**Spiekermann & Wegener**
Urban and Regional Research

Lindemannstraße 10
D-44137 Dortmund

Tel. +49 231 1899 439/441
Fax +49 231 1899 443

Klaus Spiekermann
Michael Wegener

# Regional impacts of a railway tunnel between Helsinki and Tallinn

***Final Report***

of a
**Quantitative Impact Assessment**

in the course of the
**Central Baltic Interreg IVA project**
**Helsinki-Tallinn Transport and Planning Scenarios (H-TTransPlan)**

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## Contents

# 1 Introduction

The Aalto University Department of Surveying and Planning, YTK Land Use Planning and Urban Studies Group participates in the Central Baltic Interreg IVA project H-TTransPlan - Helsinki-Tallinn Transport and Planning Scenarios. Spiekermann & Wegener, Urban and Regional Research (S&W) support the Aalto University with a quantitative impact assessment on the combined effects of a possible railway tunnel between Helsinki and Tallinn on the development of this region and beyond. This report is the Interim Report of the project which presents the methodology, the scenarios and first preliminary results.

A couple of aspects are to be included in the quantitative impact assessment, such as:

- a long-term perspective (until 2050),
- the consideration of EU-wide development conditions,
- the consideration of external factors
- the calculation of different framework scenarios (high, low dynamic),
- the variation of transport networks (tunnel link, Rail Baltica, other TEN-T projects),
- a differentiated regional perspective (with focus on the twin-region Helsinki-Tallinn)
- a map-based representation of results.

These aspects are treated in the specific combination of the simulation model used, the scenarios defined and the way the results will be presented.

It was agreed to use the regional economic simulation model SASI to forecast spatial, socio-economic and environmental impacts of different scenarios. Basic features of the model are explained in Chapter 2 of this Interim Report.

The study considers different combinations of the development of Europe-wide framework conditions, in particular on possible dynamics of the European economy, and possible future developments of the Europe-wide transport infrastructure including assumptions on the development of Rail Baltica and the existence of a rail tunnel between Helsinki and Tallinn. Chapter 3 presents the resulting scenarios to be investigated.

The scenarios as defined in Chapter 3 were implemented in the database for the SASI model, in particular the transport infrastructure scenarios were coded in the transport networks of the model. Results of the simulation of the scenarios are presented in Chapter 4. Chapter 5 draws conclusions from the results of the analysis. The Appendix contains two tables summarising the results in numbers.

## 2 SASI model

The SASI model is a recursive-dynamic simulation model of socio-economic development of NUTS-3 regions in Europe subject to exogenous assumptions about the economic and demographic development of the European Union as a whole and transport infrastructure investments and transport systems improvements.

The model has been applied and validated in several large EU projects including IASON (Integrated Appraisal of Spatial Economic and Network Effects of Transport Investments and Policies), several projects of the European Spatial Planning Observation Network (ESPON), SETI - Strategic Evaluation of Transport Investment Priorities under Structural and Cohesion Funds for the Programming Period 2007-2013 for DG REGIO (Ecorys, 2006) and Ex-ante Evaluation of the TEN-T Multi-Annual Programme 2007-2013 for DG TREN. Of specific relevance for this study on the impacts of a possible rail tunnel between Helsinki and Tallinn is the project AlpenCorS: Modelling Regional Development in Alpen Corridor South (Spiekermann and Wegener, 2005) in which the SASI model was used to assess the regional economic effects of the Brenner tunnel and associated infrastructure.

The SASI Model integrates a couple of features that are unique in their combination:

- The SASI model differs from other approaches to model the impacts of transport on regional development by modeling not only GDP per capita based on six economic sectors, but also employment (the demand side of regional labour markets) and population (the supply side of regional labour markets). The population part of the SASI model is composed of a submodel for natural population development and a migration submodel in which migrants react on regional assets such as the regional labour market, regional welfare and regional attractiveness.
- A second distinct feature of the SASI model is its dynamic strategic network database for pan-European road, rail and air networks including major historical network changes as far back as 1981 and forecasting expected network changes according to the most recent EU documents on the future evolution of the trans-European transport networks.
- The dynamic SASI model uses short time periods of one year duration and thus can take both short- and long-term lagged impacts into account. This dynamic structure enables also the phasing of infrastructure policies over time as input for the model.
- The SASI Model is able to study Europe-wide policy issues, such as European transport and cohesion policy, but, due to its relatively high spatial resolution, it can be applied also to smaller study areas at the level of European subregions, countries or parts of countries.
- Also distinct from most other regional economic models for Europe are the broad analytical and presentation facilities of the SASI model. The model software provides options for presenting results of single scenarios in the form of maps and diagrams and for comparing results of a group of scenarios in the form of combined diagrams or difference maps for Europe as a whole or for selected countries or macro-regions. Maps are presented at the NUTS-3 level.

### *Study region*

The current study area of the model are the 27 countries of the European Union plus Norway and Switzerland and the western Balkan countries Albania, Bosnia-Herzegovina, Croatia, Macedonia and Serbia and Montenegro. The SASI model forecasts accessibility and GDP per capita of 1,330 NUTS-3 or equivalent regions in the study area. (see Figure 1). These 1,330 regions are the 'internal' regions of the model. The remaining European countries are the 'external' regions, which are used as additional destinations when calculating accessibility indicators.

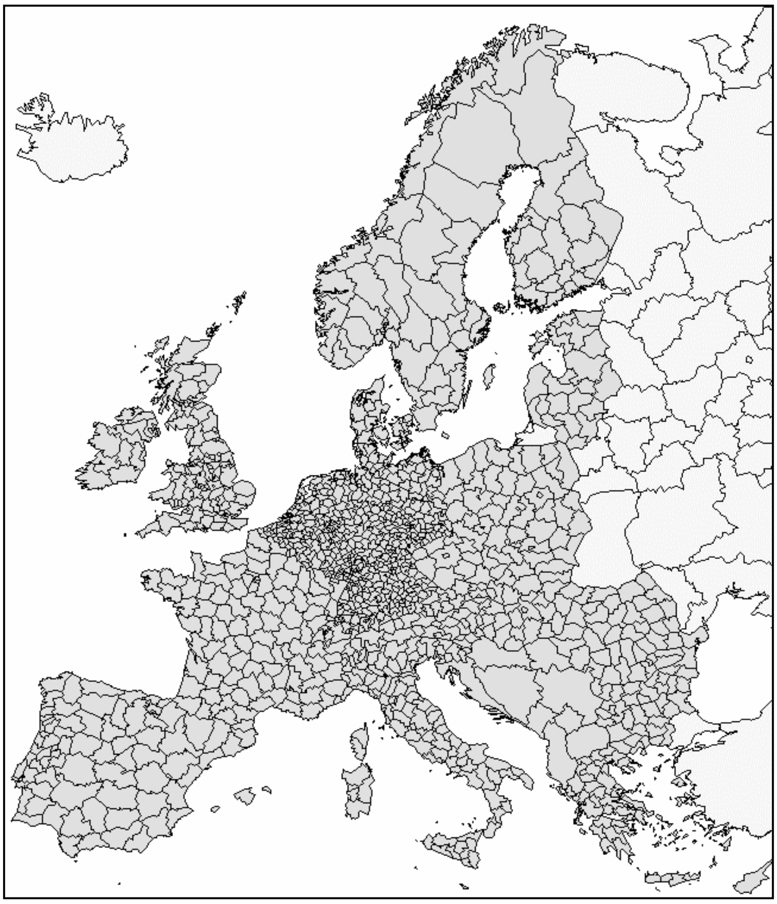

Figure 1. The SASI system of regions

The spatial dimension of the system of regions is established by their connection via networks. In SASI road (including short-sea shipping), rail and air networks are considered. The 'strategic' road and rail networks used in SASI are subsets of the pan-European road and rail networks developed by the Institute of Spatial Planning of the University of Dortmund (IRPUD) maintained by RRG Büro für Raumforschung, Raumplanung und Geoinformation (http://www.brrg.de). The 'strategic' road and rail networks contain all TEN-T links according to the most recent EU planning documents and the east European road and rail corridors by the TINA consortium as well as additional links selected for connectivity reasons (see Figure 2).

### *Model description*

The SASI model (Wegener and Bökemann, 1998; Bröcker et al., 2004a; 2004b; Wegener, 2008) differs from other approaches to model the impacts of transport on regional development by modelling not only production (the demand side of regional labour markets) but also population (the supply side of regional labour markets). The impacts of transport infrastructure investments and transport system improvements on regional production and other transport policies is modelled by regional production functions in which, besides non-transport regional endowment factors, sophisticated spatially disaggregate accessibility indicators are included.

The model does not only represent spatial redistribution effects of transport policies within the European Union but also generative effects on the European economy as a whole. Although the model does not contain a full transport submodel, it does take account of network congestion in urbanised areas. The model has six forecasting submodels (see Figure 3):

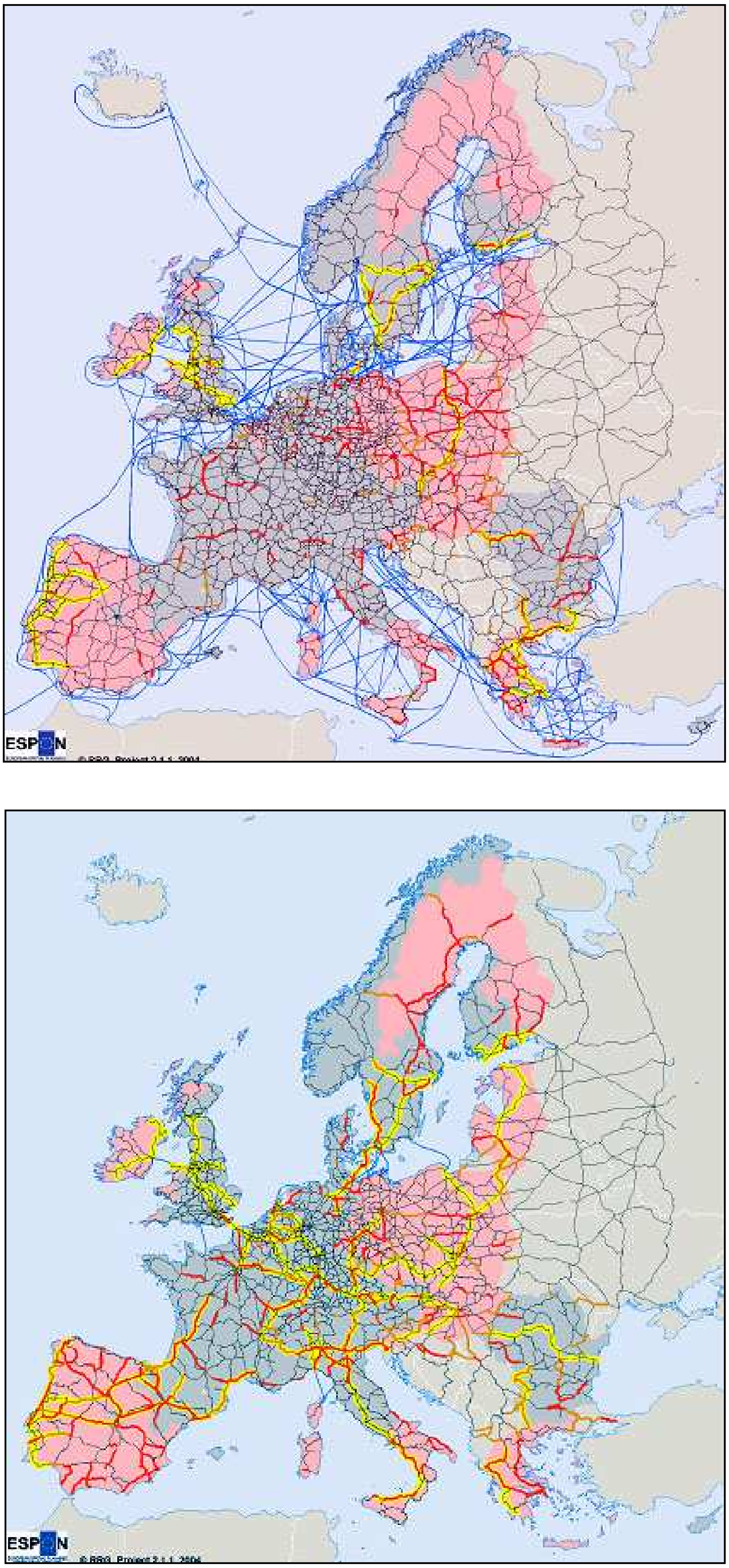


Figure 2. The SASI road (top) and rail (bottom) networks

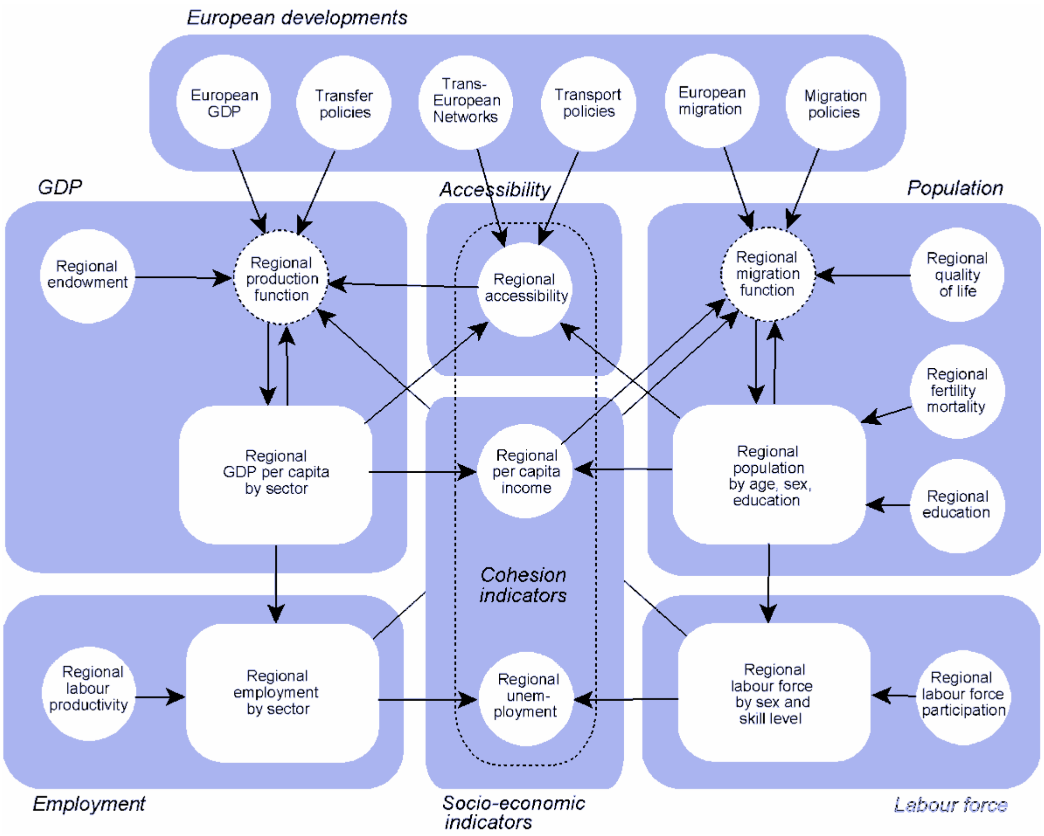


Figure 3. The SASI model

- In the *European Developments* submodel, assumptions about European developments are entered: future performance of the European economy as a whole, level of immigration and outmigration across Europe's borders and policy decisions on the trans-European networks. They serve as constraints to ensure that the regional forecasts of economic development and population are consistent with external developments not modelled.

- The *Regional Accessibility* submodel calculates regional accessibility indicators expressing the locational advantage of each region with respect to relevant destinations in the region and in other regions as a function of travel time and travel cost to reach these destinations by the strategic road, rail and air networks.

- The *Regional GDP* submodel is the core of the SASI model. It forecasts gross domestic product (GDP) per capita by six industrial sectors (agriculture, manufacturing, construction, transport and tourism, financial services and other services) generated in each region as a function of endowment indicators and accessibility. Endowment indicators measure the suitability or capacity of the region for economic activity: they include traditional location factors such as availability of skilled labour and business services, capital stock (i.e. production facilities) and intraregional transport infrastructure as well as 'soft' location factors such as indicators describing the spatial organisation of the region, i.e. its settlement structure and internal transport system, institutions of higher education and cultural facilities and quality of life.

- The *Regional Employment* submodel computes regional employment from regional GDP by exogenous forecasts of regional labour productivity by industrial sector (GDP per worker).

- In the *Regional Population* submodel births and deaths are modelled by a cohort-survival model subject to exogenous forecasts of regional fertility and mortality rates. Interregional migration within the European Union is modelled in a migration model

- The *Regional Labour Force* submodel computes regional labour force from regional GDP and exogenous forecasts of regional labour force participation rates modified by effects of regional unemployment.

A seventh submodel calculates socio-economic indicators. For each region the model forecasts the development of accessibility and GDP per capita in one-year increments until the forecasting horizon, which presently is 2031 but is planned to be extended to 2050. In addition cohesion and polycentricity indicators expressing the impact of transport infrastructure investments and transport system improvements on the convergence (or divergence) of socio-economic development in the regions and cities of the European Union are calculated.

***Inputs and outputs***

The data required to perform a typical simulation run with the SASI model can be grouped into base-year data and time-series data. Base-year data describe the state of the regions and the strategic road, rail and air networks in the base year 1981. Time-series data describe exogenous developments or policies defined to control or constrain the simulation. They are collected or estimated from actual events for the time between the base year and the present and are assumptions about future developments or policies between the present and the forecasting horizon. Exogenous assumptions are required concerning total economic development in the reference scenario, changes in regional labour productivity, regional educational attainment and regional labour force participation. These forecasts and assumptions can be taken from other sources, such as official forecasts, or defined in the form of explorative scenarios. Network data specify the road, rail and air networks used for accessibility calculations and the evolution of the networks over the simulation period.

Output of the SASI model includes regional accessibility, GDP per capita and cohesion and polycentricity indicators presented in tables, time-series diagrams and maps. Sample outputs can be seen in the sources given in the reference lists.

## 3 Scenarios

The scenarios investigated in this study are combinations of variations of two components, i.e. economic dynamic of Europe and Europe-wide transport infrastructure development. To do so, different framework scenarios on the overall future economic development path of Europe on the one hand were linked to variations of future transport network evolution on the other. The target year of the scenarios is 2050.

The definition of the economic dynamics is taken from the scenario study within H-TTransPlan (Terk, 2012). Here two economic framework scenarios are assumed: one with lower economic dynamics of less than 2 % yearly average growth in the north-European region and one with high dynamics with 3.3 % yearly average growth.

For the future transport network evolution, first, a Reference Scenario was defined which includes a modest development of transport infrastructure in Europe. In the Reference Scenario it is assumed that the current TEN-T core network proposed by the European Commission (2011) will be implemented. However, the Rail Baltica which is part of the core network is not part of the Reference Scenario.

Based on the Reference Scenario, the other transport network scenarios assume additional network elements to be implemented. Three more transport network scenarios were defined:

(1) This scenario includes all elements of the reference scenario plus the implementation of the Rail Baltica, i.e. the development of the full TEN-T core network is assumed. The comparison of this scenario with the Reference Scenario allows the assessments of the isolated effects of the Rail Baltica.

(2) This scenario includes all elements of Scenario 1 plus the additional implementation of a rail tunnel link under the Baltic Sea between Helsinki and Tallinn by 2036. It is assumed that the rail travel time between Helsinki and Tallinn will be 30 minutes. The comparison of this scenario with Scenario 1 allows the assessment of the isolated effect of this tunnel. The comparison of this scenario with the Reference Scenario allows the assessment of the combined effects of the Rail Baltica plus the rail tunnel between Helsinki and Tallinn.

(3) This scenario includes all elements of Scenario 2 plus the full implementation of the trans-European transport network as currently under discussion. The comparison of this scenario with the other scenarios allows the assessment of the effects of a TEN-T implementation beyond the core network.

The combination of economic and transport infrastructure scenarios results is a matrix of scenarios as indicated in Table 1.

*Table 1. Scenario matrix.*

| ***Economic dynamic*** *(average yearly growth rate)* | ***Transport Network Scenario*** | | | |
|---|---|---|---|---|
| | *Reference TEN-T core network without Rail Baltica* | *Scenario 1 Rail Baltica (incl. Reference Scenario)* | *Scenario 2 Rail tunnel Helsinki-Tallinn (incl. Scenario 1)* | *Scenario 3 Full implementation of TEN-T (incl. Scenario 2)* |
| *Low (2 %)* | L0 | L1 | L2 | L3 |
| *High (3.3 %)* | H0 | H1 | H2 | H3 |

## 4 Results

The scenario matrix as defined in Table 1 were implemented in the database for the SASI model. The four different network scenarios were coded in the dynamic network database, the framework scenarios on the overall economic development in Europe were included in the European development submodel of the SASI model.

Figures 4 to 15 on the following pages demonstrate the basic results of the SASI model by taking the low economic development as illustration example. The figures show the effects of the implementation of the different transport infrastructure scenarios on regions' accessibility and GDP per capita, respectively: The figures show differences between the three network scenarios L1, L2 and L3 and the Reference Scenario L0.

Figures 4 and 5 show the spatial distribution of accessibility and GDP per capita (in Euro of 2010) in northern Europe as projected by the SASI model for the year 2051 in the Reference Scenario L0. The main observation is that spatial patterns in the continent change only very slowly. Accessibility in 2051 will, as today be heavily concentrated in western Europe, irrespective of the immense investments in transport infrastructure assumed even in the Reference Scenario L0  The same applies to economic development. While the new EU member states that joined the EU in 2004 and 2007 grow faster in percentage terms than the old member states, they will, because of their lower starting values, continue to have lower GDP per capita in 2051, even despite massive EU expenditures in subsidies form the Structural Funds benefiting predominantly the countries with lower GDP per capita.

The Reference Scenario L0 contains already all elements of the European TEN-T core network except the Rail Baltica. The introduction of the Rail Baltica in Scenario L1 is the only change compared to the Reference Scenario L0, thus a comparison of Scenario L1 with the Reference Scenario L0 allows to analyse the isolated effects of the Rail Baltica. Figure 6 shows the accessibility gains of the Rail Baltica, Figure 7 shows the resulting GDP changes. It can be seen that the three Baltic States are the main beneficiaries of the Rail Baltica; their combined road and rail accessibility grows by between 10 and 30 percent. This is a stimulus to the economies of the three states; in terms of GDP per capita they grow by between 0.5 and 3 percent per annum compared to the situation without the Rail Baltica.

Compared with Scenario L1, Scenario L2 contains the rail tunnel between Helsinki and Tallinn as only additional transport network component. Figures 8 and 9 isolate the effects of the tunnel by comparing accessibility and GDP per capita not with the Reference Scenario L0 but with Scenario L1 with the Rail Baltica. The effect is striking: almost exclusively Finland is the winner as it is now better connected to the rest of the continent, whereas Estonia, Latvia and Lithuania do not benefit much.

It can be seen that the impacts on accessibility of the Helsinki region and, to a slightly lesser degree of the other regions of Finland and northern Sweden are substantial: these regions become significantly better linked to central, southern and western Europe. The accessibility effects of Tallinn and the rest of Estonia are less pronounced as the potential of the regions north of the tunnel are smaller. However, these small accessibility effects spread through all east European countries and even into Germany.

Figure 9 confirms the widely found empirical evidence that even significant improvements of regional accessibility translate into only comparably small gains in additional economic growth. And not surprisingly, given the unequal accessibility gains on each side of the tunnel, the main winners are the Finnish regions reaching far to the north in the country. These gains between 1 and

3 percent of regional GDP per capita may seem small, however, it has to be considered that in an affluent country as Finland, an additional annual income of one percent will represent about 1,000 Euro per capita per year (in Euro of 2010).

Figures 10 and 11 show the combined effects of the Rail Baltica and the tunnel on regional accessibility and GDP per capita. As to be expected, the combined effects are larger than if the two infrastructure projects are analysed separately. Now both Finland and the Baltic states are linked better both to the rest of Europe and between each other.

Finally, Scenario L3 contains all elements of the previous scenarios plus an implementation of more European transport infrastructure projects as currently under discussion in the revision of the TEN-T plans. Thus, comparing Scenario L3 with the Reference Scenario L0 gives the effects of the Rail Baltica and the Helsinki-Tallinn rail tunnel in the context of a very advanced implementation of European transport infrastructure. Figures 12 and 13 show the resulting accessibility changes and GDP changes. Now the accessibility and economic effects of the Rail Baltica and the Helsinki-Tallinn tunnel are embedded in a general growth of accessibility, and subsequent economic growth over all of eastern Europe.

It may have been noticed that in all scenarios including the Rail Baltica the region southwest of Tallinn (NUTS-3 region EE004 with the cities of Haapsalu and Pärnu) performs better in terms of both accessibility and GDP impacts than Tallinn itself. This is explained by the fact that this region is rather isolated before the Rail Baltica and will be much better linked after its introduction. Needless to say that this advantage will not similarly benefit the islands of Hiiumaa and Saaremaa, as the maps suggest, this is merely an artefact of the NUTS-3 region system..

One further reservation has to be made when interpreting the results. The rail tunnel between Helsinki and Tallinn will not link two relatively central regions like for instance the Brenner Tunnel but would link two remote regions. Accordingly, it can be expected, as shown in Figure 8, that the more remote regions of the two tunnel sides would benefit more in terms of Europe-wide accessibility and accordingly GDP than the slightly more centrally located regions south of the tunnel because for the latter regions the additional accessibility potential stemming from more remote and sparsely populated regions on the other side of the tunnel is much lower.

Figure 14 and 15, finally, compare the results of the four scenarios in compact time-series trajectories between 1981 and 2051. In both diagrams the heavy black line indicates the aggregate results for the four countries, Finland and the three Baltic States. The coloured lines represent the development in the three policy scenarios L1, L2 and L3. Figure 14 shows the development of accessibility. It can be seen that, like all European countries the four countries benefited from the large investments in the trans-European transport networks (TEN-T) after 2006. With the implementation of the Rail Baltica, Scenarios L1, L2 and L3 separated from the Reference Scenario. The significant gain in accessibility through the implementation of the Helsinki-Tallinn tunnel after 2036 is clearly visible. Figure 15 demonstrates again that even large gains in accessibility translate in only relatively small gains in GDP per capita, though, as it has been pointed out earlier, if expressed in annual gains in income, the improvements are quite substantial.

It may be asked why all these impacts of transport infrastructure are illustrates using only the moderate-growth scenarios L0, L1, L2 and L3. The reason is that the executed simulations of the high-growth scenarios H0, H1, H2 and H3 resulted in only minimal different results in percentage terms; in other words the maps would have looked very much the same, although the underlying absolute GDP numbers would have been higher.

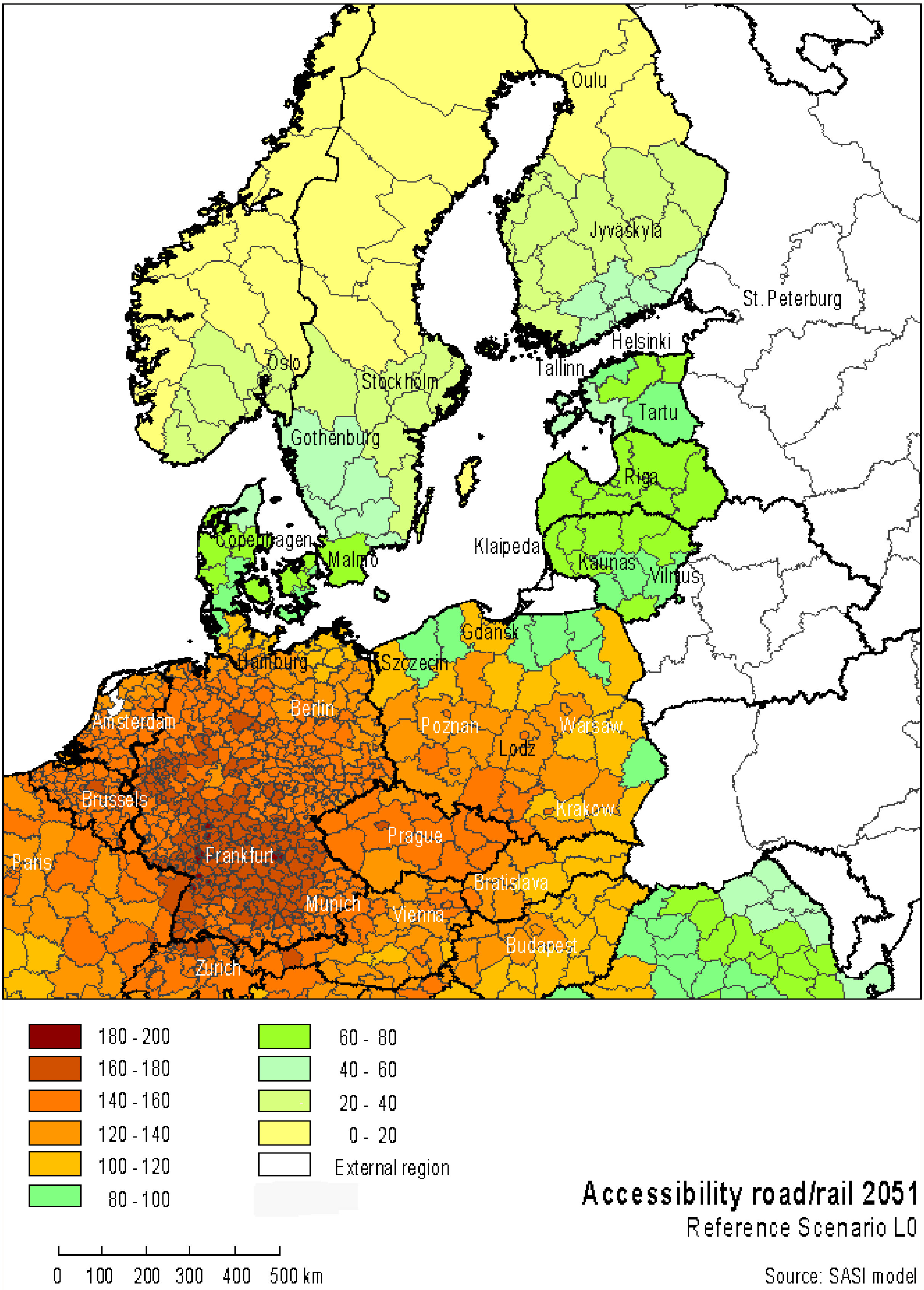


Figure 4. Accessibility road/rail in the Reference Scenario L0 in 2051

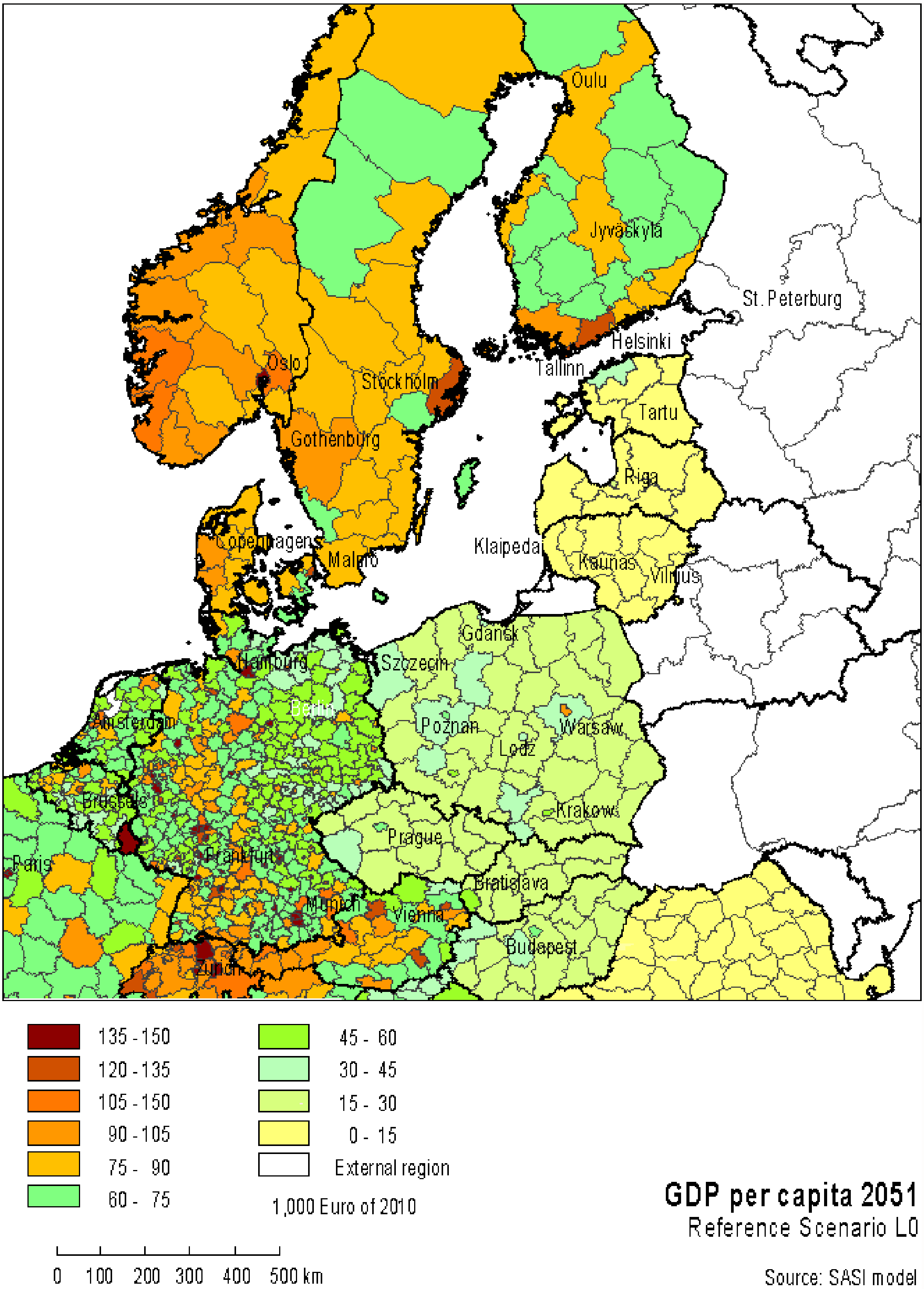


Figure 5. GDP per capita (in 1,000 Euro of 2010) in the Reference Scenario L0 in 2051

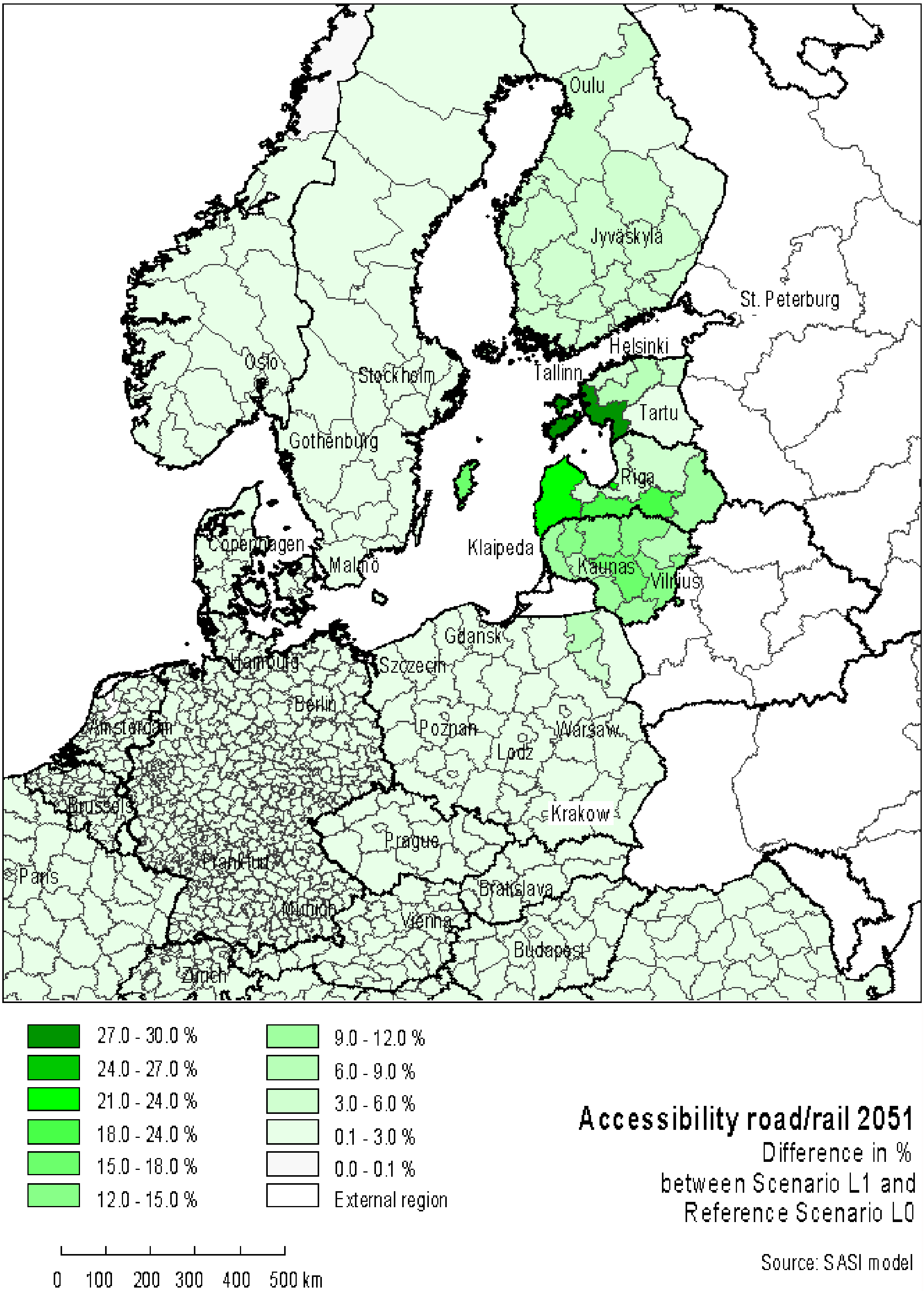


Figure 6. Isolated spatial impact of the Rail Baltica: Accessibility road/rail in 2051. Difference in accessibility between Scenario L1 and Reference Scenario L0 in percent

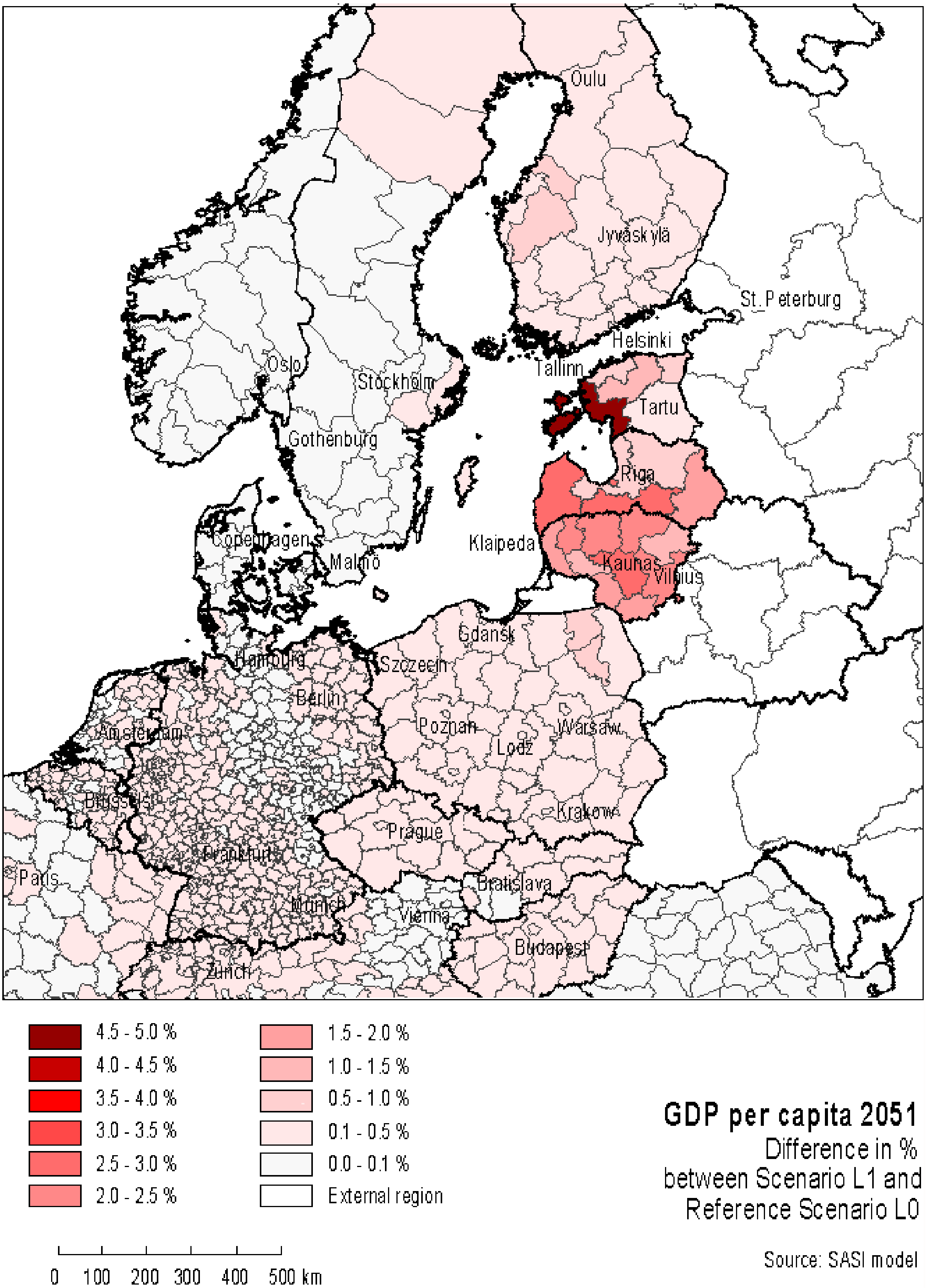


Figure 7. Isolated spatial impact of the Rail Baltica: GDP per capita in 2051. Difference in GDP per capita between Scenario L1 and Reference Scenario L0 in percent

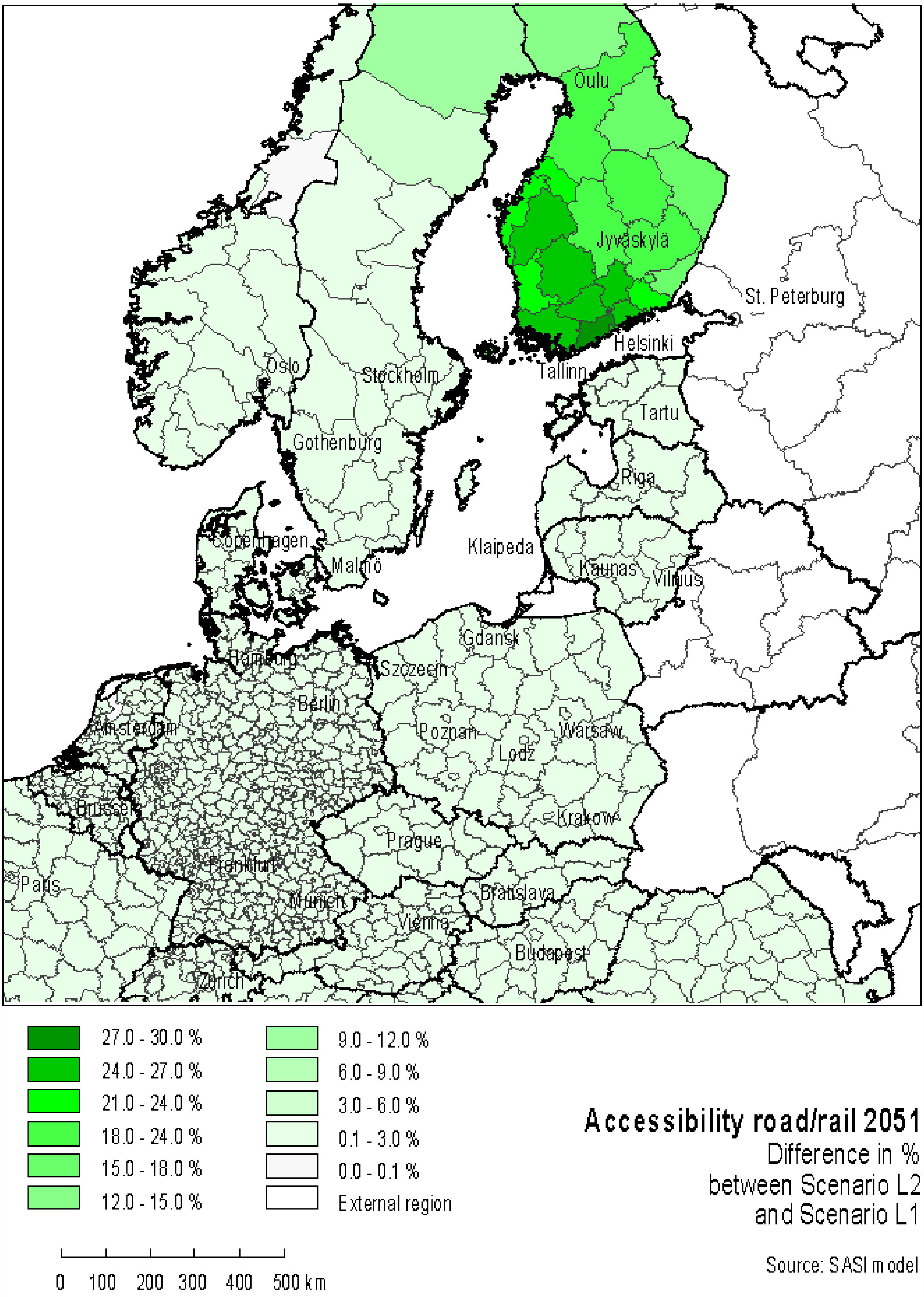


Figure 8. Isolated spatial impact of a rail tunnel Helsinki-Tallinn: Accessibility road/rail in 2051. Difference in accessibility between Scenario L2 and Scenario L1 in percent

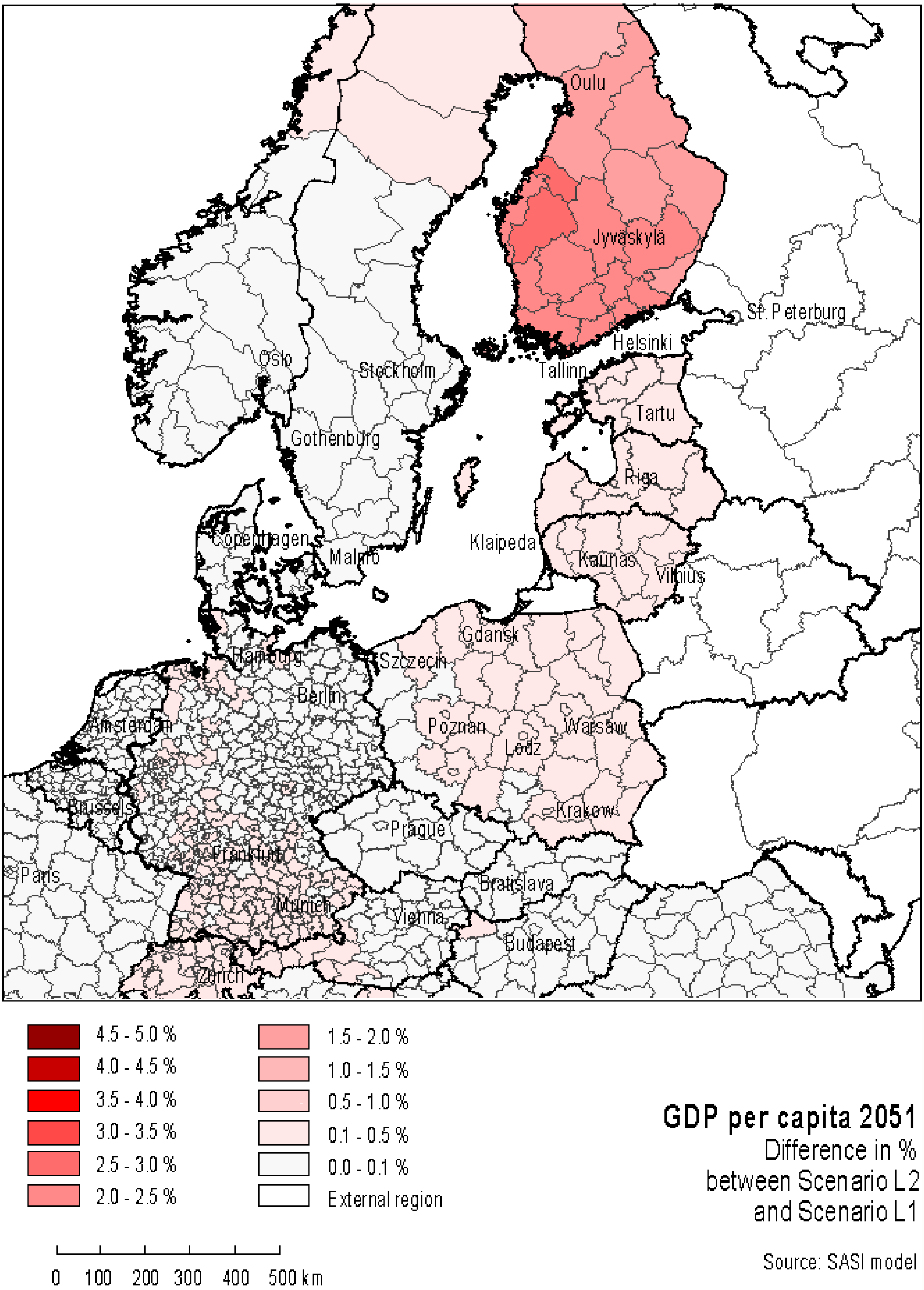


Figure 9. Isolated spatial impact of a rail tunnel Helsinki-Tallinn: GDP per capita in 2051. Difference in accessibility between Scenario L2 and Scenario L1 in percent.

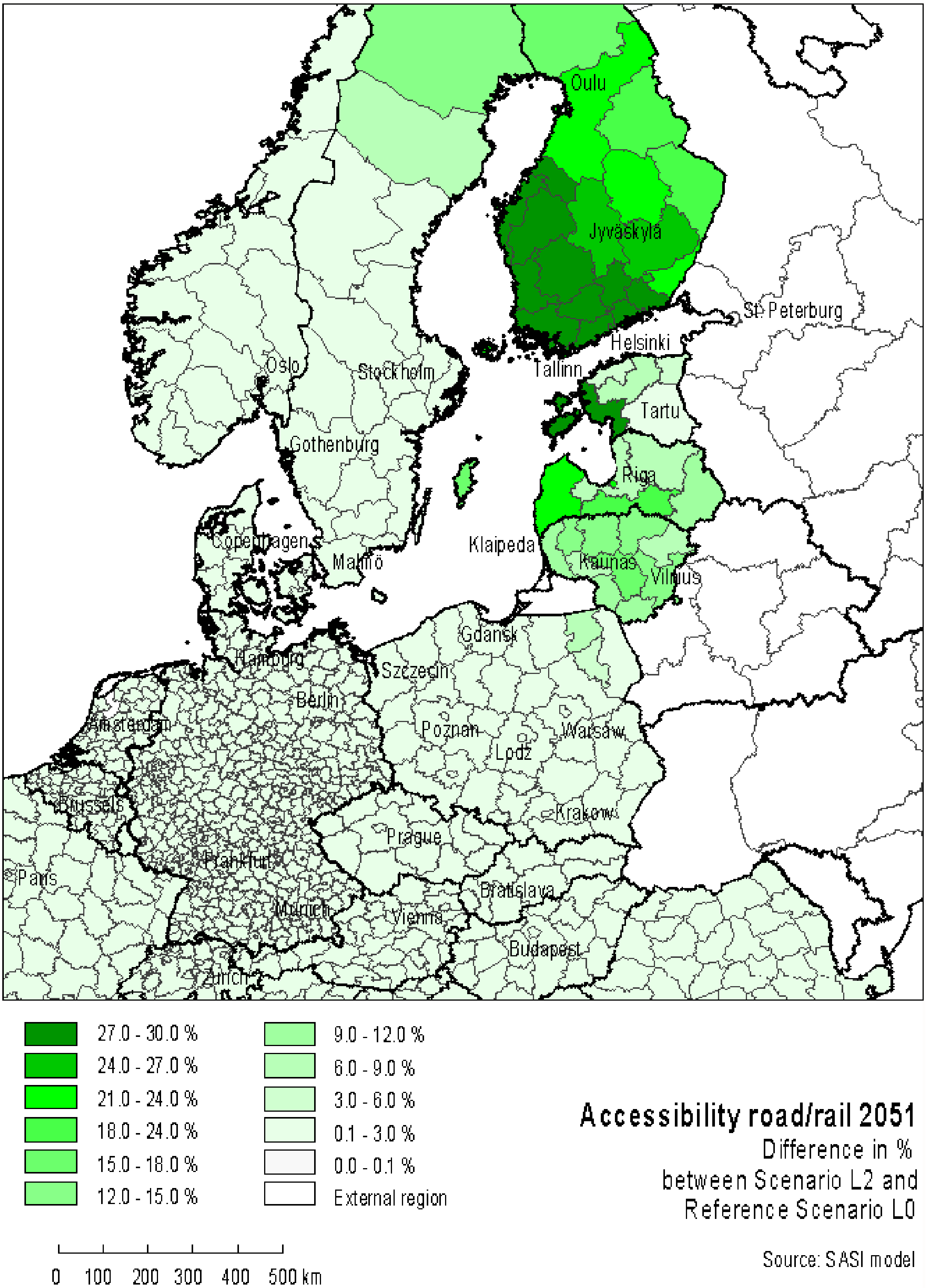


Figure 10. Isolated spatial impact of a combined implementation of Rail Baltica and a rail tunnel Helsinki-Tallinn: Accessibility road/rail in 2051. Difference in accessibility between Scenario L2 and Reference Scenario L0 in percent

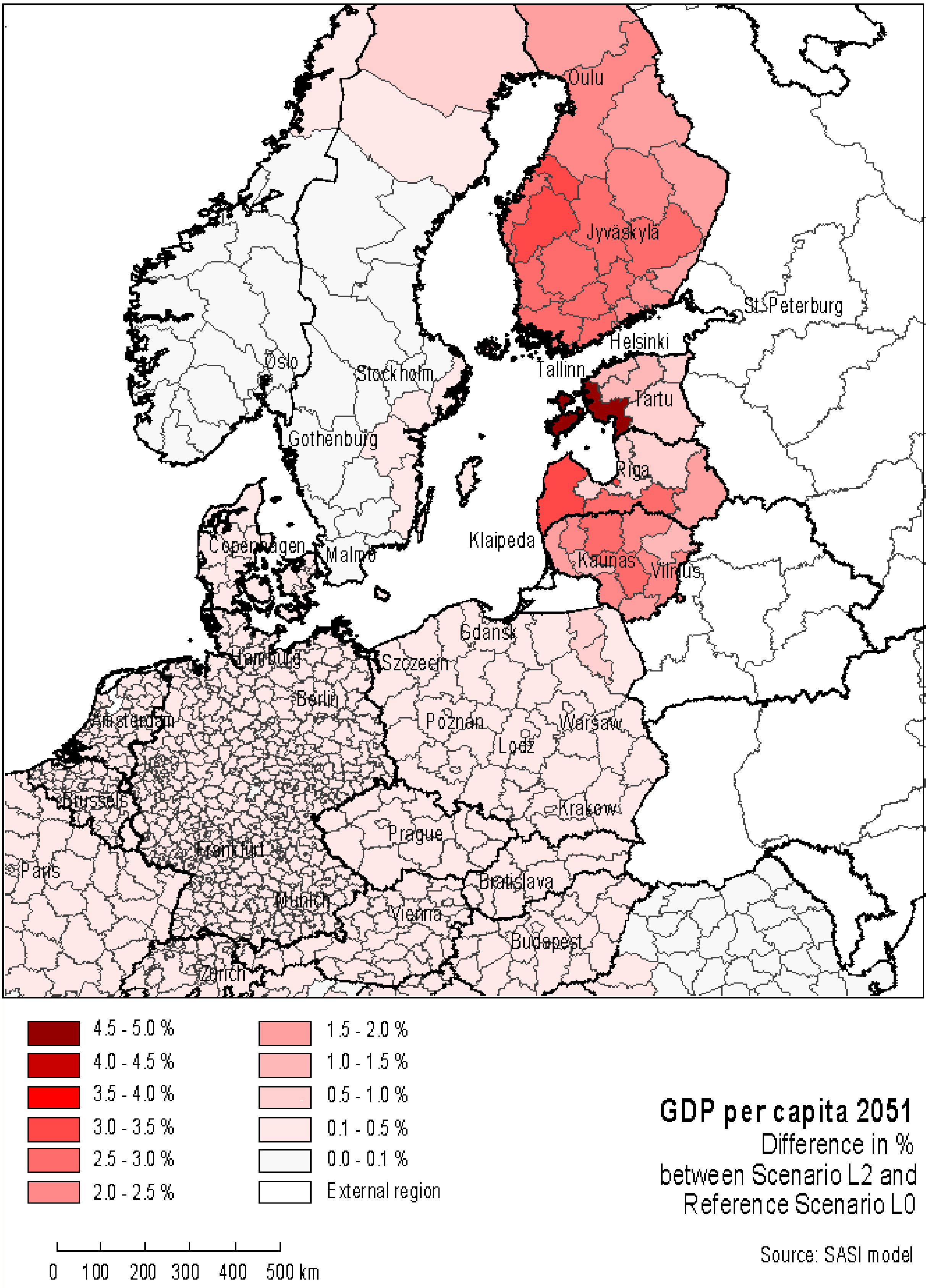


Figure 11. Isolated spatial impact of a combined implementation of Rail Baltica and a rail tunnel Helsinki-Tallinn: GDP per capita in 2051. Difference in GDP per capita between Scenario L2 and Reference Scenario L0 in percent

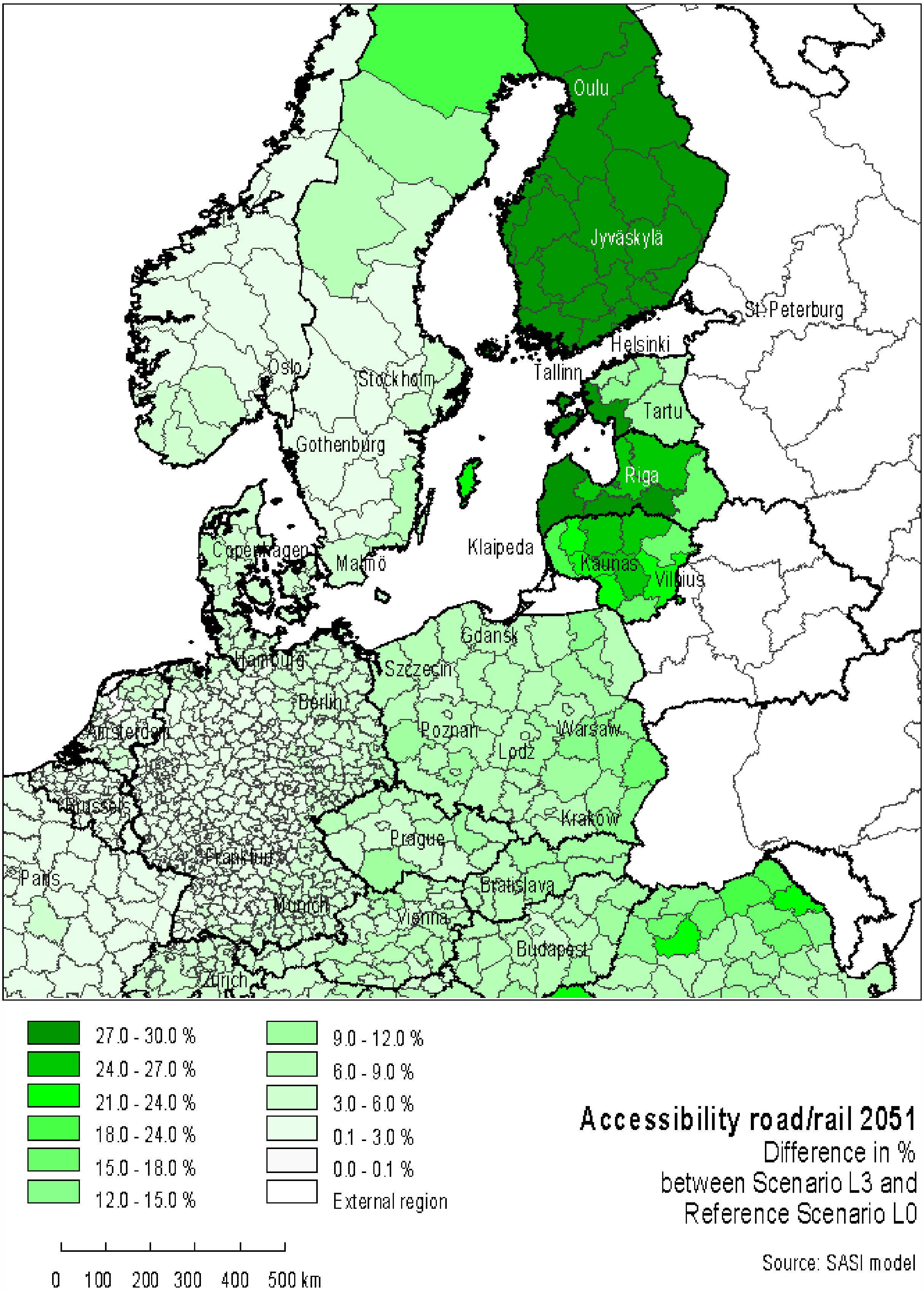


Figure 12. Spatial impact of a combined implementation of Rail Baltica, a rail tunnel Helsinki-Tallinn and further European transport infrastructure links: Accessibility road/rail in 2051. Difference in accessibility between Scenario L3 and Reference Scenario L0 in percent

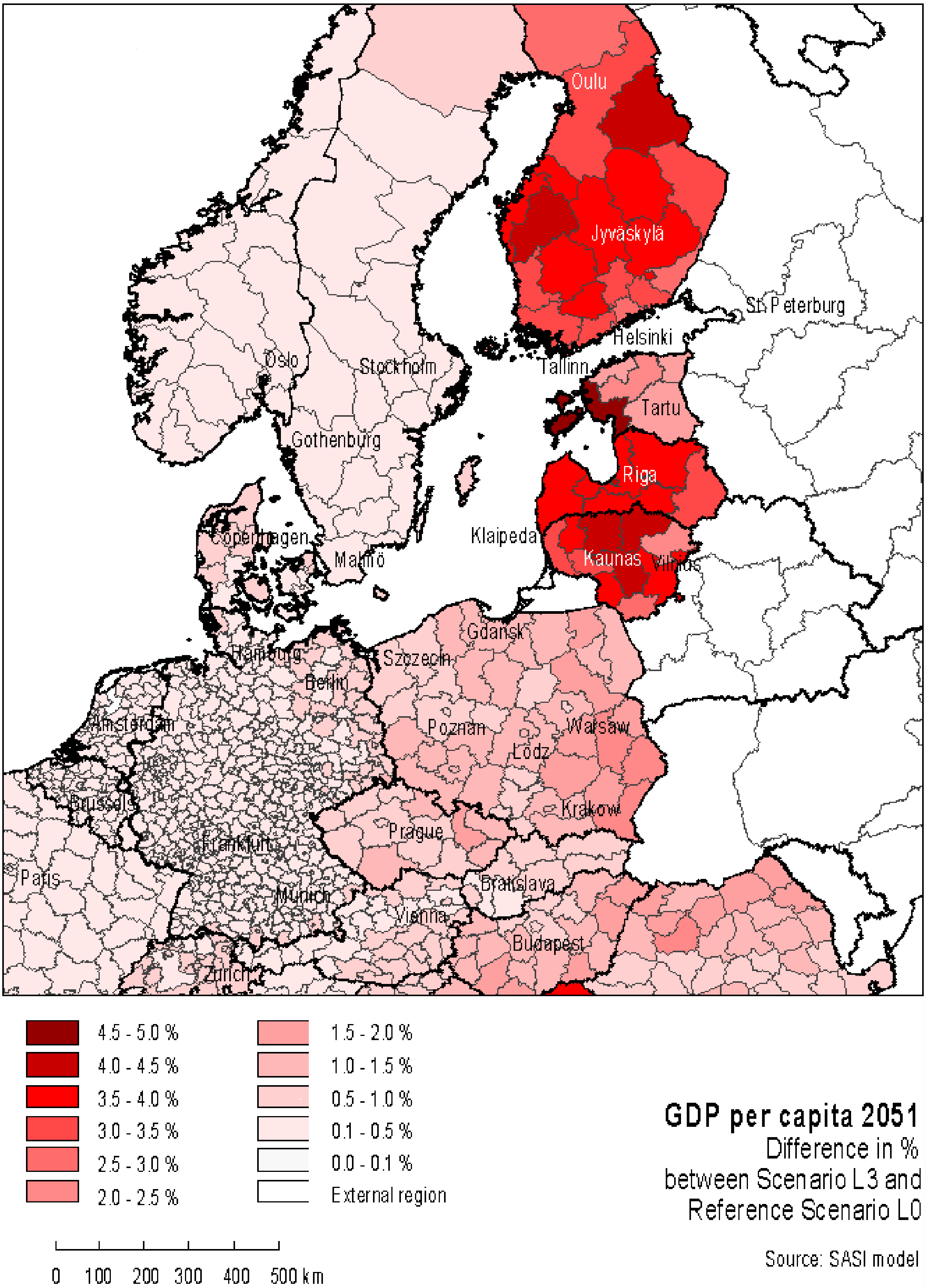


Figure 13. Spatial impact of a combined implementation of Rail Baltica, a rail tunnel Helsinki-Tallinn and further European transport infrastructure links: GDP per capita in 2051.Difference in GDP per capita between Scenario L3 and Reference Scenario L0 in percent

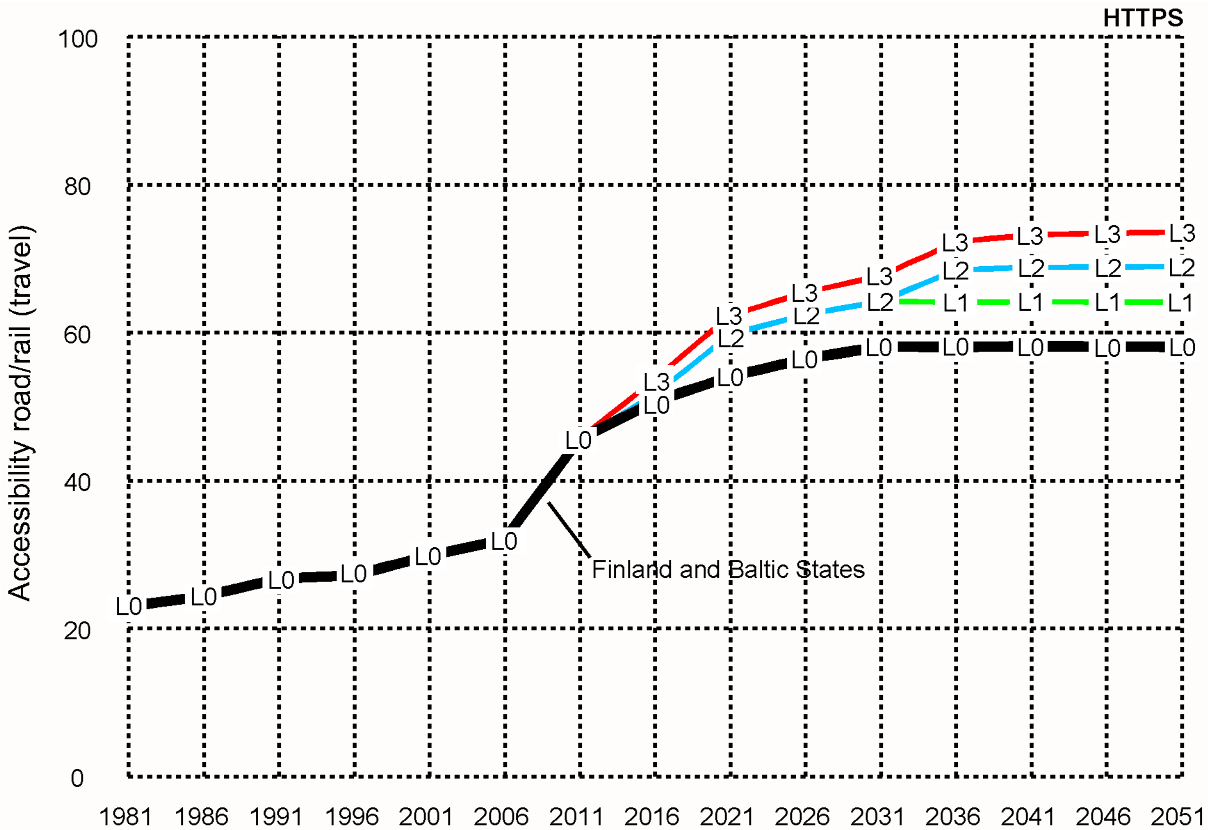


Figure 14. Accessibility road/rail 1981-2051: comparison of scenarios L0-L3

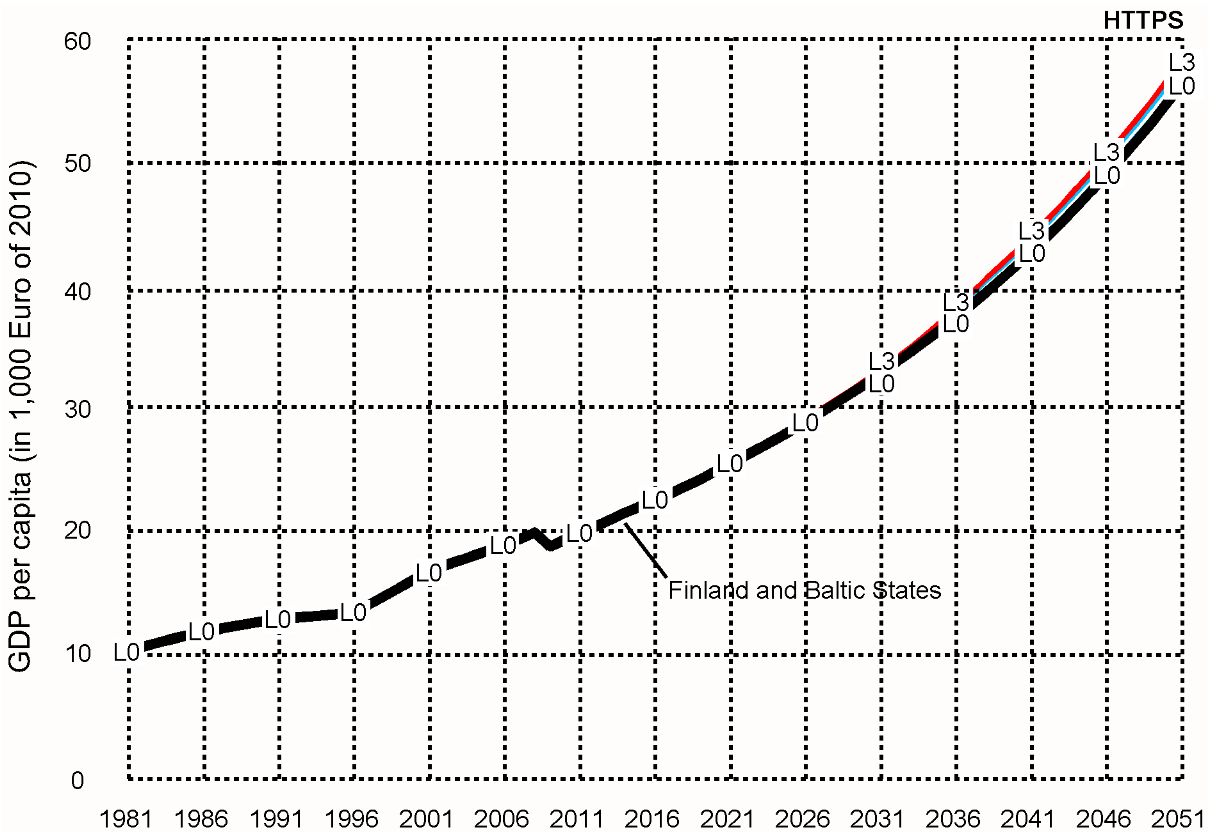


Figure 15. GDP per capita: comparison of scenarios L0-L3

## 5 Conclusions

The analysis of the likely impacts of the envisaged rail tunnel between Helsinki and Tallinn, alone and in combination with other expected transport infrastructure improvements, has shown that it would have a substantial positive effect on both European accessibility and economic development.

However, its positive impacts would be largely concentrated on the Finnish side, as Finland would gain much in connectivity to central, eastern and southern Europe, whereas Estonia would gain only better access to Finland. Only when combined with the rail Baltica and other transport infrastructure improvements, also Estonia would significantly improve in accessibility and GDP.

It also has become apparent that even large improvements in accessibility translate into only rather small gains in economic activity. Yet it has to be considered that these additional revenues accrue to every citizen every year. It is also important to note that the model results do not include the employment effects due to the construction work for the Rail Baltica and the tunnel.

In addition, as it has been pointed out in the Interim Report, the relative accessibility changes through the rail tunnel look different if the destinations of interest are limited to destinations in the Helsinki-Tallinn macro region. In that perspective, Tallinn and other regions of Estonia would benefit from the fast rail connection with the larger Helsinki metropolitan area.

In summary, the rail tunnel between Helsinki and Tallinn would be successful in linking Finland closer to the European mainland and linking Helsinki and Tallinn into one integrated metropolitan region.

## 6 Appendix

The Appendix contains tables of accessibility and GDP per capita in the NUTS-2 regions of Finland and the NUTS-3 regions of Estonia, Latvia and Lithuania of the Reference Scenario L0 as projected by the SASI model for 2051 and the percentage changes compared with the Reference Scenario of the three policy scenarios L1, L2 and L3.

Table A1. Accessibility road/rail: comparison between scenarios

| Region | | Reference Scenario L0 2051 | Difference between Scenarios L1, L2 and L3 and Reference Scenario L0 in 2051 (%) | | |
|---|---|---|---|---|---|
| | | | L1 | L2 | L3 |
| EE001 | Põhja-Eesti | 90.1 | +5.09 | +5.86 | +10.32 |
| EE004 | Lääne-Eesti | 59.9 | +28.15 | +28.96 | +34.56 |
| EE006 | Kesk-Eesti | 67.1 | +6.66 | +7.29 | +14.05 |
| EE007 | Kirde-Eesti | 74.0 | +3.40 | +3.86 | +8.79 |
| EE008 | Lõuna-Eesti | 80.5 | +2.36 | +2.93 | +10.22 |
| **EE** | **Estonia** | **79.6** | **+6.38** | **+7.05** | **+12.61** |
| FI13 | Ita-Suomi | 29.6 | +3.07 | +21.42 | +36.84 |
| FI18 | Etelä-Suomi | 48.9 | +4.66 | +32.08 | +39.22 |
| FI19 | Länsi-Suomi | 32.6 | +4.18 | +29.05 | +37.68 |
| FI1A | Pohjois-Suomi | 16.0 | +3.26 | +22.59 | +31.03 |
| FI20 | Aland | 22.6 | +3.17 | +21.66 | +27.07 |
| **FI** | **Finland** | **34.6** | **+4.20** | **+29.04** | **+37.61** |
| LT001 | Alytaus | 78.3 | +10.18 | +10.51 | +17.85 |
| LT002 | Kauno | 82.9 | +17.1 | +17.51 | +25.2 |
| LT003 | Klaipedos | 74.3 | +10.27 | +10.63 | +18.30 |
| LT004 | Marijampoles | 84.9 | +11.55 | +11.92 | +21.82 |
| LT005 | Panevezio | 70.5 | +12.91 | +13.29 | +24.26 |
| LT006 | Siauliu | 75.1 | +14.05 | +14.47 | +24.45 |
| LT007 | Taurages | 74.0 | +7.44 | +7.76 | +22.12 |
| LT008 | Telsiu | 70.4 | +12.87 | +13.27 | +21.12 |
| LT009 | Utenos | 65.9 | +7.60 | +7.90 | +15.64 |
| LT00A | Vilnius | 80.3 | +14.5 | +14.90 | +22.95 |
| **LT** | **Lithuania** | **77.4** | **+13.38** | **+13.76** | **+22.40** |
| LV003 | Kurzeme | 57.1 | +13.14 | +13.57 | +21.88 |
| LV005 | Latgale | 69.1 | +9.46 | +9.85 | +17.09 |
| LV006 | Riga | 75.6 | +22.57 | +23.16 | +31.07 |
| LV007 | Pieriga | 67.6 | +21.83 | +22.41 | +29.63 |
| LV008 | Vidzeme | 63.1 | +6.00 | +6.45 | +25.02 |
| LV009 | Zemgale | 68.0 | +19.4 | +19.96 | +27.02 |
| **LV** | **Latvia** | **68.6** | **+17.3** | **+17.82** | **+26.51** |

Table A2. GDP per capita (1,000 Euro of 2010): comparison between scenarios

| Region | | Reference Scenario L0 in 2051 | Difference between Scenarios L1, L2 and L3 and Reference Scenario L0 in 2051 (%) | | |
|---|---|---|---|---|---|
| | | | L1 | L2 | L3 |
| EE001 | Põhja-Eesti | 38.0 | +0.94 | +1.07 | +1.85 |
| EE004 | Lääne-Eesti | 9.8 | +4.76 | +4.87 | +5.74 |
| EE006 | Kesk-Eesti | 12.6 | +1.19 | +1.28 | +2.43 |
| EE007 | Kirde-Eesti | 10.9 | +0.62 | +0.70 | +1.52 |
| EE008 | Lõuna-Eesti | 12.6 | +0.47 | +0.56 | +1.86 |
| **EE** | **Estonia** | **22.1** | **+1.07** | **+1.19** | **+2.07** |
| FI13 | Ita-Suomi | 76.1 | +0.35 | +2.22 | +3.79 |
| FI18 | Etelä-Suomi | 125.7 | +0.45 | +2.76 | +3.33 |
| FI19 | Länsi-Suomi | 85.4 | +0.47 | +2.88 | +3.72 |
| FI1A | Pohjois-Suomi | 87.2 | +0.35 | +2.16 | +2.98 |
| FI20 | Aland | 122.5 | +0.21 | +1.25 | +1.57 |
| **FI** | **Finland** | **100.8** | **+0.42** | **+2.58** | **+3.35** |
| LT001 | Alytaus | 6.9 | +1.70 | +1.75 | +2.90 |
| LT002 | Kauno | 8.7 | +2.91 | +2.97 | +4.16 |
| LT003 | Klaipedos | 10.0 | +1.82 | +1.87 | +3.11 |
| LT004 | Marijampoles | 5.8 | +1.97 | +2.03 | +3.60 |
| LT005 | Panevezio | 7.9 | +2.25 | +2.32 | +4.04 |
| LT006 | Siauliu | 6.5 | +2.47 | +2.53 | +4.14 |
| LT007 | Taurages | 5.0 | +1.27 | +1.33 | +3.45 |
| LT008 | Telsiu | 7.7 | +2.24 | +2.31 | +3.57 |
| LT009 | Utenos | 7.2 | +1.28 | +1.32 | +2.50 |
| LT00A | Vilnius | 12.5 | 2.38 | +2.43 | +3.67 |
| **LT** | **Lithuania** | **9.0** | **+2.29** | **+2.35** | **+3.67** |
| LV003 | Kurzeme | 14.2 | +2.40 | +2.46 | +3.78 |
| LV005 | Latgale | 7.8 | +1.78 | +1.84 | +3.08 |
| LV006 | Riga | 23.4 | +3.06 | +3.13 | +4.13 |
| LV007 | Pieriga | 8.6 | +2.97 | +3.04 | +3.96 |
| LV008 | Vidzeme | 8.0 | +0.93 | +0.98 | +3.64 |
| LV009 | Zemgale | 7.6 | +2.77 | +2.83 | +3.77 |
| **LV** | **Latvia** | **13.8** | **+2.70** | **+2.77** | **+3.93** |

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