RESEARCH PRESENTATION MATERIALS

THE ANALYSIS AND SYSTEMATIZATION OF THE RESULTS OF FOREIGN STUDIES RELATED TO THE FEASIBILITY OF SEPARATION OF RAILWAY INFRASTRUCTURE AND TRANSPORT OPERATIONS, INVESTIGATION OF THE NATURE AND OUTCOMES OF FOREIGN RAILWAY REFORMS

(Separate Results)

May 2013

Institute of Natural Monopolies
1. The Analysis and Systematization of the Results of Foreign Studies Related to the Feasibility of Separation of Railway Infrastructure and Transport Operations

1.1 Foreign Studies analysed and Analytical Reviews (p. 3-6)

1.2 Authors’ Conclusions on Feasibility of Separation (p. 8-16)

1.3 Results of the Analysis of Individual Studies and Reviews on Separation (p. 18-37)

1.4 Approaches Used to Assess the Feasibility of Separation in Conditions of the Russian Federation (p. 39-43)

2. Foreign Railway Reforms (p. 45-53)
This study evaluates the following research and analytical reviews that relate, directly or indirectly, to the feasibility of separation of railway infrastructure and transport operation.

<table>
<thead>
<tr>
<th>No.</th>
<th>Title</th>
<th>Authors</th>
<th>Year</th>
<th>Countries Studied</th>
<th>Coverage*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Performance Analysis of Selected Railway Markets in Europe</td>
<td>SCI-Verkehr GmbH</td>
<td>2012</td>
<td>Europe</td>
<td>Indirect</td>
</tr>
<tr>
<td>2</td>
<td>European Railway Performance Index</td>
<td>Boston Consulting Group</td>
<td>2012</td>
<td>Europe</td>
<td>Direct</td>
</tr>
<tr>
<td>3</td>
<td>The Optimal Setup of a Rail System – Lessons Learned from Outside Europe</td>
<td>Roland Berger</td>
<td>2012</td>
<td>USA, Canada, Japan, China, Russia</td>
<td>Direct</td>
</tr>
<tr>
<td>4</td>
<td>EVES-rail: Economic Effects of Vertical Separation in the Railway Sector</td>
<td>inno-V / ITS (University of Leeds) / Kobe University</td>
<td>2012</td>
<td>Europe</td>
<td>Direct</td>
</tr>
<tr>
<td>5</td>
<td>Vertical Separation of Railway Infrastructure - Does It Always Make Sense?</td>
<td>Institute of Transport Studies at the University of Leeds</td>
<td>2011</td>
<td>Europe, USA</td>
<td>Direct</td>
</tr>
<tr>
<td>6</td>
<td>Railway Reform Toolkit</td>
<td>The World Bank</td>
<td>2011</td>
<td>Europe, others</td>
<td>Direct</td>
</tr>
<tr>
<td>7</td>
<td>Market Size and Vertical Structure in the Railway Industry</td>
<td>Institute of Social and Economic Research, Osaka University, Noriaki Matsushima, Fumitoshi Mizutani</td>
<td>2011</td>
<td>Europe and Japan</td>
<td>Indirect</td>
</tr>
</tbody>
</table>

*The issue of vertical separation in the railway sector is covered either directly or indirectly*
### Foreign Studies analysed and Analytical Reviews

<table>
<thead>
<tr>
<th>No.</th>
<th>Title</th>
<th>Authors</th>
<th>Year</th>
<th>Countries Studied</th>
<th>Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Evaluation of Australian Infrastructure Reforms: An Assessment of Research Possibilities</td>
<td>Australian Competition and Consumer Commission</td>
<td>2011</td>
<td>Australia</td>
<td>Direct</td>
</tr>
<tr>
<td>9</td>
<td>Railway Reform in South East Europe and Turkey. On the Right Track?</td>
<td>The World Bank</td>
<td>2011</td>
<td>Europe</td>
<td>Indirect</td>
</tr>
<tr>
<td>11</td>
<td>Testing for Economies of Scope in European Railways: An Efficiency Analysis</td>
<td>University of Lüneburg</td>
<td>2007</td>
<td>Europe</td>
<td>Indirect</td>
</tr>
<tr>
<td>12</td>
<td>Rail Freight: The Benefits and Costs of Vertical Separation and Open Access</td>
<td>Association for European Transport and contributors</td>
<td>2006</td>
<td>Europe</td>
<td>Direct</td>
</tr>
<tr>
<td>13</td>
<td>Railway Reforms: Do They Influence Operating Efficiency?</td>
<td>University of Copenhagen</td>
<td>2006</td>
<td>Europe</td>
<td>Direct</td>
</tr>
<tr>
<td>14</td>
<td>Structural Separation to Create Competition? The Case of Freight Railways</td>
<td>Antitrust Division, U.S. Department of Justice, and New Economic School, R. Pittman</td>
<td>2005</td>
<td>Europe, North America</td>
<td>Indirect</td>
</tr>
</tbody>
</table>

* Horizontal separation means differentiation of transport operations (separation of railway operations into freight operations, long-distance passenger services and intercity passenger services).
<table>
<thead>
<tr>
<th>No.</th>
<th>Title</th>
<th>Authors</th>
<th>Year</th>
<th>Countries Studied</th>
<th>Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>Regulatory Reform of Railways in Russia</td>
<td>UN Organization for Economic Co-operation and Development</td>
<td>2004</td>
<td>Russia</td>
<td>Direct</td>
</tr>
<tr>
<td>16</td>
<td>Regulatory Framework Options for the Rail Sector in South Africa</td>
<td>Department of Public Enterprises of the Government of South Africa</td>
<td>2004</td>
<td>South Africa</td>
<td>Direct</td>
</tr>
<tr>
<td>18</td>
<td>Subadditivity Tests for Network Separation with an Application to U.S. Railroads</td>
<td>M. Ivaldi, G. McCullough</td>
<td>2004</td>
<td>USA</td>
<td>Direct</td>
</tr>
<tr>
<td>19</td>
<td>The Japanese Experience with Railway Restructuring</td>
<td>Fumitoshi Mizutani, Kiyoshi Nakamura</td>
<td>2004</td>
<td>Japan</td>
<td>Direct</td>
</tr>
<tr>
<td>20</td>
<td>The Restructuring of Railways</td>
<td>United Nations Economic and Social Commission for Asia and the Pacific</td>
<td>2003</td>
<td>EU, China, Vietnam, Sri Lanka, others</td>
<td>Direct</td>
</tr>
<tr>
<td>21</td>
<td>The Implications of Introducing Competition to Railroad</td>
<td>John D. Bitzan</td>
<td>2003</td>
<td>USA</td>
<td>Direct</td>
</tr>
</tbody>
</table>
### Foreign Studies analysed and Analytical Reviews

<table>
<thead>
<tr>
<th>No.</th>
<th>Title</th>
<th>Authors</th>
<th>Year</th>
<th>Countries Studied</th>
<th>Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>Vertical Restructuring of the Infrastructure Sectors of Transition Economies</td>
<td>New Economic School, R. Pittman</td>
<td>2002</td>
<td>Russia, Poland, Lithuania, Romania</td>
<td>Direct</td>
</tr>
<tr>
<td>23</td>
<td>Competition and Co-Operation in International Rail Freight Services</td>
<td>UN Organization for Economic Co-operation and Development</td>
<td>2002</td>
<td>Europe</td>
<td>Indirect</td>
</tr>
<tr>
<td>24</td>
<td>Railway Reform. Regulation of Freight Transport Markets</td>
<td>UN Organization for Economic Co-operation and Development</td>
<td>2001</td>
<td>Europe, North America, Japan, Australia</td>
<td>Direct</td>
</tr>
<tr>
<td>25</td>
<td>Regulation of Freight Railways in North America and Europe</td>
<td>European Transport Conference</td>
<td>1999</td>
<td>Europe, North America</td>
<td>Indirect</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of Publication</th>
<th>Europe</th>
<th>Asia</th>
<th>North and South America</th>
<th>Other Countries*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research</td>
<td>9</td>
<td>3</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Analytical review</td>
<td>9</td>
<td>2</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

The majority of research studies and analytical reviews deal with European countries. Therefore, it can be concluded that separation of rail infrastructure and transport operations is more relevant in this region.

* Russia, Australia, South Africa.
1. The Analysis and Systematization of the Results of Foreign Studies related to the Feasibility of Separation of Railway Infrastructure and Transport Operations

1.1 Foreign Studies analysed and Analytical Reviews (p. 3-6)

1.2 Authors’ Conclusions on Feasibility of Separation (p. 8-16)

1.3 Results from the Analysis of Individual Studies and Reviews on Separation (p. 18-37)

1.4 Approaches Used to Assess the Feasibility of Separation in Conditions of the Russian Federation (p. 39-43)

2. Foreign Railway Reforms (p. 45-53)
### Authors’ Conclusions on Feasibility of Separation

Authors’ opinions expressed in studies that directly address the feasibility of separation of railway infrastructure and transport operations

<table>
<thead>
<tr>
<th>Research</th>
<th>Feasibility of Separation</th>
<th>Main Arguments</th>
<th>№</th>
</tr>
</thead>
<tbody>
<tr>
<td>European Railway Performance Index</td>
<td>?</td>
<td>Railway performance does not depend on the degree of liberalization, but rather on the amount of government subsidies.</td>
<td>2</td>
</tr>
<tr>
<td>The Optimal Setup of a Rail System – Lessons Learned from Outside Europe</td>
<td>✗</td>
<td>The countries under review in this study (Russia, Japan, China, USA, Canada) account for a total of 80% of global freight turnover and 50% of global passenger turnover. The main railways in these countries are integrated railways, i.e. infrastructure and transport services are provided by one firm or holding company. These integrated structures result in avoiding some additional costs of separated systems.</td>
<td>3</td>
</tr>
<tr>
<td>EVES-rail: Economic Effects of Vertical Separation in the Railway Sector</td>
<td>?</td>
<td>There is no practical evidence that vertical separation is superior to the holding company model in increasing the internal competition and in its impact on rail’s modal share in freight or passenger transport.</td>
<td>4</td>
</tr>
</tbody>
</table>

- Separation is not feasible
- Separation is feasible
- Decisions about separation should be based on the internal situation in a particular country
### Authors’ Conclusions on Feasibility of Separation

<table>
<thead>
<tr>
<th>Research</th>
<th>Feasibility of Separation</th>
<th>Main Arguments</th>
<th>№</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical Separation of Railway Infrastructure - Does It Always Make Sense?</td>
<td>✗</td>
<td>The analysis shows no correlation between vertical separation of the railway sector and the growth in rail freight traffic or rail’s share of total freight traffic (the authors believe that these are two surrogate measures of attractiveness of rail services to customers which should reflect efficiency and service quality).</td>
<td>5</td>
</tr>
<tr>
<td>Railway Reform Toolkit</td>
<td>?</td>
<td>At present, separation and integration of railway infrastructure and transport operations may have positive and negative effects, which may vary from country to country. Vertical separation is only useful in conjunction with other measures to reform the industry.</td>
<td>6</td>
</tr>
<tr>
<td>Evaluation of Australian Infrastructure Reforms: An Assessment of Research Possibilities</td>
<td>?</td>
<td>The Australian government has been reforming the railway system for over 40 years, but during this time the need for vertical separation of railway infrastructure and transport services has not been clearly established and requires further discussion. The Australian national railway infrastructure and transport services are currently separated.</td>
<td>8</td>
</tr>
<tr>
<td>Vertical and Horizontal Separation in the European Railway Sector: Effects on Productivity</td>
<td>✓</td>
<td>Horizontal separation plays a key role in the railway reform. The maximum economic effect of horizontal separation can be obtained only on condition of complete vertical differentiation.</td>
<td>10</td>
</tr>
<tr>
<td>Research</td>
<td>Feasibility of Separation</td>
<td>Main Arguments</td>
<td>№</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>---------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>----</td>
</tr>
<tr>
<td>Rail Freight: The Benefits and Costs of Vertical Separation and Open Access</td>
<td>?</td>
<td>The choice of approach to reform needs to take account of a number of factors, including: ✓ The institutional capacity for regulation ✓ Potential loss ✓ The density of flows ✓ Network traffic capacity</td>
<td>12</td>
</tr>
<tr>
<td>Railway Reforms: Do They Influence Operating Efficiency?</td>
<td>?</td>
<td>Accounting separation of railway infrastructure and transport operations plays a key role in improving the efficiency of rail transport. But whether there is an additional benefit of complete vertical separation of infrastructure and transport operations, remains an unanswered question.</td>
<td>13</td>
</tr>
<tr>
<td>Regulatory Reform of Railways in Russia</td>
<td>✓</td>
<td>Railway infrastructure and transport operations should be separated to the greatest extent possible in order to provide transparency. In case of failure to perform complete legal separation, infrastructure management and transport operations should be established as separated divisions with their own profit and loss accounts, balance sheets and management teams.</td>
<td>15</td>
</tr>
<tr>
<td>Regulatory Framework Options for the Rail Sector in South Africa</td>
<td>?</td>
<td>The first step towards separation of railway infrastructure and transport operations in South Africa has been made, as they have separate accounting, but the choice of directions for future reforms and development strategies requires further investigation.</td>
<td>16</td>
</tr>
</tbody>
</table>
### Authors’ Conclusions on Feasibility of Separation

<table>
<thead>
<tr>
<th>Research</th>
<th>Feasibility of Separation</th>
<th>Main Arguments</th>
<th>№</th>
</tr>
</thead>
<tbody>
<tr>
<td>Privatizing British Railways. Are There Lessons for the World Bank and its Borrowers?</td>
<td>![Question Mark]</td>
<td>Separation of railway infrastructure and transport operations should be carried out gradually and consistently, since this is a very complex process that requires consideration of the interests of a large number of participants. This procedure is also associated with certain costs. Upon separation and privatization of infrastructure and transport companies, they increase the efficiency of their operations over time. However, for infrastructure companies such effect is usually of a short-term nature. The ratio of positive and negative effects of vertical separation can vary in different rail systems.</td>
<td>17</td>
</tr>
<tr>
<td>Subadditivity Tests for Network Separation with an Application to U.S. Railroads</td>
<td>![X]</td>
<td>Where railway infrastructure and transport operations are separated within the United States railways, a fully integrated monopolist would have a 20-40 percent cost advantage over a vertically separated system where one company owns infrastructure, while the other performs all types of freight services. Moreover, if transport services are separated by types of cargo after the separation of railway infrastructure and transport operations, the costs could rise by 70% (due to decreased technical efficiency and poor interaction between various parts of the system).</td>
<td>18</td>
</tr>
</tbody>
</table>
## Authors’ Conclusions on Feasibility of Separation

<table>
<thead>
<tr>
<th>Research</th>
<th>Feasibility of Separation</th>
<th>Main Arguments</th>
<th>№</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Japanese Experience with Railway Restructuring</td>
<td>✗</td>
<td>In conditions of low traffic density the operator’s processes are not dependant on those of the infrastructure company very much, and therefore vertical separation is possible. In conditions of high traffic density vertical separation is not desirable.</td>
<td>19</td>
</tr>
<tr>
<td>The Restructuring of Railways</td>
<td>❓</td>
<td>In the course of restructuring of the railway sector, it is particularly important to promote competition, since it influences the choice between separation and integration of railway infrastructure and transport operations. Forms of private participation in the railway sector should be applied very carefully, following a detailed analysis of the consequences of providing access for new entrants to the market.</td>
<td>20</td>
</tr>
<tr>
<td>Vertical Restructuring of the Infrastructure Sectors of Transition Economies</td>
<td>✗</td>
<td>For Russia it is more appropriate to create several vertically integrated companies by region, due to a number of obstacles to the development of competition in the railway sector (low rail density and poor infrastructure, long-distance haulage, poor regulatory system).</td>
<td>22</td>
</tr>
</tbody>
</table>
18 studies that directly address separation of infrastructure from transport operations were analysed. The authors of 10 studies believe that decisions about separation should be based on the internal situation in a particular country. The authors of 6 studies consider that separation in the railway sector is not feasible and only 2 authors concluded that vertical separation of the railway sector has a positive effect on its development.

### Authors’ Conclusions on Feasibility of Separation

<table>
<thead>
<tr>
<th>Research</th>
<th>Feasibility of Separation</th>
<th>Main Arguments</th>
<th>№</th>
</tr>
</thead>
<tbody>
<tr>
<td>Railway Reform. Regulation of Freight Transport Markets</td>
<td>?</td>
<td>The choice of a single model for railway regulatory reform and rail structure that can be applied to all countries is debatable. Each country develops its own approach. Infrastructure management in conditions of complete separation seems to be much more difficult as compared with the integrated model. No effective management regimes for stand-alone railway infrastructure, despite its important role in shaping the competitive environment in rail freight services, are yet in place. The integration or separation process in the railway sector requires a balance between improving the quality of services and preservation of economies of scale, as well as between the development of competition and creation of incentives to innovate.</td>
<td>24</td>
</tr>
<tr>
<td>The Implications of Introducing Competition to Railroad</td>
<td>✗</td>
<td>A railway company, being a natural monopoly providing transport services using its own infrastructure, is more effective than competing operators within the same infrastructure.</td>
<td>21</td>
</tr>
</tbody>
</table>
### Authors’ Conclusions on Feasibility of Separation

Authors’ opinions expressed in studies that address the feasibility of separation of railway infrastructure and transport operations indirectly

<table>
<thead>
<tr>
<th>Research</th>
<th>Feasibility of Separation</th>
<th>Main Arguments</th>
<th>№</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Analysis of Selected Railway Markets in Europe</td>
<td>?</td>
<td>The development of European railway markets is only slightly dependent on structural models, integration or, alternatively, separation of network and operation, and to a much greater extent on specific political decisions on railway management.</td>
<td>1</td>
</tr>
<tr>
<td>Market Size and Vertical Structure in the Railway Industry</td>
<td>?</td>
<td>Vertical integration is preferable in conditions of high railway traffic. If the railway traffic is low, separation of rail infrastructure and transport operations is feasible.</td>
<td>7</td>
</tr>
<tr>
<td>Railway Reform in South East Europe and Turkey</td>
<td>✔</td>
<td>Separation of railway infrastructure and transport operations is necessary to improve the operating efficiency of companies in this field, but the restructuring process in the countries of South-Eastern Europe is very slow.</td>
<td>9</td>
</tr>
<tr>
<td>Research</td>
<td>Feasibility of Separation</td>
<td>Main Arguments</td>
<td>№</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>---------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---</td>
</tr>
<tr>
<td>Testing for Economies of Scope in European Railways: An Efficiency Analysis</td>
<td>?</td>
<td>It is impossible to unambiguously define which management model is the most preferred one, since the performance of railways is influenced by many factors. For example, completely or partially integrated European countries show both high and low degree of market openness. At the same time, both of them have rather good indicators of competition in the railway market and share of rail transport in passenger and freight traffic.</td>
<td>11</td>
</tr>
<tr>
<td>Structural Separation to Create Competition? The Case of Freight Railways</td>
<td>?</td>
<td>Each of the models of the railway structure (integrated or separated) has positive and negative sides. When selecting a model, the choice of sources for compensation of the infrastructure owner’s fixed costs is of paramount importance.</td>
<td>14</td>
</tr>
<tr>
<td>Competition and Co-Operation in International Rail Freight Services</td>
<td>?</td>
<td>Complete vertical separation of railway infrastructure and transport operations has both advantages (increased efficiency and competition in the railway sector) and disadvantages (infrastructure is owned by a single company which prejudices non-discriminatory access of operators to the market. An additional regulator should be created.</td>
<td>23</td>
</tr>
</tbody>
</table>
### Authors’ Conclusions on Feasibility of Separation

<table>
<thead>
<tr>
<th>Research</th>
<th>Feasibility of Separation</th>
<th>Main Arguments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulation of Freight Railways in North America and Europe</td>
<td>?</td>
<td>The choice of the structure and manner of reforming the sector depends on the situation in a particular country. The world practice of reforming the railway sector has not developed a universal structure which would be preferable for all countries. Admission of new entrants to the railway market and lower degree of regulation in this sector do not mean greater efficiency</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>No</strong>: 25</td>
</tr>
</tbody>
</table>

7 studies that *indirectly* address separation of infrastructure from transport operations were analysed. Authors of 6 studies believe that decisions on vertical separation of the railway sector should be based on the analysis of the situation in a particular country. In one study, the authors concluded that vertical separation is feasible.

The majority of studies assert that decisions on vertical separation of the rail sector should be based on the analysis of the internal situation in a particular country.
1. The Analysis and Systematization of the Results of Foreign Studies Related to the Feasibility of Separation of Railway Infrastructure and Transport Operations

1.1 Foreign Studies analysed and Analytical Reviews (p. 3-6)
1.2 Authors’ Conclusions on Feasibility of Separation (p. 8-16)
1.3 Results from the Analysis of Individual Studies and Reviews on Separation (p. 18-37)
1.4 Approaches Used to Assess the Feasibility of Separation in Conditions of the Russian Federation (p. 39-43)

2. Foreign Railway Reforms (p. 45-53)
1. The authors analysed the performance of rail transport in several countries.
2. The period from 1994 to 2011 was analysed with 1994, 2007 and 2011 as control years.
3. The following parameters were analysed:
   - development of transport services
   - competitive development
   - economic development
   - public investment development
   - employment development
4. A comparative analysis was performed using the following countries:
   - Germany
   - France
   - Switzerland
   - UK
   - Austria
   - Czech Republic

Decisions about separation should be based on the internal situation in a particular country.
1. The development of railways is only slightly dependent on management structure models, and to a much greater extent on specific political decisions to strengthen the position of railways in the transport market.

2. The activity of the railway infrastructure company is regulated by the state, despite the UK rail infrastructure is completely separate from transport operations and fully privatized.

3. There is a partially integrated rail management model (infrastructure and transport companies operate within a single holding company) in Germany. The degree of market openness and competition in freight and passenger services is rather high.
Results from the Analysis of Individual Studies and Reviews on Separation

**European Railway Performance Index**

(Boston Consulting Group; Europe, 2012)

---

**Methodology**

1. The Railway Performance Index analysis evaluated the critical components of railway performance:
   - intensity of use of rail transport
   - quality of service
   - safety
2. The authors analysed the performance in countries with different types of structural organization in the sector.
3. The countries were then divided into 3 groups (high-performing, medium, and low-performing).

---

**Conclusions**

1. In European countries, there is a weak relationship between the performance of rail transport and the degree of market liberalization or choice of the management structure model.
2. The performance in the rail sector is directly dependent on the amount of government subsidies and investment.

---

Decisions about separation should be based on the internal situation in a particular country.
The Optimal Setup of a Rail System – Lessons Learned from Outside Europe
(Roland Berger; USA, Canada, Japan, China, Russia, 2012)

Methodology
1. 5 countries were selected for the study based on the size and efficiency of their rail systems.
2. The study focuses on the period between 2002 and 2011. Data about railway operations was gathered from previous studies, statistical reports, interviews with railway managers, ministries and rail experts. The following parameters were evaluated:
   - Traffic
   - Investments (private, government)
   - Efficiency of railway systems
   - Quality of service
3. For each of the five countries, the following characteristics of railway systems were evaluated:
   - Key steps in the history of the rail industry
   - System setup and degree of integration
   - Key players, their goals and objectives
   - Level of competition in the industry

Conclusions
1. The countries under review in this study (Russia, Japan, China, USA, Canada) account for a total of 80% of global freight turnover and 50% of global passenger turnover. The main railways in these countries are integrated railways, i.e. infrastructure and transport services are provided by one company.
2. These integrated structures result in avoiding some additional costs of separated systems.
3. Top managers of the railway companies in the countries under review state that “integration” results in more efficient performance of some basic operations.
4. China had a negative experience of vertical separation.
Economic Effects of Vertical Separation in the Railway Sector
(Institute of Transport Studies, University of Leeds; Europe 2012)

Methodology

1. The study includes literature reviews on the implementation of different management structures in the rail sector.
2. A generic rail sector model has been developed which describes the main production processes and transactions present in the railway sector.
3. The study analyses the influence of different management structures on costs, internal competition and the share of rail transport in freight traffic and passenger traffic.
4. The study includes the analysis of government regulation systems in the rail sector in different countries with different management structures in order to establish the amount of public funds allocated for the development of railway systems.

Conclusions

1. Vertical separation in the railway sector creates misalignment of incentives between the companies involved in transport operations and management of railway infrastructure. Such misalignment usually results in so-called “induced costs” which are estimated to be around 20% of the total separation expenses, therefore “induced costs” play crucial role in planning of railway reform.
2. Rail transport, in particular, infrastructure, requires coordination. The need for coordination differs according to the situation of the railway. Railways in need for changes (upgrading, enhancements, extensions) are likely to have more coordination needs than steady-state railways (railways that have a low need for adjustments in infrastructure state and topology). Railways in need for changes are more likely to find it more difficult to work under an unbundled regime than steady-state railways with sufficient capacity to accommodate all traffic adjustments.
3. There is no practical evidence that vertical separation increases the internal competition and the rail’s modal share in freight or passenger transport. The efficiency of each structural model depends on individual situation and it is impossible to unambiguously assert which model is the most effective one.

«Induced costs» - additional costs throughout the value chain created by inadequate investment coordination, inadequate production planning coordination, inadequate capacity usage and inadequate management of real-time dispatching issues.
Vertical Separation of Railway Infrastructure - Does It Always Make Sense?
(Institute of Transport Studies, University of Leeds; Europe, USA, 2011)

Methodology

1. The study includes previous literature reviews on this topic for EU and USA.
2. The study compares some parameters for different structural models of rail management:
   - The level of competition in the rail freight transport
   - Growth in rail freight transport
   - Growth in rail passenger transport
3. The study evaluates the impact of the following factors on the above parameters:
   - Financial support by government of railway systems
   - Features of the regulation system applied in rail transport

Conclusions

1. There is no correlation between the efficiency of the rail industry and the degree of integration of infrastructure and transport operations.
2. There is no connection between vertical separation of the industry and the growth in rail freight and the rail’s share in freight transport.
Results from the Analysis of Individual Studies and Reviews on Separation

Railway Reform: Toolkit for Improving Rail Sector Performance
(The World Bank, a group of authors, review of all regions of the world, 2011)

Methodology

1. The study analyses railway reforms in major countries of all regions of the world (including Russia): current situation, results and prospects.
2. The authors investigate the key performance indicators of the railway industry in different countries all over the world, their trends before and after separation of railway infrastructure and transport operations. The study analyses changes in the following indicators:
   - Income from freight operations/ton-km
   - Income from passenger operations/passenger-km
   - Subsidies for passenger operations/passenger-km
   - Ratio of tariffs for passenger and freight operations
   - Operating ratio (operating expenses/revenue)
   - Rail traffic density
   - Locomotive capacity
   - Freight wagon capacity.
3. A number of studies are reviewed to investigate changes in economic and financial performance of the rail industry in conditions of separation or integration of infrastructure and transport operations.

Decisions about separation should be based on the internal situation in a particular country.
1. Vertical separation of train operations from railway infrastructure is insufficient by itself to improve railway financial sustainability.

2. A vertically separated infrastructure owner faces much higher fixed costs across its total business than a vertically integrated railway company.

3. Horizontal separation can sharpen market focus and management accountability, and allow for specialized operations to be devolved, divested, or compete with one another.

4. As of 2011, full separation is confined to some EU countries and some of Australia’s interstate networks. The bulk of the world’s rail traffic is carried on vertically integrated railways.

5. The challenge of vertical separation is to clarify allocations of responsibility and accountability between railway infrastructure managers and train services operators at the interfaces of railway technology, operations, safety, and economic concerns.

6. One of the advantages of vertical integration is a single point of responsibility and this is especially relevant for countries in which railway transport is essential for its economic development.
1. In this study, the authors reviewed previous literature addressing the problems of restructuring of railway transport in different countries.

2. A railway cost and revenues model has been developed which includes three players:
   - a rail infrastructure company
   - a train operating company
   - Human resources.

3. The study determines a set of main factors (e.g., costs of the train operating company for labor and the use of infrastructure) that influence the final price for the rail transport service.

4. Two scenarios for pricing and allocation of costs and revenues in the railway industry are considered:
   - Vertical integration of infrastructure and transport operations
   - Separation of infrastructure and transport operations.

5. The results are compared.

1. The larger is the market share of the biggest train operating company, the more desirable is its integration with the infrastructure company and the more effective will be such integration.

2. The higher is the intensity of use by such train operating company of railway infrastructure, the more favourable is its integration with the infrastructure company and the more effective will be such integration.
Results from the Analysis of Individual Studies and Reviews on Separation

Vertical and Horizontal Separation in the European Railway Sector
(University of Valencia, P. Sánchez, J. Monsálvez, L. Martínez; Europe 2008)

Methodology

1. The study is based on the performance of rail transport over the period from 1985 to 2004 years in 16 European countries with separated or integrated system of rail management to assess the feasibility of separation of infrastructure and transport operations. The following variables are analysed:
   - the number of employees in the industry
   - the number of rolling stock available for passenger transport
   - the number of rolling stock available for freight transport
   - the number of km of track
   - total trains-km, percentage of passenger trains-km and freight trains-km in the total trains-km
   - rail traffic density (the ratio of trains-km and the number of km of track)
   - Other

2. The authors used the Malmquist Productivity Index* based on the above variables to analyse productive change** of rail transport between the specified periods in countries with separated or integrated rail system.

3. Using the Tobit model*** the authors determined the influence of each of the above indicators on productive changes of rail transport in countries with separated or integrated rail system.

4. The authors analyzed the dynamics of indicators that most strongly affect the productive change in countries with separated or integrated rail system.

---

*The Malmquist Productivity Index is used to determine whether more output is produced with the same amount of inputs.

**The productive change means the change in terms of quantity and age of equipment used in the railway industry, as well as the effectiveness of such equipment.

***The Tobit model is used to estimate the influence of each variable in a particular set on the final result.
1. The industry may be restructured on two levels: the vertical dimension, which involves the relationship between infrastructure and operations, and the horizontal dimension, which covers the relationship between the organizations that provide freight and passenger transport services.

2. The maximum economic effect of horizontal separation can be obtained only on condition of complete vertical differentiation, i.e. creation of separate infrastructure and transport companies.

3. Individual vertical or horizontal separation results in productivity growth in the railway sector. At the same time, the countries that have completed both vertical and horizontal separation processes show significantly higher efficiency levels.
Results from the Analysis of Individual Studies and Reviews on Separation Testing for Economies of Scope in European Railways: An Efficiency Analysis (University of Lüneburg; Europe, 2007)

Methodology

1. The data set consists of 54 railway firms from 27 European countries throughout the period 2000-2004. Every year is considered as an independent observation.
2. The companies are divided into four different groups: integrated companies, infrastructure managers, passenger operators and freight operators.
3. Two economic and mathematical models were used for the analysis. Model I is based only on physical measures for the input factors:
   - number of employees
   - number of rolling stock
   - network length

   In Model II, the “physical” variables are replaced by monetary variables (operating expenditure).

   Both models have advantages and disadvantages. The use of physical measures for international comparison neglects the differences in relative factor prices among the countries, while using monetary values raises the problem of differences in price levels, accounting rules and currency conversion. To limit this problem, operating costs were converted into an artificial currency.

Conclusions

1. In 2004, some counties showed a high degree of market opening. Interestingly enough, integrated companies of these countries featured low efficiency scores
2. Generally, the integrated model is more efficient than the vertical separation of the industry.
Results from the Analysis of Individual Studies and Reviews on Separation

Rail Freight: The Benefits and Costs of Vertical Separation and Open Access
(European Transport Association; Europe, 2006)

Methodology

1. Studies conducted in the USA, European Union and other European countries were reviewed.
2. The consequences of restructuring the railway industry in these countries were analysed.

Conclusions

1. The vertical separation of railways appears to be less efficient than that of the power sector and telecommunications. Unlike in these industries, there is no emerging consensus on the most efficient and preferable way to structure railways.
2. The vertical separation model appears to be more appropriate for freight transport in the EU.

Decisions about separation should be based on the internal situation in a particular country.
Structural Separation to Create Competition? The Case of Freight Railways
(R. Pittman, Antitrust Division, U.S. Department of Justice, New Economic School; Europe, North America, 2005)

Methodology

1. The author analysed the main measures and results of railway restructuring in North America and Europe.
2. The paper summarizes the results of previous studies on the feasibility of separation of infrastructure and transport operations.
3. Based on the results of the analysis of the main restructuring measures and summary of other studies, conclusion were made on the feasibility of separation.

Conclusions

1. Searching for resources to cover fixed costs of the infrastructure company is a weak point of the complete vertical separation model, since in conditions of separation it is very hard to set charges for the use of infrastructure to the extent that would be enough for its maintenance and development.

2. Where the charges for the use of railway infrastructure are economically feasible, their amount may be inappropriate for some market participants and impede the development of competition. This problem can be solved by government subsidies or by establishing discriminatory payments* for the use of infrastructure.

3. Given that the concept of separation of infrastructure and transport operations provides non-discriminatory payments for the use of infrastructure, the infrastructure company needs government subsidies for the development of competition in the event of separation.

* Discriminatory charges means the establishment of different amounts and terms of payment for some railway market participants.
Subadditivity Tests for Network Separation with an Application to U.S. Railroads
(M. Ivaldi, G. McCullough; USA, 2004)

Methodology

Separation is not feasible

1. Three railway management models were offered for the calculation of costs in each case:
   1) Integration of infrastructure and transport operations
   2) Separation of infrastructure and transport operations into two companies
   3) Separation of infrastructure and transport operations and the establishment of several transportation companies.
2. The authors developed a unified cost model that reflects the dependence of total costs in the railway industry with different structural patterns on the following indicators: car-miles of bulk traffic, car-miles of general traffic (intermodal, etc.), replacement ties installed in a given year, index of labor prices, index of equipment prices, index of fuel prices, index of material prices, average length of haul, miles of road operated, counter for years, routing share (percent of car-miles moving in unit trains).
3. The authors analysed U.S. freight railroad indicators for the period 1978-2001. They used the McFadden function* to evaluate the impact of changes in these indicators on the performance of the railway industry with different structural patterns.
4. The authors compared the total costs and efficiency of the railway industry with different structural patterns.

* The function is used to assess the technical efficiency of multiproduct production and to establish the degree of influence of changes in certain indicators on the economies of scale.
1. The authors concluded that, where railway infrastructure and transport operations are separated within the United States railways between the infrastructure company and the operating company providing all types of frights services, the cost will rise by 20-40 percent as compared to the vertically integrated company.

2. If transport services are separated from infrastructure and several operators are created, the costs could rise by 70% (due to decreased technical efficiency and poor interaction between various parts of the system).

3. Separation of infrastructure and transport operations reduces the efficiency of coordination of the companies in the railway sector.

4. The conditions for the functioning of the railway industry vary from country to country. For example, in Europe the share of passenger traffic is much higher than in North America, which requires the development of a special approach to the reform of the railway transport.
The Japanese Experience with Railway Restructuring
(F. Mizutani, K. Nakamura; Japan, 2004)

1. The study analyzes the course of the railway sector reform in Japan: the goals and objectives of the reform, the main directions and measures, the value of privatization in the reform process.

2. The following performance indicators in the Japanese railway sector for the period 1987-1998 (before and after the reform) were analysed:
   - Operating revenue-cost ratio;
   - Average fare (persons and tons);
   - Average load per car (persons and tons);
   - Train density;
   - Transport demand (persons and tons);
   - Labor productivity in the industry;
   - Average monthly wage in the industry;
   - Average operating cost;
   - Accident rate. As a result, conclusions were made about the effectiveness of integration of infrastructure and operations.

3. The authors compared the main railway performance indicators (operating revenue-cost ratio, average operating revenue, train density, passenger traffic demand, freight traffic demand, labor productivity in the industry, average operating cost) in various countries that have implemented the reform of the railway industry (UK, Sweden).
1. The privatization of the railway industry in Japan had a number of distinguishing features:
   1) functional separation of passenger and freight operations;
   2) vertical integration of infrastructure and passenger operations;
   3) vertical separation of infrastructure and freight operations;
   4) introduction of competition in terms of performance.

2. As a result of the reform, passenger operations were divided between six regional companies and freight operations were carried by one company.

3. The authors noted that vertical separation makes it easier to promote a variety of operators, specialization of activities and better services, but on the other hand, vertical separation makes it difficult to:
   ✓ regulate prices and monitor performance;
   ✓ organize time-tabling and slot allocation of trains;
   ✓ negotiate arrangements for investment projects;
   ✓ maintain safety of train operations;
   ✓ provide integrated information and ticketing.

4. There are two factors that make a vertically separated system undesirable in Japan:
   ✓ increased operating costs;
   ✓ the existence of economies of scope between operation and infrastructure providing services.

5. In conditions of low traffic density the operator’s technological connection with the infrastructure company is not very strong, and therefore vertical separation is possible. In conditions of high traffic density vertical separation is not desirable.

6. In order to promote competition in the railway sector, a system of indicators encouraging the company’s efficient performance has been introduced, as licensing procedures and terms are too lenient. The essence of the yardstick competition scheme is to establish general evaluation criteria for companies and compare their performance indicators (for example, productivity growth, cost reduction, quality of service). If a company performs better than other companies, then it may receive rewards. On the other hand, a company that performs worse might be penalized.
The Implications of Introducing Competition to Railroad  
(J. Bitzan; USA, 2003)

1. The author reviewed previous research works on railway sector restructuring in various countries.
2. The author has developed a cost model that reflects the dependence of operators’ costs (transportation costs excluding infrastructure costs) on:
   - price of labour
   - price of materials and supplies
   - price of fuel
   - price of equipment
   - gross ton-miles
   - route miles
   - average length of haul
   - miles of track per mile of road
   - net investment in way and structures per mile of track
   - other factors.
3. The author traced the changes in these indicators and operators’ costs for Class I U.S. roads for the period from 1983 through 1997, and subsequently established the influence of each indicator on the change in operators’ costs.
4. After calculating the changes in indicators and their impact on costs, the dependence of each indicator on the structure of the industry was determined. This was followed by comparison of costs for integrated and separated industry and determination of their subadditivity.

*Cost subadditivity means in this context a situation when the cost of production of a certain amount of products by one company is less than the cost of production of the same amount of products by several companies.*
Regulation of Freight Railways in North America and Europe
(European Transport Conference; J. Drew, North America and Europe, 1999)

Methodology

1. The study analyzes the reform (background, main activities, further directions of development) of railway transport in North America (USA, Canada) and the EU (Germany, UK) as of 1999.
2. The author evaluated a number of indicators in the railway industry in the USA, Canada, UK, and Germany: freight turnover in ton/km, operator’s revenue, labor productivity, average rate per ton/km, operating costs, amount of investment in the industry, return on capital before and after the reform.

Conclusions

1. The form of restructuring depends on the situation in a particular country and is therefore strictly individual in each case. The international community has not developed a universal approach to the feasibility of separation of infrastructure from operations.
2. Admission of new entrants to the railway market usually requires the establishment of an independent regulatory authority, the scope of authority of which depends on the degree of separation of infrastructure and operations, as well as on the degree of competition in the market. Thus, each state, when reforming its railway sector, creates its own unique experience of regulation, and therefore no universal solution may exist.
3. The reform experience of various countries shows that admission of new entrants to the railway market and lower degree of regulation in this sector do not mean greater efficiency. Therefore, each state should carefully analyze the degree of regulation and competition in rail transport.
1. The Analysis and Systematization of the Results of Foreign Studies Related to the Feasibility of Separation of Railway Infrastructure and Transport Operations

1.1 Foreign Studies analysed and Analytical Reviews (p. 3-6)
1.2 Authors’ Conclusions on Feasibility of Separation (p. 8-16)
1.3 Results from the Analysis of Individual Studies and Reviews on Separation (p. 18-37)
1.4 Approaches Used to Assess the Feasibility of Separation in Conditions of the Russian Federation (p. 39-43)

2. Foreign Railway Reforms (p. 45-53)
Approaches Used to Assess the Feasibility of Separation in Conditions of the Russian Federation

Assessment of the applicability of methodologies used in the reviewed foreign studies to determine the feasibility of separation of infrastructure and transport operations

**Economic forecasting:** forecasting the direction and magnitude of changes in the economic performance of railway companies in the event of changes in the management structure model.

**Statistical analysis:** the collection, analysis and comparison of historical data on performance of railway industries with different management structure models.

**Simulation modeling:** creating models to predict the performance of processes in reality.

- **Application of the economic forecasting method to assess the feasibility of separation of infrastructure from operations in Russia** is possible.
- **Application of the statistical analysis method appears to be impossible,** since separation of infrastructure from operations has not yet occurred, and therefore, the collection and analysis of historical data is impossible.
- **Simulation modeling is inherently a very complex and time-consuming process,** which significantly limits its use in determining the feasibility of separation of railway infrastructure and transport operations in Russia.

Out of the above three groups of methods used in the reviewed foreign studies, **economic forecasting** is the most preferable method in assessing the feasibility of separation of infrastructure and transport operations in Russia.
Approaches Used to Assess the Feasibility of Separation in Conditions of the Russian Federation

When using the economic forecasting method to assess the feasibility of separation of infrastructure and operations in Russia, a series of following procedures should be done:

1. Construct a railway transportation flow chart detailing all operations in the sector and points of interaction between the infrastructure owner and the operator (single or multiple).

2. Clearly separate the functions which are currently performed by a single entity between the presumably separated infrastructure owner and the operator (single or multiple).

3. Develop a regulatory scheme of the railway sector reflecting the procedure and scope of government regulation in this area in the assumed conditions.

   - Make a rough estimate of expenditures of railway companies in the new environment, with a particular focus on the following:
     - Infrastructure owner service rating;
     - Effects of introducing competition in rail freight operations;
     - The need to increase the production and management personnel and provide corresponding facilities to ensure the transportation process in the new environment;
     - Changing the principle of centralized supply for all participants of the transportation process, as this may result in a substantial increase in the price of material and technical resources.

4. Evaluate the management process and interaction between market participants (determine the extent to which the interaction between the elements of the railway system becomes more complicated and the efficiency of control of railway operations in the new environment).

5. Assess the risks associated with the separation of infrastructure from operations through the analysis of technological, economic, organizational and regulatory changes related to such separation. The assessment should take into account the probability of each risk and its impact on the rail industry as a whole.

6. Identify and evaluate the positive and negative effects of separation of infrastructure and transport operations in the Russian railway industry. The following indicators may serve as evaluation criteria:
   - The degree of competition between operators as a result of the reform;
   - The change in total transportation costs;
   - Changes in the government regulation of the industry;
   - The level of control of and interaction between actors involved in freight operations.

7. Assess the probability and the degree to which goals and objectives are attained through separation of infrastructure and transport operations in Russia.

In summary, the feasibility of separation of infrastructure and transport operations in Russia can be determined only after analyzing rail transportation technologies in Russia, the nature and extent of government regulation of the industry, evaluating the costs of market participants in the new environment, studying management processes and interaction between actors of the railway system, assessing potential risks, identifying positive and negative aspects and establishing the probability and extent of achievement of the goals.
The performed study shows that separation of infrastructure and transport operations in Russia will result in inevitable negative consequences. At the same time, positive effects are probabilistic in nature, and they will be less pronounced, even under the most optimistic scenario.

The Institute of Natural Monopoly Research performed a study for conditions of 2007 “Theoretical Evaluation of the Feasibility of Separation of Transport Operations from Infrastructure at the Third Stage of the Structural Reform of the Railway System”

A number of possible positive effects of separation of infrastructure and operations was identified:

1) Improved quality of service provided by operators due to flexible tariff regulation, eventual shortening of application approval, shipping acceptance and delivery periods, a convenient schedule of terminal operations, etc.;
2) Increased private investment in the renewal of locomotives and freight cars;
3) A slight decrease in the cost of rail freight transportation services for some traffic routes in certain segments of the market.

A number of possible negative effects of separation of infrastructure and operations was identified:

1) The expected growth in freight transportation costs within the Russian railway may reach 223 billion rubles (+32%) (for conditions of 2007).
2) A possible increase in government spending on regulation and complication of the government regulation system due to:
   - The increased number of entities subject to regulation: the infrastructure owner, network operator, other operators, etc.;
   - The emergence of new areas of regulation: access to infrastructure services, infrastructure service tariffs;
   - Increased requirements to qualification of regulators (the regulator’s employees should have necessary skills to effectively control the costs of entities subject to regulation and to ensure non-discriminatory conditions in the rail industry).
3) The expected increase in the risk of lower technological stability and reduced safety of freight and passenger services within the railway network.
Conclusions:

1. There is no practical evidence that vertical separation increases the internal competition and the rail’s modal share in freight or passenger transport or enhances the productivity and efficiency of the rail transport. The authors of the majority of studies assert that the efficiency of each structural model depends on conditions for the functioning of the railway sector in each country. Railways with integrated infrastructure and transport operations account for over 80% of global rail freight turnover and over 50% of global rail passenger turnover.

2. The main disadvantage of vertical separation is the lack of a single point of responsibility, inconsistency of incentives for infrastructure and transport companies and the absence of clear allocation of responsibility and accountability between railway infrastructure managers and train services operators at the interfaces of railway technology, operations, safety, and economic concerns. The higher is the intensity of use by the biggest operator of railway infrastructure and the larger is the market share of such operator, the more favourable is its integration with the infrastructure company and the more effective will be such integration. Moreover, for rail networks with high traffic density and a large share of freight trains the preferable solution is not to perform vertical separation and introduce competition, but rather to improve public policy in the field of railway transport and to develop an incentive scheme and management system in the industry.
Separation of infrastructure and transport operations in some railway systems may result in an increase of total freight transportation costs by 20% to 40%. Moreover, an independent infrastructure company is more susceptible to crisis developments in the economy and may require more government subsidies than a single entity, since a vertically separated infrastructure owner faces much higher fixed costs across its total business than a vertically integrated railway company.

Searching for resources to cover fixed costs of the infrastructure company is a weak point of the complete vertical separation model. Where the charges for the use of railway infrastructure are economically feasible, their amount may be inappropriate for some market participants and impede the development of competition. Thus, to allow the entry of new players and promote competition, an infrastructure company will require additional sources to finance its fixed costs.

The results of the study “Theoretical Evaluation of the Feasibility of Separation of Transport Operations from Infrastructure at the Third Stage of the Structural Reform of the Railway System” performed by the Institute of Natural Monopolies show that separation in conditions of Russia will result in an increase of freight costs by over 30%. Moreover, complication of the government regulation system in the railway sector is expected along with the risk of lower technological stability and reduced safety of freight and passenger services.
1. The Analysis and Systematization of the Results of Foreign Studies Related to the Feasibility of Separation of Railway Infrastructure and Transport Operations, Investigation of the Nature and Outcomes of Foreign Railway Reforms (p. 3-16)

2. Foreign Railway Reforms

2.1 The Influence of Operating Conditions in the Railway Sector on the Choice of the Model of Structural Organization of the Industry (p.45-49)

2.2 Separate Results of Foreign Railway Reforms (p.51-53)
In conditions of higher share of freight traffic there are fewer possibilities for the development of competition, since the passenger transportation technology is more predictable and requires a lower degree of integration of the infrastructure owner and operator (passenger trains run on schedule, no rehandling of passenger trains is performed at train stations, etc.).

The table shows that the share of freight traffic in Russia is much higher than in any of the seven reviewed EU countries. The railways in Russia are much more important. Therefore, the realization of any risks associated with separation can result in a much greater negative effect.

### The share of railway transport in freight and passenger turnover

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Germany</th>
<th>France</th>
<th>UK</th>
<th>Sweden</th>
<th>Austria</th>
<th>Italy</th>
<th>Poland</th>
<th>Russia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Railway transport share in freight turnover (2011)</td>
<td>18%</td>
<td>14%</td>
<td>11%</td>
<td>36.5%</td>
<td>27.9%</td>
<td>8.5%</td>
<td>26%</td>
<td>43.3%</td>
</tr>
<tr>
<td>Railway transport share in passenger turnover (2011)</td>
<td>9.5%</td>
<td>9%</td>
<td>5.5%</td>
<td>9.5%</td>
<td>7.7%</td>
<td>5%</td>
<td>6.5%</td>
<td>31.5%</td>
</tr>
<tr>
<td>The trend of railway transport share in freight turnover between 2001 and 2011</td>
<td>↑</td>
<td>↓</td>
<td>↑</td>
<td>≈</td>
<td>≈</td>
<td>↓</td>
<td>↓</td>
<td>↑</td>
</tr>
<tr>
<td>The trend of railway transport share in freight turnover between 2001 and 2011</td>
<td>↑</td>
<td>↑</td>
<td>↑</td>
<td>≈</td>
<td>≈</td>
<td>↓</td>
<td>↓</td>
<td>↑</td>
</tr>
</tbody>
</table>


The higher is the share of railway transport in freight and passenger turnover of the country, the more important is the railway transport for the development of the economy and social life of the state and the higher are the risks of separation of infrastructure and transport operations. If the share of railway transport is low, the railway transport may require a new impetus, but without imposing risks on a significant share of traffic in the existing system.

### The share of freight transport in total railway transport

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Germany</th>
<th>France</th>
<th>UK</th>
<th>Sweden</th>
<th>Austria</th>
<th>Italy</th>
<th>Poland</th>
<th>Russia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share of freight train-km in total train-km, %</td>
<td>26</td>
<td>23</td>
<td>7</td>
<td>34</td>
<td>34</td>
<td>19</td>
<td>40</td>
<td>73</td>
</tr>
<tr>
<td>Share of freight traffic in the reduced turnover*, %</td>
<td>57</td>
<td>27</td>
<td>27</td>
<td>67</td>
<td>64</td>
<td>25</td>
<td>74</td>
<td>95</td>
</tr>
</tbody>
</table>

Sources: Railway access charges in the EU2008, Eurostat Statistics, Annual Report of Russian Railways, Assessment of the Institute of Natural Monopolies

In conditions of higher share of freight traffic there are fewer possibilities for the development of competition, since the passenger transportation technology is more predictable and requires a lower degree of integration of the infrastructure owner and operator (passenger trains run on schedule, no rehandling of passenger trains is performed at train stations, etc.).

The table shows that the share of freight traffic in Russia is much higher than in any of the reviewed EU countries. In Europe, the average ratio of freight trains to passenger trains is 1:3, while in Russia this ratio is 1:0.37. Thus, the Russian railway industry is focused on freight traffic, while the EU railway industry is focused on passenger traffic.

* To calculate the reduced turnover, the reduction ratio of passenger traffic (passenger-km) to freight traffic (ton-km) equal to 1 was used.
The Influence of Operating Conditions in the Railway Sector on the Choice of the Model of Structural Organization of the Industry

It should be noted that in the EU, freight trains, though their share is small, mainly run on schedule*. In this case, the technical and organizational relationship between the operator and infrastructure owner may not be as close as in case of “dispatch upon accumulation”**, which is characteristic for freight trains in Russia. Therefore, it may be concluded that the possibility for the development of competition in the case of separation in the EU is high, since the majority of trains run on schedule. In Russia, the possibility of competition in the event of separation is not high, since a large share of freight trains is dispatched upon accumulation of cargo.

To assess the possibility of competition in freight transport and the feasibility of separation of infrastructure from transport operations in conditions of Russia, the following indicators reflecting the functioning of rail systems may be compared:

- **Average weight and length (number of cars) of a freight train.** With lower average weight (and shorter length) of trains, the probability of entry of new players and competition is higher, as transportation of a lighter train (with fewer cars) is technologically and commercially easier (no co-operation with major shippers or many small shippers concentrated in one area is necessary to fill a heavy and long train, no joining of car groups is required, etc.).
- **Average freight transportation distance.** With shorter transportation distance, the probability of entry of new players and competition is higher, as shorter-distance transportation is technologically easier (no shifts and rest for locomotive crews, maintenance and replacement of locomotives, commercial inspection and en route maintenance of cars, etc. is required).
- **Freight traffic density.** With high traffic density, the probability of entry of new players and competition is lower, as the infrastructure is less available, and it is difficult to manage operations of several carriers within the same infrastructure.
- **Freight locomotive and freight car performance.** With higher locomotive and car performance, the probability of entry of new players and competition is lower, as they find it difficult to compete with high-performing competitors. Moreover, if high performance as compared to other railway systems is achieved without competition, the high level of competition is not necessary to improve performance.
- **Labor productivity.** With higher labor productivity, the probability of entry of new players and competition is lower, as they find it difficult to compete with high-performing competitors. (This evaluation criterion is rather ambiguous, since, first, in different companies different operations can be performed by outsourcing firms; second, it is difficult to determine precisely the number of employees in the industry due to a large number of companies, and third, criteria may be selected for operations attributed to one employee: freight carried (in tons or ton-km), passengers carried (in passengers or passenger-km), train-km, revenue (income), net profit, etc.)

---

* The time of departure of the train (cargo carried by the train) from the dispatch station, passage between stations, stopping and standing time, and the time of arrival to the destination station is known in advance.

** The schedule of the train (cargo carried by the train) is not known in advance, and trains are dispatched on reaching the established scheduled weight or length.
1. Such indicators as the average weight of freight trains, the number of cars and transportation distance are much higher in Russia as compared with any of the EU railways. Russia’s indicators are much closer to those of Canada and the United States.

2. Freight traffic density and traffic flow within Russian railways exceed more than twice the traffic density and flow in any of the reviewed countries.

3. Freight car and freight locomotive performance in Russia significantly exceeds that of the EU. Thus, the conditions of functioning of the railway transport in Russia are quite different from those in the EU (where the railway industry is targeted on separation of infrastructure from transport operations) and are more similar to those in North America (where infrastructure and transport operations are integrated). Therefore, the measures for restructuring the railway sector that have had a positive effect in Europe, can have quite a different effect when used in Russia. The probability of entry of a large number of new freight carriers into the market in the event of separation of infrastructure and transport operations in Russia is much lower than in the EU.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Germany</th>
<th>France</th>
<th>UK</th>
<th>Sweden</th>
<th>Austria</th>
<th>Italy</th>
<th>Poland</th>
<th>Australia*</th>
<th>Canada</th>
<th>USA</th>
<th>Russia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average freight transportation</td>
<td>320</td>
<td>375</td>
<td>215</td>
<td>345</td>
<td>205</td>
<td>300</td>
<td>245</td>
<td>320</td>
<td>1100</td>
<td>915</td>
<td>1700</td>
</tr>
<tr>
<td>distance, km</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average number of cars in a</td>
<td>13</td>
<td>10</td>
<td>20</td>
<td>13</td>
<td>12</td>
<td>12</td>
<td>17</td>
<td>89</td>
<td>72</td>
<td>69</td>
<td>61</td>
</tr>
<tr>
<td>freight train</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average weight of a freight train,</td>
<td>500</td>
<td>380</td>
<td>800</td>
<td>480</td>
<td>460</td>
<td>450</td>
<td>640</td>
<td>4250</td>
<td>2900</td>
<td>2850</td>
<td>2255</td>
</tr>
<tr>
<td>tons**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freight traffic density, million</td>
<td>2.97</td>
<td>1.16</td>
<td>1.32</td>
<td>2.05</td>
<td>3.19</td>
<td>0.89</td>
<td>2.53</td>
<td>7.55</td>
<td>7.05</td>
<td>11.05</td>
<td>24.6</td>
</tr>
<tr>
<td>ton-km/1 km of railways</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traffic flow, thousands of</td>
<td>200</td>
<td>175</td>
<td>185</td>
<td>115</td>
<td>180</td>
<td>180</td>
<td>135</td>
<td>240</td>
<td>225</td>
<td>310</td>
<td>730</td>
</tr>
<tr>
<td>car-km/1 km of railways (freight</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>and passenger cars)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freight locomotive performance,</td>
<td>63</td>
<td>45</td>
<td>n/a</td>
<td>104</td>
<td>45</td>
<td>39</td>
<td>35</td>
<td>236</td>
<td>185</td>
<td>107</td>
<td>186</td>
</tr>
<tr>
<td>million ton-km/year per 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>locomotive</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freight car performance, thousand</td>
<td>993</td>
<td>430</td>
<td>n/a</td>
<td>1520</td>
<td>886</td>
<td>511</td>
<td>576</td>
<td>6610</td>
<td>5015</td>
<td>2080</td>
<td>1963</td>
</tr>
<tr>
<td>ton-km/year per 1 freight car</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labour productivity***, thousands</td>
<td>3.4</td>
<td>3.15</td>
<td>4.45</td>
<td>n/a</td>
<td>3.2</td>
<td>2.5</td>
<td>4.7</td>
<td>4.6</td>
<td>5.1</td>
<td>5.1</td>
<td>1.4***</td>
</tr>
<tr>
<td>of train-km per year/employee</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Assessment of the Institute of Natural Monopolies

* In Australia, different separation patterns are used, but its railway industry cannot be considered as a completely separated one.

** The average net weight of a freight train, including empty freight trains, is equal to (net) turnover / train-km (including empty trains) of freight trains.

*** The direct comparison of labor productivity is inaccurate, since some operations can be outsourced.
The conditions of functioning of the railway transport in Russia are quite different from those in the EU (where the railway industry is targeted on separation of infrastructure from transport operations) and are more similar to those in North America (where infrastructure and transport operations are integrated). Therefore, the measures for restructuring the railway sector that have had a positive effect in Europe, can have quite a different effect when used in Russia. The probability of entry of new freight carriers into the market in the event of separation of infrastructure and transport operations in Russia is much lower than in the EU.

It is easier to organize the activities of several operators in conditions of the EU, where short light trains run over short distances, predominantly according to a fixed schedule, as compared to Russia, where heavy long trains require such technological en route operations, as relief and rest for locomotive crews, maintenance and replacement of locomotives, commercial inspection and maintenance of cars, etc., and where about 60% of cargo are transported as carload and collective shipments which require a high degree of integration and coordination between the infrastructure owner and the operator.
Most European countries have an integrated or partially integrated structure of the rail industry. Among European countries, there are those who announce complete or partial separation of rail infrastructure from transport operations, but in fact remain partially integrated, which speaks for the formal approach to independence and unwillingness to perform separation in practice.

The countries, where vertical separation of the railway industry was performed, show a more open access to the rail freight market. The degree of market openness changed each time the separation reforms were introduced (separation of financial reporting, establishment of separate companies, sale of companies). Therefore, vertical separation of the railway sector results in an increase in the openness of the freight market, including for foreign companies.

The experience of the countries of North America, rather than European countries, may be used to address the key problems of the development of the Russian railway transport. The majority of the restructuring instruments used in the specified countries are already applied in Russia, while separation of railway infrastructure and transport operations has not been applied in North America.
1. The Analysis and Systematization of the Results of Foreign Studies Related to the Feasibility of Separation of Railway Infrastructure and Transport Operations, Investigation of the Nature and Outcomes of Foreign Railway Reforms (p. 3-16)

2. Foreign Railway Reforms

2.1 The Influence of Operating Conditions in the Railway Sector on the Choice of the Model of Structural Organization of the Industry (p.45-49)

2.2 Separate Results of Foreign Railway Reforms (p.51-53)
The level of competition in the freight and passenger rail transport

### The analysis of the level of competition in the freight and passenger rail transport

<table>
<thead>
<tr>
<th>Country</th>
<th>HHI* for freight transportation, 2010</th>
<th>HHI* for passenger transportation, 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>Low competition (5636)</td>
<td>Low competition (8471)</td>
</tr>
<tr>
<td>France</td>
<td>Low competition (6436)</td>
<td>Low competition (9802)</td>
</tr>
<tr>
<td>UK</td>
<td>Low competition (3898)</td>
<td>High competition (647)</td>
</tr>
<tr>
<td>Sweden</td>
<td>Low competition (3990)</td>
<td>Low competition (5400)</td>
</tr>
<tr>
<td>Austria</td>
<td>Low competition (7332)</td>
<td>Low competition (8901)</td>
</tr>
<tr>
<td>Italy</td>
<td>Low competition (5797)</td>
<td>Low competition (8418)</td>
</tr>
<tr>
<td>Poland</td>
<td>Low competition (4300)</td>
<td>Low competition (3723)</td>
</tr>
<tr>
<td>USA</td>
<td>Medium competition (1710)</td>
<td>Low competition (9805)</td>
</tr>
<tr>
<td>Canada</td>
<td>Low competition (4135)</td>
<td>Low competition (8473)</td>
</tr>
<tr>
<td>Australia</td>
<td>Low competition (2020)</td>
<td>N/A</td>
</tr>
</tbody>
</table>

In general, the rail freight market shows a **low** level of competition. Only in the USA the level of competition in the rail freight market is estimated as medium competition. Taking into account that the highest level of competition is observed in the system where infrastructure is not separated from transport operations and that the level of competition is evaluated as low in the systems where separation had taken place, it may be asserted that separation of infrastructure and transport operations does not result in a significant increase in the level of competition in rail freight services.

---

The analysis of the presence of the public sector in the industry

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>100%, DB Schenker (DB AG)</td>
<td>100%, DB Bahn (DB AG)</td>
<td>100%, DB Schenker (DB AG)</td>
<td>100%, DB Bahn (DB AG)</td>
<td>100% (DB Netz AG)</td>
</tr>
<tr>
<td>France</td>
<td>100%, SNCF</td>
<td>100%, SNCF</td>
<td>100%, SNCF</td>
<td>100%, SNCF</td>
<td>100% (RFF)</td>
</tr>
<tr>
<td>UK</td>
<td>0%, DB Schenker Rail</td>
<td>0%, Virgin Trains</td>
<td>0% (6 freight companies were established after the privatization of British Rail)</td>
<td>0% (26 passenger companies were established after the privatization of British Rail)</td>
<td>0% (Network Rail) ownership, but 100% control (ORR)</td>
</tr>
<tr>
<td>Sweden</td>
<td>100%, Green Cargo AB</td>
<td>100%, SJ AB</td>
<td>100%, Green Cargo AB</td>
<td>100%, SJ AB</td>
<td>100% (Järnvägsstyrelsen)</td>
</tr>
<tr>
<td>Austria</td>
<td>100%, OBB RCA</td>
<td>100%, OBB PV</td>
<td>100%, OBB RCA</td>
<td>100%, OBB PV</td>
<td>100% (OBB Infrastruktur Betrieb AG)</td>
</tr>
<tr>
<td>Italy</td>
<td>100%, Trenitalia</td>
<td>100%, Trenitalia</td>
<td>100%, Trenitalia</td>
<td>100%, Trenitalia</td>
<td>100% (RFI)</td>
</tr>
<tr>
<td>Poland</td>
<td>100%, PKP Cargo SA (PKP SA)</td>
<td>100%, PKP Intercity SA (PKP SA)</td>
<td>100%, PKP Cargo SA, PKP Linia Hutnicza Szerokotorowa (PKP SA)</td>
<td>100%, PKP Intercity SA, PKP Szybka Kolej Miejska (PKP SA)</td>
<td>100% (PKP SA)</td>
</tr>
<tr>
<td>USA</td>
<td>0%, BNSF</td>
<td>100%, Amtrak</td>
<td>-</td>
<td>-</td>
<td>1% (Amtrak)</td>
</tr>
<tr>
<td>Canada</td>
<td>0%, CN</td>
<td>100%, Via Rail</td>
<td>-</td>
<td>-</td>
<td>1% (Via Rail)</td>
</tr>
<tr>
<td>Australia</td>
<td>0%, PN</td>
<td>100%, V/Line Passenger (one of the largest companies)</td>
<td>-</td>
<td>-</td>
<td>100% (ARTC)</td>
</tr>
</tbody>
</table>

* In this study incumbent means a company which was part of the previous single vertically integrated company and is its successor to a particular activity.
The experience of the European Union shows that government policies aimed at introducing the model of vertical separation of the railway industry are accompanied by deregulation of tariffs for the transportation of goods by rail and introduction of a contract system of ordering and paying for passenger transportation services.

In countries where the railroad industry is separated or partially separated, the functions of the regulator in the railway sector are usually performed by a separate specialized body (independent or affiliated to the ministry of transport). Therefore, vertical separation requires the creation of a specialized regulatory body with highly qualified employees.

In the majority of European countries, the largest operator is the company that is a part of the previous vertically integrated company. The level of competition in the rail freight and passenger market is estimated as low. The largest railway companies are usually owned by the government.