero and a constant variance.

The county model (Model #1) explains 80.84% of the variation in capital outlay. The population coefficient is statistically significant and is interpreted as a 1% increase in population will result in a 0.67% increase in capital outlay. The median income coefficient is also significant and is interpreted as a 1% increase in median income results in a 1.48% increase in capital outlay. The proportion of county income derived from mining, relative to tourism, agribusiness or other economic drivers, results in a significant increase in county capital investment demands. Increasing the relative reliance on county base income from mining by 1% will increase capital outlay by 2.1%. Percent of base industry income per county from agribusiness and tourism and the proportion developable land in the county were insignificant in impacting capital outlay. This indicates that the infrastructure demands of agribusiness and tourism development do not differ significantly from what the average county would demand based on its income, population, and proportion of the base economy in mining.

The resultant municipality model (Model 2) predicts capital outlays as shown below:

$$\ln C = \alpha + \beta_1 \ln Pop + \beta_2 \ln MI + \beta_3 CM + \beta_4 WS + \beta_5 EP + \beta_6 SLV + \varepsilon$$

where: 'C' equals capital outlay; 'α' is a constant; 'Pop' equals municipal population in 2006; 'MI' equals municipal 1999 median income in 2007 dollars; 'CM' equals a 1 if the municipality is in the Central Mountains region, 0 otherwise; 'WS' equals a 1 if the municipality is in the Western Slope, 0 otherwise; 'EP' equals a 1 if the municipality is in the Eastern Plains, 0 otherwise; 'SLV' equals a 1 if the municipality is in the San Luis Valley, 0 otherwise; and, 'E' is the error term assumed to have a conditional mean of zero and a constant variance. The Front Range dummy variable is the omitted variable, and is therefore picked up in the constant term.

The interpretation of the municipal model is analogous to the county model with the exception of the regional dummy variables, otherwise known as 'shifters,' as opposed to the continuous land use and economic base variables in the county model. Moreover, the municipal model is completely consistent with the county model in terms of direct and relative magnitude of the relationships between the dependent and independent variables.

**Table 1: County Model Regression Results (Denver Excluded)**

| Variables: (Dependent Variable = natural log of 2001, 2002 & 2003 average capital outlay) | Coefficients (Std. Errors) | P-Values (T-Scores) |
|---|---|---|
| Log of Population | 0.67 (0.077) | 0.000 (8.64) |
| Log of Median Income | 1.48 (0.46) | 0.002 (3.21) |
| Base Income from Mining (%) | 0.021 (0.011) | 0.069 (1.85) |
| Base Income from Tourism (%) | 0.008 (0.007) | 0.205 (1.28) |
| Base Income from Agribusiness (%) | -0.002 (0.007) | 0.759 (-0.31) |
| Public Land (%) | -0.005 (0.004) | 0.234 (-1.20) |
| Constant | -7.77 (4.61) | 0.097 (-1.69) |
| N = 64; $R^2$ = 0.8084; F-Statistic = 39.39 | | |

The interpretation of the municipal model is analogous to the county model with the exception of the regional dummy variables, otherwise known as 'shifters,' as opposed to the continuous land use and economic base variables in the county model. Moreover, the municipal model is completely consistent with the county model in terms of direct and relative magnitude of the relationships between the dependent and independent variables.

The municipality model (Model #2) explains 73.82% of the variation in capital outlay. The interpretation of the population coefficient of 1.15 is that a 1% increase in population will result in a 1.15% increase in capital outlay. The median income coefficient of 0.93 is interpreted as a 1% increase in median income results in a 0.93% increase in capital outlay. The remainder of the variables in the model is dummy variables, with the Front Range being the omitted variable. Significance of the dummy variables means that the region is significantly different than the Front Range region. The Western Slope and the Central Mountains show significant differences from the Front Range with coefficients of 0.76 and 0.65, respectively. The Eastern Plains and San Luis Valley are not significantly different than the Front Range. That is, after having controlled for the effect of population and income, the Eastern Plains and San Luis Valley municipalities invest similarly to the Front Range, while Western Slope and Central Mountain municipalities invest more in capital outlays relative to other portions of the state.

Model #3 substitutes the sum of municipal and county governmental capital outlays for county capital spending as the dependent variable. Since county and municipal capital investments within a county jurisdiction are likely complementary, this model allows us to describe a large proportion (excluding special districts) of local governmental capital expenditures within a county. Where a municipality is located among two or more counties, the municipal expenditures were allocated based upon the proportion of the population found within each affected county.

**Table 2: Municipality Model Regression Results**

| Variables: (Dependent Variable = natural log of 2001, 2002 & 2003 average capital outlay) | Coefficients (Std. Errors) | P-Values (T-Scores) |
|---|---|---|
| Log of Population | 1.16 (0.054) | 0.000 (21.58) |
| Log of Median Income | 0.935 (0.30) | 0.002 (3.12) |
| Western Slope Region | 0.761 (0.0.283) | 0.008 (2.68) |
| Eastern Plains Region | -0.262 (0.292) | 0.371 (-0.90) |
| San Luis Valley Region | 0.534 (0.419) | 0.203 (1.28) |
| Central Mountains Region | 0.655 (0.255) | 0.011 (2.56) |
| Constant | -6.61 (3.26) | 0.044 (-2.02) |
| N = 258; $R^2$ = 0.7382; F-Statistic = 117.96; * Front Range Region is the omitted dummy. | | |

**Table 3: County and Municipality Composite Model Regression Results (Denver Excluded)**

| Variables: (Dependent Variable = natural log of 2001, 2002 & 2003 average capital outlay) | Coefficients (Std. Errors) | P-Values (T-Scores) |
|---|---|---|
| Log of Population | 0.91 (0.072) | 0.00 (12.54) |
| Log of Median Income | 1.15 (0.43) | 0.010 (2.66) |
| Base Income from Mining (%) | 0.013 (0.010) | 0.210 (1.27) |
| Base Income from Tourism (%) | 0.020 (0.006) | 0.002 (3.23) |
| Base Income from Agribusiness (%) | -0.0003 (0.006) | 0.963 (-0.05) |
| Public Land (%) | -0.004 (0.004) | 0.294 (-1.06) |
| Constant | -6.06 (4.31) | 0.165 (-1.41) |
| N = 64; $R^2$ = 0.8756; F-Statistic = 65.69 | | |

**Table 3: County and Municipality Composite Model Regression Results (Denver Excluded)**

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| Base Income from Agribusiness (%) | -0.0003 (0.006) | 0.963 (-0.05) |
| Public Land (%) | -0.004 (0.004) | 0.294 (-1.06) |
| Constant | -6.06 (4.31) | 0.165 (-1.41) |
| N = 64; $R^2$ = 0.8756; F-Statistic = 65.69 | | |

The composite regression model (Model #3) explains 87.56% of the variation in capital outlay. The population coefficient is interpreted as a 1% increase in population will result in a 0.91% increase in capital outlay. The median income coefficient is interpreted as a 1% increase in median income results in a 1.15% increase in capital outlay. In the composite model, the proportion of county based income derived from tourism has a positive influence on government capital investment spending, while mining and agribusiness do not show significant differences from the county average. Increasing county base income brought in from tourism by 1% will cause a 2.0% increase in capital outlay. The proportion of public land in the county remains an insignificant predictor of capital investment within the county. This implies that the potential effect of developable acreage or relatively abundant (publicly managed) natural resources on capital spending is captured by the effect of the economic base (Mining for counties alone and tourism for the composite model) derived from that natural resource endowment.

In general, from the three models we learn that population and income are strong predictors of local governmental capital investments. In addition, mining and tourism development tend to imply modest increases in capital expenditures relative to the average, while agribusiness development and the degree of governmental stewardship of the landscape do not. As a result, mountain and west slope communities might expect larger capital budgets than would residents of the rest of the state. However, this does not necessarily imply a greater tax burden on mountain and west slope community members. This is due to the possibility of passing a proportion of the cost of community services along to the beneficiaries of those services; for example, higher sales taxes in tourism-based communities and severance taxes on mining activities.

Denver provides a special case when trying to estimate future capital outlays using regression analysis. Since Denver's capital outlay is so atypical (high) relative to all other county or municipal governments in Colorado, a cross sectional regression analysis will not adequately describe or predict its capital investments. Moreover, the inclusion of Denver skews the results such that the models also generate biased results for the other Colorado counties and municipalities. However, Denver is such an important part of the Colorado economy that some prediction of future capital outlays in Denver is needed to generate a reasonable expectation of state level capital expenditures. Here we use traditional trend line analysis of Denver's historical capital outlays to predict its future outlays. Figure 1 shows the trend of Denver's outlays from 1993 to 2003 and projects expenditures through to 2027.

The estimated capital outlay forecast at the county level (Model 1) for the State of Colorado this year not including Denver (2007) is $403,989,417 and the corresponding 2007 estimate for all municipalities (Model 2) is $724,383,405 for a total aggregate capital outlay forecast of over $1.128 billion estimated for this year alone. Adding Denver's estimated outlay of $475 million, the State of Colorado's statewide estimate in 2007 is over $1.6 billion. Estimated county level capital outlay in 2012 is $454,550,820, $804,081,799 at the municipal level and $675 million in Denver giving an aggregate state capital outlay estimate in 2012 of nearly $1.934 billion dollars. Estimated county level capital

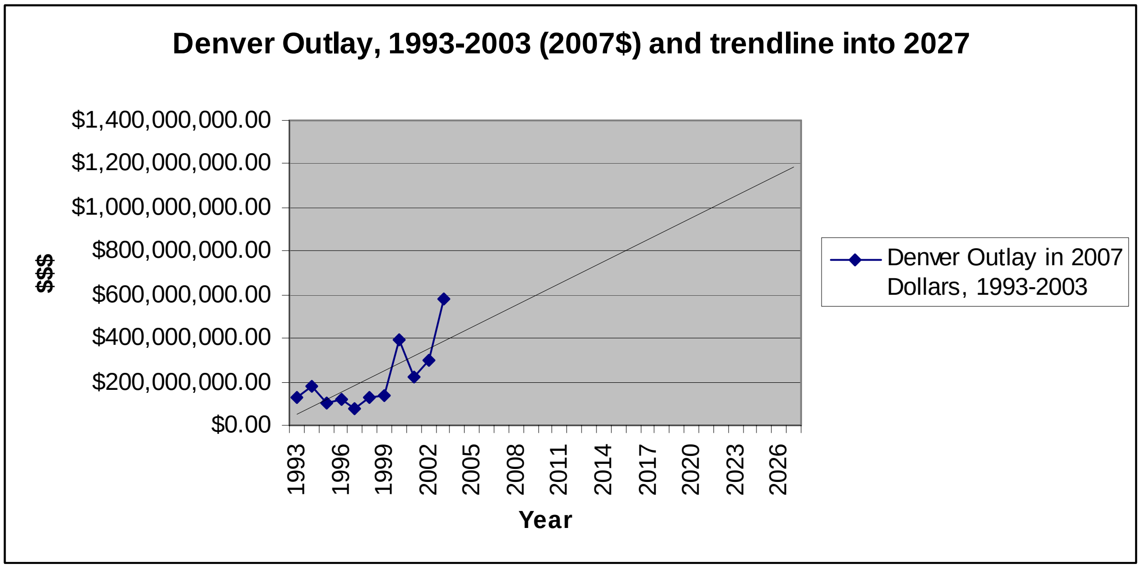
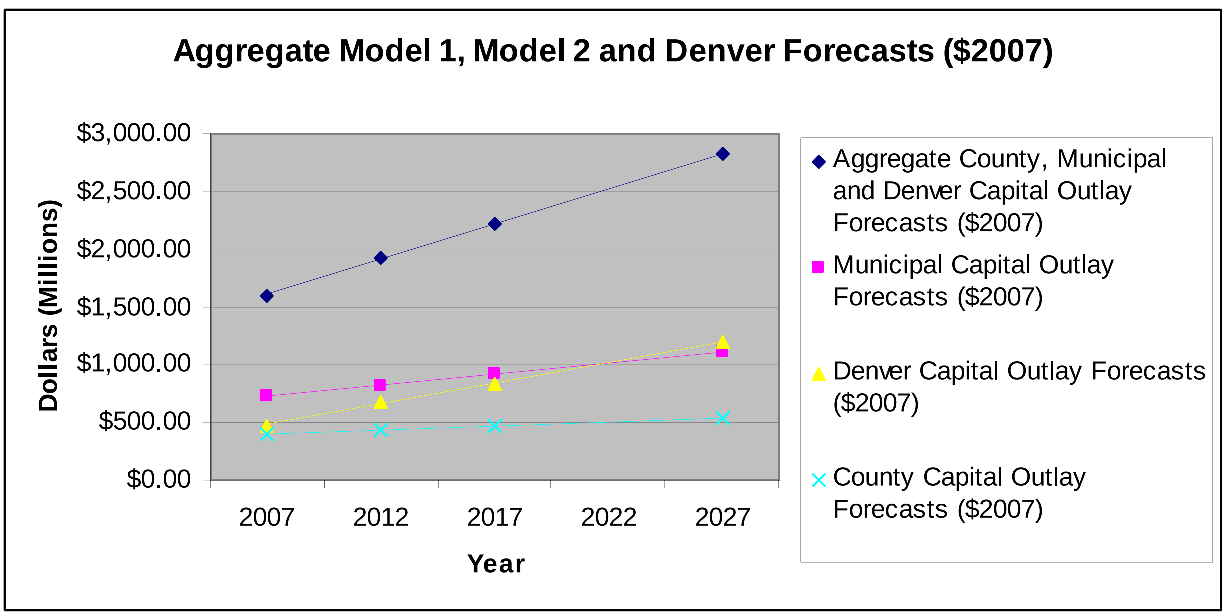



**Table 4: County, Municipality and Denver Forecasted Capital Outlay Estimates**

| Year | County Forecasts | Muni Forecasts | Denver Forecasts | Aggregate Outlay Estimates |
|---|---|---|---|---|
| 2007 | $403,989,417 | $724,383,406 | $475,000,000 | $1,603,372,823 |
| 2012 | $454,550,821 | $804,081,799 | $675,000,000 | $1,933,632,619 |
| 2017 | $507,123,326 | $883,358,455 | $830,000,000 | $2,220,481,781 |
| 2027 | $609,140,433 | $1,038,873,133 | $1,200,000,000 | $2,848,013,566 |




outlay in 2017 is $507,123,326, $883,358,455 at the municipal level and $830 million in Denver giving an aggregate state capital outlay estimate in 2017 of over $2.22 billion dollars. Estimated county level capital outlay in 2027 is $609,140,433, $1,038,873,133 at the municipal level and $1.2 billion in Denver, giving an aggregate state capital outlay estimate in 2027 of over $2.848 billion dollars.

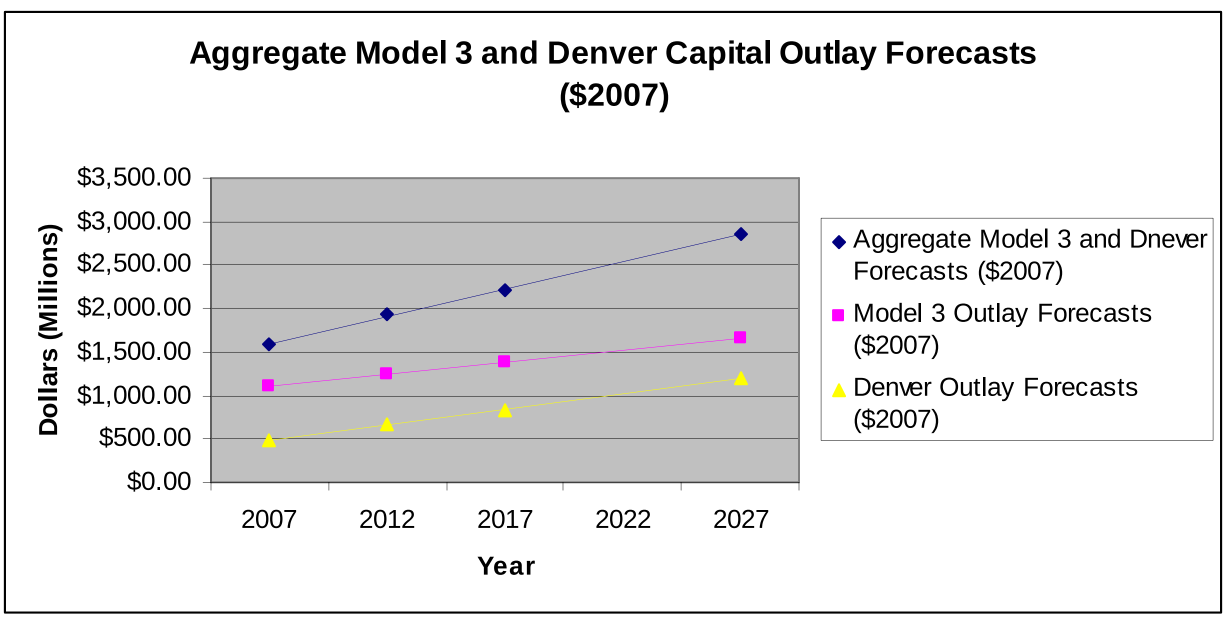
The estimated capital outlay forecast at the county and municipal aggregate level (Model 3) for the State of Colorado this year is $1.115 billion. With Denver's $475 million outlay estimate, the estimated statewide total is over $1.59 billion. Estimated county level capital outlay in 2012 for Model 3 is $1.25 billion and $675 million in Denver giving an aggregate state capital outlay estimate in 2012 of nearly $1.925 billion dollars. Estimated Model 3 capital outlay in 2017 is $1.389 billion and $830 million in Denver giving an aggregate state capital outlay estimate in 2017 of over $2.218 billion dollars. Estimated Model 3 capital outlay in 2027 is $1.658 billion and $1.2 billion in Denver, giving an aggregate state capital outlay estimate in 2027 of over $2.857 billion dollars. The two estimation approaches (the sum of Model #1 and #2 versus Model #3) result in very consistent estimates of capital outlays, differing by less than $10 million, or less than 0.5%, of predicted expenditures in 2027.

Colorado municipalities and counties can now better predict the likely fiscal impact of a variety of readily observable indictors of local economic growth. Both can predict the approximate magnitude of the increase in capital expenditures due to observed, planned or anticipated increases in population, median income, the density of development, and proportion of the local economy driven by tourism or mining, based upon their own particular circumstances and local knowledge. Counties can anticipate that roads and streets, public facilities and law enforcement are likely to figure prominently in their capital improvement budgets. Mountain counties dependent on tourism and mining can expect to spend more on airports, workforce housing, water infrastructure and recreation and less on law enforcement relative to otherwise comparable counties.

Municipalities can consider their regional location as a general indicator of land use and base economy and they can more meaningfully compare their capital investment portfolios against neighboring jurisdictions. Municipalities can generally expect a large proportion of their capital improvement budgets to be spent on roads and streets, water, sewer and public facilities. Western Slope communities have higher recreation and law enforcement expenditures relative to the state average. Mountain communities spend more on recreation, fire, water and sewer relative to the average. As a result of this analysis, local jurisdictions can better evaluate the performance of their own government agencies based upon what they would expect to be spending relative to what they actually are spending on capital improvements over time.

Table 5: Composite Regression Forecasts and Denver ($2007)

| Year | County & Municipal Aggregate Model Forecasts | Denver Trend Forecasts | Aggregate Denver & Model 3 Forecasts |
|---|---|---|---|
| 2007 | $1,115,014,360 | $475,000,000 | $1,590,014,360 |
| 2012 | $1,250,755,281 | $675,000,000 | $1,925,755,281 |
| 2017 | $1,388,931,675 | $830,000,000 | $2,218,931,675 |
| 2027 | $1,657,948,597 | $1,200,000,000 | $2,857,948,597 |



From a local policy perspective our results imply that different economic development drivers imply different public cost in order to generate public and private benefits. From a state policy perspective, Coloradoans can now better identify the likely total capital requirements, the distribution of their incidence among different types, sizes and locations of governmental units. In addition, the state can point to the desirability of uniformity and coordination in municipal, county and special district data collection and reporting with regard to capital investment planning and accounting. Special Districts are an important missing link in the forecast estimates. These entities take on many capital projects across the state, but unfortunately have generated or at least provided very little data on what the magnitudes of these outlays are, creating persistent challenges in formal or informal estimates of the size of the investment sector relative to municipalities and counties in Colorado.