3-2009

On Public Capital Investment and Economic Growth in Illinois

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An Occasional Paper of
The Paul Simon Public Policy Institute
Southern Illinois University

March 2009
Paper # 14

Foreword

The present paper was written as an analysis of the proposed capital budget plan which is being considered by the State of Illinois and which has been a major item on the political agenda in the state for well approximately two years. In the spring of 2008, Southern Illinois University President Glenn Poshard asked Dr. Subhash C. Sharma of the Department of Economics at Southern Illinois University Carbondale to do an analysis of the proposed capital improvements plan which was being advocated by then Governor Rod Blagojevich and being considered by the Illinois General Assembly. The plan would make a major investment in infrastructure improvements in the state, and it would have been the first major capital plan to pass the General Assembly in almost a decade. It follows in the tradition of two other major capital improvements bills advocated by earlier Governors and passed by the Illinois General Assembly. In 1985 under the leadership of Governor James R. Thompson, the state passed the Build Illinois Plan, which claimed at the time to be the largest public works project in the state's history. It was funded at $2.3 billion total. In 1999 at the beginning of his administration, Governor George Ryan initiated and the General Assembly passed a new capital budget called the Illinois FIRST plan for the infrastructure improvements and capital needs. Illinois FIRST was funded at $12 billion total. The current Illinois Works plan would follow in the footsteps of those two prior major investments made in infrastructure by the people of Illinois if it were to be approved. The plan is still being considered by the Illinois General Assembly, and this proposal or something like it will be one of the major items for consideration by the new Governor Pat Quinn and his administration.

The background of the current paper is that in the spring of 2008, President Poshard was appointed by the former Governor, along with former Speaker of the U.S. House, Dennis Hastert, to be the Co-Chairs of the Illinois Works Coalition. Both are experienced legislators, and they represent a bi-partisan approach to the problem. Their assignment was to gather information from a wide variety of sources regarding the bill, its possible effects, and the kinds of projects the public wanted to see included in any such legislation. Toward achieving that objective the Illinois Works Coalition held hearings throughout the state and received input and feedback from a wide array of concerned citizens, interest groups, and governmental officials. The Coalition also launched a study of the potential economic impact such a plan might have on the state and its economy. The present paper is the product of a study done by Dr. Sharma, and his colleague, Dr. Basharat Pitafi, who Dr. Sharma recruited to help him conduct the analysis. Dr. Sharma and Dr. Pitafi are both experts in this kind of economic impact analysis, and they conducted the study using standard econometric techniques which are explained in the paper. They were asked by President Poshard to consider three different funding levels, i.e. at $25 billion, $30 billion, and $35 billion and to project the economic output, employment effects, value added effects, and tax income generated by each investment scenario. Those results are calculated and provided in the Results section of this study. Overall the potential investment returns under any of these three scenarios are seen to be very positive with the payoffs growing with each increment of public investment.

This study provides an example of the practical and applied analysis that economists can contribute to the public discourse which can enlighten the citizens and the mass media and that can help governmental decision makers make more informed and rational decisions about public policy. The Paul Simon Public Policy Institute is pleased to present this paper to a wider public.

John S. Jackson
Series Editor
March 10, 2009

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Introduction

Illinois, now known as the "Land of Lincoln", was admitted as the 21st State in the Union on December 3, 1818. Illinois is the 5th most populated state in the country; the population of the state grew from 12.19 million in 1997 to 12.78 million in 2007 [Tables A1 and A2 in appendix A]. Chicago is the largest city in the state and the 3rd largest in the country. The unemployment rate in the state varied from as low as 4.45 percent in 1999 to as high as 6.73 percent in 2003 and 6.49 percent in 2008 [Table A3 in appendix A]. From 1997 to 2008, the unemployment rate in Illinois has been higher than the national average, in all years except in 1997-98 and 2006.

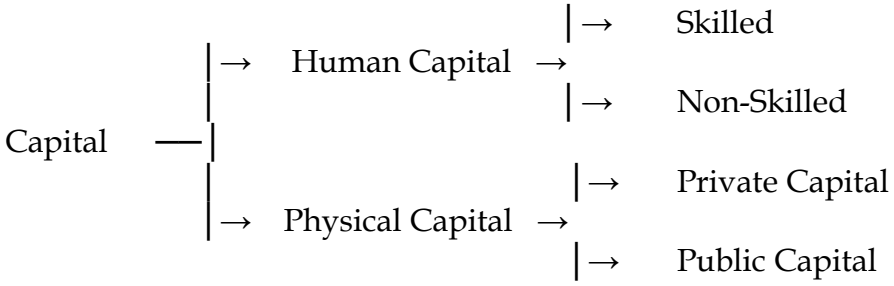
The gross state product in Illinois increased from $404 million in 1997 to $609.6 million in 2007 [Table A4 in appendix A]. Gross state product (GSP) is the value of all the final goods and services produced in a state in a given time period.[1] Real per capita gross state product is a measure of the standard of living in a state and a major determinant of the amount of goods and services people consume. Increase in real per capita gross state product over time provides an estimate of the growth in the standard of living in a state, and interstate comparison of per capita gross state product at any given time allows one to compare standard of living across states. Illinois was ranked 15th in the nation in terms of real per capita gross state product in 2007. The real per capita gross state product in Illinois increased from $35,000 in 1997 to $39,500 in 2007 [Tables A5 and A6 in appendix A]. However, while in 1997 the per capita real state gross product was $3,260 higher than the national per capita real GDP, i.e., Illinoisans enjoyed a higher economic activity and standard of living than the rest of the nation, by 2007 this difference was reduced to only $1,548, indicating that as compared to the National standard of living, the Illinoisans are losing ground in their standard of living.

To produce goods and services in a region, one needs the factors of production, i.e., inputs to the production process. The commonly used factors of production are land, labor and capital. Land includes natural resources as well as physical land space

* The authors would like to thank Dr. John S. Jackson for helpful comments on an earlier version and David Gross for directing us to some useful information.

used in production. Labor is the workers' time used in the production of goods and services. Capital, in general, consists of the long lasting machines, tools, buildings, roads, bridges, and other infrastructure needed to produce goods and services.

Capital is usually classified into two main categories: physical capital (such as factories/plants, equipment, and physical infrastructure), and human capital (such as the training and skills of the labor force). Physical capital is further subdivided into public capital and private capital. Roads, bridges, some transportation, and government owned schools, colleges and universities are some of the components of the public capital and factories/plants, equipment, etc. are some examples of the private capital. The human capital is also subdivided into two categories skilled human capital and non-skilled human capital. In summary, capital can be represented as:



Private capital is accumulated and maintained by private firms, organizations, and individuals in their interest but as a productive resource it also benefits the economy at large. Public capital includes infrastructure facilitates set up and operation of small and large business, and can, therefore, attract new businesses and provide growth opportunities for old businesses. Also plentiful human capital implies a healthy, skilled, and trained labor force and, thereby, increases the attractiveness of a region to business enterprise. Generally, a good infrastructure in a state (i.e., public investment) attracts private capital and also increases the skilled human capital in a state. Public capital investment not only affects national output, productivity, and growth but it can also influence the international competitiveness of a country.

Public Capital Investment and Economic Growth

[1] It is similar to gross domestic product (GDP) for a country, which is the value of all the final goods and services produced in a country in a given time period.

There is a large body of literature on the role of public capital in economic growth. Gramlich (1994) in his article titled, "Infrastructure Investment: A Review Essay," thoroughly reviews the literature on the role of infrastructure investment on economic growth. He notes that macroeconomists have noted for a long time that public capital is an important input in the production of aggregate output. One example of the effects of public capital is the slowdown in productivity growth around 1973. Gramlich (1994) relates the 1973 slowdown in the US productivity growth with the slowdown in the US public capital accumulation since the late 1960s. In a series of papers on public expenditure and productivity, or economic growth, Aschauer (1989a, 1989b, 1989c) notes that in the US and some other developed countries the slowdown in aggregate productivity followed the slowdown in infrastructure investment. The 1973 slowdown in productivity growth has also been related by economists to energy prices, social regulation, work force and research and development among other factors, but Aschauer's observation holds. Romp and de Haan, in a recent survey paper on public capital and economic growth (Romps and Haan, 2007), note that the literature suggests that public capital can raise per capita income under appropriate circumstances.

In addition to the above studies, there are many others devoted to the role of public spending and investment on national output and economic growth, e.g., Conrad and Seitz (1994), Crowder and Himarios (1997), Fernald (1999), Ford and Poret (1991), Kalaitzidakis and Kalyvitis (2004, 2005), Milbourne, Otto and Voss (2003), Miller and Tsoukis (2001), Munnell (1990, 1992), Pereira and Andraz (2001), Pereira and Frutos (1999), Ramirez (2000), Sanchez-Robles (1998), Shioji (2001), and Tatom (1991). In empirical studies, sometimes the availability of reliable data on the flow of infrastructure stock in a state or a country is a concern. To derive the flow of infrastructure stock, one needs a reliable depreciation rate of the stock, and it is difficult to have a standard measure of the depreciation of roads, bridges, transportation facilities, etc. Based on the survey of literature on this topic, Romp and de Haan (2007) conclude that there is almost a consensus in the literature that public capital has an enhancing effect on economic growth.

This view is consistent with explanations of the growth in the US economy during the late 1990s. As noted earlier, capital consists of two components i.e., the public capital and private capital. A sizeable decrease or increase in any component of capital can affect productivity growth. During the late 1990s, a large increase in private capital resulting from investment by companies in the information technology infrastructure fueled the economic growth. During times of slow economic and private

capital growth, governments often try to increase public capital spending to stimulate the economy.

The capital plan for Illinois was advanced well before the national government acted. However, it is very congruent with the Federal government's current plans to stimulate the economy. For example, the recent American Recovery and Reinvestment Act of 2009 that was signed into law by President Obama. The Act is meant to stimulate the economy through government spending to help generate jobs, income, and sales, and to also create public capital in the form of physical infrastructure, human capital, and technology. The spending is targeted toward improving roads, bridges, waterways, and mass transit, improving educational facilities, increasing access to education, science and technology research, increasing renewable and clean energy capabilities, increasing access to healthcare, lowering healthcare costs, computerizing health records, assisting the vulnerable, and providing relief to taxpayers and state and local governments.

The Act includes $111 billion in funds for infrastructure and science, $53 billion for education and training, $43 billion for energy, $59 billion for healthcare, $81 billion for protecting the vulnerable, $144 billion for state and local fiscal relief, $8 billion for other purposes, and $288 billion for tax relief which provides additional funds for infrastructure and science ($15 billion), education and training ($25 billion), energy ($22 billion), and protecting the vulnerable ($61 billion). [2]

On Feb 24, 2009, President Obama, in his address to both houses of Congress, said to the nation, "History reminds us that, at every moment of economic upheaval and transformation, this nation has responded with bold action and big ideas. In the midst of civil war, we laid railroad tracks from one coast to another that spurred commerce and industry. From the turmoil of the Industrial Revolution came a system of public high schools that prepared our citizens for a new age. In the wake of war and depression, the G.I. Bill sent a generation to college and created the largest middle-class in history. And a twilight struggle for freedom led to a nation of highways, an American on the moon, and an explosion of technology that still shapes our world. In each case, government didn't supplant private enterprise; it catalyzed private enterprise. It created the conditions for thousands of entrepreneurs and new businesses to adapt and to thrive".

[2] Source: recovery.gov (Feb 28, 2009).

Infrastructure Investment in Illinois

In 1985, the administration of Governor James R. Thompson in Illinois started a program called, Build Illinois. The Lieutenant Governor at that time, George H. Ryan, was the Chairman of the Build Illinois Task Force. The 1985 plan document[3] states that this undertaking is "the largest of its type in Illinois history." The document also notes that Build Illinois is the "largest public works and building program in 15 years." Further, this document states that the Build Illinois program intended to provide "infrastructure and physical improvements for schools, roads and sewer systems, increase the housing stock in Illinois, and improve our environment and recreational facilities." The document also states that, in the long run Build Illinois will create jobs and local governments will have more tax revenues. In the same document, it is noted that the "federal intergovernmental aid to cities and towns has fallen considerably: Overall assistance, since 1981, has been reduced by 20 percent."

A total of $2.3 billion was appropriated for the Build Illinois program. Out of this, $1.28 billion was marked for the improvement of the infrastructure of businesses. The Lieutenant Governor's office was directly responsible for monitoring the projects. Build Illinois provided loans for small and large businesses, and incentives for startup businesses. Moreover, in this program some financing was also provided for specific projects proposed by local governments. Through the Build Illinois program, local and state officials worked together with a common goal to improve the standard of living in the state and increase the state's competitiveness in the nation.

The second initiative for improving the infrastructure in the state was started by then Governor George H. Ryan. In May 1999, Governor Ryan proposed and the Illinois General Assembly passed a legislation called Illinois FIRST.

Illinois FIRST stands for Illinois Fund for Infrastructure, Roads, Schools, and Public Transit. The Illinois FIRST program included $12 billion in state and federal funds over five years, meant for schools, transit, roads and infrastructure. A government document[4] shows that under this program projects included, "highways, bridges, school classrooms, mass transit, water and sewer lines, economic development projects, park and playground development, biking and hiking trails, fire engines and equipment, police cars and equipment and community centers for senior and youth

[3] Illinois Municipal Review, 1985, pages 11-12, http://www.lib.niu.edu/1985/im851111.html
[4] http://www.state.il.us/Gov/4therec01/rebuildil.htm

programs." The composition of Illinois FIRST funding was as follows: [5] state $6.3 billion; local $1.1 billion, national: $4.6 billion, making a total of $12 billion. Out of a total of $12 billion, $2.2 billion was assigned to schools (state $1.1 billion, local: $1.1 billion); $4.1 billion for public transit (state: $2.1 billion and national: $2.00 billion); $4.1 billion for roads (state: $1.5 billion and local: $2.6 billion); and $1.6 billion from the state for other infrastructures.

By spring 2001, Illinois FIRST funded: [4]

- 5,281 road and highway projects
- 618 grants for fire fighting vehicles and equipment
- 580 improvements to parks and playgrounds
- 525 grants to schools for construction, technology and equipment
- 225 projects to improve sewer or water systems
- 139 grants for public cars and law enforcement equipment
- 136 grants for equipment at youth centers
- 88 grants for senior citizens programs
- 23 projects at Illinois colleges and universities

Besides these very large one-time programs for rebuilding Illinois, each year state government also usually allocates funds for capital projects. These projects are for improving the infrastructure in the state including (but not limited to) construction, renovation, repairs expanding or improving state facilities, roads, buildings, utilities and other facilities[6].

In Spring 2008, the Governor of Illinois at the time, Rod R. Blagojevich, created a task force called "The Illinois Works Coalition", co-chaired jointly by Hon. J. Dennis Hastert and Hon. Glenn Poshard. The mission and purpose of the coalition was summarized as follows.

"Illinois' infrastructure is a vital asset that significantly contributes to our overall success. A strong state infrastructure fosters business growth, world-class schools, and thriving communities.

[5] http://www.ncbg.org/schools/illfirst.htm
[6] For the yearly capital spending expenditures visit: http://www.ilga.gov/commission/cgfa2006/Resource.aspx?id=6

Investment in infrastructure creates jobs and sets the stage for Illinois' continued economic leadership. However, it has been nine years since the Illinois General Assembly passed a capital bill.

The Illinois Works Coalition recognizes that our current infrastructure requires crucial investment and it is our collective resolve to ensure the passage of a minimum $25 billion Illinois works capital investment program in the 95th General Assembly."

According to the Illinois Works document, "to pass a capital program in the Illinois General Assembly, three bills must be considered:

1 A bill that outlines the capital program's budget.
2 A bill that authorizes the issuance of bonds to pay for the capital program.
3 A bill that identifies a funding stream for debt service for the issued bonds."

The document further notes that, "Illinois has not had a capital bill for nine years and as such there are many needs that must be addressed in the next capital bill." In Fall 2007, the Illinois Senate passed a $25 billion version of Illinois Works. In Spring 2008, other versions of this bill were discussed and debated in the state legislature but as of the writing of this article no bill has been passed in the state legislation.

Here we analyze the economic impact of three spending scenarios on the state of Illinois. The three scenarios were provided to us by the Illinois Works Task Force co-chairman Dr. Glenn Poshard. These are $25 billion, or $ 30 billion, or $35 billion in spending, to be carried out over a seven year period. The distribution of spending over seven years was provided to us by the Governor's Budget Office (Table A7 in appendix). The rest of this article reports the methodology and results of the analysis.

Methodology

The impact analysis in this study was conducted using IMPLAN (Impact Analysis for Planning) software from Minnesota IMPAN Group. IMPLAN software is the most commonly used software to perform economic impact analysis. It is used to investigate many different kinds of economic impacts including those of government spending, operation of industries, and opening or closing of factories, military bases, colleges, etc. "IMPLAN was originally developed by the USDA Forest Service in

cooperation with the Federal Emergency Management Agency and the USDI Bureau of Land Management" (IMPLAN Professional, Version 2, page i). Later in 1993, Minnesota IMPLAN Group Inc. was formed to privatize the development of IMPLAN data and software. The Minnesota IMPAN group's website lists US federal government agencies, state government agencies, local governments, academia, and for-profit and non-profit organizations among over 500 users of IMPLAN.

IMPLAN is based on the mathematical model known as the Input-Output model that was developed by Professor Wassily Leontief in the 1930s. Professor Leontief won the Nobel Prize in Economics in 1973. Leontief's work was later extended by James Meade who was awarded the Nobel Prize in 1977 and by Sir Richard Stone who received the Nobel Prize in 1984. A brief introduction of the input-output model building is provided in Appendix B (For details see Miller & Blair, chapters 2 to 4.)

In this study, impact analysis was conducted using IMPAN's social accounting matrix (SAM) for the state of Illinois for 2006. IMPLAN's SAM includes output data from the U.S. Department of Commerce's Bureau of Economic Analysis (Industry Economic Accounts data), the U.S. Census Bureau (Annual Survey of Manufacturers data, Value of Construction Put in Place data), the U.S. Department of Agriculture's National Agricultural Statistics Service (Value of Production data), and the U.S. Department of the Interior's U.S. Geological Survey (Mineral Commodity Summaries). The employment and household income data is from the U.S. Department of Labor's Bureau of Labor Statistics (Covered Employment and Wages data), Bureau of Economic Analysis (Regional Economic Information System data), and the U.S. Census Bureau (County Business Patterns data). The expenditure information and household payments of income taxes is from the U.S. Department of Labor, Bureau of Labor Statistics (Consumer Expenditure Survey). State and local government revenue and expenditure data is from the U.S. Census Bureau (State and Local Government Finances and Employment data). Further details of the data sources can be found in the IMPLAN manual available from the Minnesota IMPAN Group.

Explanation of Important Terms

IMPLAN allows for the estimation of three kinds of effects of a change in economic activity in a geographical area: Direct Effects, Indirect Effects, and Induced Effects.

Direct effects are the initial changes in an industry when expenditures are made for the purchase of its output.

Indirect effects are the effects in other industries created by the purchase of goods and services by the directly affected industry.

Finally, the *Induced effects* are the effects on all local industries caused by the expenditures of household income generated in the directly and indirectly affected industries.

As an example, suppose $1 billion is to be spent on building a road. Contractors hired to build the road are paid $1 billion and they recruit labor to perform the job. This will be the direct effect. Next, when a contractor buys concrete and hires a trucking company to deliver concrete to the location, the amount of money paid to the concrete manufacturer and the trucking company is an indirect effect. The labor hired by the concrete manufacturer and the trucking company is an indirect effect on labor. Then the income earned by workers directly employed in this project (e.g., working at the road building site), and indirectly employed (e.g., hired by the concrete manufacturer to meet the demands of this project) is spent on goods and services they buy (e.g. groceries, recreational equipment, etc.) are the induced effects of building a road.

When a government capital spending project starts, it will generate economic activities including employment, labor income and value added into the economy of the state. *Labor income* consists of employee compensation and proprietary income. *Total value added* into the economy consists of four components of the economy: employee compensation, proprietary income, other property type income, and indirect business taxes, i.e.,

Labor Income = Employee Compensation + Proprietary Income

Value Added = Labor Income + Other Property Type Income
+ Indirect Business Taxes

Employee Compensation includes wages and salary components and benefits. Benefits include retirement payments, health and life insurance and any other non-cash payments.

Proprietary Income is the income received by self employed individuals, e.g. private business owners, doctors, lawyers and so on.

Other Proprietary Type Income is the income received by individuals in the form of rents for their properties; royalties, and dividends paid by corporations. This category also includes the profits earned by corporations.

Indirect Business Taxes are the excise tax and sales tax paid by individuals to businesses.

Results

In order to estimate the economic impact of the state capital spending proposals, expected changes in output, employment, labor income, value-added, government revenues, and propriety income have been calculated, for each of the three spending scenarios (Table A7 in appendix A). The distribution of spending over seven years: i.e. FY09: 10%, FY10: 15%, FY11: 20%, FY12: 20%, FY13: 15%, FY14: 10%, and FY15: 10%, was provided to us by the Governor's Budget Office.

A summary of total impacts is reported in Table 1. At the time of this study the social accounting matrix data was available in 2006 dollars. Thus, all impact amounts reported here are in 2006 dollars. But since the money would be spend in future years in current dollars, we believe, the actual impacts would be higher than are reported here. We consider the impacts reported here as lower bounds. For example, under the $25 billion dollar spending plan, the direct spending should have been $25 billion, but since the output reported here is in 2006 dollars, it is only $23.06 billion (Table 2). Since, the output would be higher (than reported here), so the actual employment numbers would also be higher than reported here.

Under the $25 billion spending proposal, output is expected to increase by a total of $57.78 billion. Employment is expected to expand by about 443 thousand jobs, generating labor income of about $23.7 billion. Total value-added would increase by $32.5 billion. In addition, about $2.4 billion in state and local tax revenues would be generated.

Under the $30 billion spending proposal, the expected increase in output is $69.84 billion. Employment would increase by about 535 thousand jobs, generating labor income of $28.7 billion. Total value-added is expected to increase by $39.2 billion. Nearly $2.9 billion in state and local tax revenues would be generated.

Table 1
Summary of Impacts

Spending	Total Output ($ million)	Total Employment	Total Labor Income ($ million)	Total Value-added ($ million)	Total State and Local Tax Revenues ($ million)
$25 billion	57,774	443,596	23,739	32,501	2,396
$30 billion	69,838	535,154	28,682	39,224	2,897
$35 billion	80,128	611,024	32,758	44,872	3,322

Under the $35 billion spending proposal, output would increase by $80.13 billion. Employment expands by about 611 thousand jobs, generating labor income of about $32.8 billion. Total value-added would increase by $44.9 billion. About $3.3 billion in state and local tax revenues would be generated.

The impacts on output, employment, labor income, and value-added are decomposed into direct, indirect and induced effects as shown in Table 2. For the $25 billion proposal, the direct effect increases output by $23 billion, [7] employment by about 186 thousand jobs, labor income by $11.2 billion, and value-added by $12.7 billion. The indirect effect creates additional $9 billion of output, about 48 thousand jobs, $2.8 billion of labor income, and $4.2 billion of value-added. The induced effect expands output further by $25.6 billion, employment by 209 thousand jobs, labor income by about $9.7 billion, and value-added by $15.6 billion.

For the $30 billion proposal, the direct effect increases output by $28 billion, employment by about 224 thousand jobs, labor income by $13.5 billion, and value-

[7] Since in the scenarios analyzed, the money is spent over 7 years (see Table A7 in appendix), the purchasing power of amounts spent decreases over time due to inflation; therefore, the direct effect is less than the total outlay.

added by $15.3 billion. The indirect effect creates additional $10.9 billion of output, about 58 thousand jobs, $3.5 billion of labor income, and $5.1 billion of value-added. The induced effect expands output further by about $31 billion, employment by 252 thousand jobs, labor income by about $11.7 billion, and value-added by $18.8 billion.

For the $35 billion proposal, the direct effect increases output by $32 billion, employment by about 254 thousand jobs, labor income by $15.4 billion, and value-added by $17.5 billion. The indirect effect creates additional $12.5 billion of output, about 67 thousand jobs, about $4 billion of labor income, and $5.9 billion of value-added. The induced effect expands output further by $35.4 billion, employment by 289 thousand jobs, labor income by about $13.4 billion, and value-added by $21.5 billion.

Table 2
Detailed Analysis: Direct, Indirect, and Induced Impacts

Impacts	Total Output ($ million)	Total Employment	Total Labor Income ($ million)	Total Value-added ($ million)
$25 billion Spending				
Direct	23,060	186,482	11,201	12,710
Indirect	9,073	47,781	2,839	4,220
Induced	25,640	209,333	9,699	15,570
Total	57,774	443,596	23,739	32,501
$30 billion Spending				
Direct	27,973	224,062	13,520	15,308
Indirect	10,913	58,360	3,452	5,118
Induced	30,952	252,732	11,709	18,798
Total	69,838	535,154	28,682	39,224
$35 billion Spending				
Direct	32,230	254,287	15,369	17,469
Indirect	12,501	67,705	3,994	5,905
Induced	35,396	289,032	13,394	21,497
Total	80,128	611,024	32,758	44,872

Details of the sources of revenues generated due to spending are provided in Table 3. Under the $25 billion spending proposal, about $2.5 billion in state and local revenues, and $5.6 billion in federal revenues are generated. In state and local revenues, $79 million are from employee compensation, $604 million from household expenditures, $289 million from corporations/enterprises, and $1.5 billion from indirect business taxes. In federal revenues, $2.27 billion are from employee compensation, $165 million from proprietary income, $2.26 billion from household expenditures, $670 million from corporations/enterprises , and $235 million from indirect business taxes.

Under the $30 billion spending proposal, about $3 billion in state and local revenues, and $6.8 billion in federal revenues are generated. In state and local revenues, $96 million are from employee compensation, $729 million from household expenditures, $347 million from corporations/enterprises, and $1.8 billion from indirect business taxes. In federal revenues, $2.75 billion are from employee compensation, $197 million from proprietary income, $2.74 billion from household expenditures, $804 million from corporations/enterprises, and $285 million from indirect business taxes.

Under the $35 billion spending proposal, about $3.4 billion in state and local revenues, and $7.7 billion in federal revenues are generated. In state and local revenues, $109 million are from employee compensation, $833 million from household expenditures, $399 million from corporations/enterprises, and about $2.1 billion from indirect business taxes. In federal revenues, $3.14 billion are from employee compensation, $224 million from proprietary income, $3.12 billion from household expenditures, $825 million from corporations/enterprises, and $327 million from indirect business taxes.

Table 3
Detailed Analysis of Federal, State, and Local Tax Revenues ($ million)

	$25 billion		$30 billion		$35 billion	
	State/ Local Revenues	Federal Revenues	State/ Local Revenues	Federal Revenues	State/ Local Revenues	Federal Revenues
Employee Compensation	79	2,269	96	2,746	109	3,139
Proprietary Income	0	165	0	197	0	224
Household Expenditures	604	2,264	729	2,735	833	3,123
Enterprises/ Corporations	289	670	347	804	399	925
Indirect Business Taxes	1,502	235	1,820	285	2,088	327
Total	2,475	5,604	2,993	6,769	3,431	7,740

Details of the components of value-added generated due to spending are provided in Table 4. Value-added income consists of employee compensation, proprietary income, other property type income, and indirect business taxes. With the $25 billion spending proposal, employee compensation increases by about $20 billion, out of which $9 billion is from the direct effect, $2.2 billion is from the indirect effect, and $8.7 billion is from the induced effect. Proprietary income increases by about $3.6 billion, with $2.1 billion from the direct effect, $601 million from the indirect effect, and $959 million from the induced effect. Other property type income increases by about $7 billion, with $1.3 billion from the direct effect, about $1 billion from the indirect effect, and $4.6 billion from the induced effect. Indirect business taxes increase by about $1.74 billion, out of which $186 million is from the direct effect, $314 million is from the indirect effect, and $1.24 billion is from the induced effect.

With the $30 billion spending proposal, employee compensation increases by about $24.3 billion, out of which $11 billion is from the direct effect, $2.74 billion is from the indirect effect, and $10.6 billion is from the induced effect. Proprietary income increases by about $4.4 billion, with about $2.5 billion from the direct effect, $715 million from the indirect effect, and $1.16 billion from the induced effect. Other property type income increases by about $8.4 billion, with about $1.6 billion from the direct effect, $1.28 billion from the indirect effect, and $5.6 billion from the induced effect. Indirect business taxes increase by $2.1 billion, out of which $228 million is from the direct effect, $382 million is from the indirect effect, and about $1.5 billion is from the induced effect.

With the $35 billion spending proposal, employee compensation increases by $27.8 billion, out of which $12.6 billion is from the direct effect, $3.18 billion is from the indirect effect, and about $12 billion is from the induced effect. Proprietary income increases by $4.94 billion, with about $2.8 billion from the direct effect, $811 million from the indirect effect, and $1.32 billion from the induced effect. Other property type income increases by about $9.7 billion, with $1.83 billion from the direct effect, $1.47 billion from the indirect effect, and $6.4 billion from the induced effect. Indirect business taxes increase by $2.4 billion, out of which $266 million is from the direct effect, $441 million is from the indirect effect, and about $1.7 billion is from the induced effect.

Table 4
Detailed Analysis of Value-added Impact

	Employee Compensation ($ million)	Proprietary Income ($ million)	Other Property Type Income ($ million)	Indirect Business taxes ($ million)
$25 billion Spending				
Direct	9,129	2,071	1,323	186
Indirect	2,237	601	1,067	314
Induced	8,740	959	4,633	1,238
Total	20,108	3,631	7,023	1,738
$30 billion Spending				
Direct	11,048	2,472	1,559	228
Indirect	2,736	715	1,283	382
Induced	10,552	1,157	5,593	1,494
Total	24,336	4,346	8,436	2,105
$35 billion Spending				
Direct	12,562	2,807	1,833	266
Indirect	3,182	811	1,469	441
Induced	12,070	1,324	6,394	1,708
Total	27,815	4,942	9,698	2,416

Conclusion

Public capital and infrastructure provide the soil in which business enterprise and economic activity grows. It improves the competitiveness of a county, state, or country, and provides advantages in inter-jurisdictional competition for economic resources such as private investment and talent. A strong public capital base can encourage new business and allow existing business to grow and prosper. Maintenance and improvement of public capital plays an important role in supporting and expanding economic activity and employment, and the standard of living in a state.

As noted earlier in this study, in 1997, the real per capita state gross product of the Illinoisans was $3,260 above the national real per capita GDP. However, this difference is reduced to only $1,548 in 2007. Thus, Illinoisans have been losing (since 1997) in their standard of living as compared to the national standard of living. One of the reasons for this could be that Illinois does not have a capital spending bill since the last nine or ten years. We believe that to maintain the public infrastructure in the state, it is important to set a budget aside for capital spending at regular intervals. It is even more important to increase the capital spending during recessionary periods, as President Obama reminded the nation in his State of the Union Address on February 24, 2009, that every time the nation has faced deep economic crisis the Federal Government increased the public investment in the infrastructure of the nation.

The state of Illinois considered a major program to invest in public capital in 2008. The expected impacts of the program are analyzed in this study. Three spending scenarios are examined: $25 billion, $30 billion, and $35 billion, over a period of seven years. The impact of spending on output produced in the state, employment, labor income, value added, and tax revenues, is estimated under each scenario.

The estimates indicate that under the $25 billion spending scenario, output is expected to increase by about $58 billion, employment by 443 thousand jobs, labor income by nearly $24 billion, and value-added by $32.5 billion. In addition, about $2.4 billion in state and local tax revenues are expected to be generated. The impact of the $30 billion spending scenario is expected to be an increase in output of nearly $70 billion, an increase in employment of 535 thousand jobs, an increase in labor income of about $29 billion, and an increase in value-added of $39.2 billion. About $2.9 billion in additional state and local tax revenues are also expected. In the case of the $35 billion spending scenario, output would increase by about $80 billion, employment by 611 thousand jobs, labor income by about $33 billion, and value-added by almost $45 billion. Also, $3.4 billion in state and local tax revenue generation is expected.

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Appendix A: Tables

Table A1
US and States population by rank in 2007

States	Population	Rank	States	Population	Rank
United States	301,621,157	--	Kentucky	4,241,474	26
California	36,553,215	1	Oregon	3,747,455	27
Texas	23,904,380	2	Oklahoma	3,617,316	28
New York	19,297,729	3	Connecticut	3,502,309	29
Florida	18,251,243	4	Iowa	2,988,046	30
Illinois	**12,852,548**	**5**	Mississippi	2,918,785	31
Pennsylvania	12,432,792	6	Arkansas	2,834,797	32
Ohio	11,466,917	7	Kansas	2,775,997	33
Michigan	10,071,822	8	Utah	2,645,330	34
Georgia	9,544,750	9	Nevada	2,565,382	35
North Carolina	9,061,032	10	New Mexico	1,969,915	36
New Jersey	8,685,920	11	West Virginia	1,812,035	37
Virginia	7,712,091	12	Nebraska	1,774,571	38
Washington	6,468,424	13	Idaho	1,499,402	39
Massachusetts	6,449,755	14	Maine	1,317,207	40
Indiana	6,345,289	15	New Hampshire	1,315,828	41
Arizona	6,338,755	16	Hawaii	1,283,388	42
Tennessee	6,156,719	17	Rhode Island	1,057,832	43
Missouri	5,878,415	18	Montana	957,861	44
Maryland	5,618,344	19	Delaware	864,764	45
Wisconsin	5,601,640	20	South Dakota	796,214	46
Minnesota	5,197,621	21	Alaska	683,478	47
Colorado	4,861,515	22	North Dakota	639,715	48
Alabama	4,627,851	23	Vermont	621,254	49
South Carolina	4,407,709	24	District of Columbia	588,292	--
Louisiana	4,293,204	25	Wyoming	522,830	50

Source: Bureau of Economic Analysis

Table A2
US and Illinois population over time

Year	United States	Illinois
1997	272,646,925	12,185,715
1998	275,854,104	12,271,847
1999	279,040,168	12,359,020
2000	282,194,308	12,439,219
2001	285,112,030	12,516,683
2002	287,888,021	12,578,317
2003	290,447,644	12,625,246
2004	293,191,511	12,680,053
2005	295,895,897	12,719,550
2006	298,754,819	12,777,042
2007	301,290,332	12,825,809
2008	304,059724	12,901,563

Source: Bureau of Economic Analysis and
http://www.census.gov/popest/states/NST-ann-est.html

Table A3
US and Illinois unemployment rate (%) over time

Year	United States	Illinois
1997	4.94	4.83
1998	4.50	4.48
1999	4.22	4.45
2000	3.97	4.50
2001	4.74	5.43
2002	5.78	6.55
2003	5.99	6.73
2004	5.54	6.24
2005	5.08	5.78
2006	4.62	4.62
2007	4.63	5.10
2008	5.81	6.49

Source: Bureau of Labor Statistics

Table A4
US and Illinois gross product ($ million, current)

Year	United States Gross Domestic Product	Illinois Gross State Product
1997	8,237,994	403,982
1998	8,679,657	423,855
1999	9,201,138	443,751
2000	9,749,103	464,194
2001	10,058,168	476,461
2002	10,398,402	487,129
2003	10,886,172	510,296
2004	11,607,041	534,429
2005	12,346,871	554,099
2006	13,119,938	583,990
2007	13,743,021	609,570

Source: Bureau of Economic Analysis

Table A5
Per capita real GDP by state
(in 2000 dollars)

States	2007	Rank	States	2007	Rank
United States	38,020	---	Georgia	35,265	25
District of Columbia	126,421	---	Louisiana	35,181	26
Delaware	56,496	1	Pennsylvania	35,153	27
Connecticut	51,911	2	Wisconsin	34,890	28
New York	49,038	3	Kansas	34,770	29
Massachusetts	47,351	4	North Dakota	34,694	30
New Jersey	45,052	5	Vermont	34,197	31
Alaska	44,807	6	Ohio	34,040	32
California	42,376	7	Tennessee	33,742	33
Virginia	41,617	8	Arizona	33,655	34
Minnesota	41,353	9	Florida	33,417	35
Colorado	40,805	10	Michigan	32,846	36
Washington	40,361	11	Utah	32,774	37
Wyoming	40,303	12	Indiana	32,724	38
Nevada	40,210	13	Missouri	32,590	39
Maryland	39,596	14	New Mexico	30,943	40
Illinois	**39,568**	**15**	Kentucky	30,364	41
Hawaii	38,850	16	Maine	30,282	42
Oregon	38,339	17	Idaho	29,843	43
Texas	37,793	18	Alabama	29,603	44
New Hampshire	37,375	19	Oklahoma	29,470	45
Nebraska	37,075	20	South Carolina	28,894	46
North Carolina	37,053	21	Montana	28,201	47
Rhode Island	36,543	22	Arkansas	27,781	48
Iowa	35,814	23	West Virginia	24,929	49
South Dakota	35,596	24	Mississippi	24,477	50

Table A6
US and Illinois per capita real GDP
(in 2000 dollars) over time

Year	United States	Illinois
1997	31,619	34,879
1998	32,643	35,853
1999	33,702	36,642
2000	34,547	37,317
2001	34,501	37,143
2002	34,673	37,060
2003	35,207	37,963
2004	36,086	38,451
2005	36,836	38,542
2006	37,623	39,216
2007	38,020	39,568

Source: Bureau of Economic Analysis

Table A7
Capital Plans at Various Levels
Total Funds: Federal, State and Local (Dollars in Millions)

	$25B Scenario	$30B Scenario	$35B Scenario
Purpose	Funds allocated ($ million)		
Road Programs	15,625	17,008	17,802
Education	4,875	6,585	8,094
Environmental/Energy/Tech	1,136	2,236	3,103
Transportation (Public Transit, Rail/Passenger/ Airports)	2,588	3,870	5,443
State Facilities	553	553	553
Economic Development/Member Projects	625	625	625
Total	25,402	30,877	35,620

The spending under each scenario is distributed over time as follows:

FY09	FY10	FY11	FY12	FY13	FY14	FY15
10%	15%	20%	20%	15%	10%	10%

Appendix B: Technical Discussion

Input-Output Model

In this appendix, a brief introduction to the input-output model used in this study is provided.

The input-output model expresses relationships between sectors of the economy in a geographic area that could be a country, a state, a county, or a set of counties. The model divides the economy into *n* sectors (the IMPLAN software uses 509 sectors, recognized by the U.S. Department of Commerce). The goods are exchanged between different sectors by sales and purchases of goods, e.g., the auto industry buys the steel, tires and sells the final product – automobiles. The transactions from sector i to j are accounted in monetary terms.

The total output of sector i is denoted by x_i and the total final demand for the goods produced by sector i is denoted by y_i. Further, we denote by z_{ij} the monetary value of the goods from sector i to sector j, i.e. z_{ij} is the monetary value of goods bought by sector j from sector i. The sector j's demand for inputs from all sectors of the economy will depend on the amount of goods produced by sector j over the same period. For simplicity, here we assume n=5, i.e., the economy is divided into five sectors. Let x_1, x_2, x_3, x_4 and x_5 be the total outputs of the five sectors, and y_1, y_2, y_3, y_4 and y_5 the total final demands for each of these sectors. The total output of each sector can be written as:

$$\begin{aligned} x_1 &= z_{11} + z_{12} + z_{13} + z_{14} + z_{15} + y_1 \\ x_2 &= z_{21} + z_{22} + z_{23} + z_{24} + z_{25} + y_2 \\ x_3 &= z_{31} + z_{32} + z_{33} + z_{34} + z_{35} + y_3 \\ x_4 &= z_{41} + z_{42} + z_{43} + z_{44} + z_{45} + y_4 \\ x_5 &= z_{51} + z_{52} + z_{53} + z_{54} + z_{55} + y_5 \end{aligned} \qquad (1)$$

The first equation denotes that the total output produced by sector one, i.e. x_1, is distributed as follows in the economy. y_1 is the final demand of the output of sector one. Out of the remaining (x_1-y_1) output, z_{11} is used as an input in sector one, z_{12} is used as an input in sector two, and z_{13}, z_{14}, and z_{15} are used as inputs in sectors three, four and five respectively. Similarly, the other equations in (1) can be interpreted.

Note that the sector j produces total output x_j, and z_{ij} are the inputs bought from sector i by sector j, then the ratio of input to output is denoted by a_{ij}, i.e.

$$a_{ij} = z_{ij} / x_j \quad , \tag{2}$$

a_{ij}'s are called the input-output coefficients.[8] For example, if z_{14} = \$200 and x_4 = \$10,000 then a_{14} =0.02. This is interpreted in the following way: if sector four produces \$1.00 work of output then it purchases two cents of input from sector 1. From equation (2), we can write

$$z_{ij} = a_{ij}x_j \tag{3}$$

Substituting z_{ij} from (3) in equation (1), we obtain

$$\begin{aligned} x_1 &= a_{11}x_1 + a_{12}x_2 + a_{13}x_3 + a_{14}x_4 + a_{15}x_5 + y_1 \\ x_2 &= a_{21}x_1 + a_{22}x_2 + a_{23}x_3 + a_{24}x_4 + a_{25}x_5 + y_2 \\ x_3 &= a_{31}x_1 + a_{32}x_2 + a_{33}x_3 + a_{34}x_4 + a_{35}x_5 + y_3 \\ x_4 &= a_{41}x_1 + a_{42}x_2 + a_{43}x_3 + a_{44}x_4 + a_{45}x_5 + y_4 \\ x_5 &= a_{51}x_1 + a_{52}x_2 + a_{53}x_3 + a_{54}x_4 + a_{55}x_5 + y_5 \end{aligned} \tag{4}$$

Moving all x terms to the left,

$$\begin{aligned} &x_1 - a_{11}x_1 - a_{12}x_2 \ldots - a_{15}x_5 = y_1 \\ &x_2 - a_{21}x_1 - a_{22}x_2 \ldots - a_{25}x_5 = y_2 \\ &\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ &x_5 - a_{51}x_1 + a_{52}x_2 \ldots - a_{55}x_5 = y_5 \end{aligned}$$

or simplifying further

$$\begin{aligned} (1-a_{11})x_1 - a_{12}x_2 - a_{13}x_3 - a_{14}x_4 - a_{15}x_5 &= y_1 \\ -a_{21}x_1 - (1-a_{22})x_2 - a_{23}x_3 - a_{24}x_4 - a_{25}x_5 &= y_2 \\ -a_{31}x_1 - a_{32}x_2 - (1-a_{33})x_3 - a_{34}x_4 - a_{35}x_5 &= y_3 \\ -a_{41}x_1 - a_{42}x_2 - a_{43}x_3 - (1-a_{44})x_4 - a_{45}x_5 &= y_4 \\ -a_{51}x_1 - a_{52}x_2 - a_{53}x_3 - a_{54}x_4 - (1-a_{55})x_5 &= y_5 \end{aligned} \tag{5}$$

Equations (5) can be written in matrix notation as

$$(I\text{-}A)x = y \qquad (6)$$

where

$$x = \begin{Bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \end{Bmatrix}, \quad y = \begin{Bmatrix} y_1 \\ y_2 \\ y_3 \\ y_4 \\ y_5 \end{Bmatrix}, \quad A = \begin{Bmatrix} a_{11} & a_{12} & a_{13} & a_{14} & a_{15} \\ a_{21} & a_{22} & a_{23} & a_{24} & a_{25} \\ a_{31} & a_{32} & a_{33} & a_{34} & a_{35} \\ a_{41} & a_{42} & a_{43} & a_{44} & a_{45} \\ a_{51} & a_{52} & a_{53} & a_{54} & a_{55} \end{Bmatrix}$$

and I is a 5x5 identity matrix:

$$I = \begin{Bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{Bmatrix}$$

If $|I\text{-}A| \neq 0$, then $(I\text{-}A)^{-1}$ exists and x can be uniquely determined as

$$x = (I\text{-}A)^{-1}y \qquad (7)$$

where $(I\text{-}A)^{-1}$ is referred to as the Leontief inverse.

Example:

Suppose the five production sectors in the economy are: 1: Agriculture, 2: Manufacturing, 3: Health, 4: Transportation, 5: Services, each producing and using output as follows. The agricultural sector produces $1100 million worth of output, out of which $100 million is used by the sector itself, $400 million by the manufacturing sector, $100 million by the health sector, $100 million by the transportation sector, $100 million by the services sector, and $300 million by the household sector. This is represented in the table below by the row titled Agriculture. The manufacturing sector produces $1300 million worth of output, out of which $150 million is used by the sector

[8] A limitation of such input-output models is the constancy of the coefficients; thus the proportions of inputs required to produce a unit of output in a sector remain the same over time.

itself, $200 million by the agricultural sector, $200 million by the health sector, $200 million by the transportation sector, $200 million by the services sector, and $350 million by the household sector. This is represented in the table by the row titled Manufacturing. The health sector produces $700 million worth of output, out of which $50 million is used by the sector itself, $100 million by the agricultural sector, $100 million by the manufacturing sector, $50 million by the transportation sector, $100 million by the services sector, and $300 million by the household sector. This is represented in the table below by the row titled Health.

			Purchasing sector						Total Output
			Agriculture z_1	Manufacture z_2	Health z_3	Transport z_4	Services z_5	Households y	
Selling sector	Agriculture	x_1	100	400	100	100	100	300	1100
	Manufacture	x_2	200	150	200	200	200	350	1300
	Health	x_3	100	100	50	50	100	300	700
	Transport	x_4	300	200	50	50	100	100	800
	Services	x_5	200	200	100	100	50	250	900
	Total Demand		900	1050	500	500	550	1300	4800

The transportation sector produces $800 million worth of output, out of which $50 million is used by the sector itself, $300 million by the agricultural sector, $200 million by the manufacturing sector, $50 million by the health sector, $100 million by the services sector, and $100 million by the household sector. This is represented in the table by the row titled Transportation. The services sector produces $900 million worth of output, out of which $50 million is used by the sector itself, $200 million by the agricultural sector, $200 million by the manufacturing sector, $100 million by the health sector, $100 million by the transportation sector, and $250 million by the household sector. This is represented in the table by the row titled Services. Then, using (2), matrix A is obtained.

$$A = \begin{Bmatrix} 0.09 & 0.36 & 0.09 & 0.09 & 0.09 \\ 0.15 & 0.12 & 0.15 & 0.15 & 0.15 \\ 0.14 & 0.14 & 0.07 & 0.07 & 0.14 \\ 0.38 & 0.25 & 0.06 & 0.06 & 0.13 \\ 0.22 & 0.22 & 0.11 & 0.11 & 0.06 \end{Bmatrix}$$

When there is a change in final demands of some sectors, for example due to an increase in government spending and purchases, the y vector above will change. The new vector, x, of industrial output can be computed from (7). The resulting change in output and associated changes in employment and income can be then be calculated.

The input-output framework is often extended into a social accounting matrix (SAM) in order to model the impacts of an economic event in greater detail. A SAM provides the means to account for commodity and payment flows between all producers and consumers, including institutions (households and government) as well as industries. The rows in a SAM list suppliers or payees. This includes industries, commodities, factors, institutions, and importers. The columns list consumers or payers, including industries, commodities, factors, institutions, and exporters. The cell at the intersection of each row and column shows the payment by the column consumer to the row payee. Although commodities are primarily produced by industries, SAM treats them as separate entries. This allows for accounting of any commodities produced by institutions. SAM also records inter-institution transfers e.g., household to government payments or taxes, and government to household payments such as unemployment benefits.