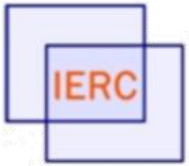
INTERMEDIATE RESULTS

IMPACT STUDY TO ESTIMATE ROAD SAFETY AND ECONOMIC EFFECTS OF THE INTRODUCTION OF PTI IN TURKEY



Institute for Economic Research & Consulting
Meerbusch 2017

Univ.-Prof. **Dr. Wolfgang H. Schulz**: *wh.schulz@ierc.de*
Sebastian Scheler, MSc: *sebastian.scheler@zu.de*

CITA International Motor Vehicle Inspection Committee

THE STUDY:

- The following slides are representing the status quo of the study
- „*Impact study to estimate road safety and economic effects of the introduction of PTI in Turkey*"
- conducted for CITA
- by Prof. Dr. Wolfgang H. Schulz and Sebastian Scheler in May 2017.

OBJECTIVES OF THE STUDY:

- show impact of the introduction of PTI;
- gather data;
- empirical evidence and model;
- recommendations for actions in other countries.

SHORT HISTORY OF PTI IN TURKEY:

- Historically there was a system of simple technical check-ups and verification of papers;
- Turkey decided to introduce directive 96/96/EC.;
- Two regions tendered: both were won by the German company TÜVSÜD and two Turkish partners (Akfen and Doğuş) by the end of 2004;
- As of today there are 204 fixed, 5 motorcycle, 76 mobile and 13 mobile tractor stations;
- New stations are opened, depending on increased demand.

Data, Statistic Tools and Limitations:

- Gathering publicly available, as well as paid for, data from TÜIK (Turkish Statistical Institute) and TÜVTÜRK as well as the World Bank and the General Directorate for Security in Turkey;
- Processing of the data in Excel, R and SPSS;
- Choice of models (Pure time-series model & Pure traffic-parameter model);
- Assessing the plausibility of the data.

SAFETY IMPACT ASSESSMENT:

Two empirical analyses were undertaken:

1. Short-term safety impact assessment of PTI introduction in Turkey;
2. Long-term safety impact assessment of PTI introduction in Turkey.

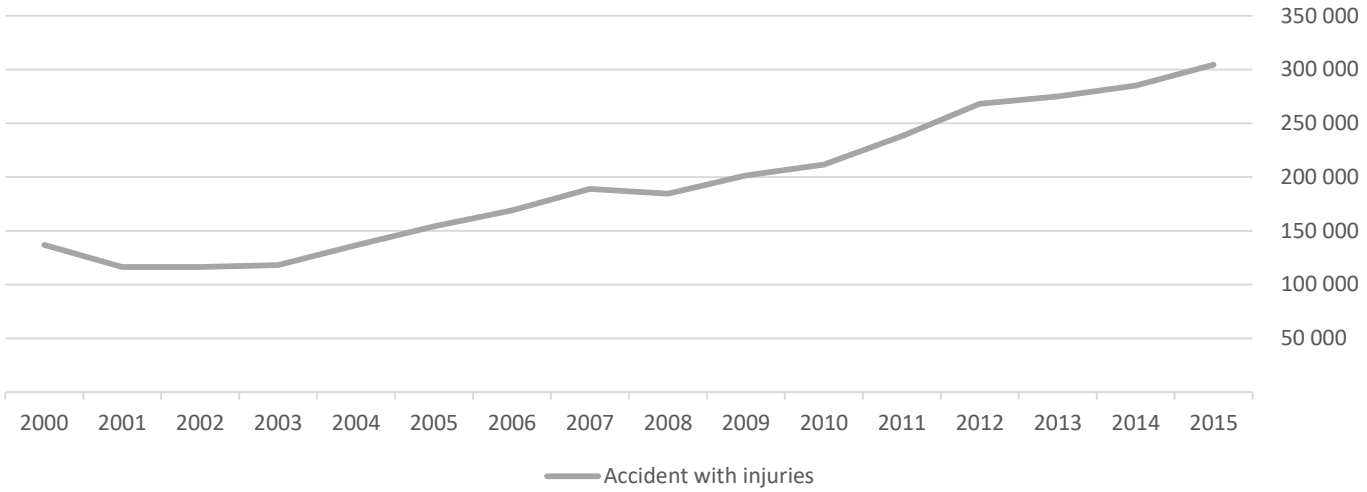
Objectives:

- A complete introduction of PTI on a state level in one year is difficult to reach;
- However, the acceptance of PTI by the car users can be increased by feasible traffic safety improvements;
- The short-term safety impact assessment tries to find out whether an incomplete introduction of PTI generates feasible traffic safety impacts even in the year of introduction;
- The long-term safety impact assessment shows the general welfare shift of an economy by PTI enabling resource savings by avoiding accidents.

IN THE FOLLOWING TWO GRAPHICS, THE DEVELOPMENT OF ACCIDENT NUMBERS AND THEIR CONSEQUENCES IS ILLUSTRATED.

WHILE TRAFFIC ACCIDENTS WITH INJURIES ARE INCREASING OVER TIME, THE NUMBER OF ACCIDENTS WITH FATAL CONSEQUENCES IS FALLING AFTER A LOCAL PEAK IN 2007.

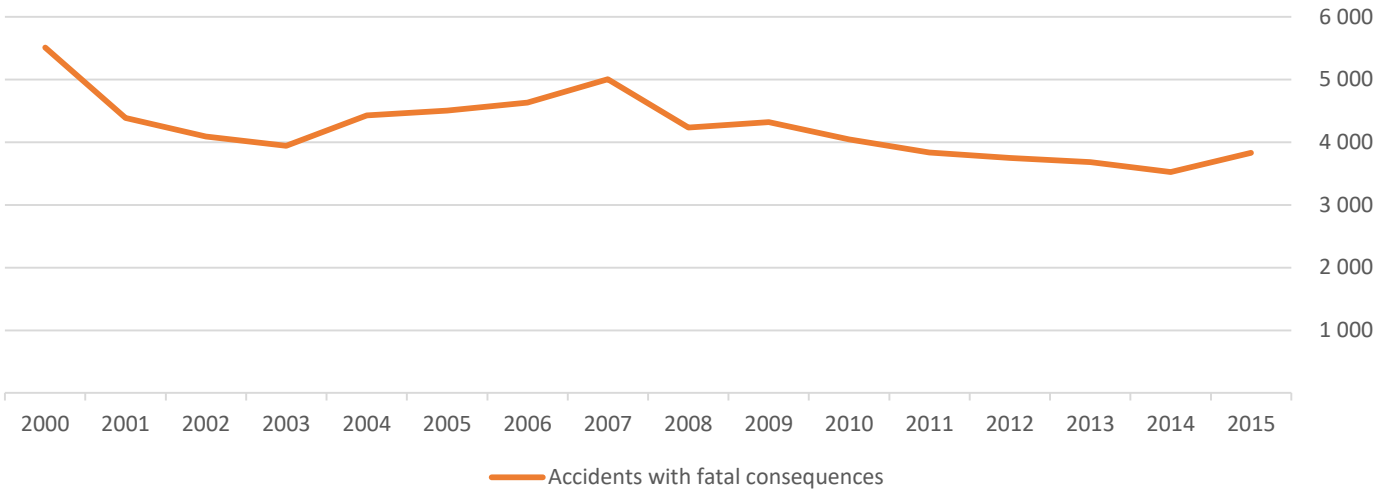
DEVELOPMENT OF INJURED FROM ROAD ACCIDENTS



Development of injured in road accidents over the period from 2000 to 2015

(own illustration; data source: TÜIK 2016)

DEVELOPMENT OF FATALITIES FROM ROAD ACCIDENTS



Development of fatalities from road accidents over the period from 2000 to 2015

(own illustration; data source: TÜIK 2016)

RESULTS OF THE MODELING:

The following slides will present the results of the modelling.

The results represent the status quo of the project.

We are working on refining the model and gather more data in order to improve the resilience of the model.

For detailed questions please contact the authors.

You can find the contact information on the first page.

SHORT-TERM SAFETY IMPACT ASSESSMENT OF PTI INTRODUCTION IN TURKEY:

THE FUNCTIONAL RELATION:

- $AC_t = \beta_1 LR_t + \beta_2 LDR_t + \beta_3 NPC_t + \beta_4 GDP_{t+1} + \beta_5 GDP_{t+3} + \beta_6 GDP_{t+7} + \lambda t + \sum_{j=1,2,3,4,5,6,7,8}^{T-1} d_j D_j + e_{i,t}$
  - With AC_t as dependent variable measuring the effects on the number of road accidents.
  - With e as unobserved random variable adding noise to the relationship between dependent variable and predictors.
  - The predictors are explained on the next slide.
  - Where d_j is the coefficient of the Dummy D_j for introducing PTI, the latter equal to one-year j, zero elsewhere.
  - Where λ is the coefficient on the time trend increasing with equal step.
  - With F-Value = 1612.840 (Sig. 0.000) for all predictors.
  - With adjusted R square of 0.99.

COEFFICIENTS OF THE SHORT-TERM IMPACT ASSESSMENT MODEL

Independent Variables	Standardized Coefficients	T-value	Sig.
t (trend)	-1.524	-4.217	.002
D (dummy for introducing PTI)	-.315	-4.254	.002
LR (length of all roads)	.100	1.586	.144
LDR (length of divided road)	.986	5.732	.000
NPC (number of passenger cars)	1.107	2.709	.022
GDP (t+3)	.381	3.495	.006
GDP (t+1)	.166	1.695	.121
GDP (t+7)	.061	.577	.577

a. Dependent Variable: Accidents (AC)

b. Linear Regression through the Origin

SUMMARY OF SHORT-TERM SAFETY IMPACT ASSESSMENT:

Statistical Summary:

1. R-Values and F-Values are significant and show the statistical goodness of the selected model approach;
2. t-values are significant and show the trustworthiness of each variable and that they have a statistically significant impact on the model results.

Impact of the introduction of the current model of PTI in Turkey – short term

Annual reduction of 82,925 accidents during the 1st year

US$ 274 million of savings during the 1st year*

* Using the Turkish cost-unit rates of US$ 3,342

DIFFERENCES BETWEEN SHORT-TERM AND LONG-TERM ANALYSIS:

- The main difference between both models is the chosen dependent variable;
- For the short-term model the dependent is the number of road accidents;
- For the long-term model the dependent is number of accidents with fatal consequences related to population;
- Four models were tested;
- Model 1 started only with the Dummy D_j for introducing PTI;
- Subsequently variables were added to control for different effects;
- Dummy D_j is overall significant and the coefficient is relatively stable.

LONG-TERM SAFETY IMPACT ASSESSMENT:

	Model 1	Model 2	Model 3	Model 4
(Intercept)	87.70***	88.67***	87.27***	86.03***
	(3.92)	(4.65)	(4.64)	(3.82)
Dummy variable for introduction of PTI	-35.00***	-35.83***	-34.78***	-32.02***
	(7.06)	(7.47)	(7.31)	(6.85)
GDP growth		-7.90		
		(19.46)		
GDP growth (lag 1 year)			3.53	
			(19.42)	
Road growth				37.64
				(35.92)
R Square	0.51	0.51	0.51	0.54
Adjusted R Square	0.49	0.47	0.46	0.49
Number of Observations	26	26	26	25
Root Mean Square Error (RMSE)	16.62	16.92	16.97	15.74

*** p < 0.001, ** p < 0.01, * p < 0.05

SUMMARY OF LONG-TERM SAFETY IMPACT ASSESSMENT:

Statistical Summary:

1. Four models were tested and all models have significant R-Values and F-Values;
2. t-values of each model are also significant;
3. The models differ a little bit in the variable. However, comparing the values of the regression coefficient for the relevant variable the "Dummy variable for introduction of PTI" of each model shows only a small fluctuation, which is an expression for the trustworthiness of the coefficient value.

Impact of the introduction of the current model of PTI in Turkey – long term

2,700 fatalities avoided since PTI was introduced

102,000 less accidents on average

US$ 340 million of savings on average*

* Using the Turkish cost-unit rates of US$ 3,342

Overall Summary of Results:

Short Term – first year

- ✓ Annual reduction of 82,925 accidents
- ✓ US$ 274 million of savings*

Long Term – annual average

- ✓ 2,700 fatalities avoided since PTI was introduced
- ✓ 102,000 less accidents
- ✓ US$ 340 million of savings*

Furthermore…

- ✓ Economical impact of fatality savings to be calculated when unitary costs are available
- ✓ Potential increase of benefit when coverage rises from 87% to 100%

* Using the Turkish cost-unit rates of US$ 3,342

Further Research Needs:

Full Economic Assessment of PTI Introduction is needed

1. Comparable cost-unit rates for fatalities and injuries
2. Costs of implementation, enforcement and operation
3. Direct and indirect employment effects (PTI, garage industry)
4. GDP-effects because of higher quality of cars
5. Consumer effects by longer life-cycle of cars

FURTHER RESEARCH NEEDS:

STAKEHOLDER	ANALYT. GOAL	ECONOMIC TOOLS
Car users PTI Industry Garage Industry Insurance Industry Car dealer Police Public authorities	Primary effects: Benefits and costs on user level, Industry level	Cost-benefit analysis
		break-even analysis
	Secondary effects: fiscal effects employment effects	input-output analysis financial analysis
		Incidence analysis

About the authors:

Prof. Dr. Wolfgang H. Schulz

Managing Partner of the Institute for Economic Research & Consulting GmbH. Since 2013 Head of Department of the Chair for Mobility, Trade and Logistics at Zeppelin University. Since 2010 Lifetime Member of the Midwest Political Sciences Association, Chicago. Since 2009 Scientific Member of the Commission for Transport of the Federation of German Wholesale and Foreign Trade.

Sebastian Scheler, MSc

Since 2016 Research Fellow at the Chair for Mobility, Trade and Logistics at Zeppelin University.

Since 2016 Junior Research Analyst at the Institute for Economic Research and Consulting.

Fluent in German, English, Italian and Danish.

The IERC was founded in 2003 as a private research institute by Prof. Dr. Wolfgang H. Schulz and has specialized since then in research and consulting in the area of transport economics.

The research of the IERC has focused on traffic planning and the transport industry; the main research focus is on e-mobility and intelligent cooperative transport systems. The research methodology includes road-safety analyses, cost-benefit analyses, break-even analyses, market studies, competition and integration of traffic systems, valuation of assessment systems, methods of forecast and valuation of traffic development, telematics, passenger and freight services, requirement analyses (elasticities, conjoint analysis, certain preference methods and new econometric approaches), road usage fees and traffic related taxation issues.

The macroeconomic analyses are extended by economic analyses and the estimation for private profitability (e.g. break-even analyses, assumption analyses). The research not only focuses on regional or local matters but also on a national and European level.

In the past years, the institute has participated in a number of European research projects (e.g. SEiSS (Exploratory Study on the potential socio-economic impact of the introduction of Intelligent Safety Systems in Road Vehicles, Study for the Directorate-General Information Society); AUTOFORE (Study on the Future Options for Roadworthiness Enforcement in European Union, Study for the Directorate-General for Transport and Energy); eIMPACT (Assessing the Impacts of Intelligent Vehicle Safety Systems, Sixth Framework Program, DG Information Society and Media); PRE-DRIVE C2X (PREparation for DRIVing implementation and Evaluation of C-2-X communication technology, Seventh Framework Program of the European Commission), which contained a broad range of different transportation issues.