

Regional Impacts of a US-35 Toll Road in West Virginia

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Background

- In the United States, tolling has been used as an alternative financing option for highway projects
- Toll roads can help meet highway demands by supplementing existing sources of highway funds with private capital
 - Toll projects allow new roads to be constructed sooner than with traditional financing
 - Upfront payments provided by private partners can provide immediate capital and assist in creating a cash reserve

The benefits of a toll system

- A toll is superior to a gas tax in terms of fairness (only users pay for it)
- Toll roads often allow highway systems in high growth areas to keep up with capacity growth
- Toll roads can be managed publicly, privately, or through a Public-Private Partnership (P3)
- Toll roads improve the regional economy



The purpose

- The purpose of this study is
 - 1) to review existing literature on tolling and its economic impacts and
 - 2) to estimate the potential regional economic impacts of implementing a new West Virginia toll road



Previous studies on tolling

- Previous toll studies fall into the following groups:
- 1. Toll pricing models and methods (Agnew, 1977; Yildirim, 2001; Bergendor et al.; 1996; Xu, 2009)
 - Agnew (1977) used optimal control theory to control congestion and stationary demand
 - Xu (2009) developed a dynamic congestion pricing model based on a discrete choice framework
- 2. Toll traffic/revenue forecasting (Bain, 2005 & 2009; Muriello and Vilain, 2005)
 - Bain (2009) showed that toll road traffic forecasts are characterized by large errors and considerable optimism bias
 - Muriello and Vilain (2005) discussed challenges for forecasting; many exogenous factors are difficult to project

Previous studies on tolling

- 3. Impacts of a toll road (Tampere et al., 2009; Pugh and Fairburn, 2008; Vadali, 2008)
 - Tampere et al. (2009) discussed social welfare gain of tolling and its possible adverse effects on traffic streams
 - Pugh and Fairburn (2008) evaluated the impacts of a toll road on industrial land development and employment
 - Vadali (2008) examined the effects of toll roads on property values
 - Various reports conducted toll feasibility studies



- Based on the literature review, I found that
 - Traffic forecasting is difficult because many factors can affect traffic
 - Predicting traffic volume for toll roads is even harder
 - Shortcomings are addressed in previous studies:
 - The accuracy of traffic forecasts has not improved over the years (Flyvbjerg et al., 2005)
 - Optimism bias caused toll road traffic forecasts to be overestimated by an average 23% (Bain, 2009)
 - Only 2 of 14 toll roads met the forecasted traffic levels during their 5 years of operation and 4 toll roads were overestimated by 70% or greater (J.P. Morgan, 1997)
 - Little attention has been paid to the evaluation of economic impacts of a toll road with various toll rate scenarios

Potential toll projects in West Virginia

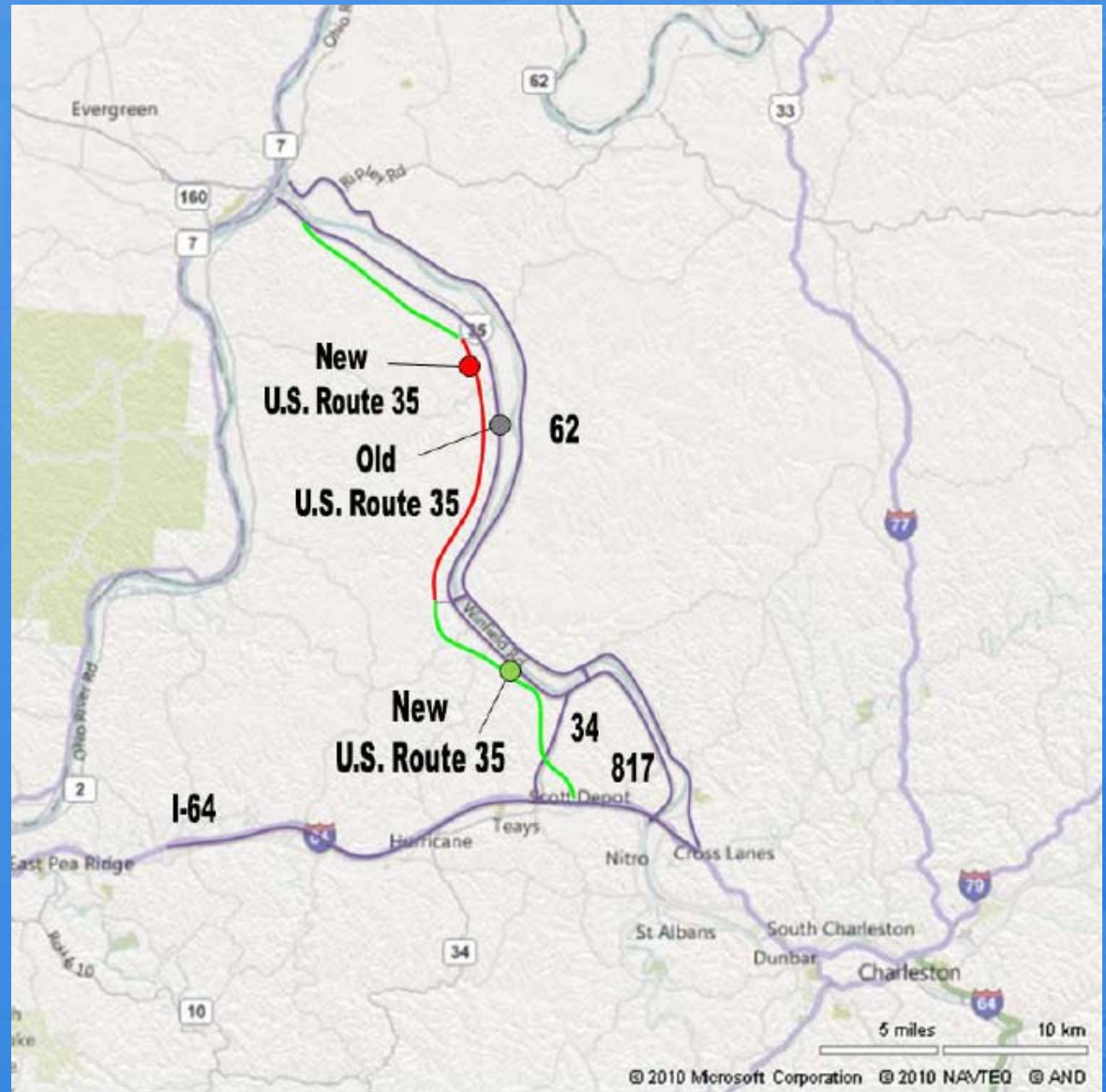
- Several toll projects are discussed: US-35, King Coal Highway, Bridge Street Bridge (Grafton), and WV-705 (Morgantown)
- Traffic and toll revenue forecasting and economic impact analysis can provide key ex-ante information for a new toll road/bridge
- Therefore, this study uses Regional Economic Models (REMI) to measure economic impacts of a potential toll road on US-35. It measures positive and negative effects of toll revenue and evaluates toll rate scenarios by using the net economic impacts

US-35 in WV

- The US-35 corridor is a multi-lane and partial access-control facility. US-35 refers to the road being built from Henderson in Mason County to I-64 in Putnam County
- A potential toll plaza is located within the 13-mile section between the Buffalo Bridge and Mason CR 42 for US 35



Study area



Source: (Jacobs Engineering Group, Inc., 2011)

The data

- Annual Average Daily Traffic (AADT) projections are used to forecast the annual traffic volume for the alternative toll rates
- Six toll rate scenarios are:
 - Scenario 1: The West Virginia Turnpike Mainline toll rate: \$2.00 for passenger cars and \$6.75 for trucks and no annual adjustment thereafter
 - Scenarios 2/3/4/5/6: The toll rate is increased by 20/40/60/80/100% and adjusted by inflation thereafter

Traffic forecasting

Table 1. Toll Price Elasticity of Demand, Comparison of Previous Study Results

Facility/ Area	Demand Elasticity	Closest	Rural or Urban Highway	Year of Data Collection	Source
WV Turnpike	-0.16	More than 1 hour	Largely rural	2005	Wilbur Smith
NJ Turnpike	-0.2 to -0.3	Varies by section; in some places parallel	Largely urban	2005	Steer Davies Gleave
Coleman Bridge in VA	-0.16 (short-term) to -0.33 (long-term): -0.25 on average	2 to 7.5 miles (3.5 to 9 minutes)	Largely urban	2002-2004	Charles River Associates
San Francisco Bay Bridge	< -0.05	*	Urban	1996	Gifford & Talkington
Verrazano Narrows Bridge in NYC	-0.05	*	Urban	1995	Wilbur Smith
Richmond, VA Pike	-0.34	*	Urban	1995	Wilbur Smith

*Information could not be obtained.

- This study uses the elasticity of demand of -0.16 for a short-run and the elasticity of demand of -0.33 (2030) to incorporate a long-run effect

Revenue forecasting

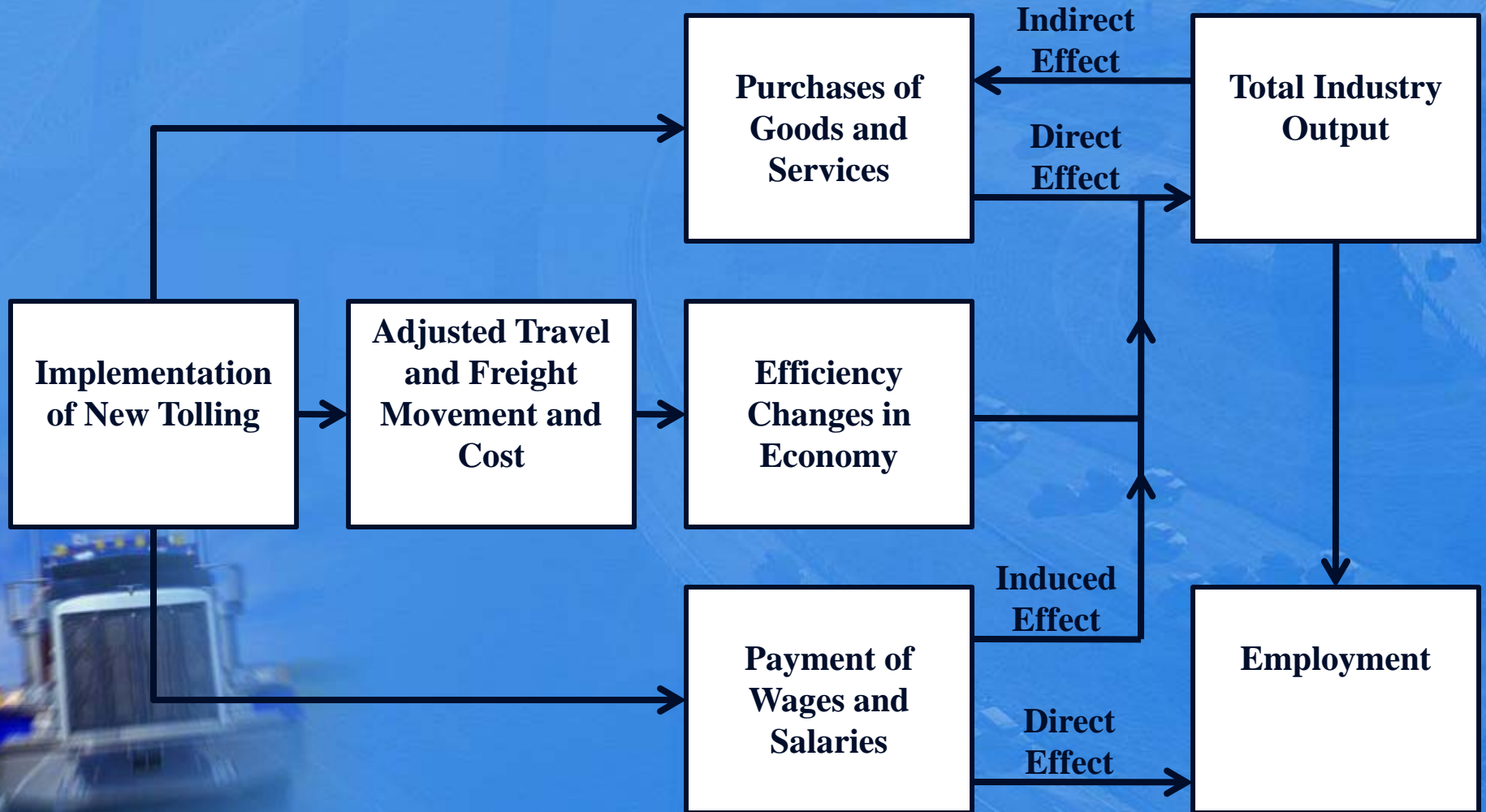
- Toll revenue = Predicted traffic volume * weighted average rates (“per-mile” toll rates of WV Turnpike Mainline for passenger and commercial vehicles)
- This study adopts the Personal Consumption Expenditures Price Index (PCEPI) as an inflation adjustment factor
- Forecasted revenues are used as input variables for economic impact analysis

Economic impact model

- MacroSys Research and Technology (2003) defines
 - a direct effect as the vector of goods and services on which the initial spending is made;
 - indirect effect as the sum of total commodity multipliers for industries minus the direct effect;
 - induced effect as the sum of total commodity multipliers for households.



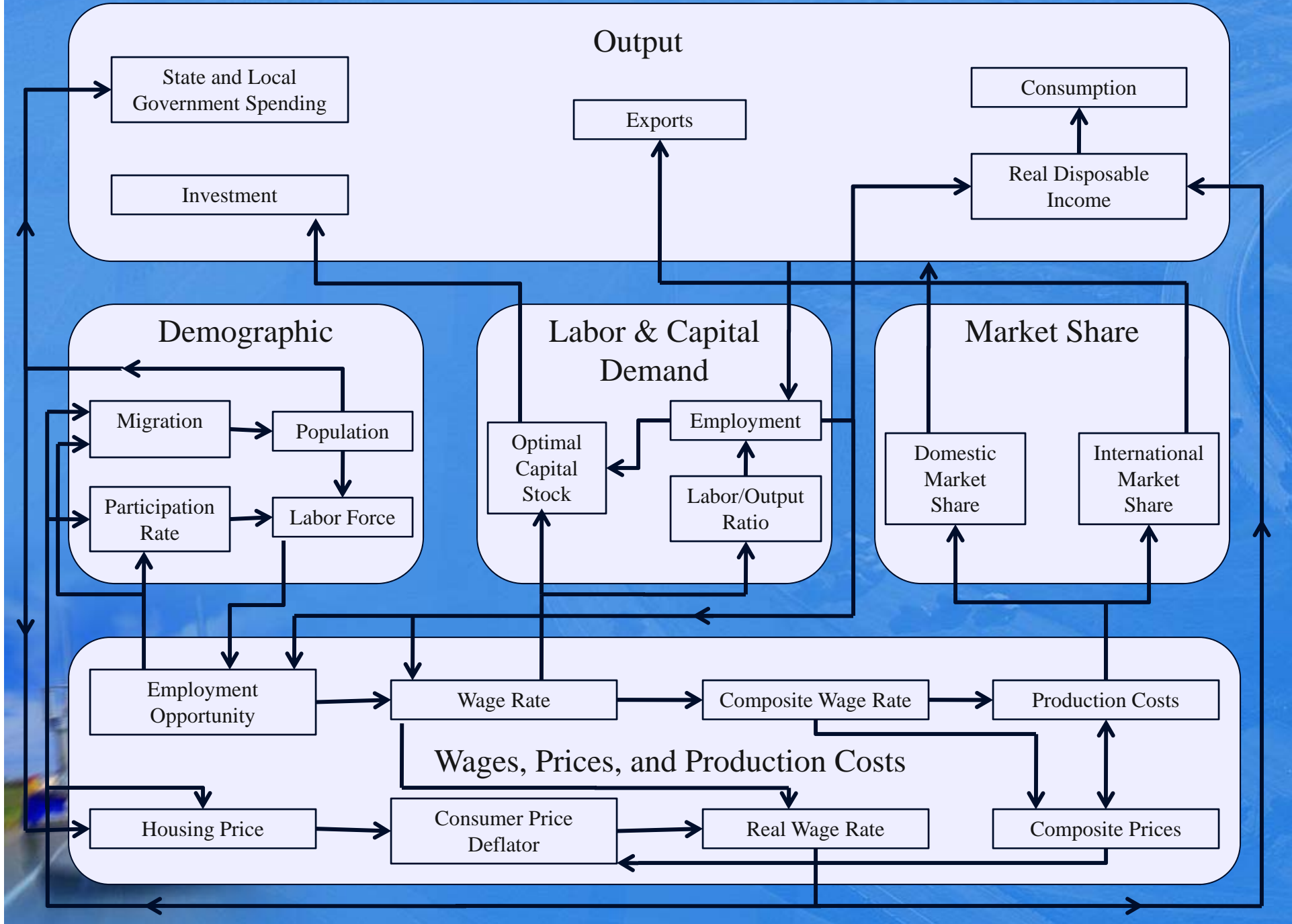
**Figure 2. Economic Effects of Implementation of New Toll Roads
(Modified from MacroSys Research and Technology, 2003)**



- Several software packages are currently available to measure regional economic impacts
 - **REMI**: a dynamic model which forecasts how changes in the economy and adjustments to those changes will occur on a year-by-year basis
 - **TREDIS**: web-based economic impact analysis and benefit-cost analysis for transportation projects
 - **IMPLAN**: framework assesses not only the impacts in a local community but also can track local trade to see how these impacts changes surrounding regional economies
 - **RIMS II**: RIMS II multipliers is used to estimate the impact of a final-demand change on total output, employment, earnings.
 - **REDYN**: web-based, multiregional, and dynamic economic geography analysis engine

- *REMI* results show the cause and effect relationship between the toll project and the levels of state employment and income
- This study uses the *REMI* to quantify both negative and positive economic effects of a potential toll plazas in West Virginia. The net economic effects can be used as decision criterion for a toll project
- *REMI* has five model blocks:
output; demographic; labor and capital demand; wage, prices, and production costs; and market shares

Figure 3. REMI Model Blocks and Linkages (Source: REMI, 2008)

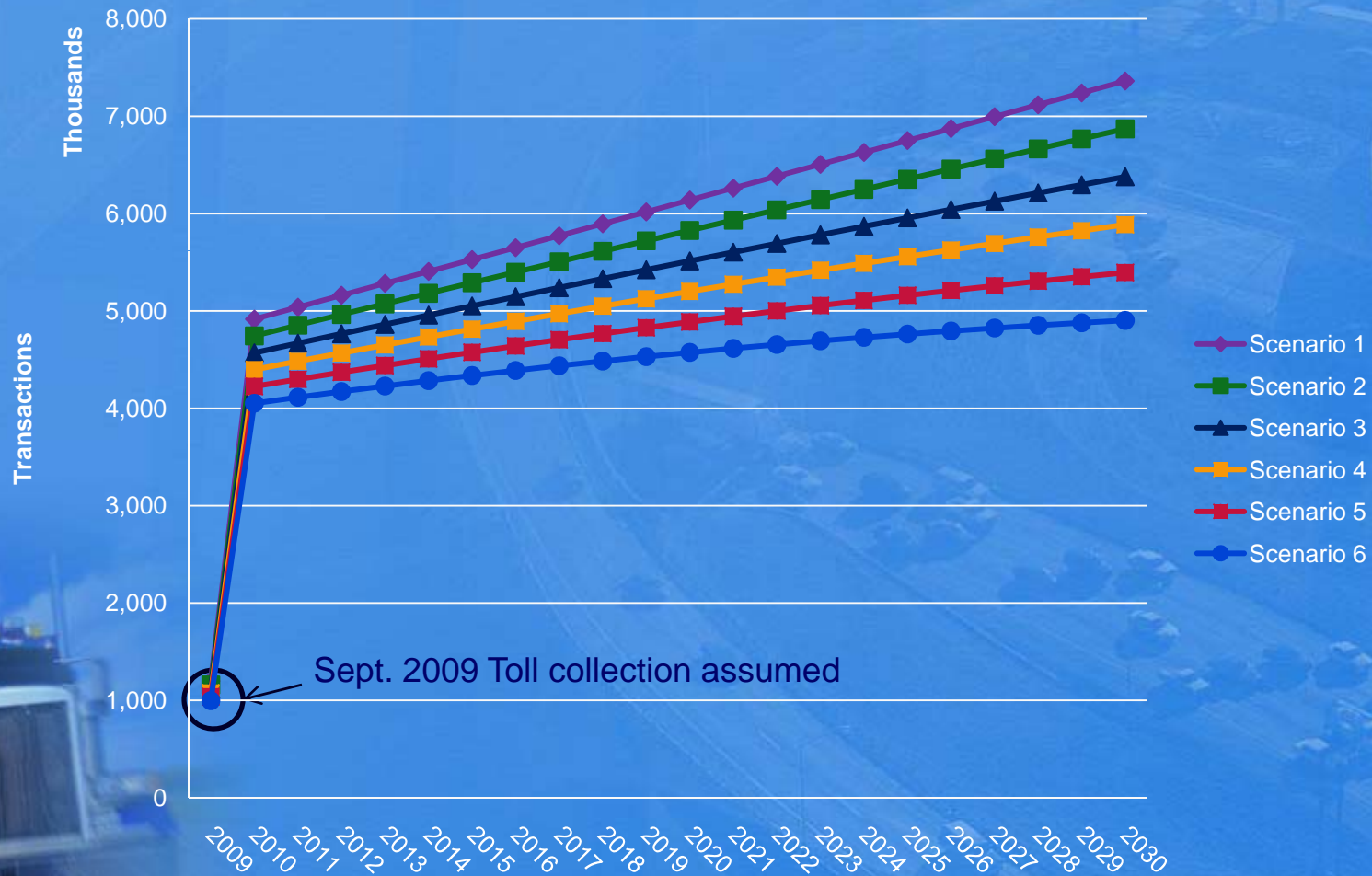


Economic impact analysis

- Positive impacts of toll revenue
 - TranSight (v 2.1): use the forecasted toll revenue in government funding
- Negative impacts of toll revenue
 - PI+: use 1) the forecasted toll revenue from commercial vehicles in production cost and 2) the forecasted toll revenue from passenger vehicle in consumer price
- Net economic impacts of toll revenue

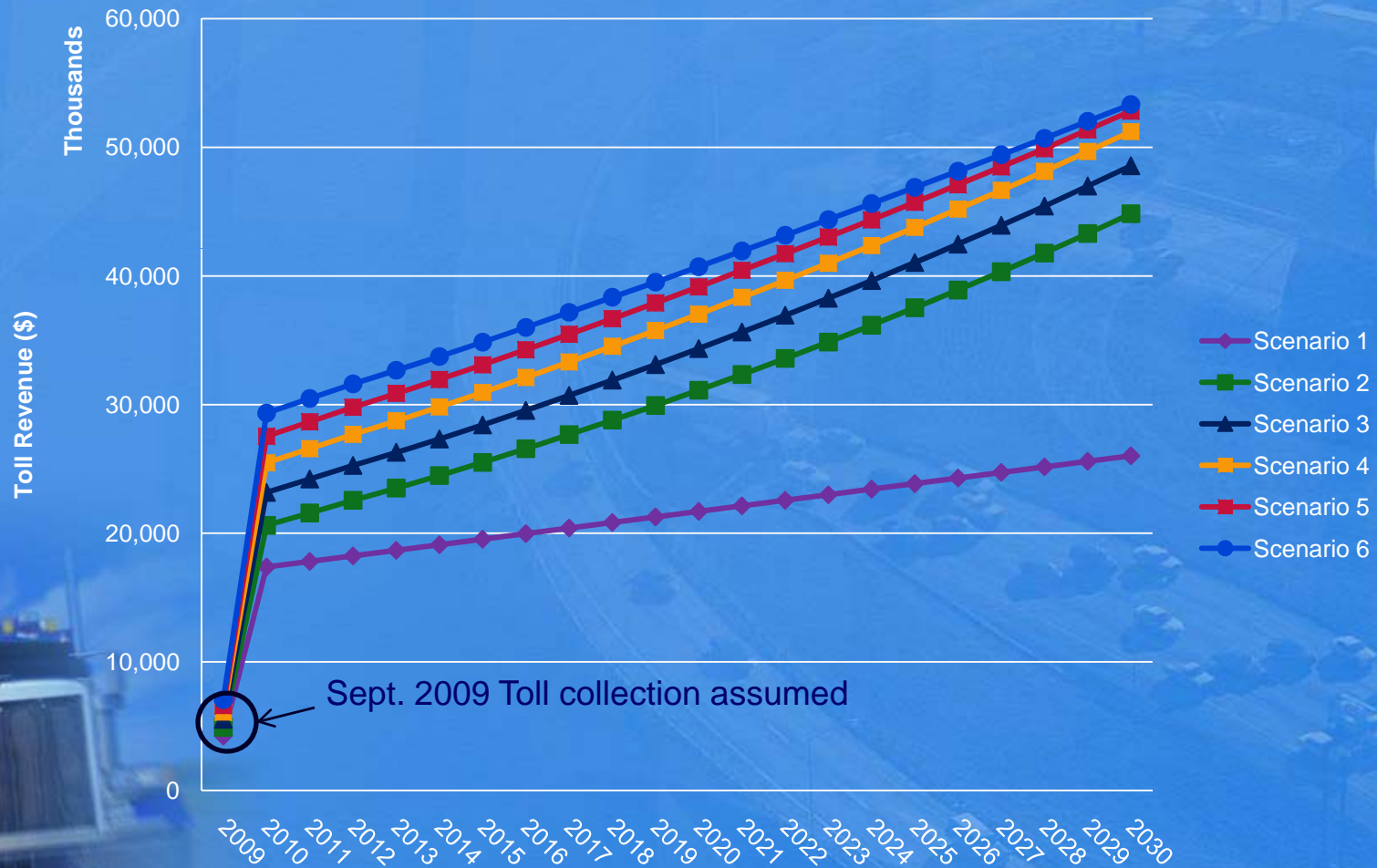
The results: traffic forecasting

Predicted Transactions of All Vehicles for US 35



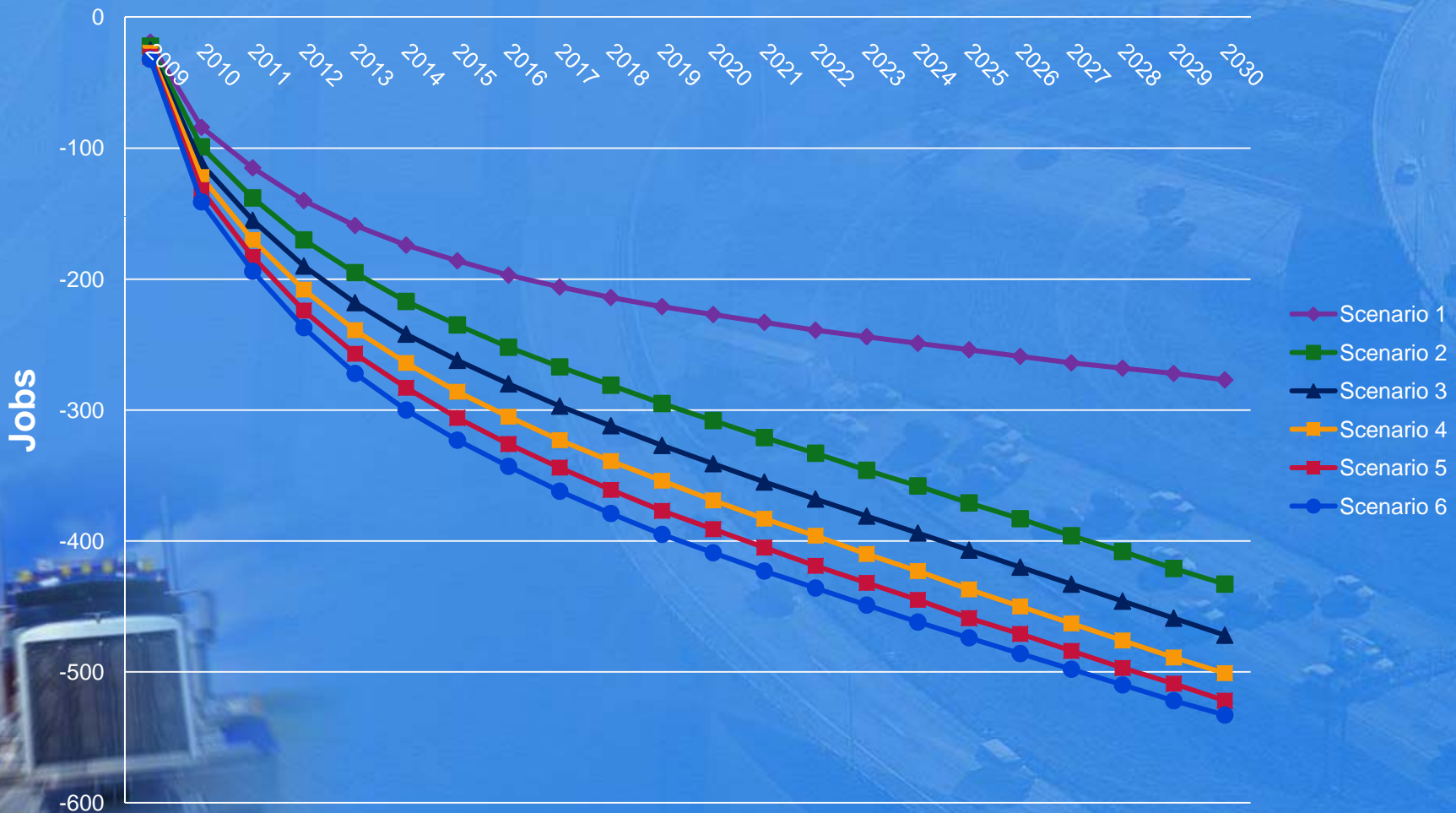
The results: revenue forecasting

Predicted Toll Revenue from All Vehicles for US 35



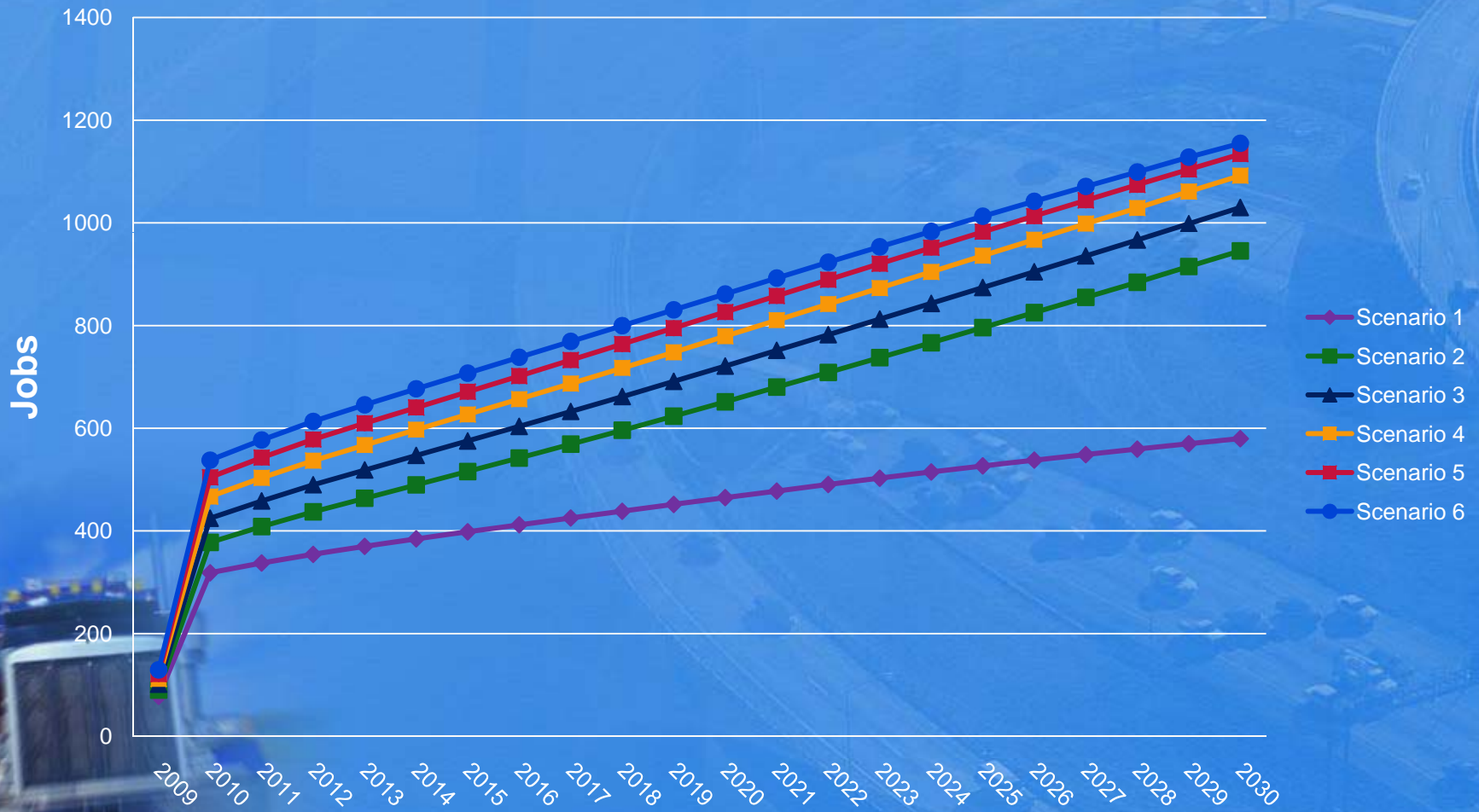
The results: **negative** impact

Change in State Total Employment from US35 Toll Project



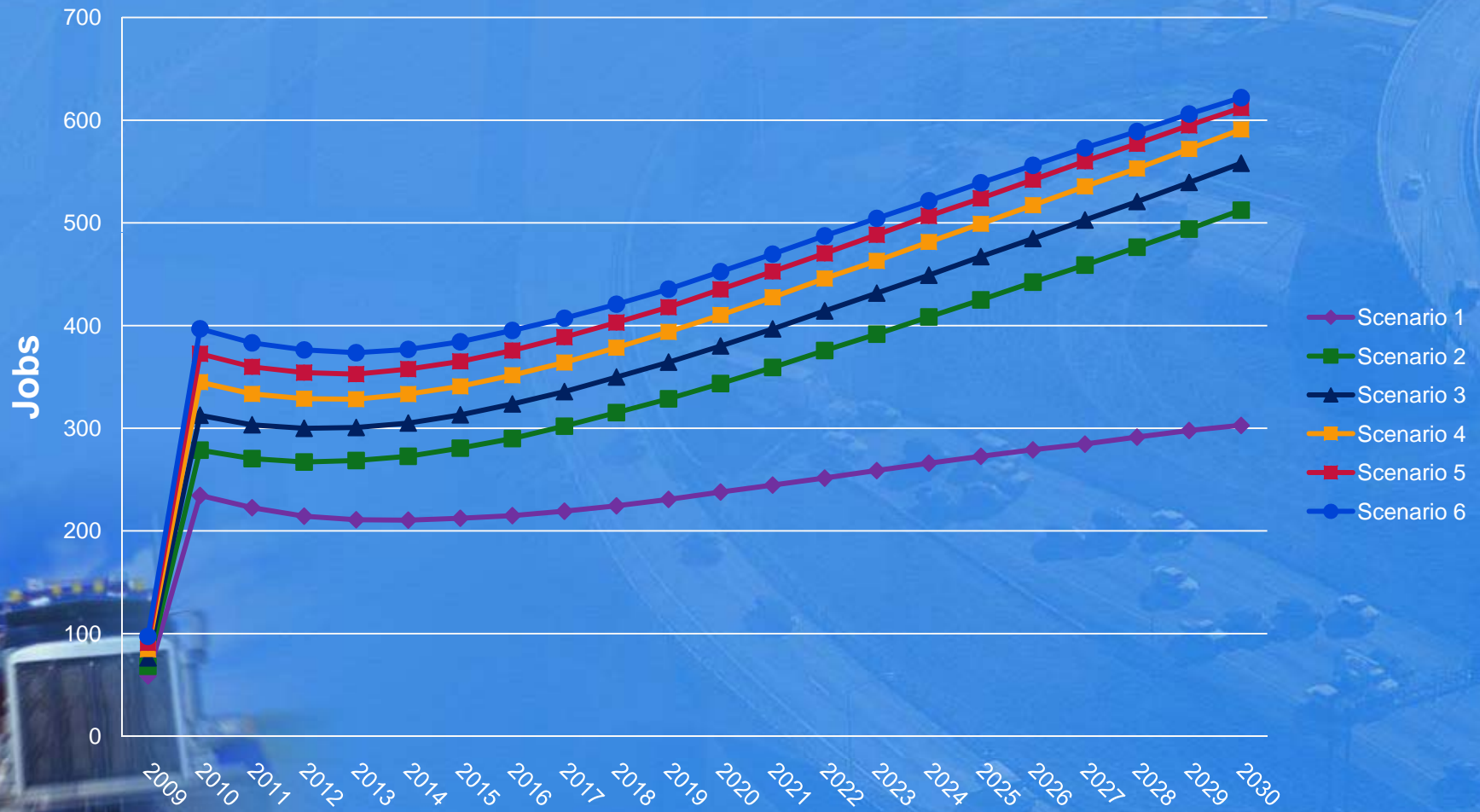
The results: **positive impact**

Change in State Total Employment from US35 Toll Project



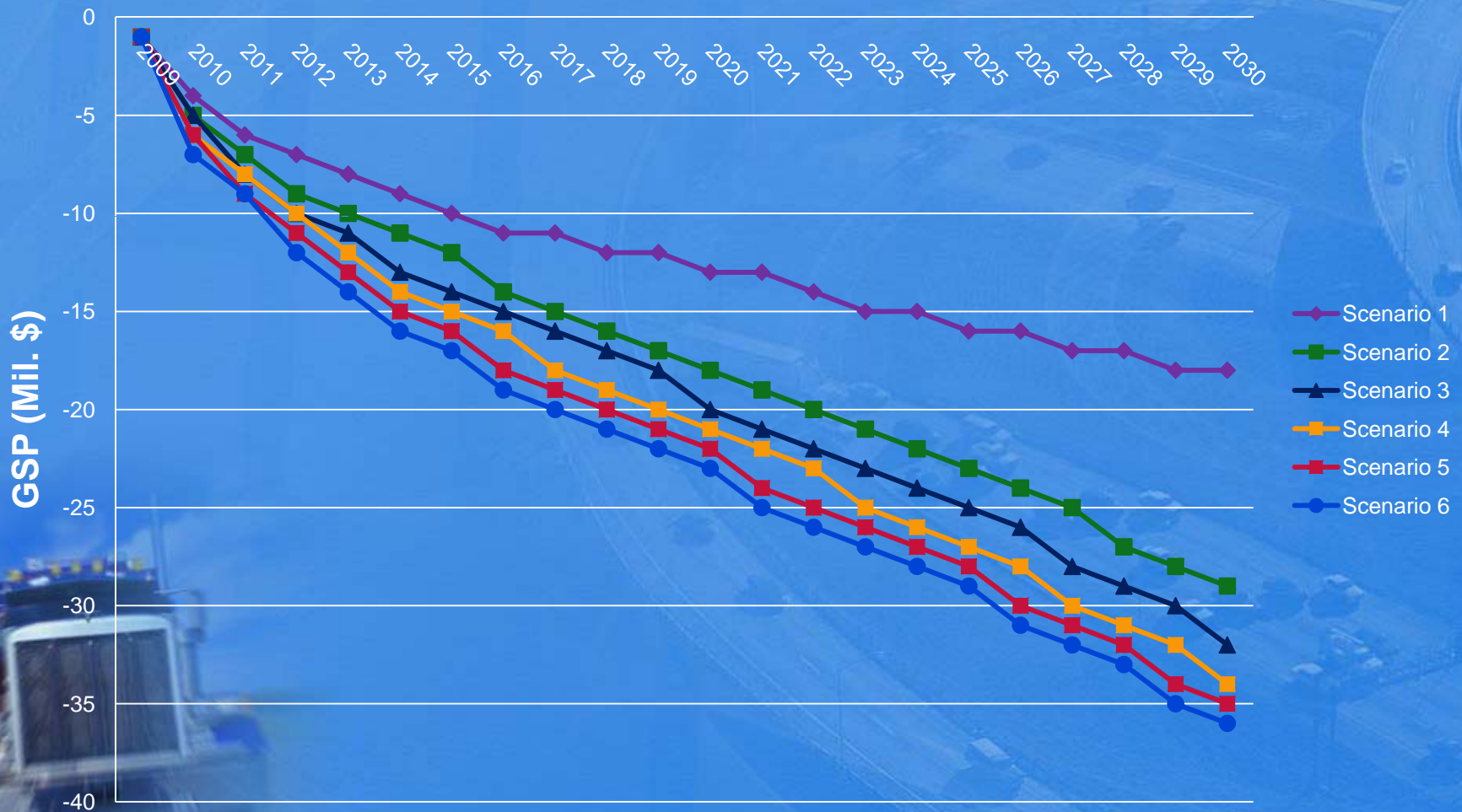
The results: net economic impact

Change in State Total Employment from US35 Toll Project



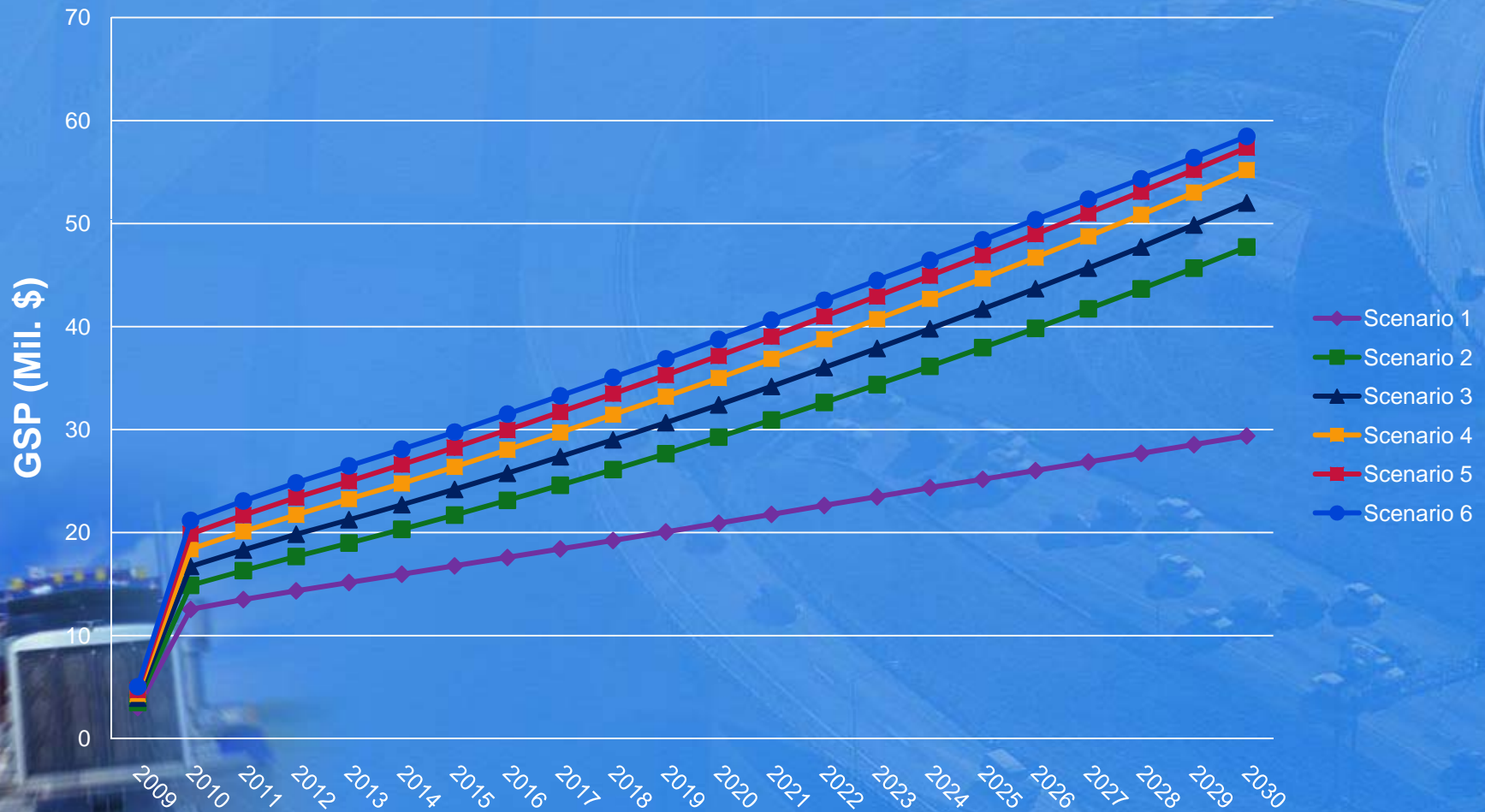
The results: **negative** impact

Change in Gross State Product from US35 Toll Project



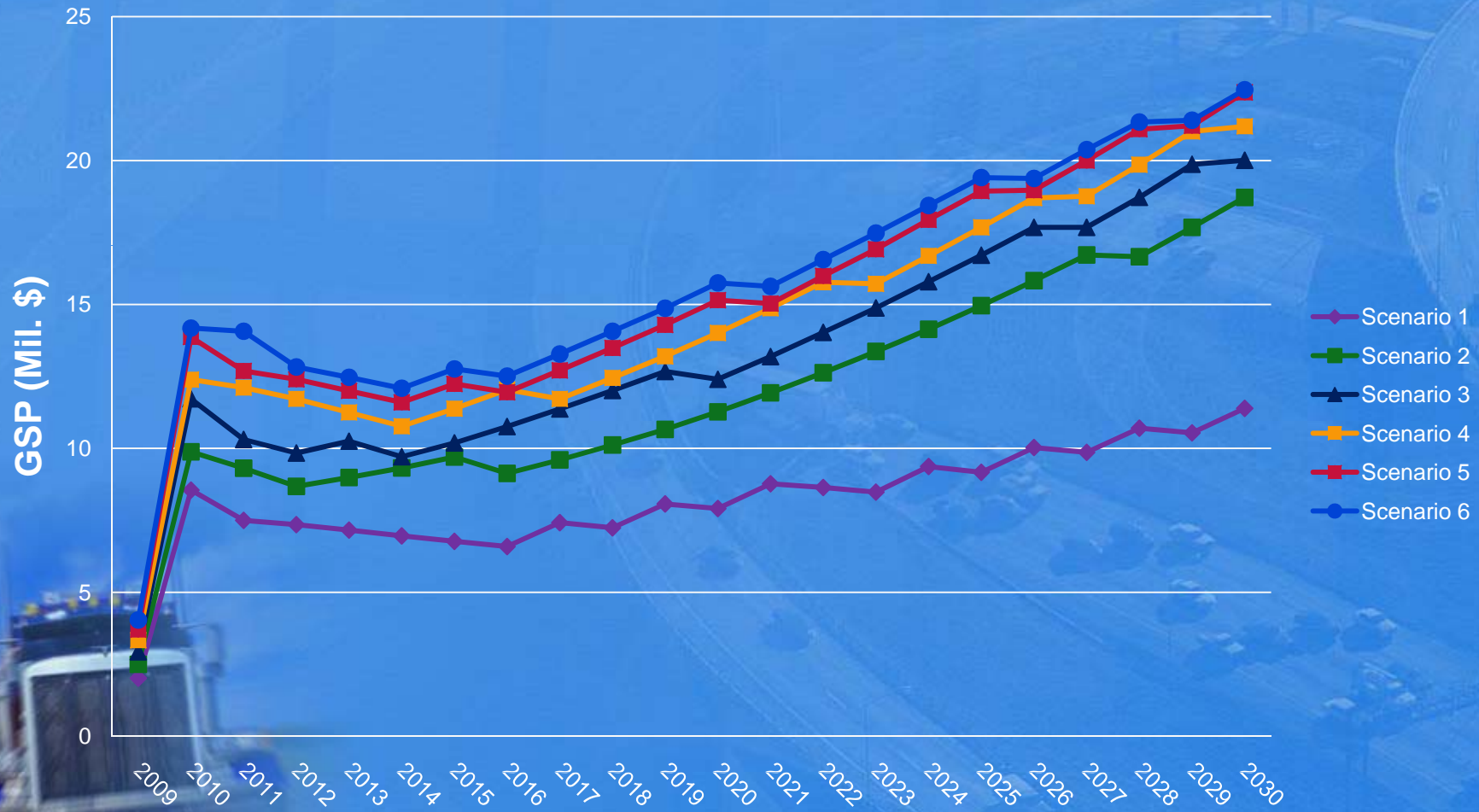
The results: **positive impact**

Change in Gross State Product from US35 Toll Project



The results: net economic impact

Change in Gross State Product from US35 Toll Project



Conclusions

- Toll rate increases are likely to reduce traffic volume, and higher toll rates lead to a larger traffic decrease in long-term traffic volume
- Marginal toll revenue of an additional 20% toll increment tends to be smaller for higher toll rates because of the larger offset effect of toll increase (reduced traffic volume)
- Positive net economic impacts are found for all toll rate scenarios on state employment and GSP. This suggests that the benefits of the tolling largely overshadow the costs for a region

Conclusions

- Economic impacts for the long-term tend to be larger than those for the short-term. This implies that a toll project can be an effective financing option for a long-term transportation project in West Virginia
- Future studies should compare the economic impacts of all alternative financing options (e.g., tolling, vehicle mileage road user fee, registration fees, and fuel tax)





Thank you

