

Potential of Railway Transport Liberalization in Turkey

Turgut Ozkan, Gozde Yanginlar, and Salih Kalayci

Abstract—Nowadays, railway liberalization considered so vital for businesses to improve their overall financial performance. In this paper, we study the economic development of the Turkish railway transportation and how the deregulation has affected cost efficiency. We test this theoretical prediction using a data base that contains financial information from TCDD and TUIK. This paper presents the results of a research into railway regulation and liberalization in Turkey. Our final results includes for the period 1928–2014. Results provide support to our theoretical contentions. The research finds evidence of relationship between railway liberalization and offers new insights in theory, paving the way for further research on these topics.

Index Terms—Railway liberalization, VAR, impulse response, variance decomposition, multivariate regression, Johansen Cointegration test.

I. INTRODUCTION

Many railways all over the world have been intended to various liberalization processes during last decades. Liberalization is a key element for increase the competitiveness of the railway. Turkish government has made major changes in railway management so Turkey is ready for market liberalization in railway industries. In 2011, a new railway transport policy was developed. After liberalization of railway law have legalized, construction and administration of the railway infrastructure would be separated organizationally and legally from the operation of train by TCDD. Liberalization of the railways in Turkey was intended to create productivity and efficiency in the long term. Competitors have a chance to enter into railway industry and railway operators would have the status of independent and predict the market needs.

In this study, it reviews the literature relating to the rail liberalization in order to identify the main effects and drivers in many countries. The major goal of this paper is to draw a comparative picture of the Turkish railway sector liberalization and indicates to relationship between railway liberalization and financial outcomes. There may have been several goals for rail liberalization. It aimed to improve economic performance and efficiency in costs of railway. Paper structure is the following. Section II discusses results of the railway liberalization in the world. Sections III. deals with data sets about periods and counties. Section IV analysis

all data, Section V evaluates of evidences and concludes the article. We have chosen macro econometric approach in our study. We analyses the relationships between the GDP, trade volume and the passenger revenue, from 1928 to 2014 based on annual data in TCDD. Complete and consistent cost data can only be derived from TCDD which is examined for period 1928 to 2014 and observed in all details in change.

II. LITERATURE REVIEW

Rail liberalization has been widely covered both in transport literature and in scientific literature and the themes faced are numerous. Ref. [1] concluded that rail liberalization increased competition and deregulation enhanced productive efficiency. Ref. [2] explained the changes in the American railway industry which impacted affects the way enterprises take short-term and long-term decisions on pricing, quality and investment in capacity and new technology. Ref. [3] found considerable improvements rail liberalization and surveyed on many studies that restructuring of railway improved profitability and productivity. Ref. [4] researched railway operations in 23 European countries during 1995–2001. It evidences that many venture enterprises have a chance to enter into the market in the railway liberalization process and deregulation increased efficiency. Ref. [5] emphasized that vertical and horizontal reforms are necessary in the rail industry which has to combine for productivity. Ref. [6] provided the results of a comparison of rail liberalization levels across four European countries which are Italy, France, Germany and Spain. It found that there is not only description for all countries in the railway liberalization. It indicated that there is a relationship between state and rail companies and entry in the rail industry has not yet developed and concluded that the railway liberalization can help to enforce competition and eliminate the barrier to entry into market. Also, enterprises in rail industry increased to have competitive advantages. Ref. [7] demonstrated that organizational structure is made by governments for EU railways. Ref. [8] reviewed process of liberalization of regional railway market: South- Eastern European (Greece, Bulgaria, Romania and Croatia, Serbia, B&H, Monte Negro and FYR of Macedonia). It is declared that South- Eastern European countries, except for Romania and Bulgaria are ready for railway liberalization. Ref. [9] found that the lack of market entry cannot be related to production economic characteristics in Britain. Ref. [10] investigated the economic development of Swedish railway.

III. METHODOLOGY

According to the results of multivariate regression analysis of three variables at Table I, the effect of trade volume carries

Manuscript received February 1, 2016; revised March 23, 2016.

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huge significance in order to improve freight revenue considering liberalization process of Turkey. The government mostly relies on taxes and other revenues in order to compensate the budget deficits. The liberalization gives an opportunity to develop the economy in terms of several parameters.

After adding @trend to the model, the value is more than 0.05 which proved there is no pseudo relationship among variables. The logarithm was applied to prevent variance explosion. Besides, there are no heteroskedasticity and autocorrelation as well. The residuals are distributed randomly. The evidence of corrected model can store the residuals of this regression in a vector by typing the command: *genr res01=resid* and a plot of the residuals can be obtained by: *plot res01* While a scatter of the residuals against their lagged terms can be obtained by *scat res01(-1) res01* at Fig. 1.

TABLE I: THE RESULTS OF MULTIVARIATE REGRESSION ANALYSIS

| Dependent Variable: RAILWY_FREIG_REV | | | | |
|--------------------------------------------|-------------|--------------------|--------------|--------|
| Sample 1931 – 2014. | | | | |
| Included observations 84 after adjustments | | | | |
| Variable | Coefficient | Std. Error | t-Statistics | Prob. |
| GDP | 0.086080 | 0.128286 | 0.671001 | 0.5042 |
| TRADE_VLM | 0.377110 | 0.139592 | 2.701519 | 0.0084 |
| C | 0.341824 | 0.106500 | 3.209625 | 0.0019 |
| AR(1) | 0.714056 | 0.078714 | 9.071528 | 0.0000 |
| R-Squared | 0.555746 | Mean dependent var | 0.431271 | |
| S.D. dependent var | 0.398527 | Durbin Watson stat | 1.761561 | |
| Adjusted R-Squared | 0.539087 | Inverted AR Roots | 0.71 | |

TABLE II: THE LONG-RUN RELATIONSHIP BETWEEN RAILWAY FREIGHT REVENUE GDP AND TRADE VOLUME

| Hypothesized No. of CE(s) | Eigenvalue | Trace Statistic | 0.05 Critical Value | Prob.* |
|---------------------------|------------|-----------------|---------------------|--------|
| None * | 0.342987 | 70.75498 | 29.79707 | 0.0000 |
| At most 1 * | 0.276659 | 35.89071 | 15.49471 | 0.0000 |
| At most 2 * | 0.102860 | 9.009073 | 3.841466 | 0.0027 |

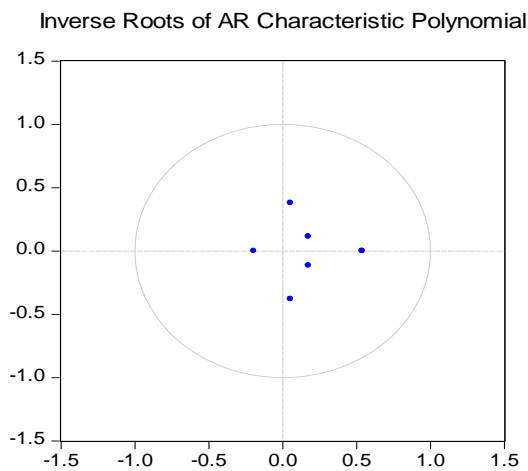


Fig. 2. Inverse roots of AR characteristic polynomial.

Railway Transport Infrastructure, Length of Lines by Nature of Transport, 2004-2013. In this article the VAR model is implemented in order to detail analyze the trend of three variables. The railway freight revenue, trade volume and GDP were determined as endogenous variables, lag order

begin from lag 1 to the end of lag 2, which indicates the VAR. In this manner, to perform Johansen co-integration test results demonstrate that there has long run co-integration affinity (see table II below). In addition, after applying inverse roots of characteristic polynomial, whole the features of root mean remains within the unit circle therewith. In this case, the model is a stationary VAR at Fig. 2 which gives an opportunity to using the impulse response analysis and variance decomposition.

Afterwards, impulse response model is carried out to analyze the tenor of the relationships between signified variables. The Results indicates that the impact of trade volume is relatively more than GDP on railway freight revenue (See Fig. 3). The Results are consistent with the multivariate regression analysis below. The result of impulse response is consistent with the variance decomposition (See Fig. 3 and Table III).

IV. DATA ANALYSIS

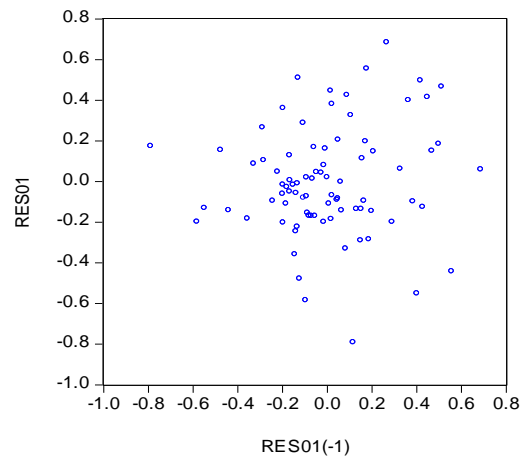


Fig. 1. Residual graph of multivariate regression.

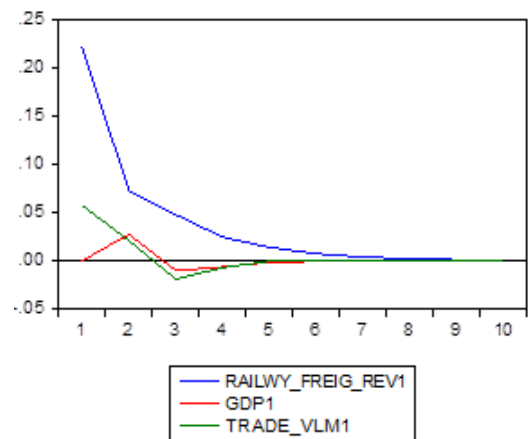


Fig. 3. Impulse response analysis.

When Lag interval is 1 – 2 the Vector Autoregressive model is stationary. The railway freight revenue, trade volume and GDP were determined as endogenous variables, lag order begin from lag 1 to the end of lag 2, which demonstrates the VAR. All the features of the root mean fell within the circles at the inverse roots of the AR Characteristic Polynomial test, which supports the idea that the VAR model is stationary at Fig. 2. In this case, the model is a stationary VAR, which gives an opportunity to implement both the

variance decomposition and impulse response analysis.

TABLE III: VARIANCE DECOMPOSITION OF RAILWAY FREIGHT REVENUE

| Period | S.E. | RWFT1 | GDP1 | TRD_VLM1 |
|--------|----------|----------|----------|----------|
| 1 | 0.228912 | 93.68695 | 0.000000 | 6.313053 |
| 2 | 0.242702 | 92.36940 | 1.288448 | 6.342153 |
| 3 | 0.248313 | 91.96600 | 1.395971 | 6.638028 |
| 4 | 0.249712 | 91.91016 | 1.444599 | 6.645241 |
| 5 | 0.250102 | 91.93170 | 1.443763 | 6.624538 |
| 6 | 0.250212 | 91.93861 | 1.442697 | 6.618694 |
| 7 | 0.250245 | 91.93981 | 1.442710 | 6.617479 |
| 8 | 0.250255 | 91.94000 | 1.442805 | 6.617194 |
| 9 | 0.250258 | 91.94011 | 1.442815 | 6.617074 |
| 10 | 0.250258 | 91.94015 | 1.442813 | 6.617036 |

TABLE IV: THE ADF TEST RESULTS OF RAILWAY FREIGHT REVENUE BEFORE CONVERTING I (0) TO I (1)

| | | | |
|-----------------------------------------------------|-------------|-----------|--|
| Null Hypothesis: RAILWAY_FREIG_REV has a unit root | | | |
| Lag Length: 1 (Automatic - based on SIC, maxlag=11) | | | |
| Exogenous: Constant | | | |
| | t-Statistic | Prob.* | |
| Augmented Dickey-Fuller test statistic | 1.487487 | 0.9992 | |
| Test critical values: | 1% level | -3.509281 | |
| | 5% level | -2.895924 | |
| | 10% level | -2.585172 | |

TABLE V: THE ADF TEST RESULTS OF GDP BEFORE CONVERTING I (0) TO I (1)

| | | | |
|-----------------------------------------------------|-------------|-----------|--|
| Null Hypothesis: GDP has a unit root | | | |
| Lag Length: 0 (Automatic - based on SIC, maxlag=11) | | | |
| Exogenous: Constant | | | |
| | t-Statistic | Prob.* | |
| Augmented Dickey-Fuller test statistic | -0.335502 | 0.9141 | |
| Test critical values: | 1% level | -3.508326 | |
| | 5% level | -2.895512 | |
| | 10% level | -2.584952 | |

TABLE V: THE ADF TEST RESULTS OF TRADE VOLUME BEFORE CONVERTING I (0) TO I (1)

| | | | |
|-----------------------------------------------------|-------------|-----------|--|
| Null Hypothesis: TRADE_VLM has a unit root | | | |
| Lag Length: 0 (Automatic - based on SIC, maxlag=11) | | | |
| Exogenous: Constant | | | |
| | t-Statistic | Prob.* | |
| Augmented Dickey-Fuller test statistic | 1.029517 | 0.9966 | |
| Test critical values: | 1% level | -3.508326 | |
| | 5% level | -2.895512 | |
| | 10% level | -2.584952 | |

TABLE VI: THE ADF TEST RESULTS OF RAILWAY FREIGHT REVENUE AFTER CONVERTING I (0) TO I (1)

| | | | |
|-----------------------------------------------------|-------------|-----------|--|
| NULL HYPOTHESIS: RAILWAY_FREIG_REV1 HAS A UNIT ROOT | | | |
| LAG LENGTH: 0 (AUTOMATIC - BASED ON SIC, MAXLAG=11) | | | |
| Exogenous: Constant | | | |
| | t-Statistic | Prob.* | |
| Augmented Dickey-Fuller test statistic | -6.291710 | 0.0000 | |
| Test critical values: | 1% level | -3.509281 | |
| | 5% level | -2.895924 | |
| | 10% level | -2.585172 | |

TABLE VII: THE ADF TEST RESULTS OF GDP AFTER CONVERTING I (0) TO I (1)

| | | | |
|-----------------------------------------------------|-------------|-----------|--|
| Null Hypothesis: GDP1 has a unit root | | | |
| Lag Length: 0 (Automatic - based on SIC, maxlag=11) | | | |
| Exogenous: Constant | | | |
| | t-Statistic | Prob.* | |
| Augmented Dickey-Fuller test statistic | -7.382292 | 0.0000 | |
| Test critical values: | 1% level | -3.509281 | |
| | 5% level | -2.895924 | |
| | 10% level | -2.585172 | |

TABLE VIII: THE ADF TEST RESULTS OF TRADE VOLUME AFTER CONVERTING I (0) TO I (1)

| | | | |
|-----------------------------------------------------|-------------|-----------|--|
| Null Hypothesis: TRADE_VLM1 has a unit root | | | |
| Lag Length: 0 (Automatic - based on SIC, maxlag=11) | | | |
| Exogenous: Constant | | | |
| | t-Statistic | Prob.* | |
| Augmented Dickey-Fuller test statistic | -7.590144 | 0.0000 | |
| Test critical values: | 1% level | -3.509281 | |
| | 5% level | -2.895924 | |
| | 10% level | -2.585172 | |

According to the Augmented Dickey Fuller (ADF) test results at table IV, table V and table VI below the data are not stationary. The code of E-views statistical program was implemented in order to convert them from non-stationary to stationary. Genr railway_freig_rev=railway_freig_rev-railway_freig_rev(-1), genr gdp1=gdp-gdp(-1) and genr exp_volume1=exp_volume-exp_volume(-1). Afterwards, converting the data from non-stationary I (0) to stationary I (1), the variables have been replaced in the Johansen cointegration test. The results demonstrate that there is a long-term relationship among airway freight revenue, Export Volume and GDP. According to Table II above, there is a long-term relationship between the variables of airway freight revenue, Export Volume and GDP.

V. CONCLUSION

The impact trend of trade volume on railway freight revenue owns great importance to enhance freight revenue regarding liberalization process of Turkey. In parallel with Ref. [11] expresses that the government generally relies more on taxes and other crucial income in order to compensate the budget deficits. In micro perspective, railway transportation liberalization process permits a huge diversification in term of job opportunities among labors and its own expansion.

In macro perspective, decision makers in the government or local authorities should firstly provide that substructure management firms are more self-reliant, to then provide competition and terminate the hegemony of on duty operators. Old communist policies are the fundamental characteristic of the market in (carriage) transport of ex-Soviet countries such as Poland and Czech Republic. The rail freight sector was emerged earlier, thus there have been new actors of market and the rivalry is sharp-cornered; depending on that fact, the volume of product transportation has been increasing as well [12]. ensure mobility services and domestic infrastructures as privatized and independent properly. German and Italian

government liberalized railway through excessive competition within the transportation sector, while the competence for domestic services was transferred to local territories which are able to award transportation activities on relevant markets. At the same time, the principal policy consequences appear to drift apart deeply. Although the extremely high expectation for high speed the most essential and attractive branch seemed as restricted in the domestic market of the Germany. Contrariwise, Italian high speed market has been improved better, while, providing the fundamental pre conditions to receive private bidders are lacking in domestic services as well [13].

The research results of this paper indicates that the adaptation of free market economy to Turkey mostly depend on the macroeconomic policies and especially after 1983 the adaptation process has accelerated when actors of the market has been emerged remarkably. Considering the features of the free market economy, the production level increased due to more competitors in the market. The more production automatically increased the railway freight transportation with other type transportation including airway, roadway and seaway.

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