



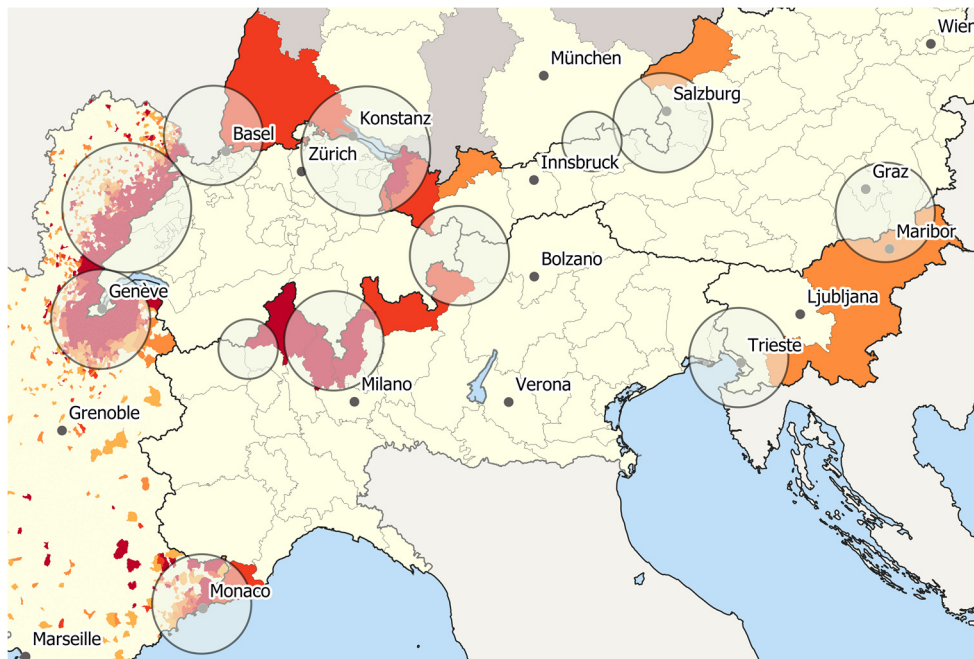
Cross-border mobility in the Alpine Region

Co-financed by the European Union through the
Alpine Region Preparatory Action Fund (ARPAF)

ARPAF Project CrossBorder – Cross-border mobility in the Alpine Region

WP 2: Analysis of existing cross-border mobility networks

Final Report



Prof. Dr. Tobias Chilla,
Anna Heugel M.A.
University of Erlangen
21. December 2018



Content

1	Background and overview	4
2	Cross-border commuting	5
2.1	Data availability	5
2.2	Spatial patterns	6
2.2.1	The Case Study regions	6
2.2.2	European positioning	6
2.2.3	Commuting statistics on the EUSALP level	8
3	Infrastructure analysis	10
3.1	Methodology	10
3.1.1	The space-time-line approach	10
3.1.2	Case study configuration	10
3.1.3	Rail analyses	11
3.1.4	Road analyses	11
3.1.5	Reflection of methodology	12
3.2	Case study profiles	13
3.2.1	Introduction	13
3.2.2	Basel	14
3.2.3	Brig-Domodossola	16
3.2.4	Geneva	18
3.2.5	Jura	20
3.2.6	Kufstein-Rosenheim	22
3.2.7	Lake Constance	24
3.2.8	Monaco	26
3.2.9	Salzburg	28
3.2.10	Styria	30
3.2.11	Terra Raetica	32
3.2.12	Ticino	34
3.2.13	Trieste	36
3.3	Comparison	38
3.3.1	General idea	38
3.3.2	Monocentric patterns	38
3.3.3	Polycentric patterns	41
3.3.4	Linear patterns	44
3.3.5	Transnational metropolitan perspective	47
4	Conclusion	48
5	References	49
6	Annexes	50
6.1	Eurostat map on cross-border commuting	50
6.2	Studies	51
6.3	Definitions	54

List of Figures

Fig. 1	Study design – overview.	4
Fig. 2	Overview of cross-border labour market data of official statistics with lowest available territorial level.	5

List of Maps

Map 1	Cross-border Commuters in case study regions (incoming commuters to each country of the regions).	6
Map 2	Outgoing commuters – mapping official data.	8
Map 3	Incoming commuters – mapping official data.	8
Map 4	Case study profile Basel.	14
Map 5	Case study profile Brig-Domodossola.	16
Map 6	Case study profile Geneva.	18
Map 7	Case study profile Jura.	20
Map 8	Case study profile Kufstein-Rosenheim.	22
Map 9	Case study profile Lake Constance.	25
Map 10	Case study profile Monaco.	26
Map 11	Case study profile Salzburg.	28
Map 12	Case study profile Styria.	30
Map 13	Case study profile Terra Raetica.	32
Map 14	Case study profile Ticino.	34
Map 15	Case study profile Trieste.	36
Map 16	Comparing monocentric case studies with regard to road mobility.	39
Map 17	Comparing monocentric case studies with regard to rail mobility.	40
Map 18	Comparing polycentric case studies with regard to road mobility.	42
Map 19	Comparing polycentric case studies with regard to rail mobility.	43
Map 20	Comparing linear case studies with regard to road mobility.	45
Map 21	Comparing linear case studies with regard to road mobility.	46
Map 22	Rail mobility in metropolitan perspective.	47
Map 23	Commuter outflows 2015 – the only official and harmonized data collection on European level for questions of cross-border commuting.	50

List of Tables

Table 1	European overview of cross-border commuters.....	7
Table 2	Characteristics of cross-border commuting systems.....	13
Table 3	Case study profile Basel.....	15
Table 4	Case study profile Brig-Domodossola.....	17
Table 5	Case study profile Geneva.....	19
Table 6	Case study profile Jura.....	21
Table 7	Case study profile Kufstein-Rosenheim.....	23
Table 8	Case study profile Lake Constance.....	24
Table 9	Case study profile Monaco.....	27
Table 10	Case study profile Salzburg.....	29
Table 11	Case study profile Styria.....	31
Table 12	Case study Terra Raetica.....	33
Table 13	Case study profile Ticino.....	35
Table 14	Case study profile Trieste.....	37
Table 15	Overview of definitions of official labour market statistics.....	58

1 Background and overview

The ARPAF cross-border project addresses the increasing cross-border mobility across the Alpine Region. It aims at identifying gaps in the infrastructure and at facilitating sustainable cross-border commuting, avoiding negative impacts on economy, society and the environment.

Work Package 2 analyses the existing cross-border mobility networks. This report presents the results that were elaborated in the time period June to December 2018.

The methodological approach is visualised in a simplified way in Fig. 1: The analytical perspective combines information on commuting and on infrastructure quality.

Cross-border commuting primarily means daily transfers between home and work, crossing at least one national border. The data comprises both outgoing and incoming persons, based on official statistics on all levels (national, regional, European). Wherever helpful, the statistics are complemented with case studies (reports, articles, etc.).

Infrastructure quality refers to both commuting via road and rail. Infrastructure quality means 'hard' characteristics as the route course and possible speeds, but also service quality in the case of rail transport. The main information resources comprise timetables of public transport and real-time travel data from online apps.

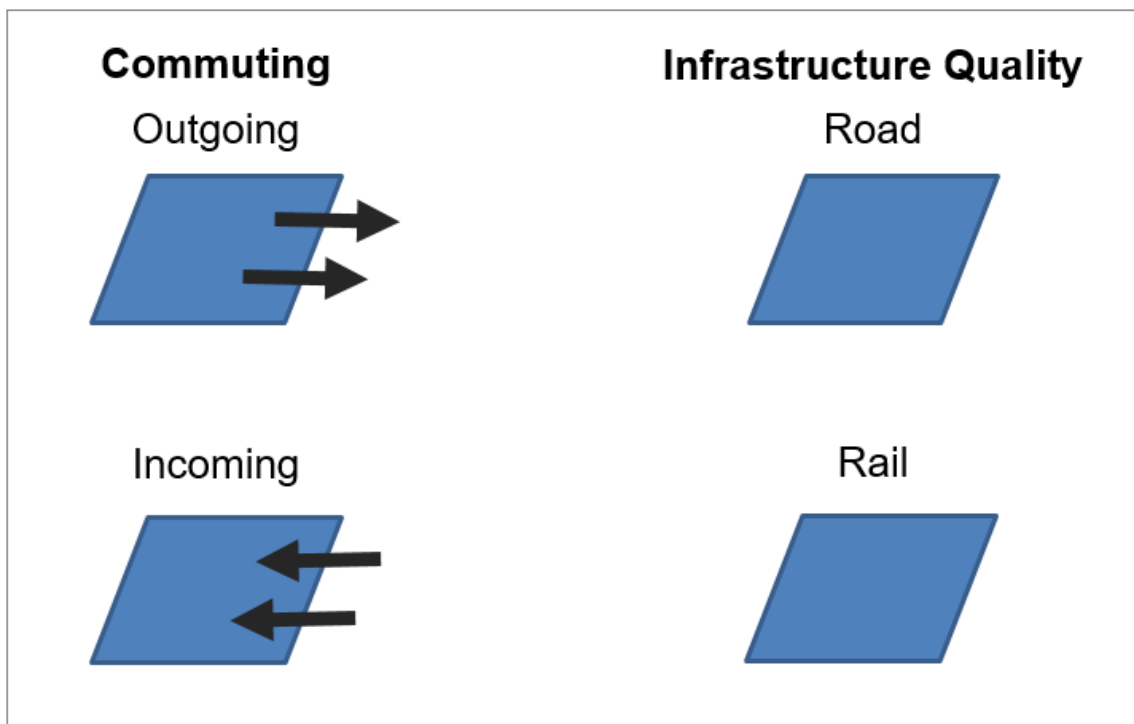


Fig. 1 Study design – overview.

2 Cross-border commuting

2.1 Data availability

Questions of cross-border commuting are of high complexity as there is still no harmonised data base, and a series of methodological challenges hamper large-scale analyses (cp. COM 2018, COM2017/534; MKW 2009, ESPON Metroborder 2011). The annex chapter 6.3 illustrates the diverse and not always congruent definitions of commuters as well as of employees. Map 23 in the annex shows the situation on the European level: Eurostat has compiled a European wide map of cross-border commuting outflows on NUTS 1 or 2 level, largely based the Labour Force Survey. Moreover, information on incoming cross-border commuters are not at all available on the European level.

This general challenge exists for the EU space as for the EUSALP perimeter. Capturing questions of cross-border commuting, thus, has to refer to multiple data sources which have to be combined in a careful, but efficient and pragmatic way.

FRANCE <i>Data source: INSEE</i> Outgoing: LAU (2015) Incoming: /	GERMANY <i>Data source: Federal Employment Agency, Eurostat</i> Outgoing: NUTS 2 (partly) (2016) Incoming: LAU (2015)	AUSTRIA <i>Data source: Statistics Austria</i> Outgoing: NUTS 3 (2015) Incoming: LAU (2015)
SWITZERLAND <i>Data source: Federal Statistical Office</i> Outgoing: NUTS 3 (2016) Incoming: LAU (2015)	LIECHTENSTEIN <i>Data source: Statistical Office</i> Outgoing: LAU (2016) Incoming: LAU (2015)	SLOVENIA <i>Data source: Statistical Office of the Republic of Slovenia, Eurostat</i> Outgoing: NUTS 2 (2016) Incoming: NUTS 0 (2015)
MONACO <i>Data source: Monaco Statistics</i> Outgoing: NUTS 0 (=3) (2016) Incoming: /	ITALY <i>Data source: Italian National Institute of Statistics</i> Outgoing: NUTS 3 (2011) Incoming: /	

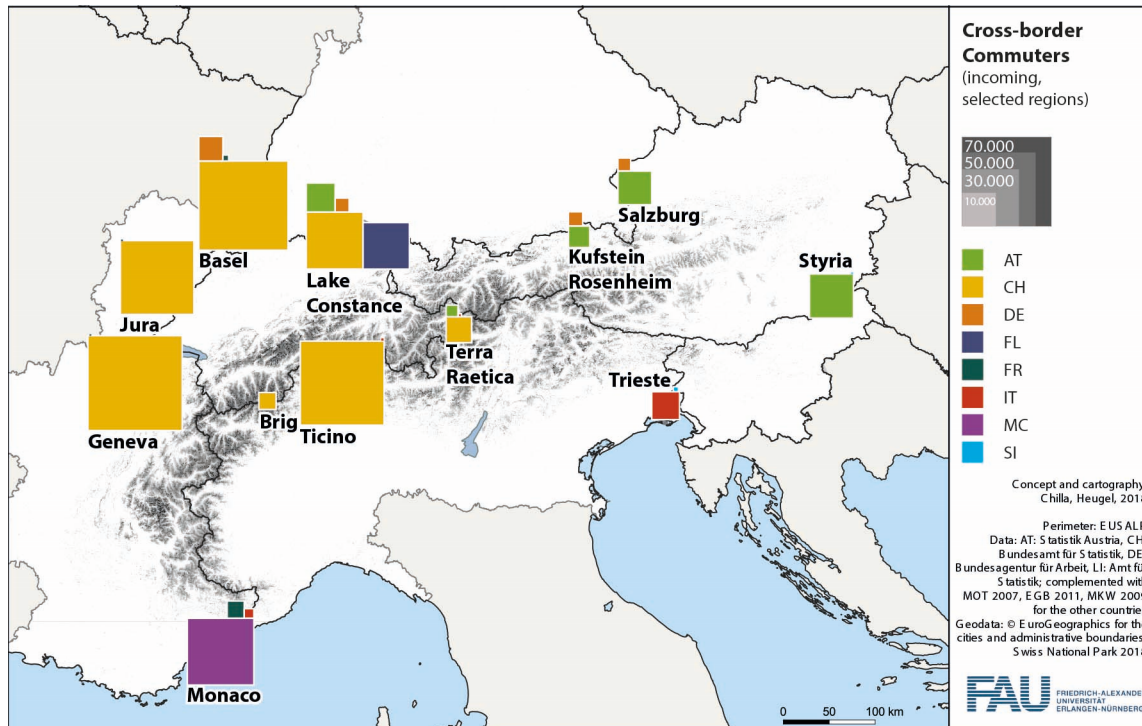
Fig. 2 Overview of cross-border labour market data of official statistics with lowest available territorial level.

Fig. 2 gives a condensed overview of the data situation for incoming and outgoing commuters in the EUSALP region. This overview clearly shows the ‘spatial misfit’ as the data is not available on the same scale in all countries. Moreover, we see several data lacks, in particular for incoming flows. Against this background, this work package conducts a pragmatic compilation of the data available. The following section shows the analytical results.

2.2 Spatial patterns

2.2.1 The Case Study regions

The spatial focus of the project is the macro-regional perimeter of the EUSALP. For the case studies, relevant border regions within the EUSALP perimeter have been selected (Map 1). The case studies comprise the regions with the highest commuting intensity (in particular along the Swiss borders, Monaco) and also take into account selected smaller commuting areas (e.g. Kufstein-Rosenheim). This selection represents the diversity of commuting patterns throughout the EUSALP region and is based on discussions with the project's stakeholders.



Map 1 Cross-border Commuters in case study regions (incoming commuters to each country of the regions).

Map 1 shows a clear picture: The border regions with the highest numbers of commuters are those with Swiss involvement, in particular Basel and Geneva with the highest values (both over 75.000). Also the regions of Jura, Ticino and Lake Constance show high values (all over 47.000). The only region without Swiss involvement with comparably high numbers is Monaco with around 46.000 commuters. The cases of Salzburg, Styria (Graz) and Trieste show the importance of metropolitan cross-border effects.

The exact values and sources of the data displayed in Map 1 are presented in more detail in chapter 3.2.

2.2.2 European positioning

Cross-border commuting is of growing importance due to the ongoing efforts of political liberalisation and because of the growing cross-border integration of economic activities (MKW

2009, Eurostat 2018b). Table 1 illustrates that in the EUSALP region, cross-border commuting shows much higher values than the European average. The contrast between EUSALP values and EU values is striking: 0,9% cross-border share amongst the employees on the EU level, and 1,6% within the Alpine region, i.e. almost the double value.

The difference between incoming and outgoing commuters on the EUSALP level is mainly to be explained with the cases of Vienna, the German-French and the Czech-German border region. In these cases, commuting across national borders is automatically commuting across the EUSALP perimeter.

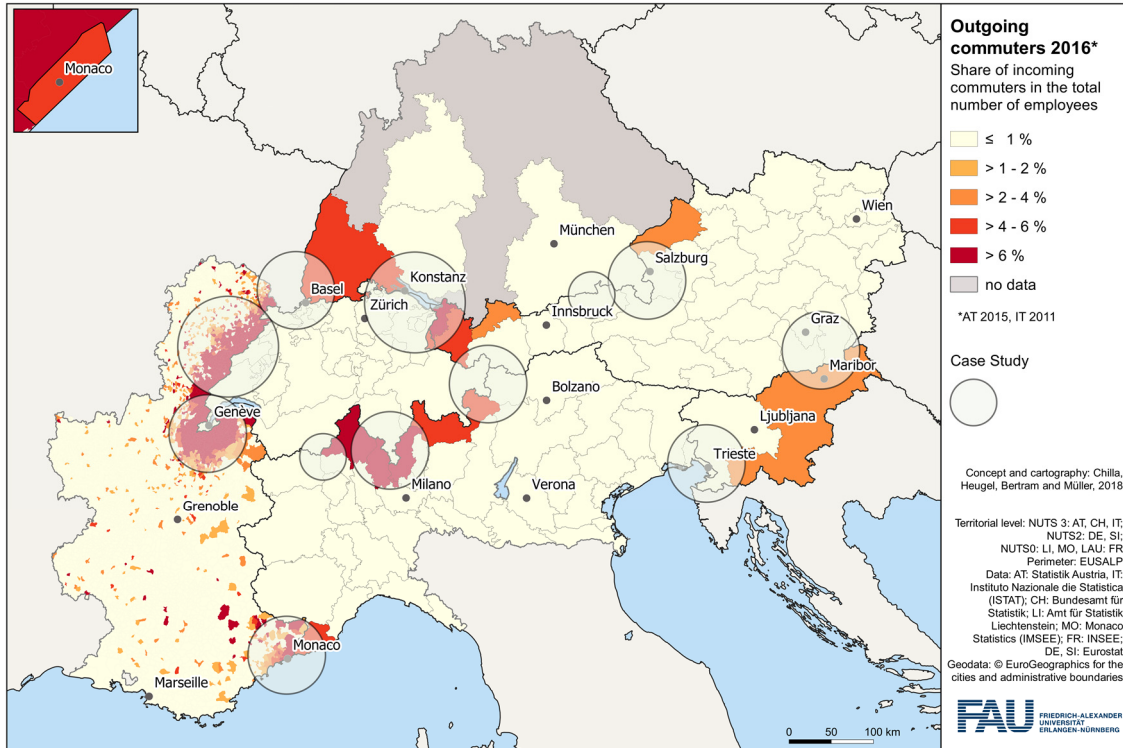
Cross-border commuters (outgoing)	Employees total	Share
EU 28		
2 Mio	220 Mio	0,9%
EUSALP		
0,53 Mio outgoing	37 Mio	1,4%
EUSALP		
0,6 Mio incoming	37 Mio	1,6%

Table 1 European overview of cross-border commuters. Sources: Eurostat 2018a; for incoming commuters National Statistical Offices data and regional reports, see chapter 3.2.

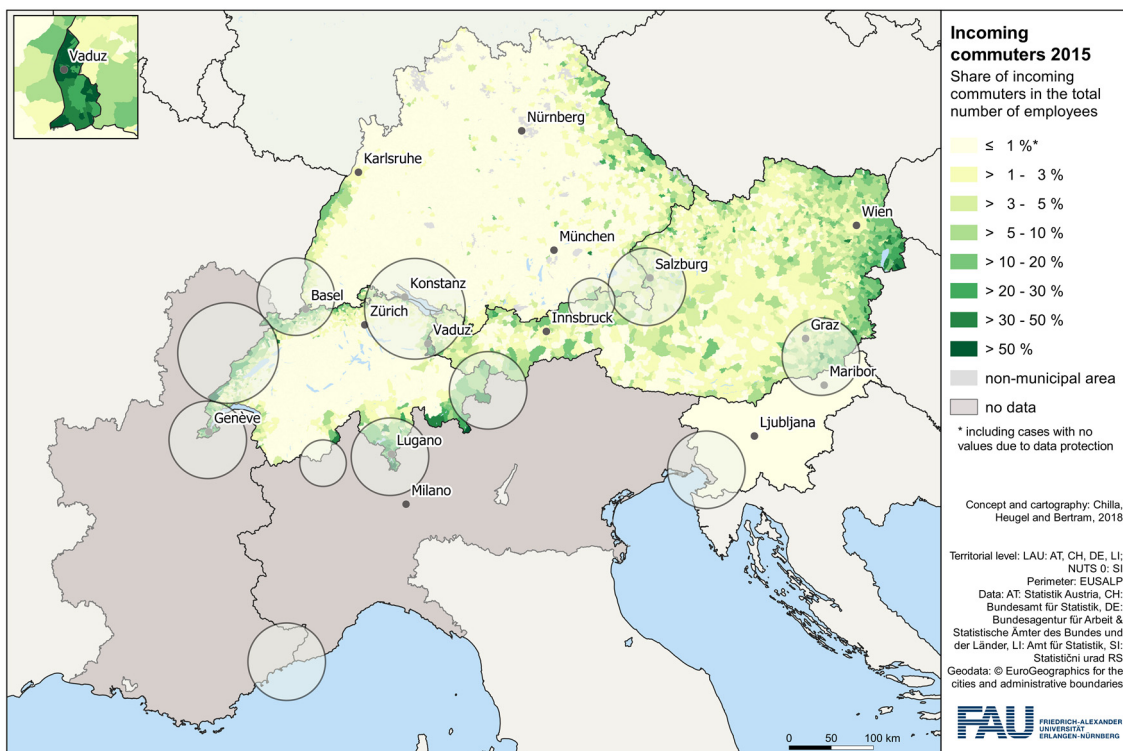
This contrast between EU and EUSALP can be explained by a multitude of reasons, comprising the two most obvious ones:

- Firstly, the Alpine region, traditionally, can be regarded as a region with many borders: Mountains have often served as 'natural borders' between political spheres that nowadays turn out to be contact zones between political systems. This leads to the simple correlation: the more borders within an area, the more (potential) cross-border commuters.
- Secondly, and very much linked to the first argument, the language borders are not always congruent with the political borders. Commuting along the Swiss borders and between Germany and Austria as well as between Switzerland and Southern Tyrol is very much facilitated by only minor language barriers in daily life. This argument of de-facto permeability is accompanied by the juridical permeability due to the Schengen treaty which applies to all EUSALP borders for person mobility.
- Thirdly, the differences between labour markets are present, in particular along the most attractive labour market of Switzerland, offering comparably high (net) wages.
- Fourthly, a series of metropolitan settlements is situated near the border, namely Geneva, Basel, Monaco, Trieste, and Milano. The dynamic on these metropolitan labour markets links suburbanisation effects across borders with the use of differences in wages, tax regimes and real estate prices.

2.2.3 Commuting statistics on the EUSALP level



Map 2 Outgoing commuters – mapping official data¹.



Map 3 Incoming commuters – mapping official data.

¹ The databases of the displayed data are described in chapter 6.3.

Outgoing commuters

Map 2 shows the *outgoing* commuters due to the official national and European statistics in relative terms. The darker red the colour, the higher is the share of commuters amongst the employees.

The cartographic illustration shows in particular the following aspects:

- Again, the high importance along the Swiss borders is very visible. Here we find the highest shares of outgoing commuters from the surrounding countries to Switzerland (mostly more than 6% of employees).
- Cross-border labour market regions with high numbers of commuters are often oriented towards a metropolitan centre (Geneva, Basel, Monaco), even if Ticino and Jura can be regarded as exceptions.
- The map also shows the shortcomings of the data situation even though domestic data are used. The available spatial scale is not very accurate as even NUTS 3 regions only provide a rough picture of the cross-border mobility.
- The map of outgoing commuters shows the case study regions of the project are well selected as they are all located in regions of high cross-border commuting shares.

Incoming commuters

Map 3 shows the data situation of *incoming* commuters: Again, the darker green the colour, the higher the share of commuters amongst the employees.

The map illustrates the following aspects:

- Many of the already mentioned spatial patterns are confirmed also from this perspective (relevance of the Swiss/Liechtenstein labour market, metropolitan cross-border influence etc.).
- Border commuting is a rather local effect. The municipal scale shows that border commuting is most important in short distance to the border.
- The problem of data availability is very obvious here in particular as for France and Italy no data is available at all and this gap cannot be filled with Eurostat data.
- Moreover, national differences in data definition come into play. For example, the darker colours (i.e. higher values) in the inner country of Austria can most probably be explained with its specific statistical consideration of second homes.

3 Infrastructure analysis

3.1 Methodology

3.1.1 The space-time-line approach

Our methodology compares a) the selected case study regions across the EUSALP space and b) the quality of the most important cross-border linkages via road and rail within the selected cases. This comparative approach presents the analytical results in a cartographic manner that visualises the accessibility quality in a simplified but meaningful way. This approach – called ‘space-time-line’ approach, is mainly based on time table data and internet based real time/travel time data (for more details, see MDI RLP 2017, BBSR 2017, Chilla & Heugel 2018). Whilst applying the so-called space-time-line approach, the analyses focus on the speed of connections between settlements. The approach is elaborated for road and rail connections. In both cases the speed is calculated in relation to the linear distance².

Additionally, a metropolitan accessibility analyses on the EUSALP scale provides a more transnational perspective for the rail mobility (cp. chapter 3.3.5).

3.1.2 Case study configuration

For the analysis of the infrastructure quality within the case study regions, the definition of the commuting network is of crucial importance. To give an example, it is obvious that the Geneva region is one of the most intense cross-border regions Alpine wide (and beyond). It is well known, that the French municipality Annemasse is one of the most important commuting ‘sources’. But Annemasse it not the only node of the commuting network, and at the same time, it is not feasible to involve all municipalities in the analysis. This is why it is important to define criteria for the selection of the network nodes. The general idea is ‘infrastructure analyses follows commuting analyses’, i.e. that those spaces where commuting statistics indicate important flow corridors, the infrastructure quality is assessed in more detail. The concrete situations are described in more detail in the case study profiles of chapter 3.2.

Selection of nodes

The general idea is to choose nodes where commuting is important in relative or absolute terms (i.e. high percentage or a high absolute number of commuters; based on statistical information or experts’ assessments):

- Concretely speaking, the selected nodes comprise settlements with more than 5.000 inhabitants in order to consider the most important quantities of commuting flows and...
-settlements with train stations in order to allow a comparison of mobility modes.
- If rail infrastructure is not present, the largest settlements in the respective area are selected.
- In rural areas (e.g. Jura) the following rule applies: If settlements have less than 5.000 inhabitants, those (smaller) settlements are selected that have the highest share/number of cross-border commuters.

² measured via luftlinie.org

Linkages

In mono-centric commuting patterns (e.g. Geneva), the linkages are of a starlike form; in polycentric commuting regimes (e.g. Jura, Ticino), the network is of more decentralized character.

The linkages...

- ...have to cross national borders.
- ... have a minimum length of ca. 5 km (shorter distances are more relevant for soft mobility modes and would pose cartographic challenges; e.g. Delle/Boncourt).
- have a maximum length of ca. 50 km (as commuting relations are very much focusing on this scale).
- ... that are on the same infrastructure line must not all be involved.

3.1.3 Rail analyses

For rail connections, the time is measured by the fastest train connection³ between central stations. Additionally, the number of connections⁴ are displayed. The basis for the data collection is the travel service site of Deutsche Bahn⁵. The requests refer to the 14th November 2018 (complete day starting at 4 a.m.) and uses generally the default search settings of the search mask⁶ excluding the categories bus, boat and dial-a-ride (taxi/bus). For the case studies, only connections with max. one change are taken into account. This is due to the argument that more than one change makes public transport unattractive compared to individual / soft / multi-modal mobility forms.

In the cartographic illustration, the connections are represented as lines. The line width shows the number of connections and the colour of the lines illustrates the speed of the fastest connection. The cartographic illustration of the *space time lines* for public transport shows the technical quality of the connections: The more direct and the better the technical level of the railway line is the faster is the connection. Topographical barriers can also affect the speed of the connections. One might ask to what extent high-speed trains bias this analysis: Firstly, there are not many relevant cross-border linkages that are served on the local level with high-speed connections (exception e.g. Basel-Freiburg). In those cases, it seems not to be impossible that commuters prefer exactly that kind of connection even if higher ticket prices have to be paid.

In addition, the organisational quality is illustrated by the daily number of connections and also the speed of the connection: If a connection is part of the high-speed network, the connection is faster than of connections that are only part of the regional train net.

3.1.4 Road analyses

For road connections, the time is quantified by the calculated real-time travel time of the route in GoogleMaps. The requests have been conducted at 8 a.m. on Tuesday, Wednesday and Thursday

³ average of both directions

⁴ average of both directions

⁵ reiseauskunft.bahn.de

⁶ Default settings: prefer fast connections, standard duration of transfer

on 13th to 15th November 2018 for both directions between central stations⁷. Central stations have been chosen in order to compare rail and road connections on the same basis. For settlements without a railway station another central point is used. On each of the days, the fastest connection regardless of the route is chosen. Statistical outliers are eliminated.

In the cartographic illustration, the connections between the cities are also illustrated as lines but this time with arrows. The arrows indicate the direction of the connection. The colour of the line shows the speed of the average rush-hour connection⁸. That means that this cartographic illustration shows also the technical quality of the route and further the de facto quality including rush hour effects. Indirectly, a slow speed can not only refer to a low level of technical quality but also show that the given infrastructure does not meet the needs of the commuters that need to use the infrastructure.

3.1.5 Reflection of methodology

Obviously, the analyses of road and rail cannot be fully identical. One might argue that the road values tend to be more negative due to the train station focus. Firstly, not all car drivers have to reach the trains stations in the (crowded) city centres; secondly, train mobility has to add the 'last mile' between trains station and home and potential waiting times before entering the train. Moreover, delays are not taken into account for trains but traffic-jams are considered for cars. On the other hand, bus (and boat) connections that potentially improve the public transport quality had to be excluded.

These limitations had to be taken into account due the project framework: the predominantly transnational focus of the project demands a consistent and comparable data basis. Overall speaking, the comparative perspective gives a solid impression of the cross-border accessibility situation.

⁷ The selected week should avoid holidays and extreme weather conditions

⁸ The speeds are displayed in 10 categories. In order to avoid that values with a difference less than 0,6 km/h are displayed in two different categories two values have been modified.

3.2 Case study profiles

3.2.1 Introduction

The following case study profiles provide more specific descriptive and analytical output. For all case study regions, the numbers of commuters, characteristics of the commuting system and the infrastructure quality is presented:

- Commuting numbers refer to the best possible data base (national statistics if available, otherwise regional studies and reports). The national statistics are based on different methodologies (see methodologies in detail in Annex 6.3), e.g. the German and Swiss data tend to underestimate the phenomenon as in Germany only employees paying compulsory social security contributions and in Switzerland only foreigners crossing the border are statistically captured. For the case of Switzerland it is well known that also Swiss inhabitants live in France and work in Switzerland (OCSTAT 2013). The time reference is 2015 if available in order to ensure comparative perspective (2015 because for this year national data were available in all involved countries). Incoming data refer to all kind of commuting, not to particular countries of origin.
- Brief interpretations from the comparison of road/rail for each case. After exploring the individual profiles, a comparative analysis across the case studies will be presented.
- The profiles propose the affiliation to a certain type of commuting pattern (Table 2). This heuristic is not based on systematic data analysis but on a condensed synthesis of the main spatial characteristics. This typology will be presented from a comparative perspective in chapter 3.3.

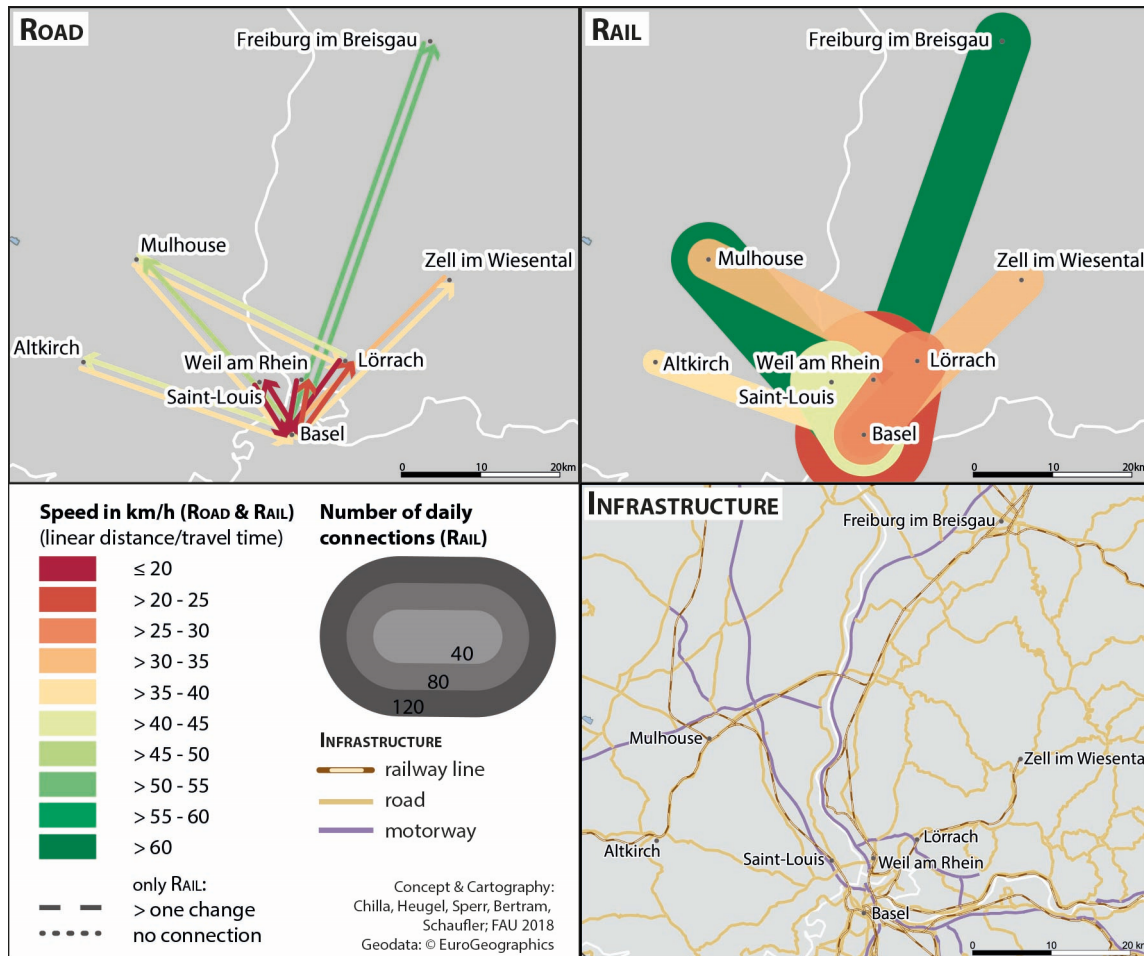
Settlement system characteristic	Spatial commuting structure	Number of countries involved
Metropolitan	Monocentric	Bilateral
Urban	Linear	Trilateral
Rural	Polycentric	Multi-lateral

Table 2 Characteristics of cross-border commuting systems

The objective of the case study profiles is twofold. Firstly, it is important to understand the main characteristics of the regional situation. Important characteristics of the infrastructure are displayed in overview maps, the commuting numbers are roughly presented and in some cases morphological information are included. It is important to understand the main differences and parallels before the case studies are compared amongst each other. Secondly, the comparison of rail and road qualities can already be compared within the case study profiles.

It goes without saying that these general characterisations from the comparative perspective have to be complemented by in-depth knowledge before concrete political measures can be concretised.

3.2.2 Basel



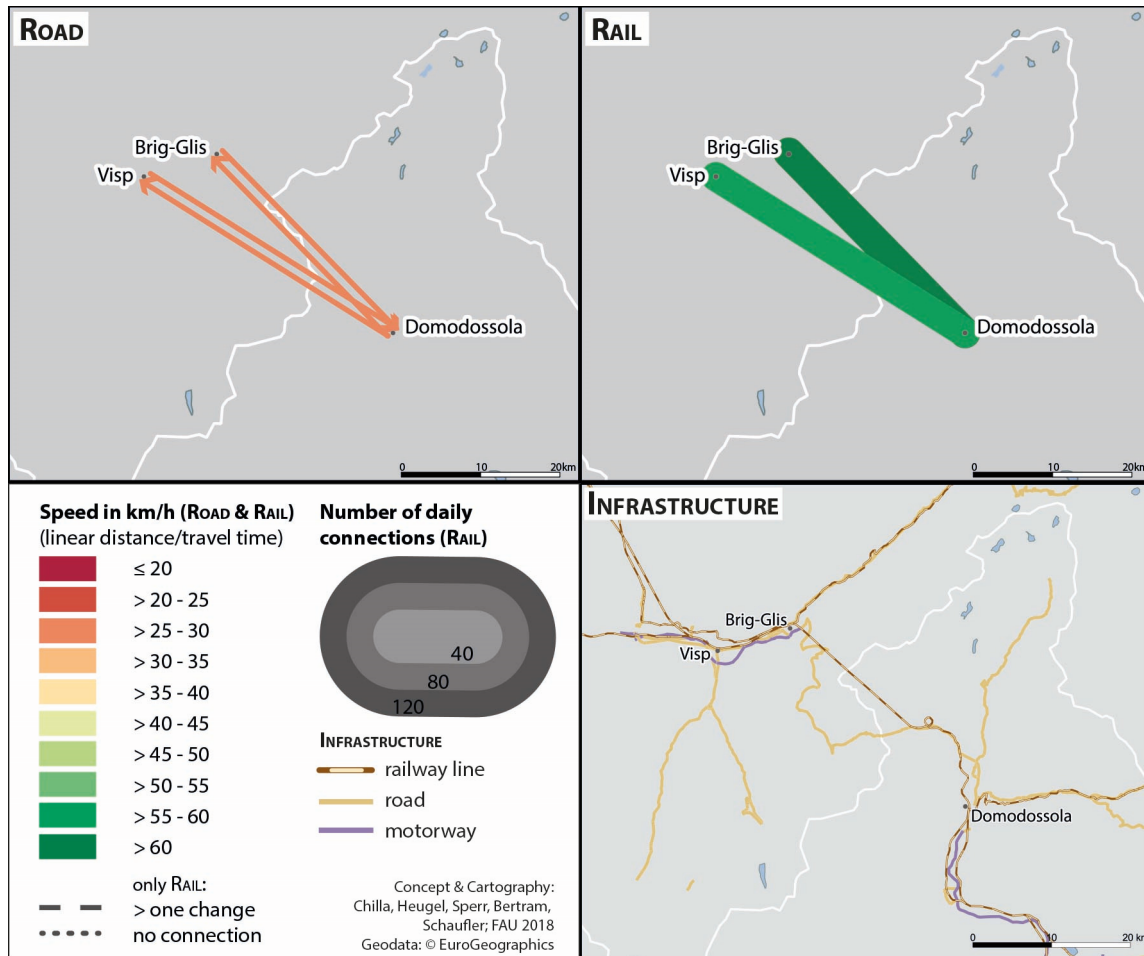
Map 4 Case study profile Basel.

	CH	DE	FR	Sum (approx.)
Incoming commuters (total)	68.948	5.139	100-500	75.000
Time ref.	Q4 2015	2015	2006	
Spatial ref.	Basel Stadt, Basel Landschaft, Aargau (NUTS 3)	Freiburg, Breisgau- Hochschwarz- wald, Lörrach, Waldshut (NUTS 3)	Not explained	
Source	BFS 2018	BA 2016	MOT 2007: 14	
Characteristics of commuting system	Metropolitan – mainly monocentric – trilateral			
	The labour market of the city and region of Basel attracts in particular French but also German employees. Minor commuter flows exist from France to Germany.			
Infrastructure quality road	<ul style="list-style-type: none"> - The near distance connections around Basel are comparably slow and show rush hour effects on several roads. - Also the longer distance linkages show rush hour effects (with the exception of Freiburg where the average speed is higher due to highway infrastructure in the 'hinterland'). 			

	<ul style="list-style-type: none"> - In summary, the road infrastructure is – from the cross-border perspective – overstrained. However, compared to other monocentric metropolitan regions, the situation is rather good.
Infrastructure quality rail	<ul style="list-style-type: none"> - The number of connections (thickness of lines) is pretty high, with the exception of Altkirch in the French rural area. This is also due to the fact that the linkages of Weil am Rhein and St. Louis comprise also tram lines. - The speed of most connections is comparably high, with the exception of Basel – Weil am Rhein. The latter connection is rather slow as the regional train (fastest connection) stops at Basel Bad station (the analysis is based on Basel SBB train station as reference) and many other connections even demand to change the train at Basel Bad station. In contrast, the regional train from St. Louis to Basel goes directly. On both linkages, the tram lines provide a high frequency of connections even if the speed is rather slow due to the fact that tram lines have lots of stops. - The rapidness of the connections Mulhouse-Basel and Freiburg-Basel can be explained with some high-speed inter-city connections.
Comparative remarks	<ul style="list-style-type: none"> - Road and rail are of comparable quality in the Basel region, so public transport is a real alternative to individual mobility. - Compared to the other case study regions, the cross-border mobility situation is rather good, even if there are still punctual shortcomings.

Table 3 Case study profile Basel.

3.2.3 Brig-Domodossola



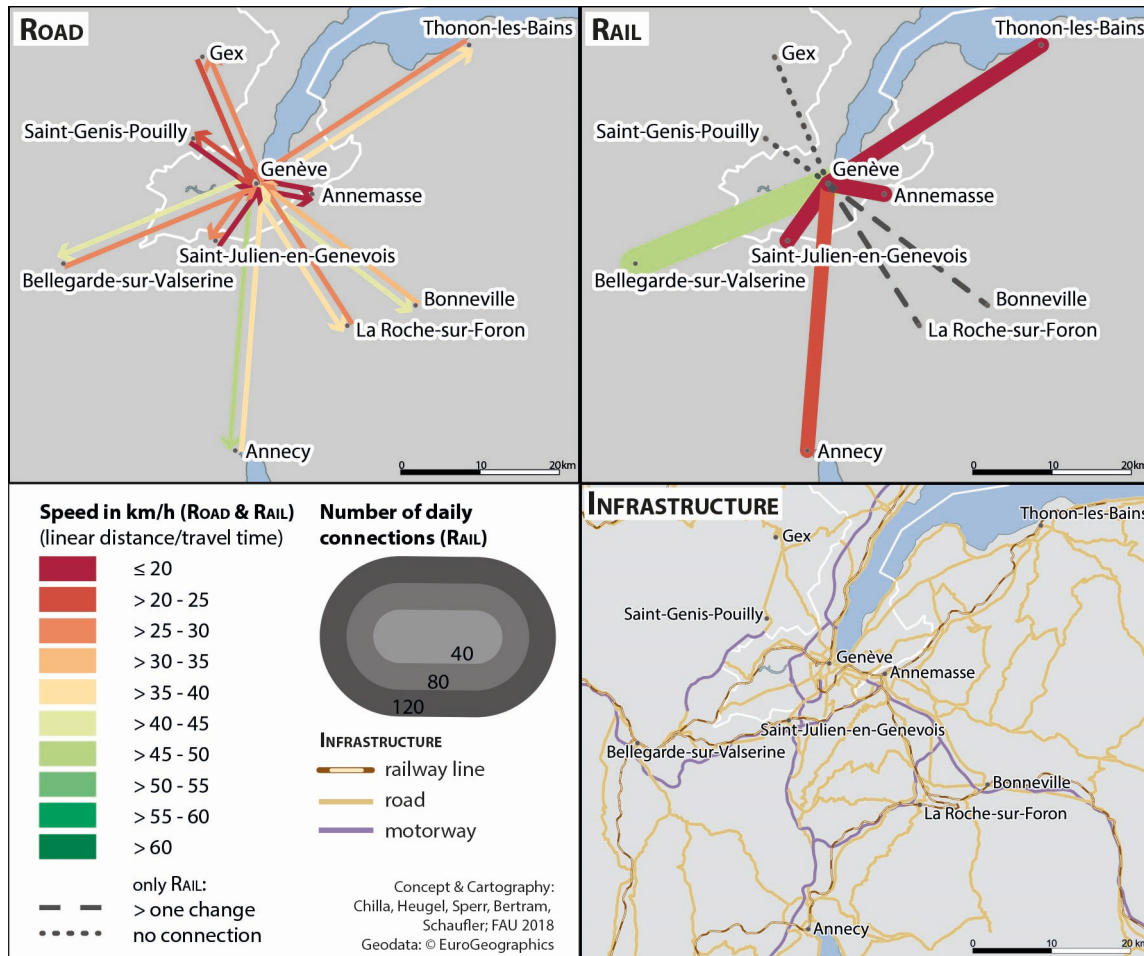
Map 5 Case study profile Brig-Domodossola.

	CH	IT	Sum (approx.)
Incoming commuters (total)	2.706		2.700
<i>Time ref.</i>	Q4 2015		
<i>Spatial ref.</i>	Valais (NUTS3)		
<i>Source</i>	BFS 2018		
Characteristics of commuting system	Rural – linear – bilateral		
	Commuting from the Italian to the Swiss side in a rather rural and mountainous context		
Infrastructure quality road	The speed is nearly the same for both directions and slow due to the morphology in that area (Simplonpass, 2.005 m). In either direction, around 1.800 m altitude difference have to be surmounted which is – in particular in winter times – problematic for commuting on a daily basis.		
Infrastructure quality rail	The speed of the rail connections is high for both linkages as the trains uses the Simplontunnel. The connection frequency is at one connection per hour.		

Comparative remarks	Comparing the two means of transport rail connections are quite faster than the road and offer a good alternative to the road. Compared to the other case studies the rail infrastructure quality is quite good in both number of connections and speed.
---------------------	---

Table 4 Case study profile Brig-Domodossola.

3.2.4 Geneva



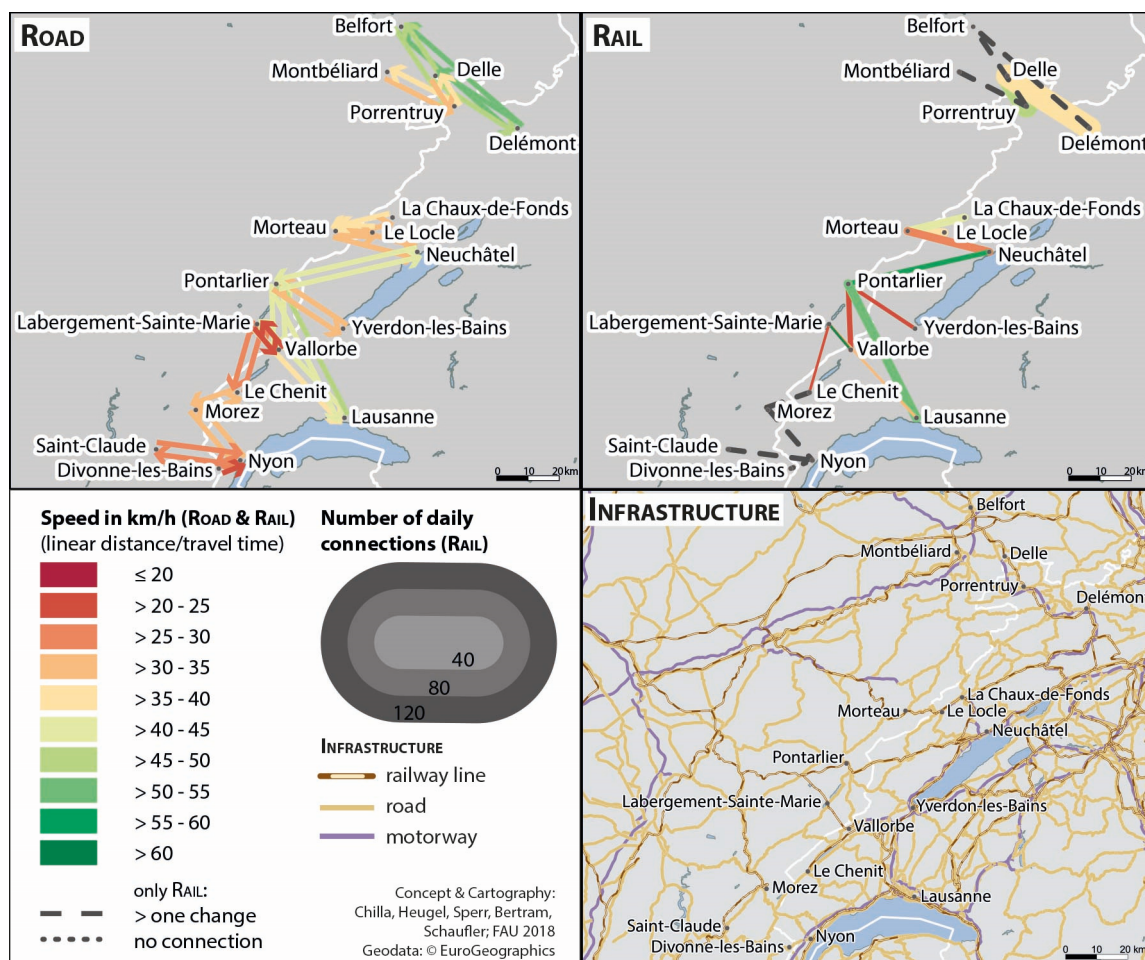
Map 6 Case study profile Geneva.

	CH	FR	Sum (approx.)
Incoming commuters (total)	77.874	-	78.000
Time ref.	Q4 2015		
Spatial ref.	Genève (NUTS 3)		
Source	BFS 2018		
Characteristics of commuting system	Metropolitan – monocentric – bilateral		
	<p>The dynamic labour market of the city/region of Geneva attracts French employees. The overall pattern is rather concentric, with the exception of the Lake Geneva in the North-East.</p> <p>A characteristic of the commuting system is that in addition to the French commuters a lot of international officials work in Geneva who are not captured in the statistics and that a considerable number of Swiss citizens live in France and work in Geneva (OCSTAT 2013). Therefore the number of persons really crossing the border and using the infrastructure is still higher.</p>		
Infrastructure quality road	<ul style="list-style-type: none"> - All linkages show comparably slow speeds and rush-hour effects. - The near distance connections are clearly slower than the longer ones. - Overall speaking, the cross-border road infrastructure is clearly overstrained. 		

<p>Infrastructure quality rail</p>	<ul style="list-style-type: none"> - The cross-border rail infrastructure is problematic. Two cross-border axes have no rail connections to Geneva (Northern direction, Gex and St. Genis Pouilly) and two offer only connections with more than one change (Southern direction, Bonneville and La Roche sur Foron). The other linkages are of rather poor quality except of the linkage Geneva – Bellegarde-sur-Valsérine. - Until now, the tramways network does not cross the border. A tramway line to Annemasse is currently under construction and there are plans to connect Saint-Genis-Pouilly and Saint-Julien-en-Genvois with a tramway. - Until now, no cross-border commuter rail (S-Bahn) network comparably to other metropolitan regions exists in this region. However, new lines are currently under construction (Léman Express lines 1-4) which will directly connect Annemasse, Thonon-les-Bains, La-Roche-sur-Foron, Bonneville and Annecy with Geneva (date of planned opening 15.12.2019).
<p>Comparative remarks</p>	<ul style="list-style-type: none"> - Road infrastructure is overstrained and cross-border rail infrastructure needs to be improved which is already in process. - Compared to the other case study regions, the cross-border mobility situation is currently problematic.

Table 5 Case study profile Geneva

3.2.5 Jura



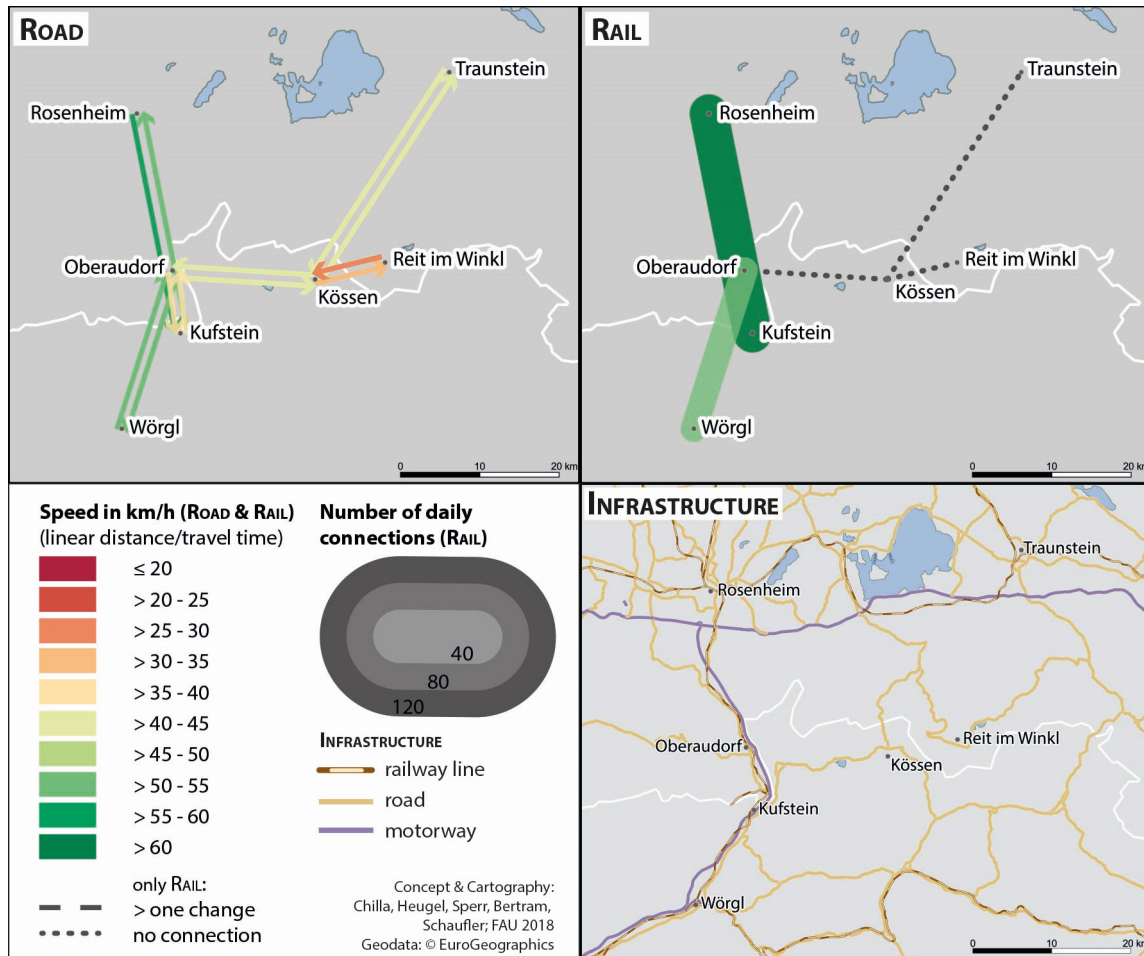
Map 7 Case study profile Jura.

	CH	FR	Sum (approx.)
Incoming commuters (total)	47.078	-	47.000
<i>Time ref.</i>	Q4 2015		
<i>Spatial ref.</i>	Vaud, Neuchâtel, Jura (NUTS 3)		
<i>Source</i>	BFS 2018		
Characteristics of commuting system	Rural – polycentric – bilateral		
	Commuting from France to Switzerland to different destinations, mainly dominated by the Swiss watchmaker industry.		
Infrastructure quality road	<ul style="list-style-type: none"> - The highest speeds via road can be found in the Northern parts, the lowest speed on the links Nyon - Divonne-les-Bains and Vallorbe – Labergement Sainte Marie. - The differentiation of the speeds between the linkages can often be explained with the routing and quality of the route. Routes with a non-direct routing meaning that the route is quite longer than the linear distance show low values. Routes that go via motorway are faster. - Rush-hour effects are visible for some linkages (e.g. connections to Porrentruy, Morteau – Le Locle and Morteau – La Chaux de Fonds, Divonne les Bains – Nyon). 		

<p>Infrastructure quality rail</p>	<ul style="list-style-type: none"> - Nearly all nodes have a rail connection but some of the linkages need more than one change. One should add that most recently (Dec. 18), the service on the line Delle – Belfort has been reactivated which means an improved connectivity for the lines Belfort – Porrentruy and Belfort – Delémont. Other axes show fast but only few connections (e.g. Pontalier – Neuchâtel). The rest of the connections are rather slow and of low frequency. - The best connections in terms of speed and frequency (one train per hour) are the two connections from Delle to Porrentruy and Delémont.
<p>Comparative remarks</p>	<p>In principle, this is a typical picture for a rural, polycentric context: despite a significant number of train lines, the polycentric structure can only hardly be served with rail connections alone.</p> <p>For most of the linkages rail connections are not a very competitive alternative to individual transport.</p>

Table 6 Case study profile Jura.

3.2.6 Kufstein-Rosenheim



Map 8 Case study Kufstein-Rosenheim.

	AT	DE	Sum (approx.)
Incoming commuters (total)	4.412	2.085	6.500
Time ref.	2015	2015	
Spatial ref.	Tiroler Unterland (NUTS 3)	Rosenheim, Traunstein, city of Rosenheim (NUTS3)	
Source	Statistik Austria 2018	BA 2016	
Characteristics of commuting system	Semi-rural – polycentric – bilateral The commuting patterns in the region are rather modest and symmetric. The cross-border dimension interferes very much with the large scale transnational flows of the Brenner pass that cross the Kufstein-Rosenheim area.		
Infrastructure quality road	The situation is characterised by a contrast between the aboved mentioned transport corridor and the side linkages: - The fastest road linkages are routes in the large transport corridor (Rosenheim – Kufstein and Oberaudorf – Wörgl) - The speed of the other connections is comparable with other non-motorway speeds.		
Infrastructure quality rail	Again, the contrast between the transnational corridor and the side linkages is striking: Train connections only exist in the Inn valley		

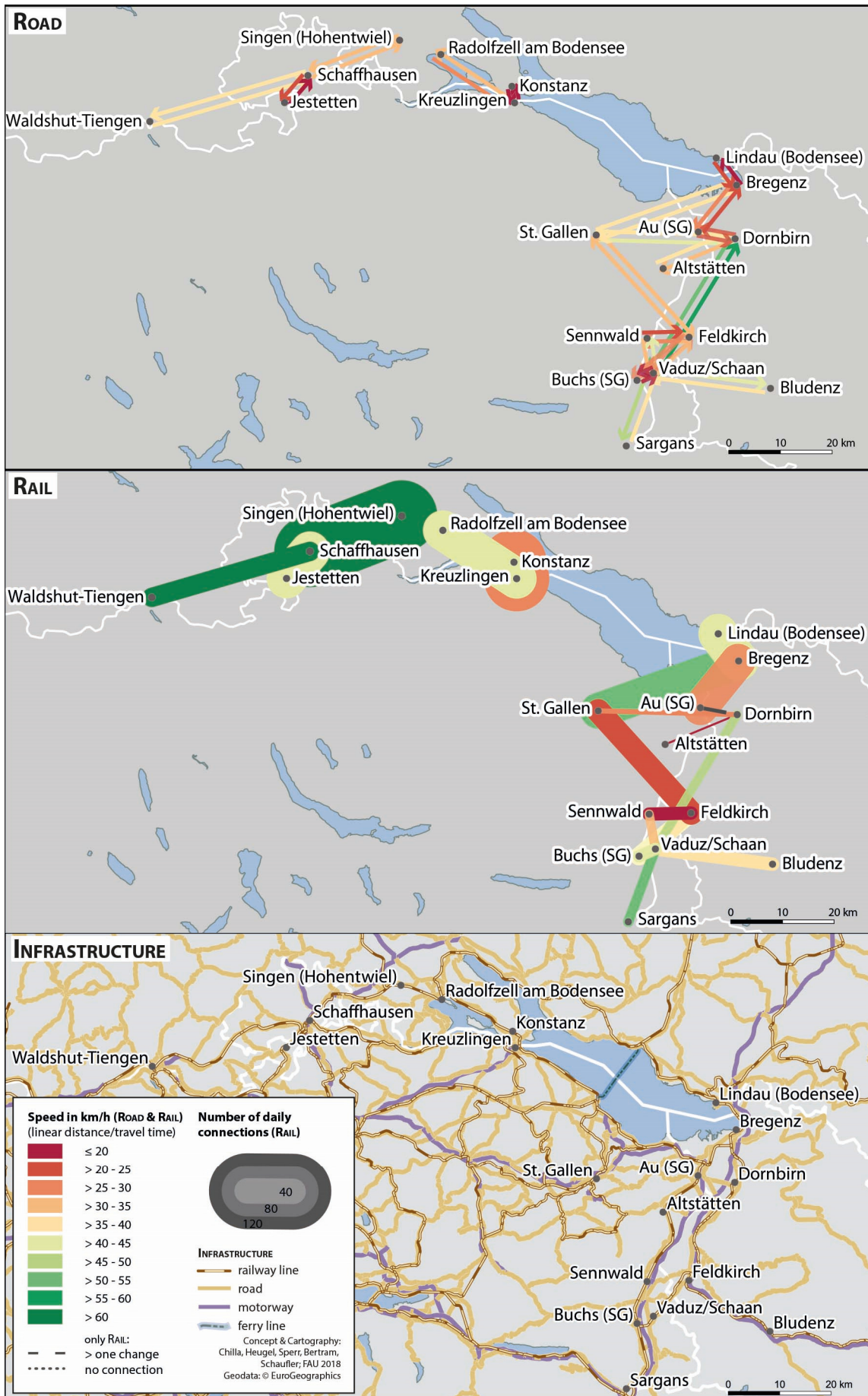
	corridor Rosenheim – Kufstein – Wörgl. These connections are quite fast.
Comparative remarks	<ul style="list-style-type: none"> - In the Inn valley corridor, public transport via train is a competitive alternative to private transport. - For all the other nodes and linkages public transport is not a competitive alternative. Multi-modal modes might be a good solution for the current situation.

Table 7 Case study profile Kufstein-Rosenheim.

3.2.7 Lake Constance

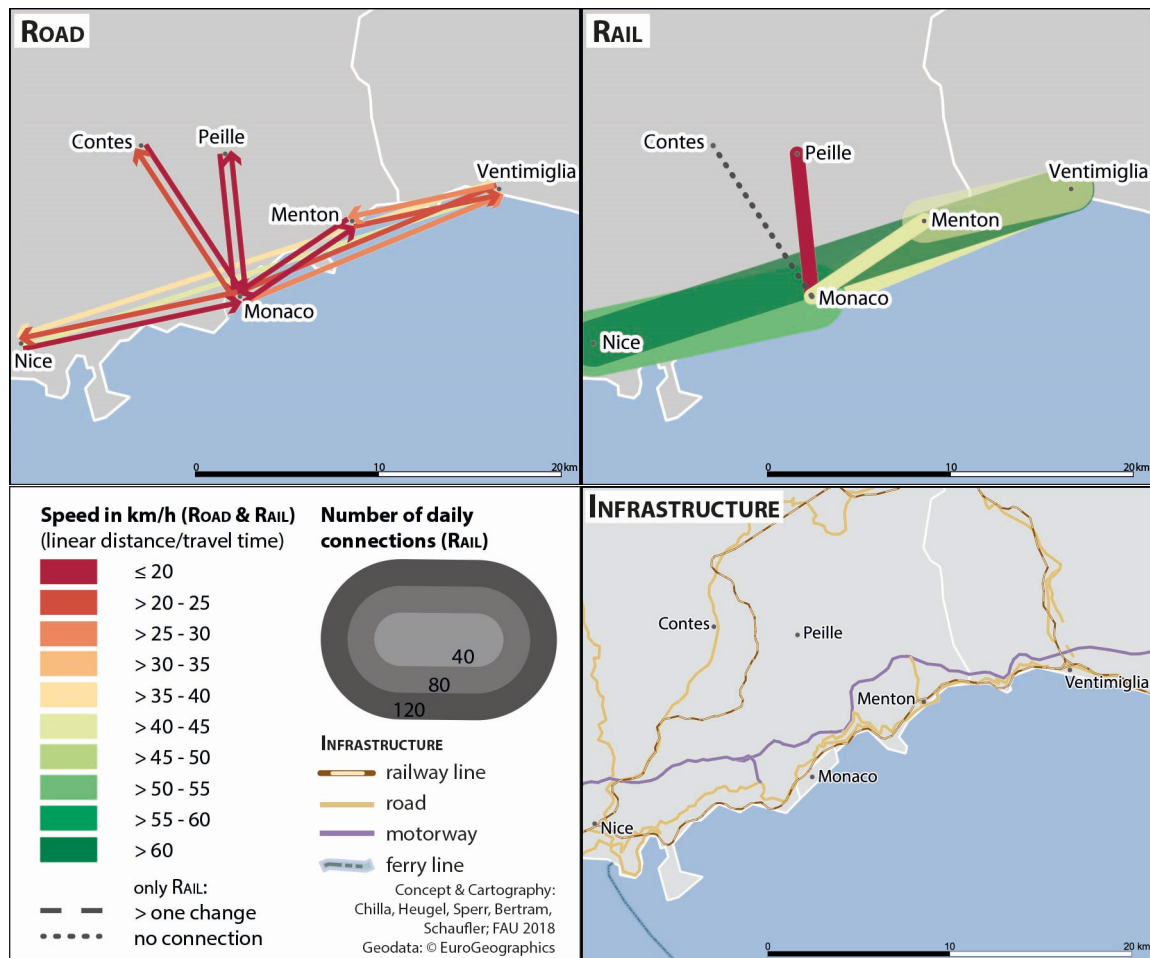
	CH	LI	DE	AT	Sum (approx.)
Incoming commuters (total)	28.013	19.652	1.778	7.140	57.000
<i>Time ref.</i>	Q4 2015	2015	2015	2015	
<i>Spatial ref.</i>	Schaffhausen, Zürich, Thurgau, St. Gallen, Appenzell Ausserrhoden, Appenzell Innerhoden (NUTS 3)	Liechtenstein	Konstanz, Lindau, Bodensee-kreis, Ravensburg, Oberallgäu (NUTS 3)	Bludenz-Bregenzer Wald, Rheintal-Bodenseegebiet (NUTS 3)	
<i>Source</i>	BFS 2018	AS 2018	BA 2016	Statistik AT 2018	
Characteristics of commuting system	Semi-urban – polycentric – multi-lateral				
	The labour markets of Switzerland and Liechtenstein are the attracting nodes. In particular, the Eastern part of Lake Constance region and the Rhine Valley show complex patterns. A series of medium sized cities in a rural context are interwoven in a cross-border manner.				
Infrastructure quality road	<ul style="list-style-type: none"> - Whilst the accessibility via the Rhine valley highways is comparably well, the shorter connections crossing the borders are far slower. Rush-hour effects are most visible around the Liechtenstein capital Vaduz. - In the Western part, the values show rather modest but symmetric values. This picture is due to a rather modest, but not overstrained road infrastructure which is typical for a border region in a rural context. 				
Infrastructure quality rail	<ul style="list-style-type: none"> - The rail transport around Schaffhausen is of good quality. The highest number of connections can be found between Schaffhausen and Singen. Some of the connections are also operated by long-distance/high speed traffic (1/5 of all connections). The fastest connection is reached with the regional train IRE. Between Jestetten and Schaffhausen the number of connections is also high due to commuter rail traffic. The linkage between Waldshut-Tiengen and Schaffhausen is also quite fast, even if the number of connections is the lowest (one train per hour) compared with the two other linkages. - Around Konstanz, the quality of the rail linkages is also good. The number of connections between Konstanz and Kreuzlingen is high due to various types of train (commuter, regional, interregional). The number of connections between Radolfzell and Kreuzlingen is also comparably high. - In the Eastern part of Lake Constance and the Rhine valley, the best rail connections both in number and speed can be found around Bregenz. The lowest speed of the three linkages to Bregenz is Au – Bregenz which needs a change in St. Margrethen. Between St. Gallen and Bregenz the fastest connection is achieved with long distance/high speed traffic, regional traffic needs a change in St. Margrethen. All other linkages are more problematic either in number or in speed. 				
Comparative remarks	<ul style="list-style-type: none"> - On several linkages, public transport is competitive compared to mobility via car – in particular around Schaffhausen /around Bregenz. - Also due to the complex and polycentric structure of this multi-lateral border region, there are several gaps visible in both mobility modes: The accessibility of Vaduz/Schaan shows some gaps in both modes, the train connectivity from Vorarlberg to Switzerland suffers the need to change. 				

Table 8 Case study profile Lake Constance.



Map 9 Case study profile Lake Constance.

3.2.8 Monaco



Map 10 Case study profile Monaco.

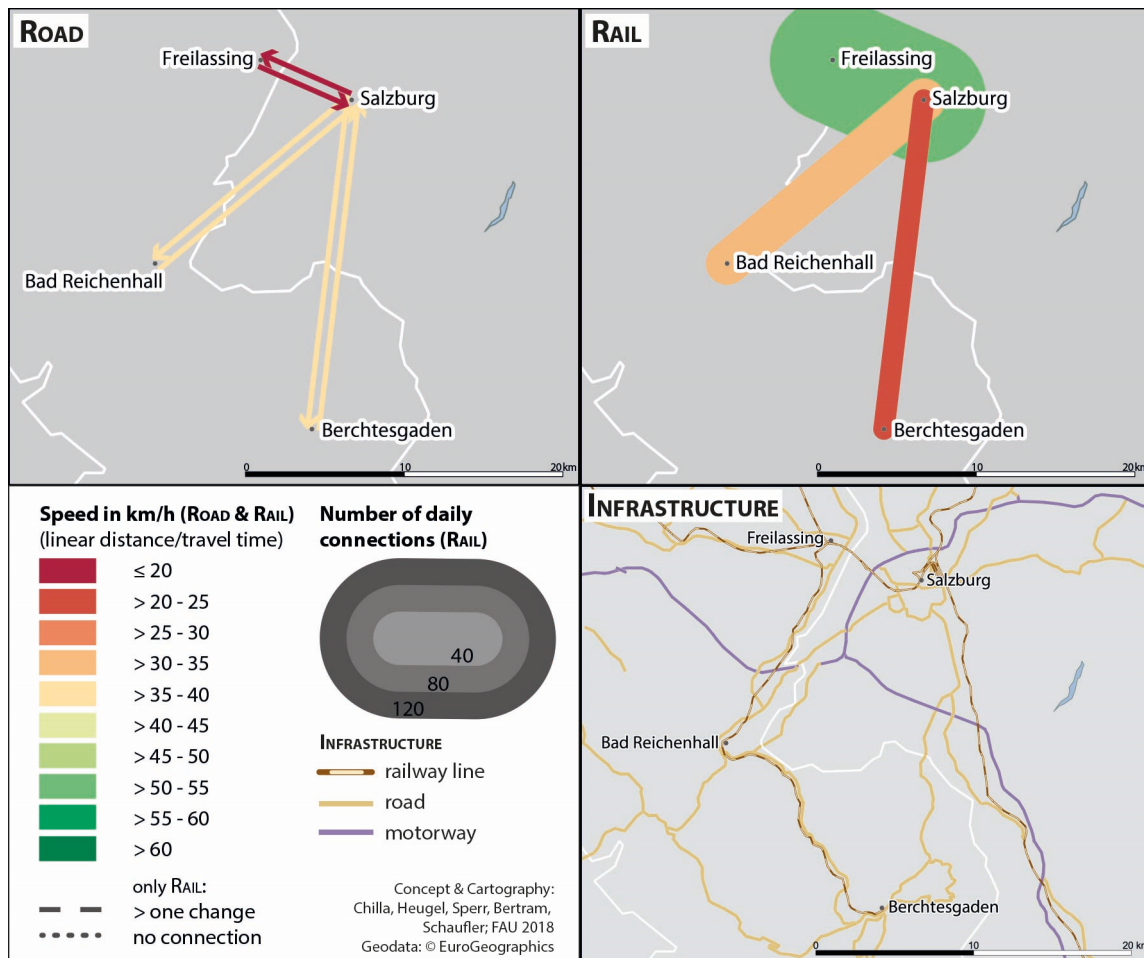
	MO	FR	IT	Sum (approx.)
Incoming commuters (total)	42.600	2.500	900	46.000
Time ref.	-	-	-	
Spatial ref.	-	-	-	
Source	EGB 2011 ⁹	EGB 2011	EGB 2011	
Characteristics of commuting system	Metropolitan – monocentric – trilateral			
	Commuting flows from France and Italy to Monaco, few commuters between France and Italy. The small state of Monaco with its metropolitan and highly dynamic labour market is the attracting hub.			
Infrastructure quality road	<ul style="list-style-type: none"> - The speed of the road linkages is rather slow for most of the cases. - Rush hour effects are visible for some linkages to Monaco. 			
Infrastructure quality rail	<ul style="list-style-type: none"> - The speed and the number of the train connections directly along the coast are good. - The fastest connections of the linkages Monaco – Nice and Monaco – Ventimiglia are reached with long distance traffic (TGV and EC). In contrast, the connections to the mountainous hinterland are worse (Peille) or non-existent (Contes) 			

⁹ The map MOT 2015 indicates slightly smaller values for the Monaco case without concretising details

Comparative remarks	For the linkages along the coast, the rail connections are good and a competitive alternative to individual transport. The hinterland connectivity is difficult due to the very rural context in a steep morphology.
---------------------	--

Table 9 Case study profile Monaco.

3.2.9 Salzburg



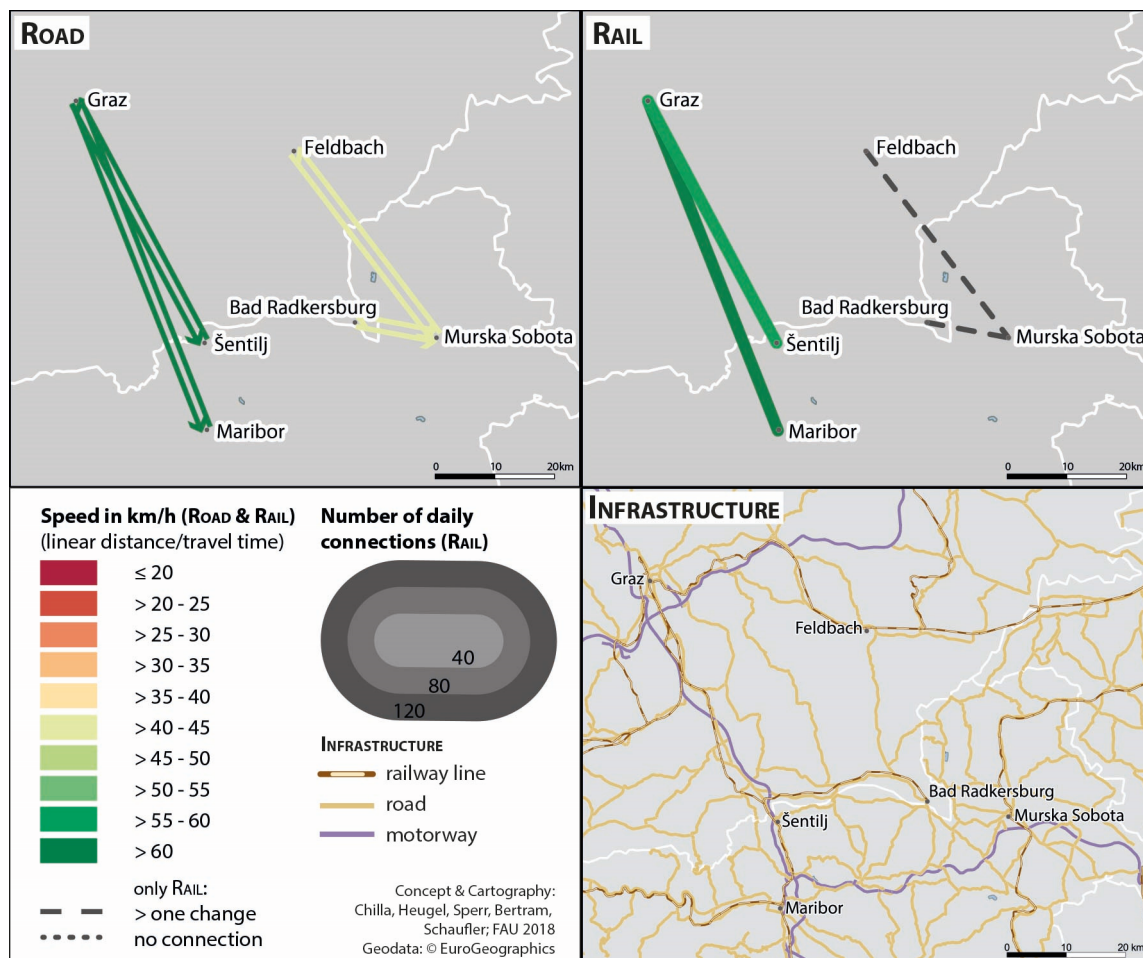
Map 11 Case study profile Salzburg.

	AT	DE	Sum (approx.)
Incoming commuters (total)	9.920	1.371	11.500
Time ref.	2015	2015	
Spatial ref.	Salzburg und Umgebung (NUTS 3)	Berchtesgadener Land (NUTS 3)	
Source	Statistik Austria 2018	BA 2016	
Characteristics of commuting system	Urban – monocentric – bilateral The commuting flows run mainly from Germany to Austria, due to the rather metropolitan hub of Salzburg city. A particularity of this case is the fact that some people live and work at Austrian locations but have to cross the border several times due to the geometry of the border (e.g. from Lofer in the very South to Salzburg). These people are not part of the commuting numbers but use cross-border infrastructure on a daily basis anyway.		
Infrastructure quality road	<ul style="list-style-type: none"> - Especially the linkage between Salzburg and Freilassing shows slow values as the city traffic hinders high speed. - Linkages to Berchtesgaden and Bad Reichenhall are faster, due to higher maximum speeds, and rush hour effects are not visible – mainly because the speed is generally very low in both directions (15,5 vs. 18,8 km/h). 		

Infrastructure quality rail	<ul style="list-style-type: none"> - The rail connection between Salzburg and Freilassing shows a high frequency and speed, this is due to various types of trains on that connection (two commuter rail lines, regional and long distance/high-speed trains). - The linkages from Berchtesgaden and Bad Reichenhall are slower also due to the route (via Freilassing). Nevertheless, the frequency is still good (Berchtesgaden – Salzburg with one train per hour).
Comparative remarks	<ul style="list-style-type: none"> - The rail connection from Salzburg to Freilassing is a good alternative to individual transport, whereas for Bad Reichenhall and Berchtesgaden individual transport is faster.

Table 10 Case study profile Salzburg.

3.2.10 Styria



Map 12 Case study profile Styria.

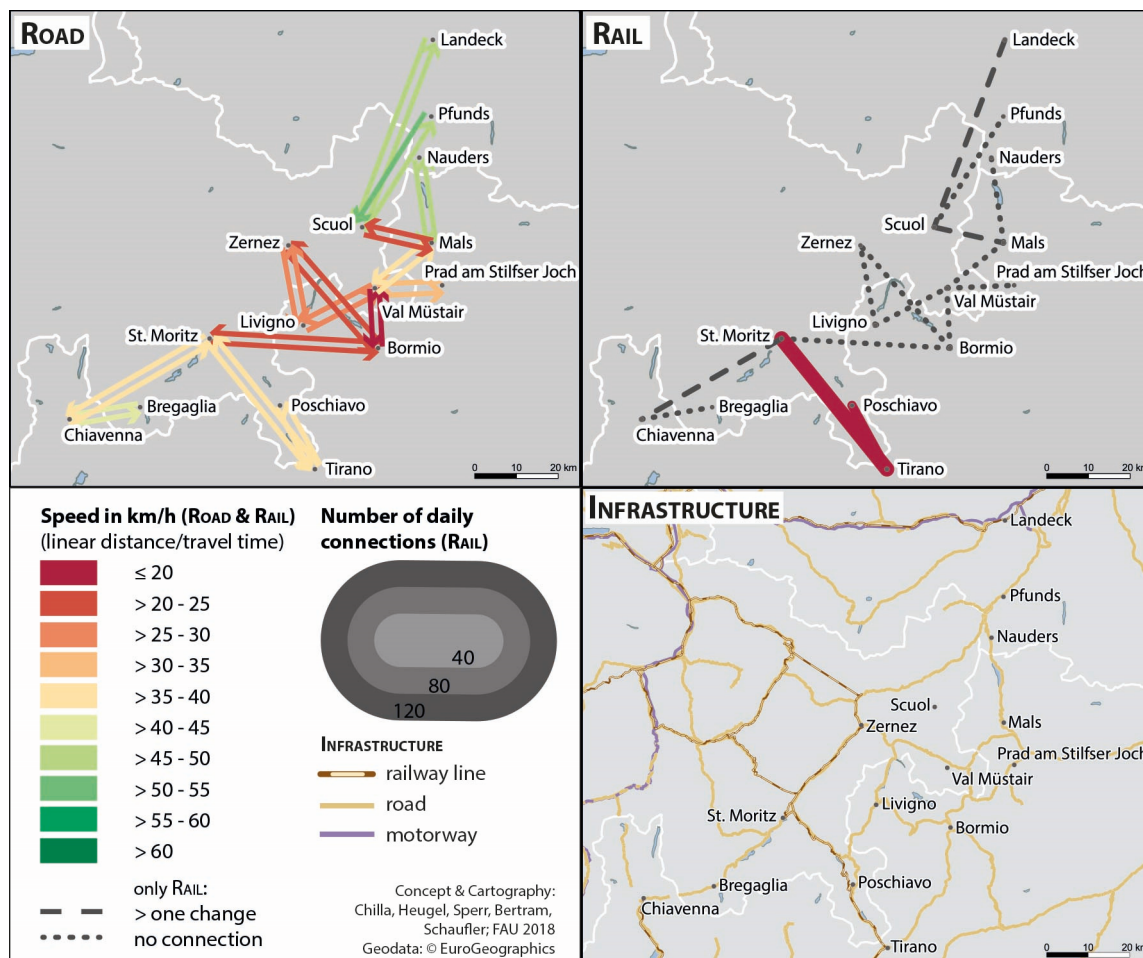
	AT	SI	Sum (approx.)
Incoming commuters (total)	17.367 ¹⁰	34	17.500
Time ref.	2015	2013	
Spatial ref.	Oststeiermark, West- und Südsteiermark, Graz (NUTS 3)	From Styria (NUTS 2) to Slovenia (NUTS 0)	
Source	Statistik Austria 2018	Statistik Austria 2015	
Characteristics of commuting system	Semi-urban – linear – bilateral Commuting flows are very asymmetric from Slovenia to Styria where in particular Graz is a dynamic urban labour market. There is also a high number of commuters from Hungary but these linkages are not analysed as they are not part of EUSALP.		
Infrastructure quality road	- The road linkages from Maribor and Šentilj to Graz allow fast average speed and show no rush-hour effects which can mainly be explained by existing motorway.		

¹⁰ Including the commuters from Hungary. Slovenian cross-border commuters in Styria: 6.075 (Statistik Austria 2015)

	<ul style="list-style-type: none"> - The link between the other cities are slower (as there is no highway) but show pretty positive values compared to other border regions.
Infrastructure quality rail	<ul style="list-style-type: none"> - A few, but fast connections link Graz and Šentilj/Maribor. - There is no direct cross-border connection between Murska Sobota and Bad Radkersburg and Feldbach.
Comparative remarks	<ul style="list-style-type: none"> - For the Eastern part rail is no alternative to individual transport. - For the Western part, both mobility modes are of good quality.

Table 11 Case study profile Styria.

3.2.11 Terra Raetica



Map 13 Case study profile Terra Raetica.

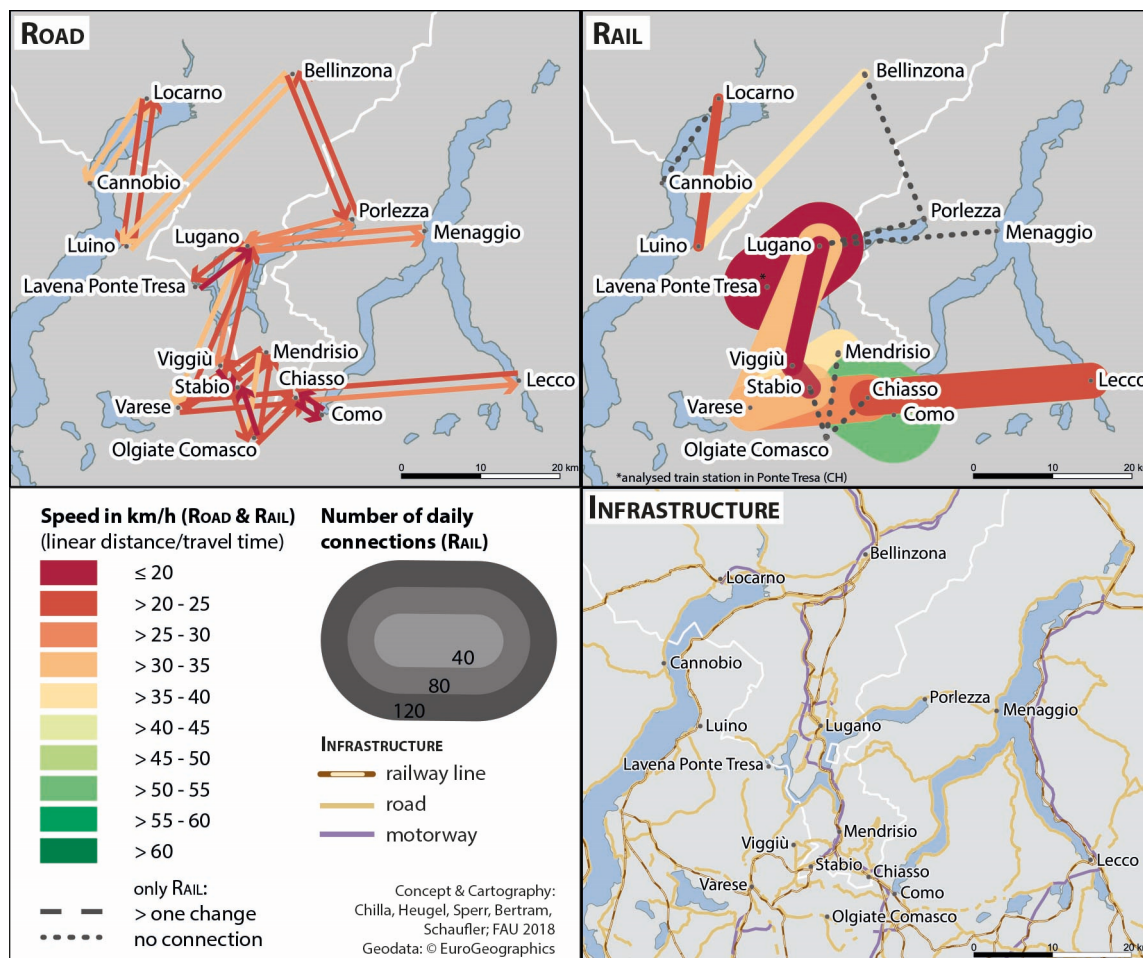
	CH	AT	IT	Sum (approx.)
Incoming commuters (total)	5.656	1.136	< 100 ¹¹	7.000
Time ref.	Q4 2015	2015		
Spatial ref.	Graubünden (NUTS 3)	Tiroler Oberland (NUTS 3)		
Source	BFS 2018	Statistik Austria 2018		
Characteristics of commuting system	Rural – polycentric – trilateral Commuting from Austria and Italy to Switzerland			
Infrastructure quality road	- The different speeds of the accessibility via road mainly reflects the morphological context that is very mountainous. The fact that no rush-hour effects are visible shows that the infrastructure in this rural context is not overstrained.			

¹¹ Indirect information from statistics on outgoing commuters from Tiroler Oberland and Graubünden/Grisons

Infrastructure quality rail	<ul style="list-style-type: none"> - At the moment, the rail infrastructure is rather poor despite of considerable commuter flows. One of the major political topics is the connection of the rail infrastructure between Lower Engadine and South Tyrol. Ongoing exchanges processes (e.g. 'Schlanderser Gespräche') aim generally at developing adequate solutions including bus systems, ticketing, timing etc. - Public transport via bus plays an important role which is not visible in this analysis (cp. https://www.terraraetica.eu/de/mobilita-raetica/fahrplan-online.html)
Comparative remarks	<p>The morphology clearly limits daily cross-border flows in large quantities at least in parts of this border region. At the same time, public rail transport is no alternative to private transport. Bus transport already plays an important role, and ongoing political efforts are promising.</p>

Table 12 Case study Terra Raetica.

3.2.12 Ticino



Map 14 Case study profile Ticino.

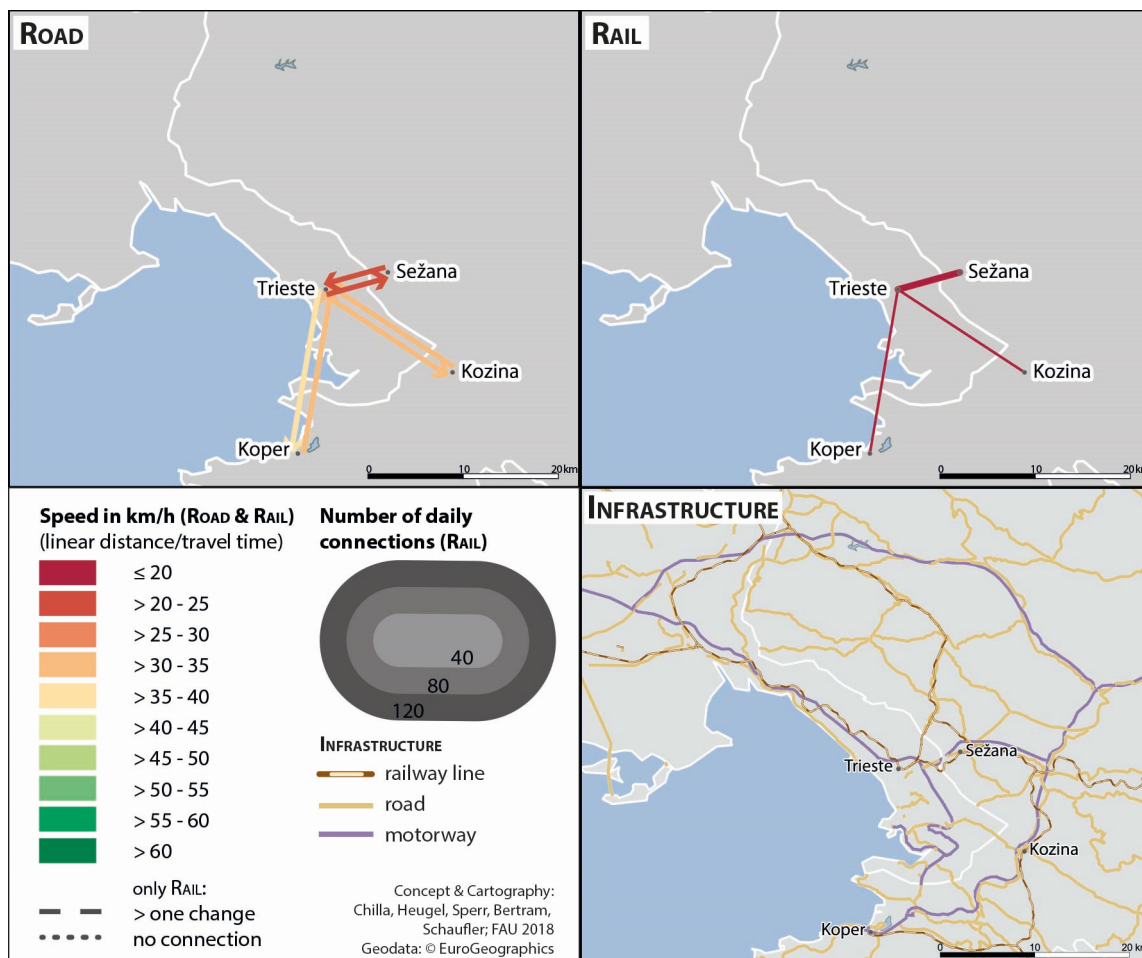
	CH	IT	Sum (approx.)
Incoming commuters (total)	61.902	<100 ¹²	62.000
Time ref.	Q4 2015		
Spatial ref.	Canton Ticino		
Source	BFS 2018		
Characteristics of commuting system	Rural – polycentric – bilateral		
	Commuting flows go in an asymmetric way from Italy to Switzerland where the financial/banking sector plays an important role for the commuting dynamic.		
Infrastructure quality road	- The average speed via road shows overall low speed, and some connections show rush-hour effects in direction to Switzerland, namely Lugano and Stabio.		
Infrastructure quality rail	<ul style="list-style-type: none"> - Several axes in this region are not linked via rail connections. - The linkages in the Southern part offer a comparably high number of connections. - At the same time, the speed of the connections is relatively slow. 		

¹² Indirect information about outgoing commuters from Ticino

Comparative remarks	A difficult morphology (mountains, lakes) with a rather poor rural transport infrastructure meets a dynamic cross-border labour market.
---------------------	---

Table 13 Case study profile Ticino.

3.2.13 Trieste



Map 15 Case study profile Trieste.

	IT	SI	Sum (approx.)
Incoming commuters <i>Time ref.</i> <i>Spatial ref.</i> <i>Source</i>	7.000 from Slovenia ¹³ 2016	300 from Italy 2007 <i>Gorenjska, Goriška, Obalno-Kraška (NUTS 3)</i> <i>MKW 2009</i>	7.500
Characteristics of commuting system	Urban – monocentric – bilateral Commuting flows go in an asymmetric way from the Slovenian side to the Italian side where Trieste is the attracting hub.		
Infrastructure quality road	<ul style="list-style-type: none"> - The road infrastructure shows modest values which can be explained with the urban context on the Trieste side and the morphological context combined with a very rural character on the Eastern side. - Due to the urban context, the link from Koper shows a rush-hour effect. 		

¹³ MKW 2009 assumes for the Schengen enacting year 2007 already 10.000 commuters from Slovenia to Italy. However, due to Eurostat (2018a), Slovenia (NUTS0) has 14.600 outgoing commuters (in 2016). As explained above, Styria receives 6.075 of them, so theoretically max. 7.500 could go to Trieste, leaving only minimal quantities for Carinthia.

Infrastructure quality rail	The rail infrastructure is of rather poor quality with a low number of slow connections
Comparative remarks	Rail transport is no alternative to public rail transport, but the accessibility via road is of rather poor quality, too.

Table 14 Case study profile Trieste.

3.3 Comparison

3.3.1 General idea

One advantage of the applied methodology is the possibility to compare the case study analyses across the modes of transport, but also across the different spatial contexts. In the following sections, we group the case study regions along the spatial patterns monocentric, polycentric and linear. We show the differences and similarities within these groups and we comment those across the groups. The objective is to reveal strengths and weaknesses in all case study regions and to allow an overall positioning.

3.3.2 Monocentric patterns

Five of the case study regions can be considered to be of rather monocentric character, namely the Basel, Geneva, Monaco, Salzburg and Trieste cases. In all cases, one metropolitan labour market functions as attracting pole. At the same time, the cases show many differences – both in the degree of metropolitan size and function and the morphological context. There can still be observed important parallels and differences.

Road (Map 16)

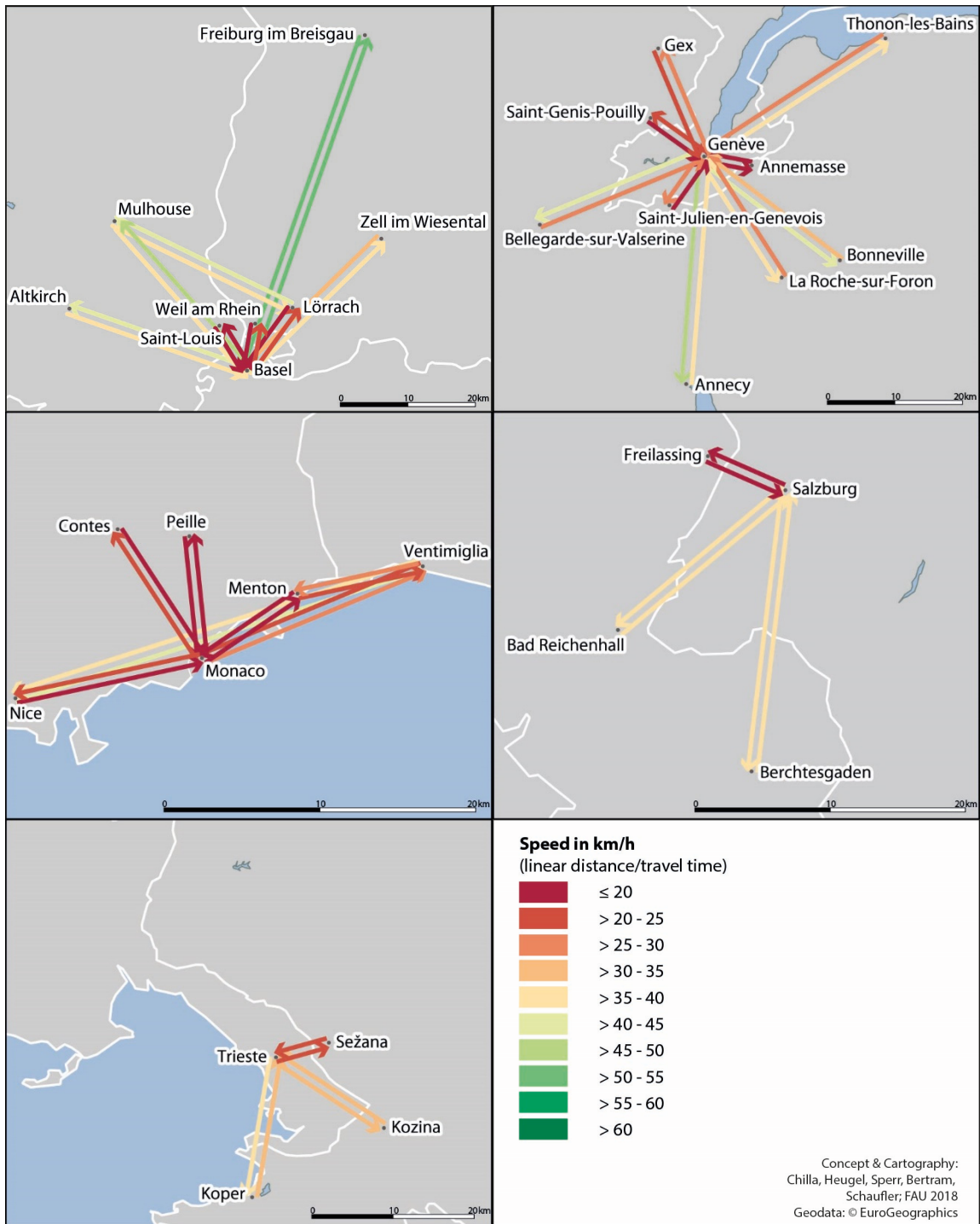
- In all cases, the short linkages show the slowest speed. This reflects the dense urban traffic in the inner districts. One should mention that the situation for individual commuters might be better than indicated here if the places of living and working do not require passing via inner-urban districts. For longer distances, the higher speed on the hinterland routes relativizes this effect.
- In the Basel, Geneva and Monaco regions, the rush hour effects are most visible. Both aspects, i.e. rush hour effects and slow speed, indicate that commuting via private car tends to be problematic. The situation is most difficult in Monaco, Geneva and Basel: They are the most metropolitan places and have the highest values of commuters.

Rail (Map 17)

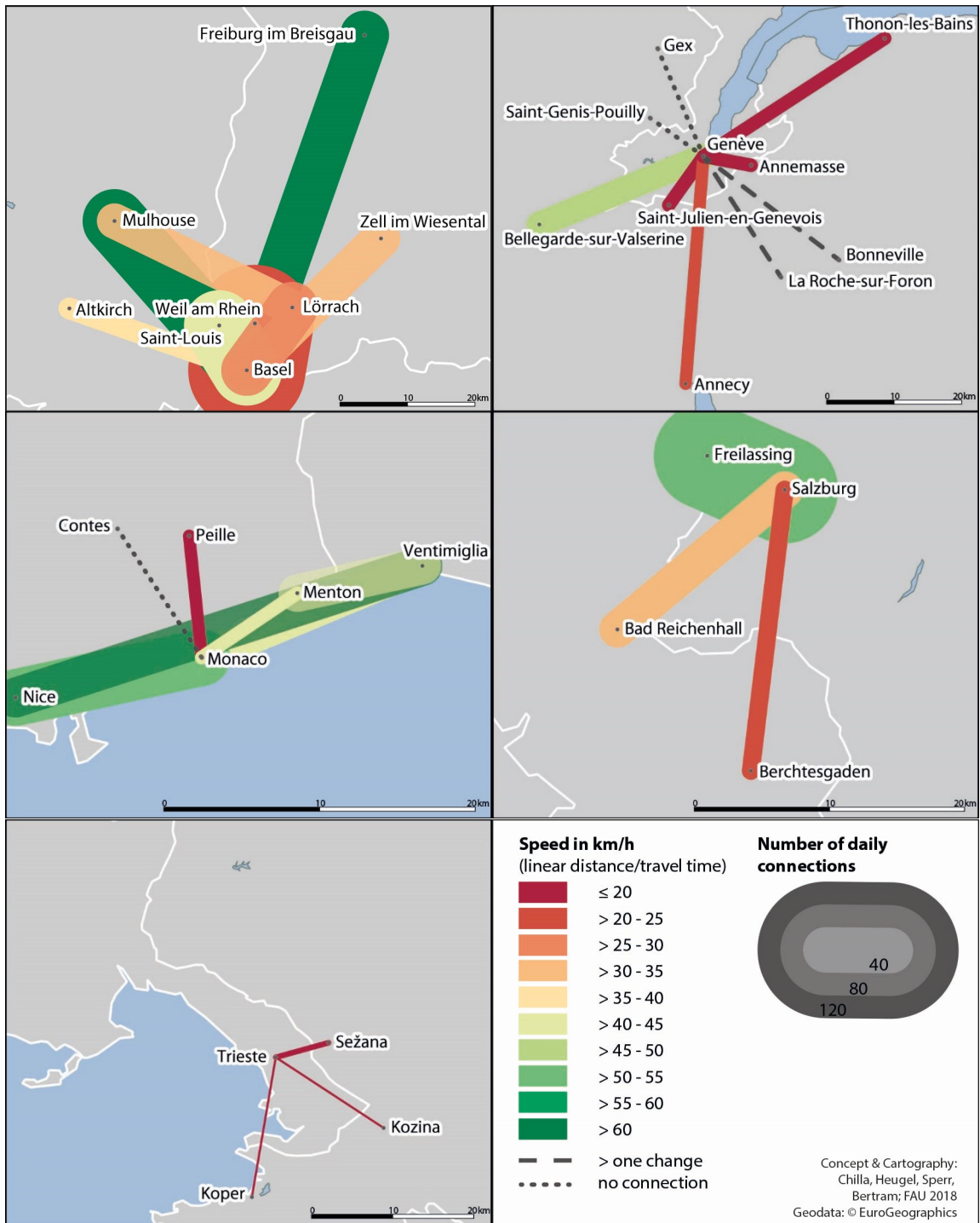
Comparing the rail situation across the cases provides rather contrasting pictures. Some linkages are very fast and of high frequency – mostly those linkages served by high speed / long distance trains (e.g. Basel-Freiburg, Nice-Monaco) and/or having commuter railways ('S-Bahn') / tramway systems (e.g. Salzburg Freilassing).

Low values are due to different reasons:

- In some regions, indirect connections and the need to change slows down the average speed (in particular Geneva where improvements are currently undertaken, Berchtesgaden/Salzburg).
- Morphology also plays a role, as again for Berchtesgaden/Salzburg and also for the Monaco case (Northern directions) and for Trieste in the Eastern direction.
- As mentioned earlier, the problematic situations, e.g. in Trieste and Geneva, might partially be relativized due to bus connections that are not included in the underlying database. Nevertheless, there is certainly a potential of rail connectivity.



Map 16 Comparing monocentric case studies with regard to road mobility.



Map 17 Comparing monocentric case studies with regard to rail mobility.

3.3.3 Polycentric patterns

Four case study regions are considered as polycentric, namely Lake Constance, Jura, Terra Raetica and Ticino. In all the cases, there is more than one attracting pole and the character of the regions is at least partially rural. The attracting poles are mainly located in Switzerland and for the Lake Constance case also in Liechtenstein.

Road (Map 18)

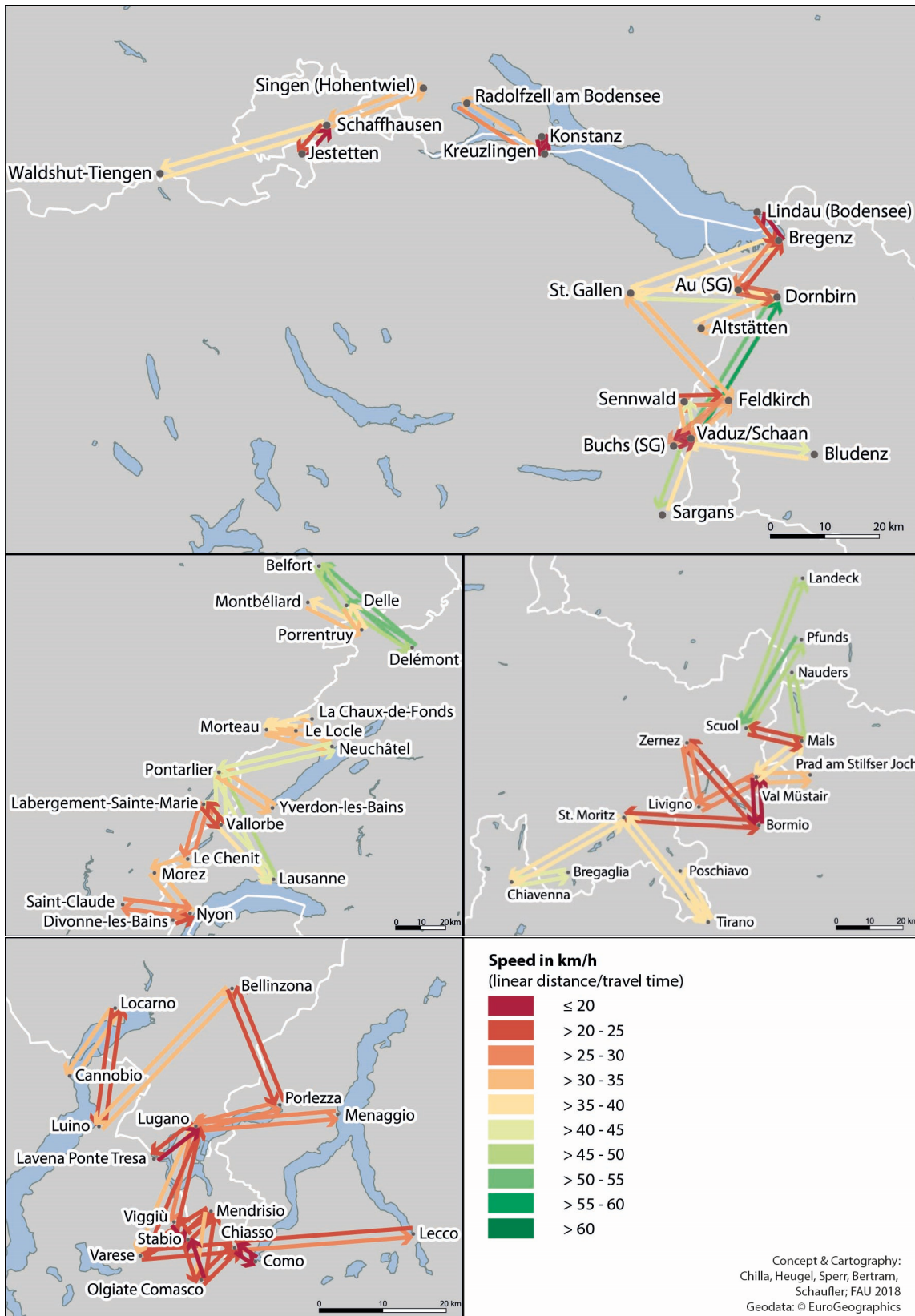
The overall impression from the comparative perspective is the diversity of patterns and the range of qualities. The explanation behind these patterns is multifaceted:

- Rush-hour effects are most visible around the most urban poles.
- Again, the shorter the connections, the slower is the average speed due to the inner-urban traffic situation.
- Morphology plays a role in Terra Raetica and Ticino.
- The quality of road connections – in particular depending on the question if a motorway is in place or not – makes a visible difference (e.g. Rhine valley).

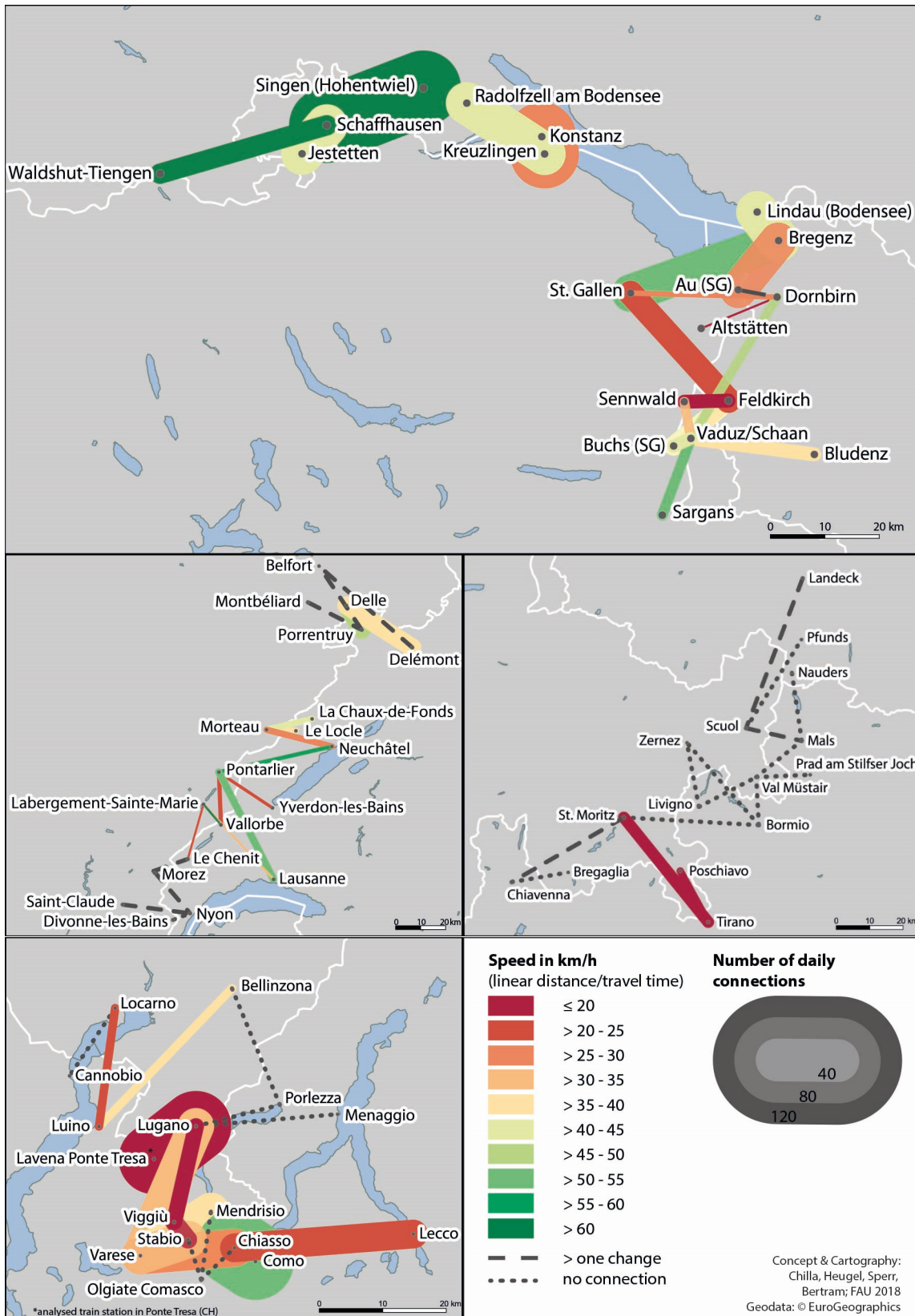
Rail (Map 17)

The overall picture is extremely diverse with regard to rail connectivity for the more polycentric cases. Again, the explanatory factors are manifold:

- The highest frequencies can again mainly be explained by the existence of interregional ('interregio') connections (e.g. Schaffhausen, St. Gallen).
- Frequency of connections is in Ticino and Lake Constance better than Jura and Terra Raetica.
- Highest speeds are visible around Schaffhausen.



Map 18 Comparing polycentric case studies with regard to road mobility.



Map 19 Comparing polycentric case studies with regard to rail mobility.

3.3.4 Linear patterns

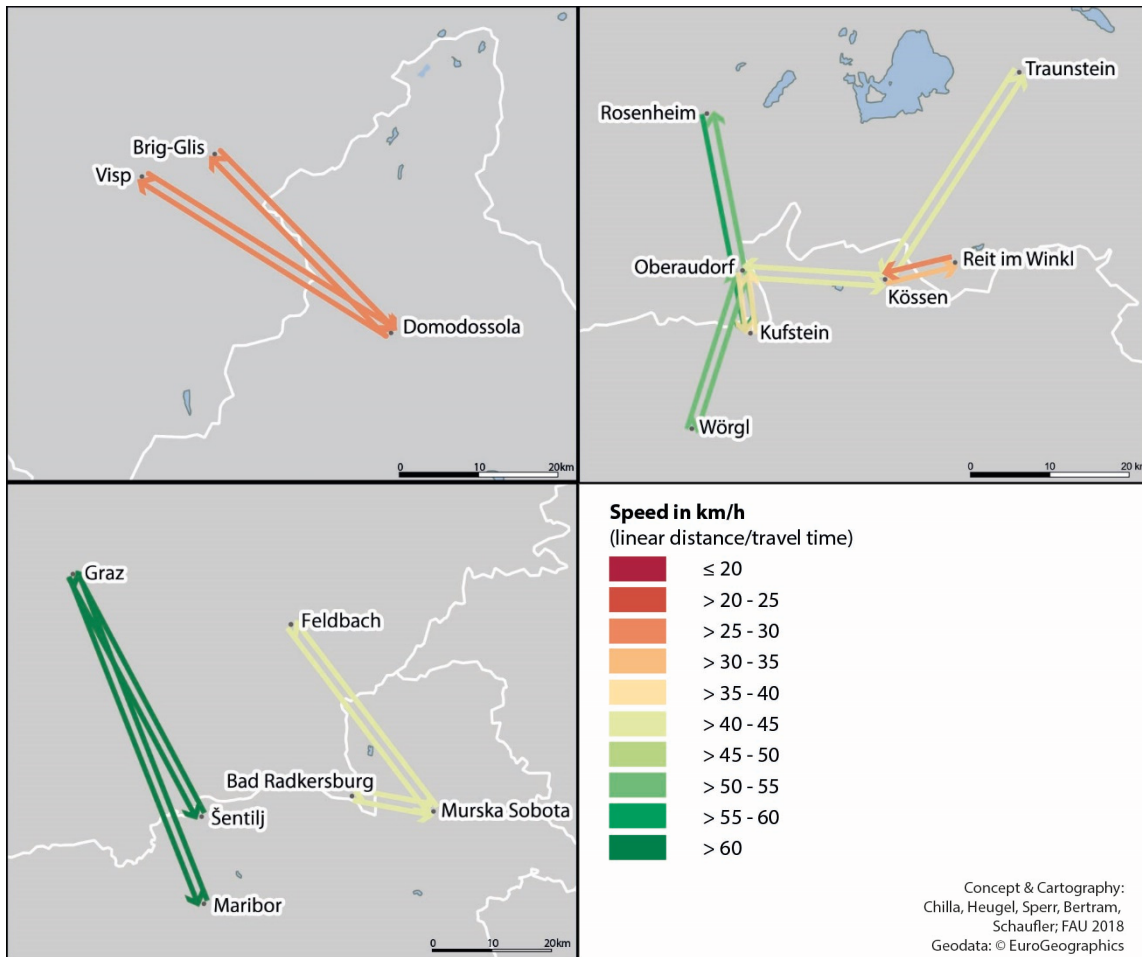
The last three case studies can be summarised as regions with a predominantly linear character, namely Brig-Domodossola, Kufstein-Rosenheim and Styria. These regions are dominated by corridor infrastructures (pass road for Brig-Domodossola, highways in Styria and Kufstein-Rosenheim). The attracting labour market for the cases Brig-Domodossola and Styria is located on one side (Switzerland and Austria) whereas in the case of Kufstein-Rosenheim commuter flows exist to both sides (Austria, Germany).

Road (Map 20)

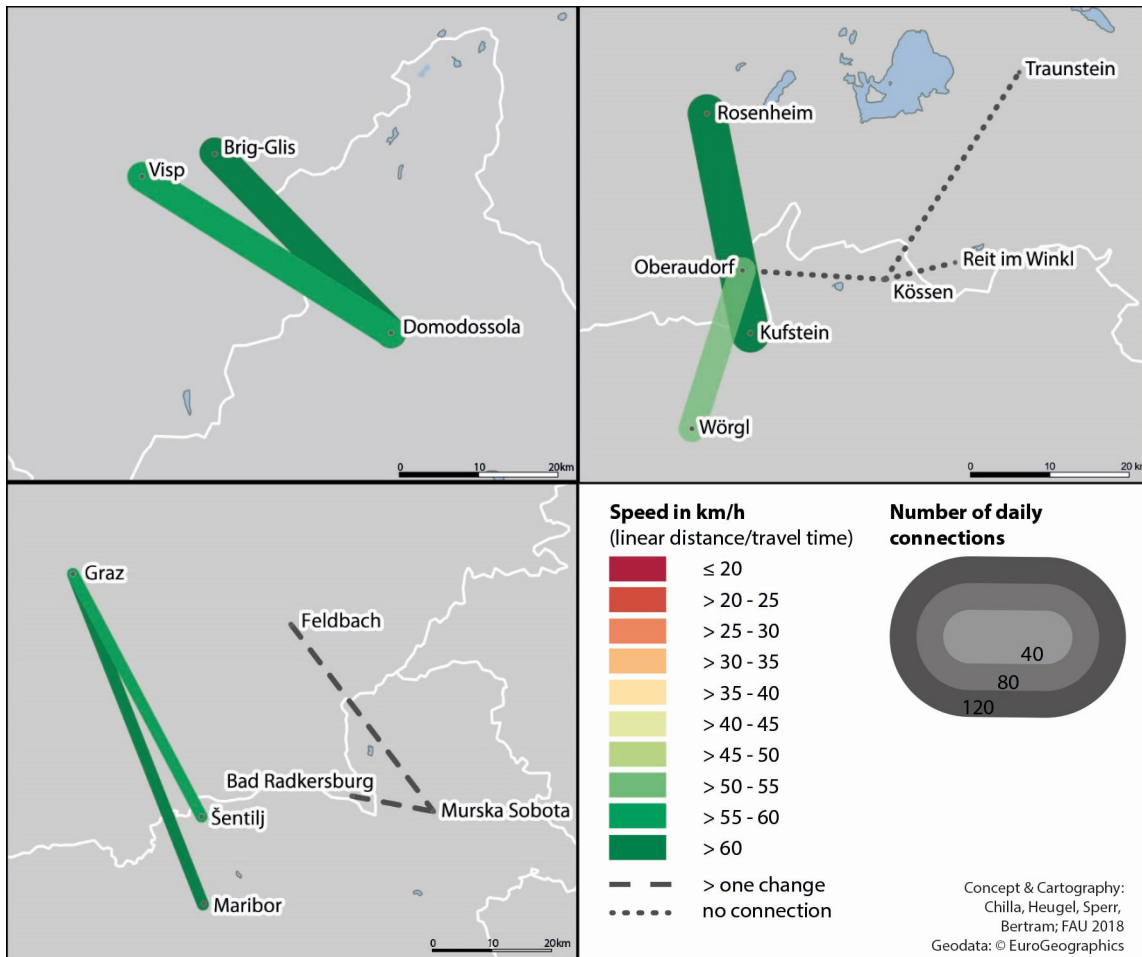
The overall picture shows faster connections in comparison to the monocentric and polycentric case studies with the exception of Brig-Domodossola. The highest speeds (between Maribor and Graz, Wörgl and Rosenheim) are reached on motorways. Rush hour effects are not visible on the analysed routes.

Rail (Map 21)

Also for the existing rail connections, rather fast values can be observed. However, the frequency is low in Styria and on several relevant commuting routes, no rail connection is in place. This is a typical picture for (semi-)rural contexts: it is comparably easy to reach fast speed but much more difficult to offer a high frequency.



Map 20 Comparing linear case studies with regard to road mobility.

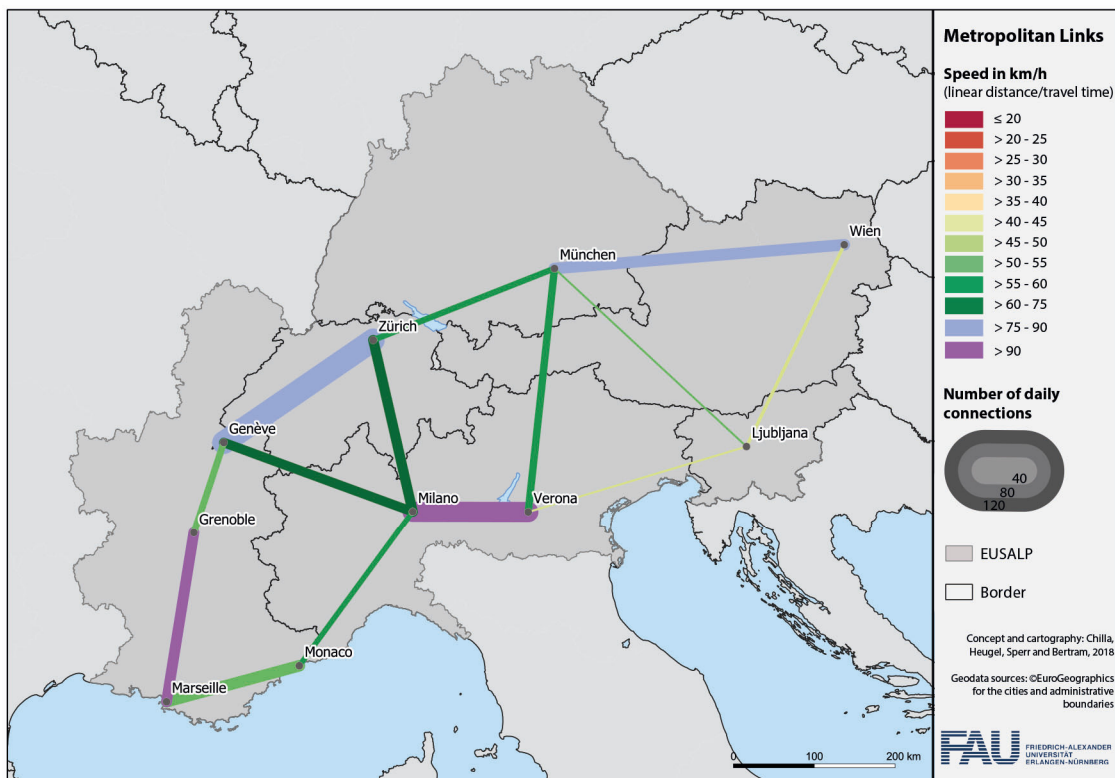


Map 21 Comparing linear case studies with regard to road mobility.

3.3.5 Transnational metropolitan perspective

The metropolitan accessibility analyses on the EUSALP scale provides a more transnational perspective, linking the large urbanised areas. Map 22 applies a different classification of the speed values than the above shown maps due to the much higher speed of the high speed / long-distance connections.

Firstly, the map illustrates that fast train connections not only serve transit purposes; metropolitan linkages play an important role for the Alpine region as such. Moreover, domestic linkages tend to be much better than those crossing borders. This is due to the high path dependency of transport infrastructure that depends on large-scale investments a long planning/implementation periods. This is in particular true for those connections that pass an intense relief. Both arguments also explain the Slovenian connectivity that has not yet reached the level of the other spaces. Spatial integration on the transnational scale certainly means to improve transnational accessibility.



Map 22 Rail mobility in metropolitan perspective.

4 Conclusion

The analyses of WP 2 on cross-border commuting have clearly underlined the high relevance of cross-border commuting within the EUSALP perimeter. The share of cross-border commuting is higher than the European average values. The labour markets of Switzerland, Liechtenstein and Monaco play a particular role here.

The structural and spatial patterns are very diverse: The labour markets range from very metropolitan to rather rural patterns, and the absolute and relative numbers vary largely. With regard to mobility infrastructure, the picture is even more complex: The overall observation is that the cross-border infrastructure situation is characterised, firstly, by a multitude of influencing structural factors as morphology urbanisation degree etc. The quality differences tend to be higher for the rail connectivity than for the road connectivity. Unfortunately, it was not possible to include the bus connectivity in the framework of this project that makes a certain difference for several case studies.

Secondly, the analyses underline that policy matters: political decisions, priorities and path dependencies change cross-border mobility patterns to a high extent. If macro-regional cooperation intends to address common challenges, the improvement of cross-border mobility facilities has certainly to be part of these efforts.

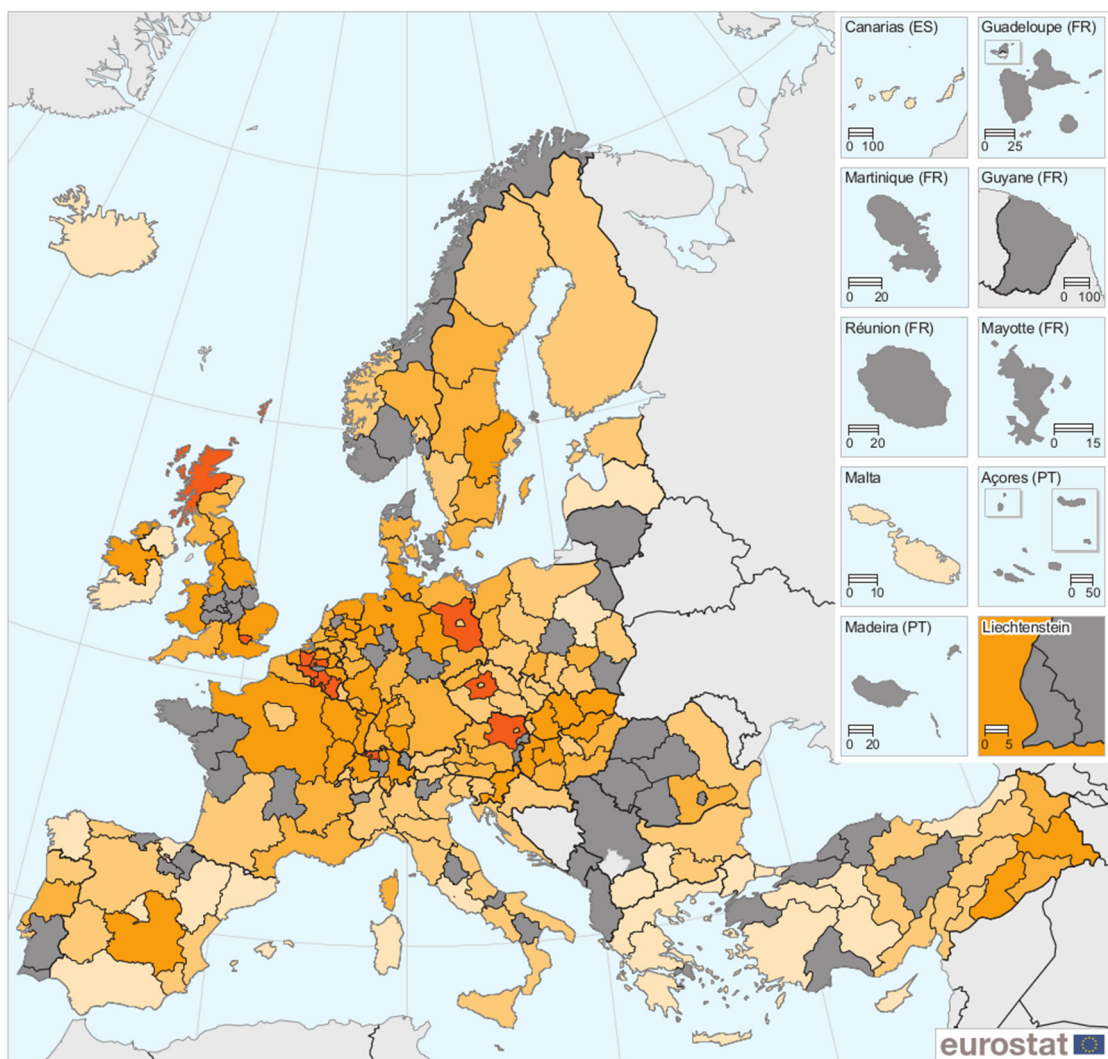
5 References

- Amt für Statistik Liechtenstein (=AS) (2018): Beschäftigungsstatistik. Matrix 03.02.106d.
- BBSR (2017): Raumb Beobachtung Deutschland und angrenzende Regionen. Räumliche Strukturen und Verflechtungen. MORO Praxis Heft 11. Online: <https://www.bbsr.bund.de/BBSR/DE/Veroeffentlichungen/ministerien/MOROPraxis/2017/moro-praxis-11-17-lang-dl.html>
- Bundesagentur für Arbeit in Deutschland (=BA) (2016): Sozialversicherungspflichtig Beschäftigte - Pendler nach Kreisen. Arbeitsmarkt in Zahlen – Beschäftigungsstatistik.
- Bundesamt für Statistik der Schweizerischen Eidgenossenschaft (=BFS) (2018): Grenzgängerstatistik (GGS)
- Chilla, T., Heugel, A. (2018): Spatial Integration of cross-border mobility structures. In: UniGR-CBS thematic issue. Cross-border Territorial Development – Challenges and Opportunities. Vol.: 1 :68-78. Online: http://www.uni-gr.eu/sites/tst-uni-gr.univ-lorraine.fr/files/users/borders_in_perspective_unigr-cbs-thematic_issue_vol.1.pdf.
- COM (2018): Border Region Data collection. Project n° 2016CE16BAT105. Final Report. Online: https://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/border_data_collect_en.pdf
- COM2017/534: Boosting growth and cohesion in EU border regions. Communication from the commission to the council and the european parliament {SWD(2017) 307 final}.
- ESPON & University of Luxemburg (= ESPON Metroborder) (2010): 'METROBORDER. Cross-border Polycentric Metropolitan Regions', Targeted Analysis 2013/2/3, Final Report 21/12/2010. Online: http://www.espon.eu/export/sites/default/Documents/Projects/TargetedAnalyses/METROBORDE R/METROBORDER_-_Final_Report_-_29_DEC_2010.pdf.
- Eurostat (2018a): Beschäftigung und Pendlerströme nach NUTS-2-Regionen. Tabelle: `lfst_r_lfe2ecomm`.
- Eurostat (2018b): Statistics on commuting patterns at regional level. Online: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Statistics_on_commuting_patterns_at_regional_level
- Mission opérationnelle transfrontalière (=MOT) (2007): Dynamiques transfrontalières et projets de territoires. Atlas de la Coopération transfrontalière 2. URL: <http://www.espaces-transfrontaliers.org/fileadmin/flipbooks/atlas2007/index.html#1>.
- Mission opérationnelle transfrontalière (=MOT) (2015): Travailleurs frontaliers aux frontières françaises. Online: <http://www.espaces-transfrontaliers.org/ressources/cartes/maps/show/travailleurs-frontaliers-residant-aux-frontieres-francaises/>
- Europäischer Gewerkschaftsbund (=EGB) (2011): Entwicklung der Rolle der IGR im Rahmen der Stärkung der grenzübergreifenden Zusammenarbeit bezüglich Tarifverhandlungen.
- MDI RLP (2017): Raumb Beobachtung Großregion. Endbericht der Modellregion „Großregion“ zum Modellvorhaben der Raumordnung (MORO) „Raumb Beobachtung Deutschland und angrenzende Regionen“. Online: <https://www.sig-gr.eu/de/publications.html#>
- MKW Wirtschaftsforschung GmbH & Empirica Kft. (=MKW) (2009): Scientific Report on the Mobility of Cross-Border Workers within the EU-27/EEA/EFTA Countries. Final Report.
- Office cantonal de la statistique (=OCSTAT) (2013): Informations statistique. Les travailleurs non résidents dans le canton de Genève. N° 26. Online: https://www.ge.ch/statistique/tel/publications/2013/informations_statistiques/autres_themes/is_tra_vailleurs_non_residants_26_2013.pdf.
- Statistik Austria (2015): Arbeitsstättenzählung 2013. Bearbeitung und Berechnung: Landesstatistik Steiermark.
- Statistik Austria (2018): Arbeitsstättenzählung 2015.

6 Annexes

6.1 Eurostat map on cross-border commuting

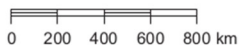
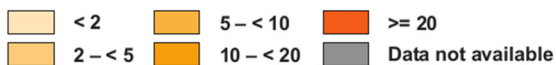
Commuter outflows, by NUTS 2 regions, 2015 (*)
(% of total employment)



(% of total employment)

Administrative boundaries: © EuroGeographics © UN-FAO © Turkstat
Cartography: Eurostat — GISCO, 05/2016

EU-28 = 8.1



(*) Severna i yugoiztochna (Bulgaria), Bayern, Hessen, Niedersachsen, Rheinland-Pfalz, Sachsen (Germany), Voreia Ellada, Kentriki Ellada (Greece), Bassin Parisien, Sud-Ouest, Méditerranée (France), Noord-Nederland (the Netherlands), Region Północny (Poland), Macroregiunea doi (Romania), Manner-Suomi (Finland), North East, North West, Yorkshire and The Humber, East of England, London, South East, South West, Wales (the United Kingdom) and Ege (Turkey): NUTS level 1. Note that when data are shown for NUTS level 1 regions, commuter outflows still concern outflows from NUTS level 2 regions and so some of the commuter outflows reported for NUTS level 1 regions may be flows between NUTS level 2 regions within the same NUTS level 1 region. Yugozapaden (Bulgaria), Calabria, Sardegna, Marche (Italy), East of England, North Eastern Scotland, Highlands and Islands (the United Kingdom), Région lémanique and Espace Mittelland (Switzerland): 2014. Mecklenburg-Vorpommern (Germany), Utrecht (the Netherlands), Kärnten (Austria) and Eastern Scotland (the United Kingdom): 2013. Prov. Namur (Belgium), Wales and South Western Scotland (the United Kingdom): 2012. Includes data of low reliability for some regions.

Source: Eurostat (online data codes: [lfst_r_lfe2ecomm](#) and [lfst_r_lfe2emp](#))

Map 23 Commuter outflows 2015 – the only official and harmonized data collection on European level for questions of cross-border commuting. Source: Eurostat 2018b.

6.2 Studies

General:

- AEBR (2012): Information services for cross-border workers in European border regions
- ESPON 2011: Metroborder
- MKW Wirtschaftsforschung GmbH & Empirica Kft. (2009): Scientific Report on the Mobility of Cross-Border Workers within the EU-27/EEA/EFTA Countries. Final Report.
- Unione italiana del lavoro (2013): Information Actions for Cooperation regarding Cross-border workers in Alpine Arch Countries - inARCO.
- Van der Valk, J. (2016): Developing cross-border statistics.
- Connect 2CE Project: <https://www.interreg-central.eu/Content.Node/CONNECT2CE.html>

Austria:

- EPFL-Chôros / K10.28: Grenzgänger 2000.
- EPFL- Chôros / K10.29: Grenzgänge: Wohn- und Arbeitsgemeinden, 2000.
- EURES Bodensee (2005): Grenzgänger in der Euregio Bodensee. Vorarlberg.
- IBK (2016): Grenzgänger in der Bodenseeregion 2016. St. Gallen.
- Kanton St.Gallen, Amt für Raumentwicklung und Geoinformation (11. 2017): Pendler Gemeinden Agglomerationsprogramm Rheintal 2016.
- ÖBB-Infrastruktur AG (2016): Verkehrserhebung Grenzübergänge Steiermark-Slowenien Endbericht. Graz.
- Translake GmbH (herausgegeben im Auftrag der EURES-Grenzpartnerschaft Bodensee) (2008): Mobilität in der Regio Bodensee. Bevölkerung. Beschäftigung. Grenzgänger. Vorarlberg.
- Translake GmbH (herausgegeben im Auftrag der EURES-Grenzpartnerschaft Bodensee) (2010): Grenzgänger in der Regio Bodensee 2009. Vorarlberg.
- Zupančič, J. (2002): Prekogranične dnevne radne migracije iz Slovenije u Austriju i Italiju. Migracijske i etničke teme 18 2–3: 151–166.

France:

- French National Institute of Statistics and Economic Studies (2015): Résider en France et travailler à l'étranger. Une situation en plein essor. Paris.
- French National Institute of Statistics and Economic Studies (2016): 160 000 travailleurs frontaliers en ACAL. Strasbourg.
- Observatoire statistique transfrontalier (2016): La structuration du bassin franco-genevois par les flux domicile-travail. Genève.
- Observatoire statistique transfrontalier (2013): Profil des actifs transfrontaliers de la zone d'emploi du genevois français. Genève.
- Observatoire statistique transfrontalier de l'Arc jurassien (2017) : Le marché du travail dans l'Arc jurassien en 2016.
- Mission Operationel Transfrontalier (MOT) (studies from 2006, 2015 and 2015 for Bern and Geneva)

Germany:

- BBSR (2017): Raumb Beobachtung Deutschland und angrenzende Regionen.
- EPFL- Chôros / K10.28: Grenzgänger 2000.
- EPFL- Chôros / K10.29: Grenzgänge: Wohn- und Arbeitsgemeinden, 2000.
- EURES Bodensee (2005): Grenzgänger in der Euregio Bodensee. Vorarlberg.
- French National Institute of Statistics and Economic Studies (2016): 160 000 travailleurs frontaliers en ACAL. Strasbourg.
- IAB = Heining, Jörg; Möller, Sabrina (2009): Grenzpendler in Deutschland: Wer sie sind, woher sie kommen, wohin sie gehen. (IAB-Kurzbericht, 27/2009), Nürnberg, 8 S.
- IBK (2016): Grenzgänger in der Bodenseeregion 2016. St. Gallen.
- Translake GmbH (herausgegeben im Auftrag der EURES-Grenzpartnerschaft Bodensee) (2008): Mobilität in der Regio Bodensee. Bevölkerung. Beschäftigung. Grenzgänger. Vorarlberg.
- Translake GmbH (herausgegeben im Auftrag der EURES-Grenzpartnerschaft Bodensee) (2010): Grenzgänger in der Regio Bodensee 2009. Vorarlberg.

Italy:

- Adria A project
- ASTAT (2007): Allgemeine Volkszählung Band 6 Pendlerströme aus Berufs- und Studiengründen 2001. Bozen.
- Baruffini, M. (2011): Cross-border commuting in the Swiss-Italian region; labour market effects of progressive integration. In: Larsen, C. et al. (ed.): Measuring Geographical Mobility in Regional Labour Market Monitoring State of the Art and Perspectives. Rainer Hampp Verlag. Mering.
- Comune, M.E., Ronconi, S. & L. Viviano (2016): The challenge of permeable borders: estimating cross-border employment between Italy and Switzerland. An analysis of sources and estimates.
- EPFL- Chôros / K10.28: Grenzgänger 2000.
- EPFL- Chôros / K10.29: Grenzgänge: Wohn- und Arbeitsgemeinden, 2000.
- Gabrovec, M. (2013): Open borders with uncoordinated public transport: the case of the slovenian-italian border. European Journal of Geography 4(4).
- IRE (2015): Approfondimento della situazione del mercato del lavoro ticinesenegli anni successivi all'introduzione dell'Accordo sulla Libera Circolazione delle Persone. Lugano.
- Repubblica e Cantone Ticino, Dipartimento del territorio (2017): Traffico transfrontaliero: rilevamento presso i valichi di confine nel 2016.
- Zupančič, J. (2002): Prekogranične dnevne radne migracije iz Slovenije u Austriju i Italiju. Migracijske i etničke teme 18 2–3: 151–166.

Liechtenstein:

- EPFL-Choros / K10.28: Grenzgänger 2000.
- EPFL-Choros / K10.29: Grenzgänge: Wohn- und Arbeitsgemeinden, 2000.
- EURES Bodensee (2005): Grenzgänger in der Euregio Bodensee. Vorarlberg.
- Translake GmbH (herausgegeben im Auftrag der EURES-Grenzpartnerschaft Bodensee) (2008): Mobilität in der Regio Bodensee. Bevölkerung. Beschäftigung. Grenzgänger. Vorarlberg.

- Translake GmbH (herausgegeben im Auftrag der EURES-Grenzpartnerschaft Bodensee) (2010): Grenzgänger in der Regio Bodensee 2009. Vorarlberg.
- IBK (2016): Grenzgänger in der Bodenseeregion 2016. St. Gallen.

Slovenia:

- ÖBB-Infrastruktur AG (2016): Verkehrserhebung Grenzübergänge Steiermark-Slowenien Endbericht. Graz.
- Gabrovec, M. (2013): Open borders with uncoordinated public transport: the case of the slovenian-italian border. *European Journal of Geography* 4(4).
- Zupančič, J. (2002): Prekogranične dnevne radne migracije iz Slovenije u Austriju i Italiju. *Migracijske i etničke teme* 18 2–3: 151–166.

Switzerland:

- EPFL- Chôros / K10.28: Grenzgänger 2000.
- EPFL- Chôros / K10.29: Grenzgänge: Wohn- und Arbeitsgemeinden, 2000.
- EURES Bodensee (2005): Grenzgänger in der Euregio Bodensee. Vorarlberg.
- French National Institute of Statistics and Economic Studies (2016): 160 000 travailleurs frontaliers en ACAL. Strasbourg.
- IBK (2016): Grenzgänger in der Bodenseeregion 2016. St. Gallen.
- IRE 2015: Approfondimento della situazione del mercato del lavoro ticinesenegli anni successivi all'introduzione dell'Accordo sulla Libera Circolazione delle Persone. Lugano.
- Kanton St.Gallen, Amt für Raumentwicklung und Geoinformation (11. 2017): Pendler Gemeinden Agglomerationsprogramm Rheintal 2016.
- Observatoire statistique transfrontalier (2013): Profil des actifs transfrontaliers de la zone d'emploi du genevois français. Genève.
- Observatoire statistique transfrontalier (2016): La structuration du bassin franco-genevois par les flux domicile-travail. Genève.
- Repubblica e Cantone Ticino, Dipartimento del territorio (2017): Traffico transfrontaliero: rilevamento presso i valichi di confine nel 2016.
- Transfrontier Operational Mission (MOT) (studies from 2006, 2015 and 2015 for Bern and Geneva)
- Translake GmbH (herausgegeben im Auftrag der EURES-Grenzpartnerschaft Bodensee) (2008): Mobilität in der Regio Bodensee. Bevölkerung. Beschäftigung. Grenzgänger. Vorarlberg.
- Translake GmbH (herausgegeben im Auftrag der EURES-Grenzpartnerschaft Bodensee) (2010): Grenzgänger in der Regio Bodensee 2009. Vorarlberg.

6.3 Definitions

Country	Source	Commuters	Employment
Austria	STATISTIK AUSTRIA	Incoming Database: Arbeitsstättenzählung	
		Beschäftigte in der Arbeitsstätte ohne Hauptwohnsitz in Österreich	Beschäftigte in den Arbeitsstätten bezogen auf Beschäftigungsverhältnisse
		Outgoing Database: Abgestimmte Erwerbsstatistik	
		Pendler ins Ausland, d.h. der Arbeitsort liegt nicht in Österreich	Erwerbstätige am Wohnort: Der Abgestimmten Erwerbsstatistik liegt inhaltlich das Konzept der International Labour Organization zugrunde (s. Eurostat), weshalb die internationale Vergleichbarkeit der Ergebnisse gegeben ist.
France	Institut national de la statistique et des études économiques (INSEE)	Outgoing Database: Recensement de la population 2015 exploitation complémentaire	
		Nb actifs travaillant dans communes "frontalières"	Au sens du recensement, la population active ayant un emploi (ou les actifs ayant un emploi) comprend les personnes qui déclarent être dans une des situations suivantes : Exercer une profession (salarée ou non), même à temps partiel ; Aider une personne dans son travail (même sans rémunération) ; Être apprenti, stagiaire rémunéré ; Être chômeur tout en exerçant une activité réduite ; Être étudiant ou retraité tout en occupant un emploi. Les actifs ayant un emploi peuvent être comptés à leur lieu de travail ou à leur lieu de résidence. Au recensement, les personnes actives ayant un emploi peuvent être comptées à leur lieu de résidence ou à leur lieu de travail. Au lieu de résidence, on parle de population active ayant un emploi.
Germany	Bundesagentur für Arbeit (BA)	Incoming Database: Beschäftigungsstatistik	
		Pendler sind in der Beschäftigungsstatistik alle sozialversicherungspflichtig Beschäftigten, deren Arbeitsgemeinde sich von der Wohngemeinde unterscheidet.	Als sozialversicherungspflichtig bzw. geringfügig Beschäftigte gelten Personen, die folgende Kriterien erfüllen:

Country	Source	Commuters	Employment
		<p>Ob und wie häufig gependelt wird, ist unerheblich.</p> <p>Einpendler sind Personen, die in ihrer Arbeitsgemeinde nicht wohnen.</p> <p>Die Wohnortgemeinde kann auch im Ausland liegen.</p> <p>Einpendler aus dem Ausland können also statistisch dargestellt werden. Für Auspendler in das Ausland gilt dies jedoch nicht, da keine Meldungen der Betriebe im Ausland zur deutschen Sozialversicherung erfolgen.</p>	<p>1) Eine Arbeitgebermeldung zur Sozialversicherung liegt vor.</p> <p>2) Die Beschäftigung ist versicherungspflichtig in mindestens einem der Zweige der Sozialversicherung (Rentenversicherung, Krankenversicherung/ Pflegeversicherung, Arbeitslosenversicherung).</p> <p>3) Es handelt sich um abhängige Beschäftigung bzw. Arbeit, die im Allgemeinen gegen Entgelt entrichtet wird (Ausnahmen sind Unterbrechungstatbestände wie z. B. Elternzeit).</p> <p>4) Es wird mindestens eine Stunde pro Woche gearbeitet.</p>
Italy	Italian National Institute for Statistics (ISTAT)	Outgoing Database: Dataset Commuting for studying or working (Census 2011)	
		<p>Employed persons resident in private household moving to the usual place of work:</p> <p>The item "Outside of the municipality of place of usual residence" includes the daily transfers, for work or study, to a municipality different from the place of usual residence, to a different municipality of the same province, to a different province of the same region, to provinces in other regions or abroad.</p>	<p>Persons aged 15 years and over that in the reference week (02nd–08th October 2011):</p> <ul style="list-style-type: none"> - worked, upon payment or payment in kind, for at least one hour in any kind of activity; - worked for at least one hour in a family-run business in which they usually work without compensation; - are absent on work (because of holidays or sickness). Employees absent on work are considered employed if the absence does not exceed three months, or if they keep drawing at least 50% of the salary during their absence. Self-employed absent on work, except for the family workers, are considered employed if they hold down the activity during their absence. The family workers are considered employed if their absence does not exceed three months.
Liechtenstein	Amt für Statistik Liechtenstein (AS)	Incoming Database: Beschäftigungsstatistik	
		<p>Zupendler (Beschäftigte aus dem Ausland): Zupendler sind Personen, die im Ausland wohnen und in Liechtenstein arbeiten. Zupendler sind alle Grenzgänger aus dem Ausland. Ab 2010: Beschäftigte mit</p>	<p>Beschäftigte nach Arbeitsgemeinde</p> <p>Alle Personen, die eine Stunde und mehr pro Woche und insgesamt 50 Stunden und mehr pro Jahr erwerbstätig sind,</p>

Country	Source	Commuters	Employment
		einem Beschäftigungsgrad von 2% und mehr.	unabhängig davon, ob sie einer bezahlten Arbeit nachgehen oder unentgeltlich tätig sind. Als Beschäftigte gelten Angestellte und Arbeiter, Selbstständigerwerbende, Inhaber, Pächter, Direktoren, Pfarrer, Lehrlinge, Aushilfen, im Aussendienst tätige Personen sowie Volontäre, Praktikanten und mitarbeitende Familienmitglieder. Ab 2010: Beschäftigte mit einem Beschäftigungsgrad von 2% und mehr.
		Outgoing Database: Beschäftigungsstatistik	
		Wegpendler (Beschäftigte im Ausland arbeitend): Wegpendler sind Personen, die in Liechtenstein wohnen und im Ausland arbeiten. Wegpendler sind alle Grenzgänger ins Ausland.	Beschäftigte Einwohner: Alle Personen, die eine Stunde und mehr pro Woche und insgesamt 50 Stunden und mehr pro Jahr erwerbstätig sind, unabhängig davon, ob sie einer bezahlten Arbeit nachgehen oder unentgeltlich tätig sind. Als Beschäftigte gelten Angestellte und Arbeiter, Selbstständigerwerbende, Inhaber, Pächter, Direktoren, Pfarrer, Lehrlinge, Aushilfen, im Aussendienst tätige Personen sowie Volontäre, Praktikanten und mitarbeitende Familienmitglieder. Ab 2010: Beschäftigte mit einem Beschäftigungsgrad von 2% und mehr.
Monaco	Monaco Statistics (IMSEE)	Outgoing Database: Recensement de la population 2016	
		Nombre de résidents de 17 ans et plus travaillant actuellement en France Unité : habitant (poids) déclaré en résidence principale à Monaco	Population active occupée (ou résidents de 17 ans et plus travaillant actuellement): comprend les personnes qui déclarent travailler (quel que soit leur statut).
Slovenia	Statistical Office of the Republic of Slovenia (SURS)	Incoming	
		Foreign daily migrants from neighbouring countries are people who are citizens of neighbouring countries (Italy, Austria, Hungary or Croatia) and work in Slovenia but do not have any registered residence in Slovenia. The data do not show all foreigners in employment from these countries, but only those who	Persons in employment are persons in paid employment and self-employed persons (excluding farmers). The labour migration survey includes persons in paid employment and self-employed persons who have compulsory social insurance, regardless of whether they work full-time or part-time and

Country	Source	Commuters	Employment
		work in Slovenia and don't have a registered residence here so they are coming to work daily.	regardless of whether they are on maternity leave, leave for care or protection of a child or are absent from work due to illness or injury or care for a family member. A person in employment must be at least 15 years old. The number of persons in employment excludes persons who are working under contracts (contract work), authorship contracts, persons engaged in student work, persons who work for direct payment, unpaid family workers, persons in employment by employers based in the Republic of Slovenia who are sent to work or professional training abroad (i.e. employees in Slovenian enterprises, on construction sites abroad, etc.) and Slovenian citizens employed by foreign employers.
Switzerland	Schweizer Bundesamt für Statistik (BFS)	<p style="text-align: center;">Incoming</p> <p>Erwerbstätige ausländischer Nationalität mit einer spezifischen Grenzgängerbewilligung (Ausweis G), welche in der Schweiz einer bezahlten Tätigkeit nachgehen (Personen)</p> <p>Database: Grenzgängerstatistik (GGS) Sources: Zentrales Migrationsinformationssystem (ZEMIS), AHV-Daten, Datenbank der beruflichen Grundbildung (SBG) und, für die Zeitreihen vor dem 4. Quartal 2010, die Beschäftigungsstatistik (BESTA)</p> <p style="text-align: center;">Outgoing</p> <p>Arbeitspendler ins Ausland (nearly for all Cantons too less values therefore the absolute values are not reliable)</p>	<p>Beschäftigte: Erhebung (unselbstständiger und selbstständiger) Beschäftigter ausgehend vom AHV-pflichtigen Lohn erhoben. Dieser Lohn entspricht einem Mindestbetrag von jährlich 2'300 CHF. Die Beschäftigten umfassen alle Personen (Unselbstständig- und Selbstständigerwerbende), die eine Tätigkeit ausüben, mit der sich Güter oder Dienstleistungen erzeugen lassen. Eine Person mit mehreren Arbeitsverträgen wird in diesem Sinne mehrmals als beschäftigt erfasst, sofern die Arbeitsverträge mit verschiedenen Unternehmen abgeschlossen wurden. Hat die Person hingegen mehrere Arbeitsverträge mit einem einzigen Arbeitgeber, so wird sie nur einmal als beschäftigte Person erfasst</p> <p>Database: Statistik der Unternehmensstruktur STATENT</p> <p>Beschäftigte: Erhebung (unselbstständiger und selbstständiger) Beschäftigter ausgehend vom AHV-pflichtigen Lohn erhoben.</p>

Country	Source	Commuters	Employment
		Database: Strukturhebung	<p>Dieser Lohn entspricht einem Mindestbetrag von jährlich 2'300 CHF.</p> <p>Die Beschäftigten umfassen alle Personen (Unselbstständig- und Selbstständigerwerbende), die eine Tätigkeit ausüben, mit der sich Güter oder Dienstleistungen erzeugen lassen.</p> <p>Eine Person mit mehreren Arbeitsverträgen wird in diesem Sinne mehrmals als beschäftigt erfasst, sofern die Arbeitsverträge mit verschiedenen Unternehmen abgeschlossen wurden. Hat die Person hingegen mehrere Arbeitsverträge mit einem einzigen Arbeitgeber, so wird sie nur einmal als beschäftigte Person erfasst</p> <p>Database: Statistik der Unternehmensstruktur STATENT</p>
EU	Eurostat	<p>Outgoing Database: Labour Force Survey</p> <p>Commuting is defined in relation to each person's main place of residence, with commuters exercising their occupation in a region (national or international) other than the one in which they reside. Commuters should return, on average, at least once a week to their main place of residence from the region where they are working. For international/cross-border commuters, nationality is not considered as a determining factor, as there are cases where people may move from one country to another in order to benefit from, for example, lower housing and living costs, but then commute back to their home country for work.</p> <p>As commuting is defined in terms of the number of persons employed, the count includes the not just employees but also the self-employed.</p>	<p>Employed persons are all persons aged 15 and over who, during the reference week, work at least one hour for pay, profit or family gain, or were not at work but had a job or business from which they were temporarily absent.</p>

Table 15 Overview of definitions of official labour market statistics