An Econometrics Analysis of Freight Rail Demand Growth in Australia

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ABSTRACT

This research examined the impacts of exchange rate, freight rate and economic activities on the growth rate of non-bulk freight demand in Australia. The paper uses a simple but robust econometrics method to estimate the demand growth function and utilizes a relatively large annual data set encompassing over four decades (1970-2011). The findings provide convincing evidence that the volatility of the Australian dollar has a substantial impact on freight rail demand within Australia. To illustrate, a 1 per cent depreciation of the dollar increase the growth rate of non-bulk freight rail demand approximately by a quarter of a percent. It is generally known that favourable international economic conditions are conducive to bulk freight demand. Our findings indicate that the impacts of such conditions also flow through to the non-bulk freight rail sector. Furthermore, the study finds that, although freight rate and macroeconomic activities exhibit the expected relationship with freight rail demand, the relationships are not strong enough to make valid statistical inferences.

Keywords: Non-Bulk Freight, Freight Rail Demand, Australia

JEL Classification: R41

1. Introduction

Several studies have attempted to model freight rail transport demand by utilizing a variety of statistical estimation methods and data sets. A major criticism that can be levelled at the existing literature (e.g., Rao, 1978; Oum, 1979a; BTE, 1990; NRNC, 1997; Ramanathan, 2001; Kulshreshtha et al., 2001; Anderson and Elger, 2012) is the use of aggregated data to
estimate the freight rail demand function. Non-consideration of sectoral impacts has limited their policy implications because freight tasks tend to differ markedly between commodities and corridors. For example, where rail has a small market share and is a viable alternative to road (such as on longer-distance corridors), the cross-price elasticity of demand may be quite high. In these cases, a small drop in price would result in a large percentage increase in rail’s market share. For other markets, including industries employing ‘just-in-time’ inventory management, rail is unlikely to be practicable. Here, cross-price elasticity would be very low. These observations simply suggest that studies based on aggregate data could lead to bias and misleading results. To mitigate such aggregation bias, this study investigates a lower level of aggregation by separating rail transport demand for Australia by bulk and non-bulk freight. It was hoped to advance further by disaggregating data across corridors and commodities, but this had to be abandoned as a result of data unavailability.

Within the scope of this paper, we focus on analysing the non-bulk freight demand in Australia. The main arena of competition between rail and road in Australia, and the populous east coast corridor in particular, is in interstate non-bulk freight. As a result, by focusing on the non-bulk freight segment, we are able to derive better policy implications from the response of freight transport demand to changes in policy variables, such as price. These issues have been the principal focus of the current debate about road–rail price neutrality in Australia (Productivity Commission, 2006). More so, although the movement of interstate non-bulk freight is a relatively small part of the total Australian freight task, it is growing rapidly, with the latest available information puts this growth at about four per cent per year (BTRE, 2006). The econometric model used herein enables us to evaluate some of the most important determinants of non-bulk freight rail demand in Australia. Our focus is on the impact of freight rate, international trade, and domestic business cycles on the growth of non-bulk freight rail demand within this nation.
The paper itself is divided into five sections. The following section provides a brief overview of recent literature on freight rail demand. Variables and data sources are presented in the third section. The fourth section outlines the econometrics methodology, discusses results and provides policy implications. Some concluding remarks complete the paper.

2. Previous Studies on Freight Rail Demand

Existing studies on freight rail demand can be divided into two groups, these being: i) time series studies, and ii) survey-based studies. Here, we focus on the literature pertaining to time series studies on freight rail demand. These time series models are usually aggregated in nature. Moreover, they do not explicitly incorporate all theoretically relevant explanatory variables, such as the explicit treatment of service quality factors seemingly resulting from data unavailability in the estimation (Pendyala et al., 2000; Mitchell, 2010). We first discuss international studies before moving on to Australian-specific studies.

2.1. International studies

Rao (1978), in one of the earliest studies available, constructed a simultaneous equation system to measure the impact of macroeconomic activity and intermodal competition on freight rail demand in Canada. Rao’s model consists of 3 stochastic equations, these being the volume component, the average length of haul, and the revenue per ton mile, together with an identity (equilibrium condition). Freight rail demand comprised the volume and average length of haul. Total number of trucks registered, commodity outputs and commodity exports variables provided macroeconomic control variables. Rao estimated the model using annual time series data for 1958-1973 by both Ordinary Least Squares (OLS) and Two Stage Least Squares (2SLS) techniques. The main determinants of demand were identified as commodity outputs and the export-share variable. Overall, railway freight demand was found to be price elastic. That the model does not allow for free variation of the elasticities of substitution between transport modes and of the own- and cross-elasticities represents a significant
drawback. Indeed, it places a considerable restriction on the parameters of intermodal competition (Oum, 1979a; 1989).

Oum (1979a) developed a demand model for freight transport as an intermediate input to the production and distribution sectors to estimate price elasticities and elasticities of substitution between three modes: railway, highway, and waterway. He used annual Canadian data (1945-1974) and employed a maximum likelihood (ML) method to estimate the parameters. Demand for freight rail was found to be price inelastic, with own-price elasticity increasing in absolute value over time. In sum, rail and road exhibited a complementary relationship until 1955, but were increasingly competitive thereafter.

A translog transport demand model was estimated by Lewis and Widup (1982) to measure price and quality-of-service demand elasticities for rail and motor carrier shipments of assembled automobiles in the United States from 1955 to 1975. Like Oum (1979b), Lewis and Widup specified the translog model by incorporating quality-of-service variables. These took the form of hedonic aggregators. This was carried out under the assumption that quality-of-service attributes affect transport demand only indirectly, i.e., through their impact on effective freight rates. Static and dynamic partial adjustment models employing the full information maximum likelihood estimator (FIML) were estimated. Lewis and Widup’s results show that rail price elasticities gradually declined in absolute value over time, yet estimated motor-carrier elasticities increased. Furthermore, cross-price elasticity estimates showed that both modes were competitive and were potentially highly interchangeable.

Wilson (1984) also used a translog function to analyse modal demands for grain transportation. His paper studied intermodal competition in grain transportation. In particular, it looked at the effects of rail car shortages and of multiple-car rail rates for shipments from North Dakota to Minneapolis and Duluth. Monthly data (July 1973 to December 1982) were used. An iterative three-stage least squares (IT3SLS) estimation procedure was used to
estimate the system of equations (i.e., translog cost function and factor share equations) jointly. Wheat and barley were estimated separately. It was found that both rolling stock shortages and multiple-car rates did not result in significant change in the structure of cost and derived demand functions. Yet shortages in rolling stock resulted in changes in relative modal prices and modal shares, although the modal shift to road was not quite as intensive as Wilson expected.

Fitzsimmons (1981) used annual and quarterly U.S. grain data to study the barge-rail competitive relationship. An ad-hoc model was employed. The author found that changes in foreign and domestic consumption of grains and soybeans generated substantial changes in rail volume. Overall, the demand for rail transportation, together with the cross elasticity for rail relative to inland water carriers, was clearly inelastic.

By way of contrast, Wilson et al. (1988) analysed the market for transport services by incorporating both supply and demand functions into a system of behaviour equations. The resulting model was formulated for the road and rail markets for wheat transport in the United States. Monthly data (July 1973 to June 1983) was used, while a three-stage-least-squares method was employed for the estimation. Competitive conditions rather than rail costs had the greatest effect on rail rates. Price elasticities for rail were all elastic. Those for road depended mainly on rail car availability.

Modern time series econometric techniques such as cointegration, error correction and vector autoregressive (VAR) methods have been used in more recent studies to uncover the determinants of freight rail demand. Ramanathan (2001), in a particularly significant study, applied the concepts of cointegration and error correction to explore the long-run relationships between transport performance (passenger and freight), together with other macroeconomic variables, in India. Annual data were used (1956-1989). The results showed that tonne-kilometres were highly correlated with industrial growth. In addition, they were
likely to increase faster than the index of industrial production, while freight performance was relatively inelastic to price changes. Long-run price elasticity with respect to freight rail demand stood at a relatively low –0.188, while its elasticity with respect to industrial output was 1.183. Short-run elasticities were much smaller and statistically insignificant. This was despite the fact that a strong cointegration was identified among the variables.

Ramanathan’s single-equation framework with respect to cointegration assumes the existence of (at most) a single cointegrating relationship. It did not take the possible endogeneity of explanatory variables into consideration. To address this, Kulshreshtha et al. (2001) used a multivariate cointegrating vector autoregressive (VAR) modelling framework to explore the long-run structural relationship for rail freight transport demand in the same country. Annual time series data (1960-1995) were employed. Economic growth was found to be the major determinant of freight transport demand and vice-versa. The results also indicated a high GDP elasticity, together with a low price elasticity, for the real freight rate; that is, the price variable behaved exogenously. It follows that any disequilibrium in the short-run is normally corrected in the long run via adjustments in freight transport demand and GDP. The demand system is therefore stable in the long run and, after a typical system-wide shock, converges to equilibrium in around three years.

Shen et al. (2009) applied six econometric models, including the OLS regression model, the Partial Adjustment (PA) model, the reduced Autoregressive Distributed Lag model (ReADLM), the unrestricted Vector Autoregressive model (VAR), the Time-Varying-Parameter (TVP) model and the Structural Time Series model (STSM), to derive estimates of road plus freight rail demand elasticities, in addition to forecasts of future demand. The forecasting performance of the various models was evaluated on the basis of the mean absolute percentage error (MAPE). Shen et al.’s analysis employed annual data (1974–2006) on the road plus freight rail demand in Great Britain at both aggregate and commodity group
Industrial production offered a good explanation of both road and freight rail demand. Actual magnitudes of income elasticity estimates also varied as a result of the different models estimated. The comparison results showed that no single model outperformed the others in all situations.

Finally, Anderson and Elger (2012) explored, in a Swedish study (1963–2007), empirical linkages between cycles and trends in freight transportation activity (road, rail, sea, and total tonne-kilometres) and real economic activity (GDP, industrial GDP, goods imports, and goods exports). The authors used Engle’s (1974) band spectrum regression estimator for the modelling work. It was determined that that freight demand was coupled to GDP over the long term. Furthermore, there were no signs of decoupling. Freight demand was highly volatile over the short to medium term, with fluctuations largely being an outcome of temporary changes in imports and exports. Over the long term, however, the performance of all transportation modes was related to GDP. Income elasticity varied between 0.8 and 2.6 depending on mode.

2.2. Australian studies

Very few published studies have used Australian data, and most of these are industry reports. For instance, BTE (1990) examined freight traffic shares between modes (road, rail, sea, air) on various corridors. This study examined the effects of income and freight rates on freight tonnage consigned between city pairs. Data were from 1964 to 1986 for Melbourne-Sydney and Eastern States-Perth, and from 1971 to 1986 for the Adelaide and Brisbane corridors. A freight demand model with modal freight rate, freight rate for alternative modes, gross national product (GNP) and dummy variables as explanatory variables was developed. Four modes (road, rail, sea, air) with four models respectively were examined per corridor. Road freight appeared to be very responsive to GNP changes, with rail freight being much less responsive to GNP. This was especially the case for the Melbourne-Sydney corridor. Air
freight was more responsive to GNP, while coastal responsive to GNP was similar to rail. The responsiveness of freight flows to rate changes varied across modes and corridors. The general result was the longer the route, the more responsive to price changes.

BTE (1999), in another study, attempted to use the Simple Ordinary Least Squares (OLS) estimation procedure to forecast interstate non-bulk freight demand and interstate mode share. Annual data (1970-1995) were used for interstate non-bulk freight across seven corridors. Total interstate non-bulk freight was projected to rise from about 47 billion net tonne-kilometres (ntkm) in 1995 to about 126 billion ntkm in 2020. For the trends in each mode’s share of the interstate non-bulk freight task, as well as forecasts derived using logistic substitution models of mode share, rail’s modal share was found to be declining slowly. Indeed, its share of the interstate non-bulk freight market was forecasted drop to just over 20 per cent by 2020, if the trend continued.²

NRTC (1997) studied the effect on road and rail transport demand of a proposed increase in heavy vehicle mass limits. This was estimated to lead to a 2 per cent reduction in road freight prices. This study was based on cost minimization. Total cost, i.e., the sum of disequilibrium and adjustment costs occurring when the actual freight amount is different from the desired amount, was minimized. Quarterly data across six major corridors from December 1985 to March 1993 were used. On the basis of initial diagnostic tests, however, the rail freight variable was dropped from subsequent estimations.

Ersnt & Young (2006) used yearly and monthly panel data set (2000-2005) for a number of routes³ to measure quantitatively the relationship of known drivers of modal share with

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2 In absolute terms, however, the rail task in 2020 would be about 26 billion ntkm, up by around 73 per cent from 15 billion ntkm in 1995.
3 Melbourne-Brisbane, Brisbane-Melbourne, Sydney-Brisbane, Brisbane-Sydney, Sydney-Melbourne, and Melbourne-Sydney. Ersnt & Young (2006) estimated the elasticity ranges for each rail service characteristic and price as follows: Price: -2.4653 to -1.155; Transit time: -2.3421 to -0.3872; Reliability: 0.0081 to 0.1247; Monthly capacity: 0.7354 to 0.7671; and Availability: 0.1587 to 0.243
commodity and route specific rail freight tonnage. An OLS estimation of linear aggregate demand fixed-effect model as well as the double log aggregate demand fixed-effect model was used. The dependent variable in both models is tonnage by commodity and route. Explanatory variables are price by route, transit time by route, reliability by route, monthly capacity by route, availability within timeframe by route, and total final consumption expenditure.

Modern time series methods were used by the Productivity Commission (2006) to ascertain the existence of a relationship between GDP, trade, prices, and demand for road and rail freight. Data from 1964 to 2000 were used, and a Vector Error Correction Model (VECM) and a Johansen Cointegration Test were employed to estimate the relationships. The dependent variables are: Australian domestic freight task in billion tonne-kilometres in total and disaggregated by: mode (rail and road); load (bulk and non-bulk); area (urban and non-urban); and vehicle type (rigid and articulated). Explanatory variables included own price, cross price, GDP, and a measure of trade (exports and imports). The study found that own-price elasticities were low, which means that the derived demand for freight transport is inelastic. This outcome implies that only a small percentage of the aggregated freight task is contestable. For all components other than rail bulk, GDP as a proxy for income was significant, and indeed positive, while the most important influence on the demand for bulk rail freight, by way of contrast, was changes in exports.

Mitchell (2010) concentrated on the functional forms of freight rail demand. He used yearly freight movement data (1973-2001) for seven inter-capital corridors4 to estimate short- and long-run own-price, cross-price and substitution elasticities between road, rail and sea freight transport of non-bulk inter-capital freight. Two different functional forms were estimated. These were: (i) dynamic translog cost function; and (ii) dynamic linear logit

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4 Sydney-Melbourne, Sydney-Brisbane, Sydney-Adelaide, Sydney-Canberra, Melbourne-Brisbane, Melbourne-Adelaide, and Eastern state capitals-Perth
system of expenditure shares and implied cost function. Storage and warehousing costs were not accounted for, while an explicit treatment of service quality factors was excluded. An iterative seemingly unrelated regression (ISUR) estimation and full information maximum likelihood (FIML) were both used. The dynamic linear logit model preserved concavity, while the long-run elasticities exceeded short-run elasticities. According to Mitchell, the dynamic linear logit specification provided more satisfactory results for inter-capital non-bulk freight demand than the translog cost specification. The dynamic linear logit model results implied that road freight transport was relatively price inelastic in the short-run across all corridors, yet it was relatively price inelastic in the long-run on short-and medium-distance inter-capital corridors. Non-bulk rail freight was also relatively price inelastic, although it was slightly more responsive than road freight. Finally, inter-capital sea freight was relatively elastic on medium- and long-distance inter-capital corridors. The own-price and cross-price elasticity estimates in this paper were generally below earlier studies (e.g., BTE 1979; 1990). This was especially the case for inter-capital road freight.

3. Variable and Data Sources

Two measures of freight transport exist, these being i) the weight of freight moved in Australia (measured in millions of tonnes), and ii) freight by weight and distance moved (measured in tonne kilometres). Freight by weight and distance moved (TKM) was chosen for modelling the freight rail demand. This choice, which follows the most commonly used approach, is supported by the view that freight tasks normally differ significantly between the distance travelled and the type of freight carried (Productivity Commission, 2006). We now focus on the major determinants of freight rail demand.

The rail freight task is theoretically a function of its own price. As a result, rail freight rate (FRATE) is used as a major determinant of demand. There are several non-price determinants. For instance, freight transport constitutes an input in the production process,
freight transport demand is therefore linked to total economic activity other than being a function of its own price. The variable of gross domestic product (GDP) is widely used to capture economic activity. It was also found to be significant in several freight demand studies (e.g., Kulshreshtha et al., 2001; Anderson and Elger, 2012; NRTC, 1997; Productivity Commission, 2006). As a consequence, Australian real GDP is used here as a proxy for the performance of the domestic economic activity. The last variable included is the exchange rate (EXR). This controls for international trade’s impact on freight rail demand. Since the future of freight demand is forecasted to involve the movement of domestically produced commodities for exports and the transportation of imports (BITRE 2006), international trade performance constitutes a critical variable in analysing freight demand. Exchange rate is defined for the purpose of our estimation as number of Australian dollars per US dollar. An increase in the exchange rate therefore indicates a depreciation of the Australian dollar, while a decrease suggests appreciation. BITRE (2012) provided the time series data of TKM and rail freight rate, while the World Bank (2012) provided GDP and exchange rate data.

Other non-price service characteristics, including flexibility and reliability, affect the mode choice for freight transport (Oum, 1979a; Lewis and Widup, 1982). Yet sufficient data simply do not exist in Australia (Productivity Commission, 2006; Mitchell, 2010; CRC, 2012). This hinders us from incorporating these variables into the model. Summary statistics of the selected variables are provided below in Table 1.

<table>
<thead>
<tr>
<th></th>
<th>GDP (in $A billion)</th>
<th>FRATE</th>
<th>TKM</th>
<th>EXR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>357</td>
<td>2.650</td>
<td>19.038</td>
<td>1.217</td>
</tr>
<tr>
<td>Median</td>
<td>308</td>
<td>2.825</td>
<td>16.750</td>
<td>1.279</td>
</tr>
<tr>
<td>Maximum</td>
<td>1190</td>
<td>3.530</td>
<td>31.300</td>
<td>1.933</td>
</tr>
<tr>
<td>Minimum</td>
<td>407</td>
<td>1.110</td>
<td>12.000</td>
<td>0.697</td>
</tr>
</tbody>
</table>
4. Methodology and Results

As detailed in the previous section, the dependent variable in this analysis is the non-bulk freight rail demand, which is represented by the total kilometres run or \( TKM \). Here, we assume that \( TKM \) can be explained by three explanatory variables, these being: i) \( FRATE \), which is the freight rate; ii) \( EXR \), which is the exchange rate and represents international trade conditions; and iii) \( GDP \), which is used to control for macroeconomic activities. With a Cobb-Douglas functional form being assumed, the original demand for rail freight can be written as follows:

\[
TKM_t = \beta_0 FRATE_t^\beta EXR_t^\gamma GDP_t^\delta e^\nu 
\]  
(1)

For estimation purpose, the above function is transformed into a log-linear form, as in equation (2). The log-linear presentation is quite useful because the coefficients of the log-linear model can be interpreted as elasticities, while the use of log values could also control for possible non-linear relationships.

\[
LTKM_t = \alpha + \beta LFRATE_t + \gamma LEXR_t + \delta LGDP_t + u_t 
\]  
(2)

Since time series data are used to estimate the model, we are also required to test for the stationarity of the variables before estimating the model. Results based on Augmented-Dickey-Fuller tests suggest that, among the four variables included in the estimation, \( LFRATE \) and \( LGDP \) contain no unit roots, while \( LTKM \) and \( LEXR \) do contain a unit root. ADF unit root test results are provided in Table 2 below.

Table 2: Augmented Dickey-Fuller (ADF) Unit Root Test Results
<table>
<thead>
<tr>
<th>Variables</th>
<th>ADF statistic</th>
<th>Critical values (Lag length)</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>$LTKM_t$</td>
<td>-0.278893</td>
<td>-2.951125 (0)</td>
<td>0.9179</td>
</tr>
<tr>
<td>$LGDP_t$</td>
<td>-2.93899</td>
<td>-3.34613 (1)</td>
<td>0.0194</td>
</tr>
<tr>
<td>$LFRATE_t$</td>
<td>-3.965295</td>
<td>-2.948404 (2)</td>
<td>0.0043</td>
</tr>
<tr>
<td>$LEXR_t$</td>
<td>-1.750429</td>
<td>-2.938987 (1)</td>
<td>0.3988</td>
</tr>
<tr>
<td>$DLTKM_t$</td>
<td>-4.5558</td>
<td>-2.95711 (0)</td>
<td>0.001</td>
</tr>
<tr>
<td>$DLEXR_t$</td>
<td>-4.30242</td>
<td>-2.93899 (0)</td>
<td>0.0015</td>
</tr>
</tbody>
</table>

Notes: *MacKinnon (1996) one-sided p-values. Critical values are at the 5% level. Lag lengths are selected using the Schwarz information criterion.

In other words, $LFRATE$ and $LGDP$ are integrated of order zero, while the other two variables are integrated of order one. If we were to use the standard ordinary least squares method to estimate the model, variables in the model must be stationary. Hence, the first difference of $LTKM$ ($DLTKM$) and the first difference of $LEXR$ ($DLEXR$) are employed in the estimation. The other two variables have not been transformed. With these modifications, the final model we estimate is given in equation (3):

$$DLTKM_t = \alpha + \beta LFRATE_t + \lambda DLEXR_t + \theta LGDP_t + u_t$$

In the final version, the dependent variable measures the growth rate non-bulk freight rail demand. As a result, the interpretation of estimated coefficients changes accordingly. For instance, $\beta$ shows how growth rate of non-bulk freight rail demand ($TKM$) responds to a one per cent change in freight rate. Likewise, $\lambda$ and $\theta$ show the responses of the growth rate of $TKM$ to a 1 per cent change in exchange rate and national output respectively. It is expected that both $\lambda$ and $\theta$ will be positive and that $\beta$ will be negative. Pre-testing of the model indicates that a linear time trend also should be included in the model. As initial estimations suggest possibility of autocorrelation in errors, the Newey-West correction procedure has
been used in the estimation of the model. Results are given in Table 3, which is found directly below.

Table 3: Non-Bulk Freight rail demand Growth Elasticities

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C$</td>
<td>-2.826</td>
<td>6.120</td>
<td>-0.462</td>
<td>0.648</td>
</tr>
<tr>
<td>$LFRATE$</td>
<td>-0.127</td>
<td>0.175</td>
<td>-0.725</td>
<td>0.475</td>
</tr>
<tr>
<td>$LGDP$</td>
<td>0.120</td>
<td>0.251</td>
<td>0.477</td>
<td>0.637</td>
</tr>
<tr>
<td>$LEXR$</td>
<td>0.229</td>
<td>0.096</td>
<td>2.380</td>
<td>0.025</td>
</tr>
<tr>
<td>$TREND$</td>
<td>-0.013</td>
<td>0.019</td>
<td>-0.658</td>
<td>0.517</td>
</tr>
</tbody>
</table>

R-squared | 0.141 | Mean dependent var | 0.027 |
Adjusted R-squared | -0.031 | S.D. dependent var | 0.063 |
S.E. of regression | 0.064 | Akaike info criterion | -2.483 |
Sum squared resid | 0.103 | Schwarz criterion | -2.206 |
Log likelihood | 44.490 | Durbin-Watson stat | 1.966 |

As Table 3 suggests, the exchange rate induces a positive change on the growth rate of freight rail demand. To illustrate, a 1 per cent increase in the exchange rate increases the growth rate of non-bulk freight rail demand by about 0.229 per cent. Recall that the exchange rate is defined as number of Australian dollars per US dollar. Hence, an increase in the exchange rate constitutes a depreciation of the Australian dollar. The responses of $TKM$ to $EXR$ therefore indicate that a cheaper Australian dollar leads, in general, to an increased overall freight rail demand. As expected by the theory, the freight rate exerts a negative impact on freight rail demand, although we are unable to make valid inferences or use the results for policy implications. This is because the estimate is not statistically significant at a standard 5 per cent level of significance. Finally, economic activities and freight rail demand seem to be positively related, but the estimate is statistically insignificant, so no further comments can be made.
These results have important policy implications on rail freight transportation in Australia. As shown above, the freight rate or domestic macroeconomic activities are not the major determinants of the growth of non-bulk freight rail demand in Australia. It follows that decreasing the freight rate, or related charges, may not be an effective option with respect to promoting growth in non-bulk freight rail demand. Furthermore, exchange rate seems to be the most important factor affecting non-bulk freight rail demand. When one bears in mind that globalization is becoming a norm, this relationship between external factors and domestic freight rail demand can be a vital piece of information for policy analysts, as well as for those involved in the Australian rail freight transportation sector. Linking freight movements in Australia with international business cycles may be a feasible strategy in the future.

5. Conclusion

This research examined the impacts of exchange rate, freight rate and macroeconomic activities on non-bulk freight rail demand in Australia by using four decades of data. The findings provide convincing evidence that the volatility of the Australian dollar has a substantial impact on freight rail demand within Australia. This suggests that international trade activities exert a considerable impact on freight demand. For example, depreciation of the dollar appears to encourage exports, but discourages imports. When the dollar depreciates, there is more domestic production and consumption because imported goods become more expensive. This creates a demand for non-bulk domestic goods rather than their imported equivalents. This might particularly be the case for non-bulk agricultural products. When there is parity or better in the Australian dollar, by way of contrast, there is a greater demand for imported goods. This might therefore reduce overall non-bulk freight movements within the nation since these arrive by ship or air. Furthermore, a positive impact on freight rail demand suggests that the increase in export-related demand exceeds the contraction of
import-related demand for freight rail. The findings also suggest that neither the freight rate nor domestic output can be considered critical determinants of the demand for non-bulk freight rail in Australia.

Overall, this study aims to promote a more nuanced understanding of the conditions that are most likely to result in an increased demand for non-bulk rail freight in Australia. One of the factors militating against a growth in non-bulk rail freight movements in Australia is capacity (NTC, 2009; Economic Access, 2008). As a result, this study demonstrates that there could be cause to invest more in rail infrastructure that could assist in the hypothetical freight movements that would conceivably take place under certain macroeconomic conditions. By separating bulk from non-bulk rail freight, it becomes clear that macroeconomic conditions favourable to bulk freight demand, such as a depreciated Australian dollar, have a similar impact on non-bulk rail freight. In previous studies, such as that conducted by the Productivity Commission (2006), changes in exports were only understood to influence the demand for bulk rail freight. In short, when the Australian dollar is depreciated, exports for bulk commodities shifted by rail increase, as per the general assumption (Productivity Commission, 2006), but demand for shifting non-bulk (domestic) commodities by rail also increases, presumably because their imported equivalents become uncompetitive.

References


Ernst & Young (2006) North-South Rail Corridor Study. DOTARS ACIL Tasman and Hyder Consulting, Canberra, Australia.


