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The Economic Effects of Services Liberalisation in Switzerland

Final Report

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Preface

The State Secretariat for Economic Affairs in Switzerland (seco) has contracted Copenhagen Economics to calculate the economy wide effects for Switzerland of a services liberalisation in Switzerland and EU. This final report documents the findings of the study.

The report has been prepared by Mr. Christian Jervelund, Mr. Patrik Svensson, Mr. Eske Stig Hansen, Miss Jonna Olsson and Dr. Claus Kastberg Nielsen. The report is based on the specifications of the contract covering the study, the inception meeting with seco on April 2nd, the interim meeting with seco on July 11th, the draft final report presentation at the seco headquarters on September 2nd as well as on the close contact between Copenhagen Economics and seco during the study.

October, 2005
Claus Kastberg Nielsen
CEO, Copenhagen Economics

Executive summary

This study assesses the effects of liberalising services provisions in Switzerland and the EU. The objective of the study is twofold. The *first* objective is to measure the current level of regulation of services provision in Switzerland and the EU. The *second* objective is to calculate the economy wide effects in Switzerland of a services liberalisation in Switzerland and the EU.

We find that the level of regulation in Switzerland is of the same magnitude as in the EU in business services, distributive (retail and wholesale) trade and air transport. For regulated professions, regulation is lower in Switzerland compared to the EU and the same goes for rail freight transportation. The rest of the infrastructure sectors, i.e. telecommunications, electricity, postal services and rail passenger transport are much more regulated in Switzerland than in the EU. This could indicate a large potential for Switzerland to liberalise its infrastructure sectors.

The economy wide effects are calculated for a number of scenarios representing different degrees of liberalisation in Switzerland and the EU. Hence, the scenarios provide insight into what drives a successful liberalisation yielding economic gains for Switzerland, but they do not serve as suggestions as to how Switzerland should design an actual services liberalisation.

In the scenario providing the upper bound for the economy wide effect in Switzerland, Switzerland is assumed to liberalise while the EU is assumed not to liberalise. We find that this will increase welfare in Switzerland by around 2 percent equivalent to a consumption increase of 5.2 billion CHF. Moreover, employment is expected to increase by 0.6 percent. In the opposite scenario EU is assumed to liberalise while Switzerland is assumed not to liberalise. We find that this leads to a 0.3 percent *lowering* in Swiss welfare equivalent to a consumption decrease of 0.8 billion CHF.

The results in these two scenarios illustrate that the main driver of economic gains for Switzerland is the country's own extent of liberalisation, not higher demand in the EU caused by EU liberalisation. In the former scenario, the Swiss liberalisation increases productivity and lowers prices in Switzerland which has a strong positive effect on the domestic market, and at the same time the relative competitiveness of Swiss firms, i.e. firms operating in Switzerland, is strengthened compared to their EU competitors. Both effects contribute to higher welfare and increasing employment. In the latter scenario, where only the EU liberalises, Swiss firms experience a drop in relative competitiveness compared to EU firms. This in turn reduces Swiss welfare; even though this effect to some extent is mitigated by a general increase in demand in the EU leading to more trade across borders for all countries, including Switzerland. The expected decrease in Swiss welfare of 0.3 percent in this scenario indicates that the negative effect of lower relative competitiveness of Swiss firms dominates the positive effect of increasing cross-border supply due to higher EU demand.

Chapter 1 The economics of services liberalisation

This study assesses the effects of liberalising services provisions in Switzerland and the EU. The objective of the study is twofold. The *first* objective is to measure the current level of regulation of services provision in Switzerland and the EU. The *second* objective is to calculate the economy wide effects in Switzerland of a services liberalisation in Switzerland and the EU.

The first objective of this study is to measure the current level of regulation in the services sectors in Switzerland and the EU. The services sectors covered in this study are regulated professions, business services, distributive (retail and wholesale) trade, telecommunications, electricity, postal services, rail transportation (freight and passenger), air transportation and banking services; a total of 9 sectors. Notice that health and education services are *not* covered in this study. Knowing how the level of regulation differs between Swiss services sectors and EU services sectors is of great importance when considering a services liberalisation. But also, we need comparable measures of the level of regulation since the scenarios for calculating economy wide effects are defined in terms of specific changes in the level of regulation in Switzerland and the EU.

The level of regulation is reflected in non-tariff barriers to services provision. A services liberalisation reduces these barriers equivalent to reducing the level of regulation. The barriers drive up costs, create rents and may reduce competition from existing and new firms. For example in wholesale trade in Switzerland, laws impose restrictions on the distribution of certain products. This drives up the cost of doing business in wholesale trade, leading to more expensive products and less competition. Another example is the electricity sector in Switzerland where the distribution network is not unbundled from the generating network. This could push up rents – the price margin over costs – as potential competitors, foreign and domestic, may choose not to enter the market of electricity distribution fearing they will receive a biased treatment by the system operator.

We find that the level of regulation in Switzerland is of the same magnitude as in the EU in business services, distributive (retail and wholesale) trade and air transport. For regulated professions, regulation is lower in Switzerland compared to the EU and the same applies to rail freight transportation. The rest of the infrastructure sectors, i.e. telecommunications, electricity, postal services and rail passenger transport are much more regulated in Switzerland than in the EU. This could indicate a large potential for Switzerland to liberalise its infrastructure sectors.

The second objective of this study is to calculate economy wide effects of liberalising services in Switzerland and the EU. We calculate economy wide effects for four independent scenarios each representing different degrees of liberalisation in Switzerland and the EU in the five services sectors of regulated professions, business services, distributive (retail and wholesale) trade, telecommunications and electricity. Later, we provide evidence for the remaining five

sectors; they are not included to begin with because of poor data quality possibly contaminating the results from the five sector analyses where data quality is high. The results from the four scenarios provide insight into what drives a successful liberalisation providing economic gains for Switzerland. However, the four scenarios do not serve as suggestions to actual service liberalisations.

Scenarios one and two provide upper and lower bounds, respectively, for the economy wide effect in Switzerland. In scenario one, Switzerland is assumed to liberalise while the EU is assumed not to liberalise. We find that this will increase welfare in Switzerland by around 2 percent equivalent to a consumption increase of 5.2 billion CHF. Moreover, employment is expected to increase by 0.6 percent. Scenario two represents the opposite. Here the EU is assumed to liberalise while Switzerland is assumed not to liberalise. We find that this leads to a 0.3 percent lowering in Swiss welfare equivalent to a consumption decrease of 0.8 billion CHF.

The results in these two scenarios illustrate that the main driver of economic gains for Switzerland is the country's own extent of liberalisation, not higher demand in the EU caused by EU liberalisation. In scenario one, the Swiss liberalisation increases productivity and lowers prices in Switzerland which has a strong positive effect on the domestic market. At the same time, the relative competitiveness of Swiss firms, i.e. firms operating in Switzerland, is strengthened compared to their EU competitors. Both effects contribute to higher welfare and increasing employment. In scenario two, where only the EU liberalises, Swiss firms experience a drop in relative competitiveness compared to EU firms reducing Swiss welfare; even though this effect to some extent is mitigated by a general increase in demand in the EU leading to more trade across borders for all countries, including Switzerland. The expected decline in Swiss welfare of 0.3 percent in scenario 2 indicates that the negative effect of lower relative competitiveness of Swiss firms dominates the positive effect of increasing cross-border supply due to higher EU demand.

We now present the level of regulation in Switzerland and the EU followed by the economy wide results from the four scenarios.

1.1. The level of regulation in services in Switzerland and EU

We measure the level of regulation by translating qualitative legislation giving rise to non-tariff barriers into a quantitative measure of the barriers for a total of 9 services sectors. It allows us to compare the level of regulation between Switzerland and the EU. The nine sectors covered are: regulated professions, business services, distributive (retail and wholesale) trade, telecommunications, electricity, postal services, rail transport (freight and passenger) air transport and banking services.

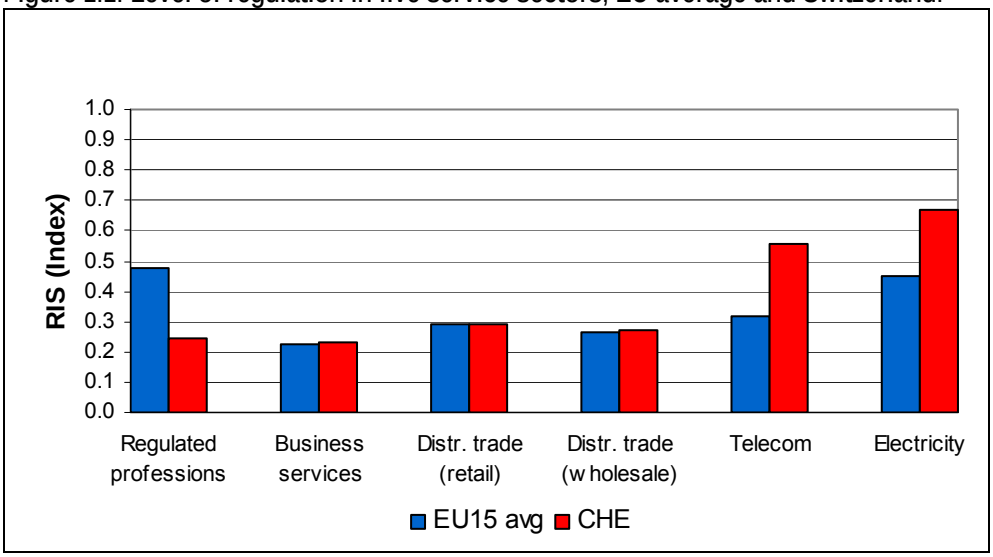
For each sector, we summarise the level of regulation in a single index called Regulation Index in Services (RIS). A high RIS value implies many barriers and consequently a high level of regulation. A low value RIS value implies few barriers.

We find that the level of regulation in business services, distributive (retail and wholesale) trade, air transport and banking service is more or less the same in Switzerland as in the EU. This is indicated by the identical size of the RIS in Figure 1.1 and Figure 1.2. The figures also show that in regulated professions and rail freight transport, Switzerland seems to have much fewer barriers than the EU indicated by a lower value of the RIS for Switzerland than for the EU.

For the remaining sectors; telecommunications, electricity, postal services and rail passenger transport, Switzerland experiences high levels of regulation compared to the EU average.

The chosen split of sectors in Figure 1.1 and Figure 1.2 illustrates which sectors enter the economy wide analysis presented later. Figure 1.1 shows the sectors included in the "main" economy wide 5 sector analysis, while Figure 1.2 shows the sectors additionally included in the extended or 9 sector economy wide analysis.

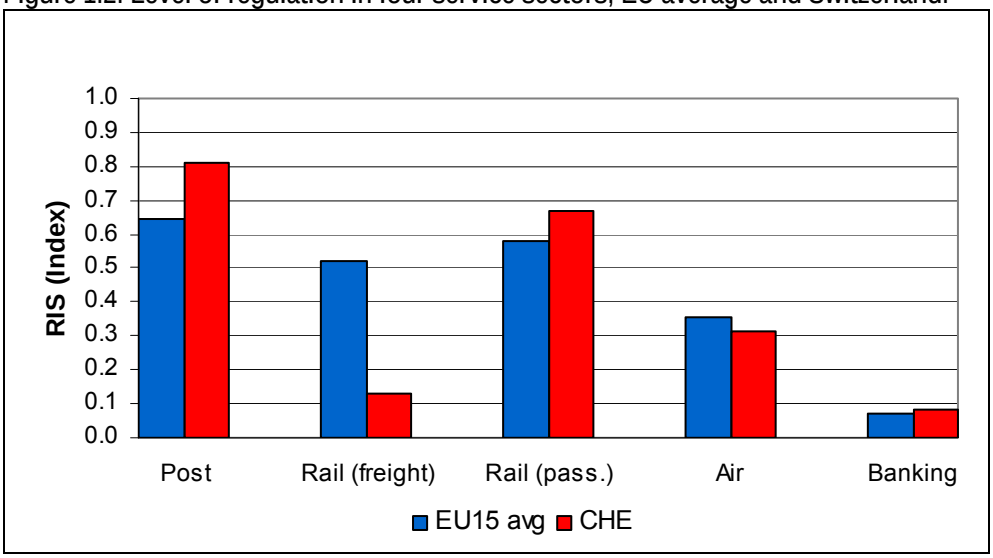
Figure 1.1. Level of regulation in five service sectors, EU average and Switzerland.



Note: The figure shows the "foreign" RIS for the five services sectors included in the simulations of the economy wide effects in four scenarios. The "foreign" RIS reflects the level of regulation for foreign firms operating within the country or region. The domestic index reflects the level of regulation for the country or region's own firms operating in the country or region, respectively. See chapter 2 for more information. A high value of RIS implies many barriers and consequently a high level of regulation. A low value of the RIS implies few barriers. The RIS is restricted to lie between zero and one. For regulated profession (proxied by the accountancy sector), business services (proxied by IT-services) and distributive (retail and wholesale) trade for Switzerland the RIS reflect the situation in 2002 after the coming into force of the bilateral agreements with the EU. For the same sectors for EU, the barrier indices reflect the situation around 2001-2003. For the telecommunication and electricity sector the year is 2001.

Source: Copenhagen Economics and Copenhagen Economics (2005).

Figure 1.2. Level of regulation in four service sectors, EU average and Switzerland.



Note: The figure shows the level of regulation in postal services, rail transport (freight and passenger), air transport and banking services measured by the RIS. For these sectors there is by construction no difference between the foreign and domestic index, see note for Figure 1.1. The figure shows the RIS for the five sectors with poor data quality not included in the simulations of the four scenarios. However, these sectors are included in an additional simulation covering all eleven sectors. For Switzerland and EU the RIS reflect the level of regulation in 2001.

Source: Copenhagen Economics and Copenhagen Economics (2005).

The RIS value in the figures measure the overall level of regulation in the selected service sectors in Switzerland and the EU. However, our methodology for constructing the RIS allows for more detailed insight into the areas where regulation exists. Being able to compare not only the overall level of regulation between Switzerland and the EU but also specific areas, may prove important in relation to a services liberalisation. For instance, identical RIS indices within a sector in Switzerland and the EU may cover the fact that the regulation in Switzerland lies in areas where the EU is very liberal and vice versa. This could mean that a services liberalisation is also possible within these sectors even though the overall level of regulation is the same.

For example, in retail trade both Switzerland and the EU obtain a RIS value of 0.29, cf. Table 1.1. However, while retail firms in the EU experience more barriers in *Establishment* than Switzerland (0.30 vs. 0.20) the opposite is true in *Uses of input* (0.18 vs. 0.38). The same is true for a number of other sectors which will be covered in chapter 2.

Table 1.1: Decomposing the overall RIS into areas, retail trade.

Retail	RIS	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Area 7
	All	Establish-ment	Uses of input	Promotion	Distribu-tion	Sales of services	After sales activities	Non-legal barriers
EU15	0.29	0.30	0.18	0.38	0.16	0.32	0.06	0.51
CHE	0.29	0.20	0.38	0.42	0.12	0.22	0.00	0.53

Note: The table shows how regulation is distributed over different areas. Retail is used to illustrate this. The RIS value in retail is similar in EU15 and Switzerland but the composition of the RIS differs.
Source: Copenhagen Economics and Copenhagen Economics (2005). Full table is presented in Chapter 2.

The RIS values convey important information in themselves. But additionally, the four scenarios of services liberalisation are directly based on changes in the RIS, such that a given scenario for liberalisation is reflected in a specific lowering of the RIS for each of the service sectors covered in the study.

1.2. The economy wide effects in Switzerland of liberalisation in 5 sectors

We calculate the economy wide effects for four different scenarios. The scenarios are chosen to supply complementary insight into what makes services liberalisation a success (or a failure) in terms of economic gains in Switzerland; thereby providing the building blocks for a successful services liberalisation. We include the five services sectors; regulated professions, business services, distributive (retail and wholesale) trade, telecommunications and electricity. The remaining four sectors will be included later, but are excluded here because they rest of less reliable data thereby possibly contaminating the results.

Of the four scenarios, scenarios 1 and 2 represent the situations where Switzerland liberalises and the EU does not, and where the EU liberalises and Switzerland does not, respectively. These scenarios give insight into the mechanisms at work when only one region liberalises at a time. Scenarios 3 and 4 will illustrate the mechanisms at work when both regions liberalise at different (scenario 3) and identical (scenario 4) pace, respectively.

The scenarios are presented in Table 1.2. More specifically, the four scenarios are identified as:

- Scenario 1: The EU remains at status quo (the current level of regulation), and Switzerland takes on a “best practice” strategy which implies adopting the level of regulation of the country in the EU with the smallest RIS;

- Scenario 2: Switzerland remains at status quo (the current level of regulation, hence, does not liberalise) while the EU member states continue on their liberalisation path. This implies implementation of the proposed services directive for the services covered by the services directive and the relevant directives in the infrastructure sectors, e.g. the electricity directive in the electricity sector[1];

- Scenario 3: The EU continues along their liberalisation path and Switzerland adopts the level of regulation of the EU country having the lowest level of regulation in each services sector *after* the country itself has adopted the directives governing the continued path of EU liberalisation;

- Scenario 4: The EU and Switzerland both liberalise following the continued liberalisation path of the EU.

Table 1.2. The four scenarios analysed in this study

Switzerland / EU	Status quo	Minimum EU-compatibility	"Best practice"
Status quo	Benchmark		Scenario 1
Liberalization path continued	Scenario 2	Scenario 4	Scenario 3

Source: Copenhagen Economics

For each of these four scenarios we calculate the economy wide effects for Switzerland using the Copenhagen Economics Trade Model (CETM). The overall implication of the results for Switzerland is that the main driver of economic gains in a service liberalisation is the country's own reduction in barriers. If Switzerland reduces its barriers to service provision, it will experience increases in welfare, wages, employment and cross-border trade, regardless of the action taken by the EU. This is demonstrated by the Swiss gain in welfare of about 2 percent and a 0.6 percent rise in employment in scenario 1 where Switzerland liberalises and the EU does not, cf. Table 1.3.

Table 1.3: Economic effects for Switzerland

Economy-wide effects	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Welfare	2.0 %	-0.3 %	1.7 %	0.8 %
Welfare (CHF billion)	5.2	-0.8	4.6	2.1
Real wages	1.7 %	0.0 %	1.7 %	1.0 %
Employment	0.6 %	0.1 %	0.8 %	0.5 %

Note: All results are reported as changes from the benchmark. Welfare is measured as comprehensive consumption. The table includes liberalisation in the five services sectors regulated professions (proxied by accountancy), business services (proxied by IT-services), retail and wholesale trade, electricity and telecommunications. The results from the remaining sectors rail passenger transport, rail freight transport, air transport, postal services and banking services are presented later in this chapter.
Source: CETM – Copenhagen Economics.

Swiss consumers will benefit from lower prices, higher employment and increased wages if barriers to services provision are reduced. The economic gains are explained by the impacts of increased productivity and reduced prices in the liberalised sectors. This has a positive effect on the domestic market, but it also increases the competitiveness of Swiss firms, compared to

[1] It is less relevant that the proposed EU directives may not be implemented in their original version since they together illustrate the trend path of liberalisation in EU. For instance, just because the proposed services directive may not be implemented in its original version, it is unlikely that no liberalisation of the covered services sectors will take place.

their European competitors. This will increase opportunities for Swiss firms on the European market and subsequently lead to an increase in cross-border supply from Switzerland to the rest of Europe. This is an important effect contributing to the positive results in scenario 1.

If Switzerland on the other hand does not reduce its barriers to service provision while the EU does, the results are reversed. Swiss firms will lose in competitiveness, and hence lose market shares on the European market. This is the explanation behind the decrease in Swiss welfare in scenario 2. When Switzerland falls behind the EU in reducing barriers to services provision, the lost competitiveness for Swiss firms on the European market will lead to shrinking markets, and eventually welfare losses in Switzerland. The effect of less cross-border supply due to lost competitiveness is to some extent mitigated by a general increase in demand in the EU, which leads to more trade across borders for all countries, including Switzerland, but the net result in scenario 2 is a decrease in cross-border supply and consequently welfare, as demonstrated by the 0.3 percent lowering in Table 1.3.

The larger the barrier reduction in Switzerland, the larger the expected total welfare gain. For example, the extent of the barrier reduction is the core difference between scenarios 3 and 4. In scenario 3, Switzerland is assumed to reduce its barriers to services provision in order to match the level of a best practice country; while in scenario 4 Switzerland "only" reduces its barriers in order to meet minimum EU compatibility. The resulting difference in welfare gains is striking. In both scenarios, the EU is assumed to follow the same continued liberalisation path. Hence, the cause of the higher welfare gains in scenario 3 compared to scenario 4 is the extent of Switzerland's own barrier reduction.

The economy wide effect for Switzerland of liberalising services has been calculated in the recent OECD (2004) study. The study finds that Swiss output would rise by 8 percent as a result of liberalising telecommunications, electricity, regulated and business services, distributive trade, gas, health care services and agriculture. This is higher than our finding of a value added gain of 3 percent in scenario one (corresponding to the 2 percent welfare gain, see appendix A). However, including health care and agriculture in the OECD study but not in the present one seems to account for a large share, 3-4 percentage points, of the 8 percent output increase. Moreover, the OECD Interlink model applied in the OECD study seems to put more weight on dynamic capital accumulation than the Copenhagen Economics Trade Model (CETM) used in the present study. This could help explain some of the remaining difference since a liberalisation would tend to increase the aggregate stock of capital increasing output and welfare. In summary, the OECD study may very well imply economic gains from liberalisation of the same general magnitude as those reported in the present study.

1.3. The economy wide effects in Switzerland of a liberalisation in all 9 sectors

We have presented the results of a liberalisation in five services sectors. However, liberalisation in the additional four sectors of banking services, railway transport (freight and passenger), air transport and the postal services sector may affect the potential welfare gains in Switzerland. While the economy wide effect based on nine sectors are less precise than the estimate obtained in the additional four sector analysis because of poor data quality of the additional five sectors, it provides insight into the general *weight* that these additional five sectors would have on total effects of liberalisation.

The simulation focuses on scenario 1: Switzerland is assumed to liberalise according to a best practice strategy, while the EU is assumed to remain in status quo. We find that the potential effects of further liberalisation could be substantial demonstrated by a Swiss welfare gain of 3.1 percent compared to a 2.0 percent gain in the five sector analysis. Furthermore, employment is expected to increase by 0.8 percent compared to the 0.6 percent in the five sector analysis.

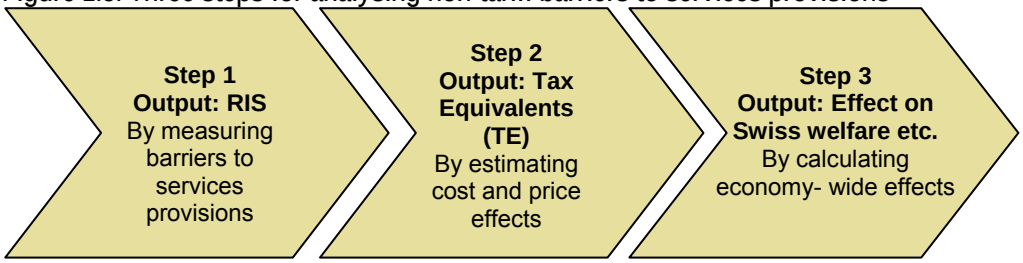
The most important driver of the positive effects is the barrier reduction taking place in the postal services sector. The barrier reduction in this sector is estimated to be extensive, and this has a direct and positive effect on the economy. However, it should be kept in mind that the estimates of effects of barrier reductions in the postal services sector, as well as in the banking services, air transport, and railway transport sectors are burdened with a high level of insecurity due to poor data quality. Rather, the result should be taken to indicate that liberalisation in other sectors may have substantial impacts on the total welfare effect in Switzerland.

1.4. The analytical framework

This section describes the analytical framework which we use to calculate the economy wide effect on the Swiss economy of a services liberalisation.

The framework is specifically designed for modelling non-tariff barriers to services provision. The framework consists of three steps, cf. Figure 1.3.

Figure 1.3. Three steps for analysing non-tariff barriers to services provisions



Source: Copenhagen Economics.

Step 1: Measuring Regulation Index in Services (RIS)

The objective of the first step is to translate qualitative information on barriers found in legislation into a quantitative measure. A quantitative measure allows us to compare more transparently barriers between countries and sectors and to make further calculations eventually resulting in economy wide effects. The quantitative measure is an index labelled the Regulation Index in Services or just RIS bound by zero and one. A high value of RIS indicates a high level of regulation or many barriers while a low value of RIS indicates a low level of regulation or few barriers.

For each services sector and country covered in this study a "foreign" and a "domestic" RIS exists. The "foreign" RIS measures the level of regulation faced by foreign firms operating within that specific country and sector. The "domestic" index measures the level of regulation faced by the country's own firms. However, for the infrastructure sectors[2] (and also for banking), the foreign and domestic RIS are identical in construction because the RIS in these sectors focuses more on the legal framework for promoting effective competition irrespective of the country of origin of firms.

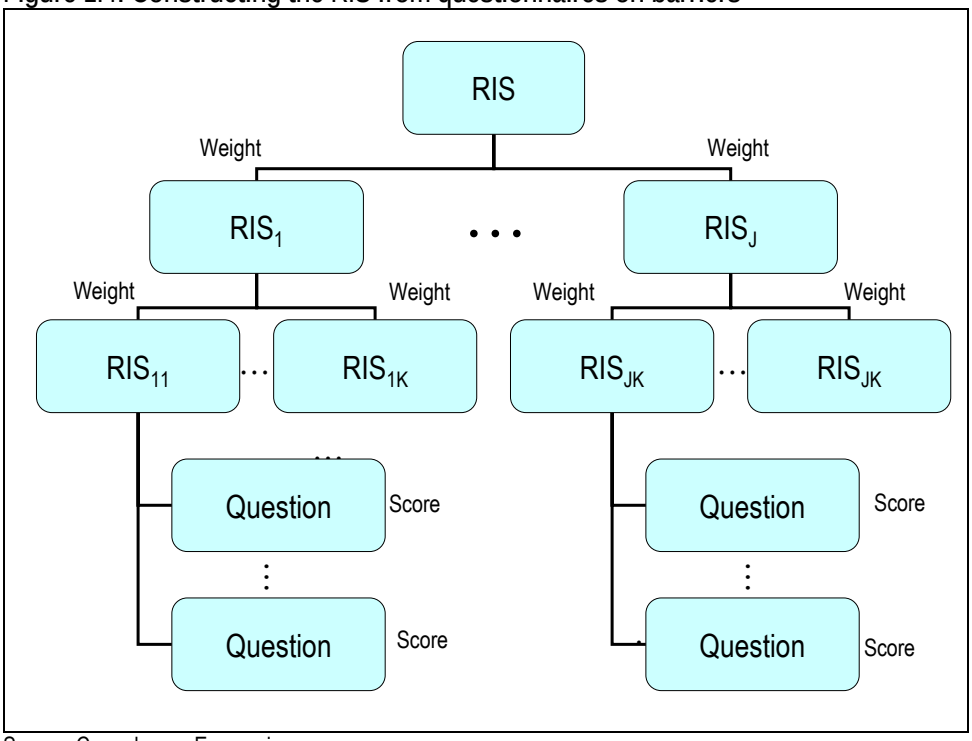
The quantification of barriers into the RIS is based on comprehensive questionnaires. For regulated professions (proxied by accountancy), business services (proxied by IT-services) and distributive (retail and wholesale) trade, the questionnaire is based on the barriers identified by the European Commission in its survey of the state of the Internal Market for services (European Commission, 2002). For the infrastructure sectors (electricity, telecommunications, postal services, rail passenger, rail freight and air transport) the questionnaire is customised to each sector, targeting the specific issues for each. For banking services, the questionnaire and answers are taken straight from Kalirajan et al (2000). The qualitative information on specific restrictions is transformed into the quantitative measure

[2] Telecommunications, electricity, postal services, rail passenger and freight transport and air transport.

called the RIS (Regulation Index in Services) using index methodology. In each of the four scenarios, the RIS values are recalculated, taking into account which restrictions will be removed in the given scenario.

The computations of the RIS start with the scores of the questions, c.f. Figure 1.4. Each question has a score and if the question is answered by "yes" this score will be added to the subcategory RIS value. Answering all questions successively gives the final subcategory value. Each subcategory is presumed to have a certain relative importance in determining the category barriers. This relative importance is reflected in weights which are used to aggregate the subcategories into the overall RIS.

Figure 1.4: Constructing the RIS from questionnaires on barriers



Source: Copenhagen Economics.

One important advantage of this hierarchal structure is the possibility to identify not only the RIS but also restrictiveness values at more detailed levels of aggregation. This proves important when addressing the question of how a certain value of RIS is composed.

While the RIS measures the level of regulation in each country, it does not directly measure the extent of heterogeneity of regulation between, i.e. the EU member states and Switzerland. If this heterogeneity is large, harmonisation and not just liberalisation in the sense of lowering barriers might yield economic gains. However, in a recent study Kox and Lejour (2005) find that heterogeneity between Swiss and EU member states' services legislation is not larger than the average heterogeneity between the EU member states themselves. This implies that the *level* of regulation is important which is what we measure by the RIS.

Step 2: Estimating cost and price effects of barriers

The objective of the second stage is to transform the RIS values into tax equivalents (TE's). RIS values cannot enter the economic model in step 3, so we have to transform the values into tax equivalents which can then enter the model. Tax equivalents can be thought of as theoretical taxes computed to create economic effects that are equivalent to the economic effects of the actual barriers.

We calculate tax equivalents by econometrically estimating the direct effect of barriers on the costs and prices of services provision. The result is a translation of the information found in the detailed RIS indices into tax equivalents.

We utilise the econometrical results of a number of acknowledged empirical studies and in two cases estimate our own model in order to cover all sectors. Consequently, the specific modelling strategies differ slightly across sectors although the general considerations presented above are fundamental to all the econometric modelling. For electricity and telecommunications we set up econometric models using publicly available data. We estimate two separate equations in order to distinguish cost and rent creating effects, the latter referring to price effects contingent on costs. We find that the coefficient estimates are insignificant at any reasonable level. This is primarily due to the low number of observations; 16, which leaves our estimates insignificant.

To validate the estimates obtained, we compare our results with other empirical evidence. The effects from trade barriers on telecommunication prices were investigated by Doove et al (2000) building on the econometric work of Boylaud and Nicoletti (2000). Doove et al (2000) find price impacts two to four times higher than those used in this study. We believe that much of this large discrepancy can be explained by the different time focus and the fact that Doove's estimates are carried out directly on prices *non-contingent* on costs. The latter means that Doove captures effects from lower costs translating into lower prices in her price estimate while we estimate separately the effects on costs and the effects on prices contingent on costs. With this in mind both estimates seem reasonable.

For regulated professions, business services and distributive (retail and wholesale) trade, we use the results in Copenhagen Economics (2005) drawing on a database of more than 275,000 observations. Their econometric model is adopted on firm level where firms within the same country are affected equally by the specific country's barriers, i.e. each firm's prices and costs are explained by data on firm level as well as on economy-wide information.

Step 3: Calculating economy wide effects in an economic model
Based on the estimated tax equivalents, the economy-wide effects of the scenarios are calculated in the third stage using the Copenhagen Economics Trade Model (CETM). The model represents state-of-the-art developments within general equilibrium models of services trade, and it has been specially designed for the analysis of barriers to trade and foreign direct investment. The model captures all linkages between the different sectors of the economy and it therefore allows for an economy-wide assessment of barriers to services trade.

Since the Swiss economy is the focus of the analysis, the current implementation of the CETM represents Switzerland and its most important trade partners, the EU-15 countries.[3] The rest of the world is aggregated into a single region, and we assume that all regions trade on the world market at constant prices. Figure 1.5 provides an overview of the regions and sectors represented in the model. The aggregation of the production sectors has been guided by the focus on service provision in the analysis. Services production takes place within 9 distinct sectors, while all other production, mainly industrial production of goods, is captured by an aggregate production sector. This is to ensure both transparency and tractability of the model.

[3] The ten new member states represent a very small share of Swiss imports and exports and are therefore not modelled separately but included in the "rest of the world" group.

Figure 1.5: Regions and sectors in the CETM

Regions	Sectors
1. Switzerland	*Service sectors*
2. Austria	1. Regulated professions
3. Belgium (incl. Luxembourg)	2. Business services
4. Denmark	3. Distributive trade
5. Finland	4. Telecommunication
6. France	5. Electricity
7. Germany	6. Banking
8. Greece	7. Rail transport
9. Ireland	8. Air transport
10. Italy	9. Postal services
11. Netherlands	10. Other services
12. Portugal	
13. Spain	*Goods-producing sector*
14. Sweden	11. Rest of the economy
15. United Kingdom	
16. Rest of the World	

Source: CETM – Copenhagen Economics

1.5. Limitations to the analytical framework

Even though we have set up a state-of-the-art methodology it is not perfect.

First of all, the methodology for identifying the barriers and the level of regulation is not perfect. In order to create an RIS that can be compared between countries, some aspects of barriers will inevitable get lost. We use questionnaires to achieve a common ground for comparing regulation; but doing so limits the scope to barriers that can be assessed answering yes or no to a question. No doubt, some barriers have been left out, yet we believe that we have captured the most important barriers by using detailed questionnaires designed to cover important aspects of barriers and regulation.

Furthermore, the barriers identified in regulated professions and business services are actually proxied by barriers in accountancy and IT-services, respectively. While this is deemed a fairly good proxy in many respects, it does also specifically imply that barriers in accountancy are fairly identical to barriers in legal services which may not be the case. Since accountancy is more loosely regulated compared to legal services, using accountancy services to proxy regulated professions will lead to a conservative impact estimate in the scenarios.

Second, not all relevant variables are included in the econometric estimations transforming RIS values into tax equivalents due to data limitations. For example, differences in labour market legislation, the tax system and competition policy between the countries may influence the impact of RIS on prices and costs, yet they are not included in the econometric model. This is due to limited availability of such data for which no obvious solution exists. However, lack of such data is not a specifically Swiss problem and, hence, does not bias the results for Switzerland.

Third, the Copenhagen Economics Trade Model (CETM) does not capture (the likely notion) that liberalisation changes firm behaviour in a way that firms start to innovate more, increase R&D, use new technologies etc. Moreover, the model does not capture the possibility that Swiss firms are being discriminated against in EU countries since the model only allows for a country to treat all foreign firm the same way. For instance, German legislation may levy extra barriers across all foreign firms and not on German firms. But German legislation cannot, in the model, levy more barriers on Swiss firms than on, e.g. Danish firms. However, this model limitation has no major impact on the Swiss results since the main driver of economic gains in Switzerland is higher efficiency of firms operating in Switzerland due to lower Swiss barriers. Discriminatory measures in EU are less important.

Despite the potential drawback of this method, it represents state-of-the-art in modelling services liberalisation. Whenever possible, we have tried to address the drawbacks. The detailed sensitivity analysis in the model analysis in Chapter 4 is an example of that.

Chapter 2 Measuring barriers in services sectors in Switzerland

In this chapter we describe how to translate qualitative information on barriers found in legislation into quantitative measures. A quantitative measure is necessary for this study since it allows us to compare in a more transparent manner, barriers between countries and sectors, and to make further calculations eventually resulting in economy wide effects.

The quantitative measure developed in this chapter is an index labelled the Regulation Index in Services or just RIS. The index is bound by zero and one. A high value of RIS indicates a high level of regulation or many barriers, while a low value of RIS indicates a low level of regulation or few barriers. We create the RIS via detailed questionnaires converting the qualitative information on barriers found in legislative rules and legal practices into the quantitative RIS.

The chapter is organised as follows: Firstly, we describe the basics of the index methodology. Secondly, we describe the questionnaires and how they are used to convert qualitative information on barriers into the quantitative RIS. We conclude the chapter with a short discussion of the pros and cons of this approach.

2.1. The index methodology

Barriers to the free working of market forces are given by a set of complex, qualitative policies in a large number of dimensions. In order to measure these properly, we need to develop a methodology that enables us to transform qualitative information about specific policies into quantitative information in a meaningful, transparent and - as far as possible - unambiguous way. In addition, the methodology should be able to retain the multi-dimensional character of the issues we analyse and at the same time allow us to organise and simplify the multi-dimensionality problem in order to improve analytical tractability. This is of great value in e.g. the econometric modelling where data availability in some cases restricts the scope for multi-dimensionality and in other cases allows more refined estimations.

Furthermore, the methodology should be capable of incorporating hypothesised scenarios that result in new index values being both readily interpretable and realistic forecasts of the qualitative changes implied. The hypothesised scenarios focus directly on changes in legislation and when incorporating these changes the resulting index values should be directly comparable with the starting point, i.e. the benchmark value.

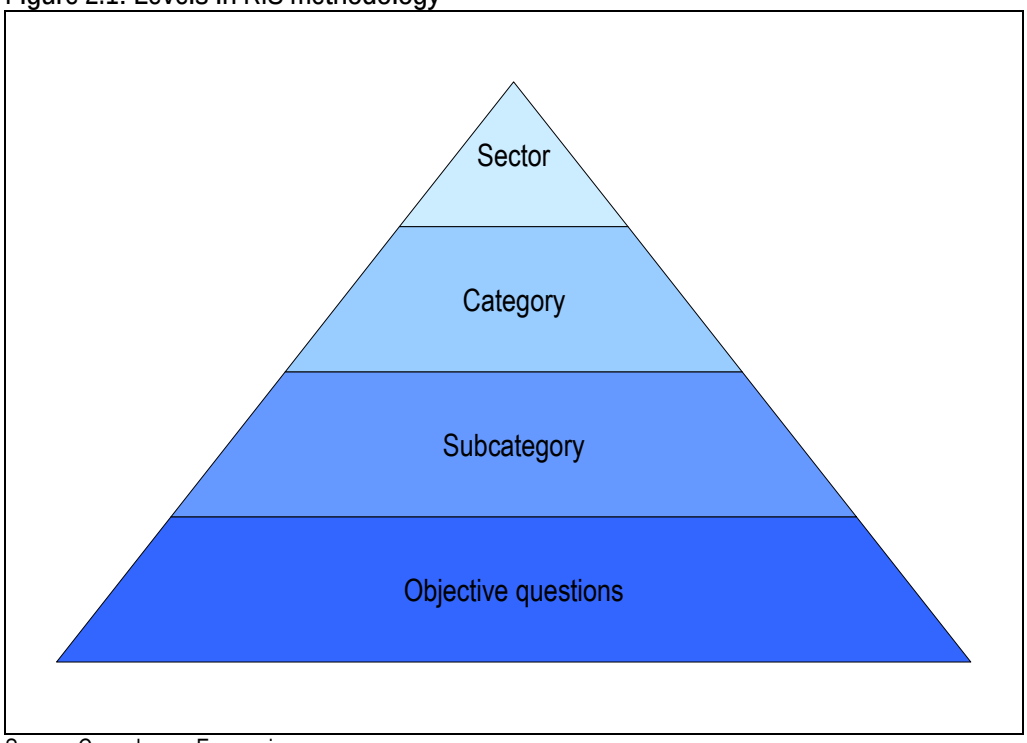
Finally, this study considers a range of sectors differing widely with respect to their technological and economic maturity, with some sectors still possessing many of the classical features known from the theory of natural monopolies and others being ready for full market

opening.[4] For instance, in some infrastructure sectors we would perceive the mere decreasing of competitive perplexities to the incumbent as an important barrier reduction, whereas in other sectors the most severe barrier to free competition is nationality requirements in establishment of a business. Thus, the developed methodology should also be flexible enough to aim at very different stages and characteristics in a market opening process, and the index has to incorporate different scope and level of detail according to the sector specifics.

Construction of the Regulation Index in Services (RIS)
The considerations above lead to the construction of a "Regulation Index in Services" which we will simply denote RIS. The index structure is hierarchical, where specific restrictions are evaluated and scored at the lower level. The scores are weighted and summarised in aggregate indices. The advantage of this approach is that it provides a clear linkage between specific and detailed barriers and the overall RIS used in the economic analysis.

The hierarchy of the index consists of four levels c.f. Figure 2.1. For each country, we evaluate several *sectors*. We evaluate the barriers in different stages of the value chains. This is done by breaking down the value chain into more *categories* describing different types of barriers. These categories are further divided into *subcategories* each containing the specific *questions* regarding the restrictions on service provision.

Figure 2.1: Levels in RIS methodology



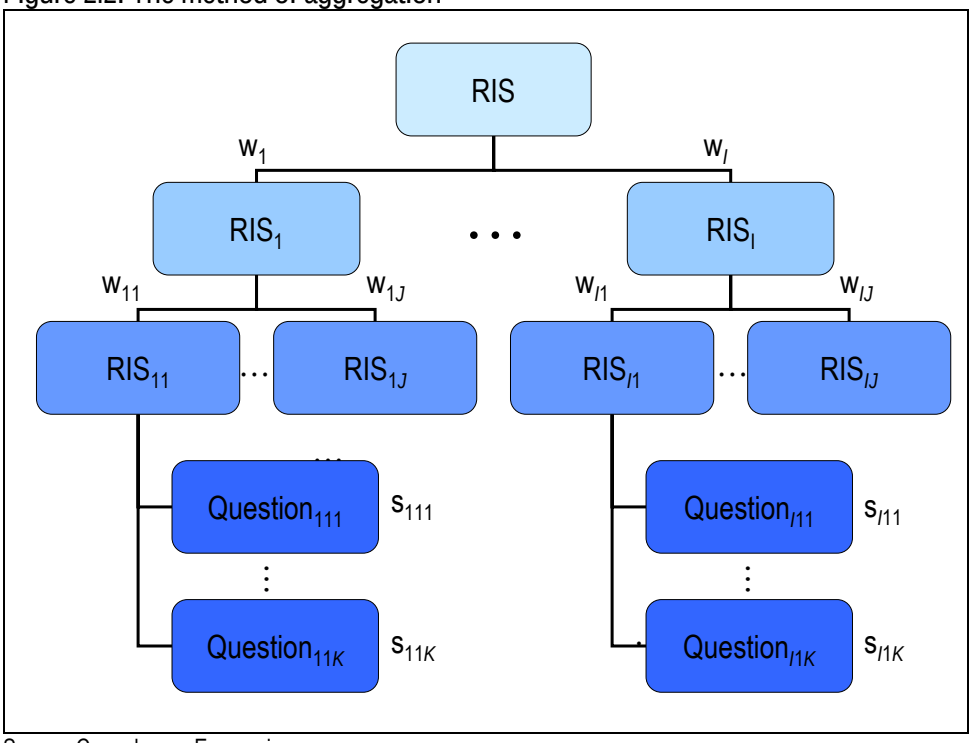
Source: Copenhagen Economics.

Specifically, the computations start with the scores of the objective questions, c.f. Figure 2.2. Each question has a score, and if the question is answered by "yes", this score will be added to the subcategory RIS value. Answering all questions successively gives the final subcategory value. Each subcategory is presumed to have a certain relative importance in determining the category barriers. For instance, "nationality or residence requirements" might play an influential role on the "establishment"-barriers. This relative importance is reflected in weights which are

[4] The distinctive feature of natural monopolies is the combination of high fixed costs and (extremely) low marginal costs of production, such that the establishment of more than one firm would incur unnecessary high costs.

used in aggregating the subcategories to category values. Similarly, there are corresponding weights for the categories in order to compute the overall RIS.

Figure 2.2: The method of aggregation



Source: Copenhagen Economics

One important advantage of this hierarchal structure is the opportunity to aggregate RIS values at different levels allowing the researcher to attain information with most any desired level of detail. E.g. a full-scale cross-country comparison is likely to be applied to category or even subcategory RIS values, whereas the econometric analysis is better applied to more aggregate RIS indices.

As should be clear, the RIS is simply a function of scores and weights. Consider a certain sector within a certain country, e.g., the Swiss accountancy sector. Let categories be characterised by index i, subcategories by index j and objective questions by index k. Further, refer to s as the score of an objective question and IF as an indicator function being one, if the question is answered by "yes", and zero if answered by "no". These belong to the lowest level of Figure 2.2 and *IF* is simply a dichotomous variable translating the questions into the numerical values 0 and 1. We can now calculate the subcategory RIS for, say, the "nationality or residence requirements" (j) belonging to the "Establishment" category (i), according to

$$RIS_{ij} = \sum_{k} s_{ijk} IF_{ijk}$$

The more "yes-answers" at high scoring questions, the higher the RIS. When the answers are mutually exclusive the condition bounding the index upwardly to (exactly) one would be

$$\max_{k} s_{ijk} = 1,$$

which is always imposed in this study.[5] When turning to the RIS at category level we need to introduce weights, w, in order to compute

$$RIS_i = \sum_j w_{ij} RIS_{ij} \ .$$

Analogous to above, the weights should sum to one. In our example this value would give the "Establishment" RIS for accountancy in Switzerland. Equivalently, the sector RIS is given by

$$RIS = \sum_i w_i RIS_i$$

Clearly, all the computations reduce to multiplying and summing, but the presentation above reveals the importance of using valid weights and scores as these alone constitute the RIS.

Practically, the RIS values are calculated using the scores and weights of Copenhagen Economics (2005) and a new set of scores and weights for the infrastructure sectors. In both cases guesstimates have been applied.[6] Essentially, guesstimates seem to be the favourite choice of most researchers conducting similar analyses, c.f. Findlay and Warren (2000) and Nguyen-Hong (2000).[7] Moreover, an important strength of the methodologies of Copenhagen Economics (2005), and the additional scores and weights applied here is the large number of objective questions which reduces the importance of assigning "wrong" values to single weights and scores. As far as possible, though, we try to qualify the weights by looking at empirical investigations. For example, Jamasb and Pollitt (2005) state that production costs amount to roughly 40% of total electricity costs, which is used to weigh categories concerning electricity generation altogether by 0.40.

2.2. The questionnaires as the building blocks of the RIS

As already mentioned, the sectors differ widely with respect to economic maturity, technologies, monopolies etc. In particular, the provision of infrastructure services is strongly affected by the underlying technological conditions, e.g. the railway network is a highly capitalised area working with almost no production costs, but a high level of fixed costs. Therefore, it has been – and in many cases is still being – highly regulated. In contrast, most business and distribution services do not require much investment in physical capital and a totally different market structure has emerged. For this reason we prefer to create two sub-frameworks: (i) a sub-framework applying the same criteria to the sectors considered and (ii) a sub-framework applying different criteria according to sector specifics.

Specifically, the sectors accountancy, IT-services, retail and wholesale follow the questionnaires of Copenhagen Economics (2005) where the criteria are identical across sectors; electricity, telecommunication, air, rail and postal services will be evaluated by a new methodology with sector specific criteria, c.f. Table 2.1. This is a sensible way of differentiating, since the former group of services is formed by quite similar industries in contrast to the latter group that consists of industries with distinctive characteristics such as high capital intensity (rail and electricity) and network externalities (e.g. telecommunications). Most importantly, though, the infrastructure sectors have been characterised by strict regulation and/or a

[5] If all answers belonging to a subcategory are subsidiary, and hence additive, the condition translates to $\sum_k s_{ijk} = 1$.

[6] The reader is referred to Copenhagen Economics (2005) for a further treatment of the scores and weights.

[7] Actually, the researcher may apply the techniques of factor analysis at each aggregating step, but this may result in more than one index. In Copenhagen Economics (2005) factor analysis was deployed at the last step of aggregation in both cases resulting in two factors. See also chapter 4.

government monopoly until recently and therefore possess a range of immediate barriers not included in the more advanced questionnaires of Copenhagen Economics (2005).

Table 2.1. Questionnaires by sectors

Identical criteria questionnaires	Sector specific criteria questionnaires
IT-services	Electricity
Accountancy	Telecommunications
Retail	Air transport
Wholesale	Postal services
	Rail transport (freight and passenger)
	Banking services*

*: The questionnaire and answers for EU countries and Switzerland are taken straight from Kalirajan et al (2000).
Source: Copenhagen Economics

Table 2.2 gives an example of how the two setups differ. Notice, that the first sub-framework includes questions general enough to be answered by all industries. However, that might not be very relevant for e.g. the incumbent in telecommunications. On the other hand the second sub-framework aims directly at the telecommunications sector with some of its technological characteristics.

Table 2.2: The two sub frameworks

Sub-framework I		Sub-framework II	
Questions (all sectors)	Answer	Questions (telecommunications)	Answer
1.2. Nationality or residence requirements	CHE	2. Local loop unbundling (LLU)	CHE
Nationality required to practice + Permanent or prior residence (more than 12 months)	N	Availability of full LLU	N
Nationality required to practice + less than 12 months for prior residence	N	Types of LLU available	-
Nationality required to practice + Domicile or representative office only	N	Types of collocation available	-
No nationality requirements + Permanent or prior residence (more than 12 months)	N	Maximum waiting time for collocation space after request	-
No nationality requirements + less than 12 months for prior residence	N	Retail margin on rental rate for full LLU	-
No nationality requirements + Domicile or representative office only	Y		
No restrictions	N		

Source: Copenhagen Economics

The only difference in the output of the two sub-frameworks is that the first allows for a distinction between barriers affecting domestic firms and barriers affecting foreign firms. This difference can be denoted: “discrimination”. For example, rules about price setting (maximum and minimum prices, etc.) apply to both foreign and domestic firms. Hence, these rules are non-discriminatory. On the other hand, nationality requirements restrict foreign firms only and are thus considered to be discriminatory. E.g. for accountancy firms there is a number of restrictions to be fulfilled by the employees in order to practice. Where thorough knowledge of national laws is a natural precondition for providing accounting services of high quality, strict nationality requirements simply preclude foreigners from the domestic market and hence serve as a discriminatory barrier.

This level of detail is unattainable in the infrastructure sectors where the mere introduction of competitive pressures is at stake. One could of course apply the same questionnaires, but this would result in much irrelevant information. If telecommunications are still dominated by monopoly, there is not much value to know whether foreigners can or cannot be employed in the sector – the market outcome will most certainly be much more affected by the former

barrier. Thus, the measured barriers should be interpreted as barriers affecting both domestic and foreign firms.

More on the questionnaires and how they are used in scenario design
Having decided on the type of questionnaires to be used for each sector, we now describe the questionnaires in greater detail and how the answers to the questionnaires are closely linked to scenario design.

One of the main challenges is to draw the fine line separating relevant from irrelevant in the barrier space. Some countries might have liberalised formally, but is de facto being highly discriminating by e.g. the use of cumbersome administrative procedures. Lax enforcement of rigorous laws could be an example of the opposite. The picture is further blurred by a range of barriers being more of cultural and demographic nature, e.g. language problems. Since the study aims at the effects of political initiatives the latter seems to be less relevant, but indeed this is not always the case. For instance the Services Directive proposal as of 13.1.2005 foresees to implement "single points of contact" in order to overcome administrative and language problems.

As noted above the sectors have been divided into two groups according to the two sub-frameworks. The first constitutes a group of similar industries and is therefore treated in the same way. The small differences among these industries might nonetheless be captured as the questionnaires contain more than 200 objective questions. If a question is irrelevant to a sector this will typically be mirrored in absence of data and hence answers to the questions. It was the strategy of Copenhagen Economics (2005) to treat missing information on specific questions as evidence of no barriers. The reason for this is, that it is more difficult to obtain the information that a particular restriction does not exist than to obtain information about restrictions that actually exist.

The second group consists of sectors with greater diversities and therefore the questionnaires are adapted to sector specifics. Due to the intensity of purpose, these questionnaires are generally shorter, but all questions are answered without exceptions. Both the first and second set of questionnaires posses a scope and level of detail which is unique compared to other contemporary studies.

As a concrete example we present an excerpt of the telecommunications questionnaire in Table 2.3. We compare Switzerland with Denmark, which is the "best practice" country in the telecommunications sector. Also the weight and scores are presented. Notice, that for simplicity of exposition we have chosen a category with no subcategories, or – if one prefers – with just one subcategory comprising the entire category.

Table 2.3: Excerpt of the telecommunication questionnaire

Questions	Switzerland	Denmark	Weight	Score
5. Ownership			0.20	
Full public ownership (100%)	No	No		1
Mostly public ownership (71-99%)	No	No		0.75
Mixed ownership (30-70%)	Yes	No		0.50
Mostly private ownership (0-29%)	No	No		0.25
Full private ownership (0%)	No	Yes		0

Source: Copenhagen Economics

Table 2.3 demonstrates how the category "Ownership" is divided into a scale ranging from purely public to purely private ownership with descending scores. Obviously, public ownership is a severe impediment to trade in services, i.e. if the (former) monopoly firm providing telecommunications services is publicly owned most of the market will not be subject to normal competitive pressures. Public firms have little or no incentives to maximize profits leading to lax use of resources and lower productivity. Since the incumbent in Swiss telecommunications has mixed ownership, Switzerland obtains a score of 0.50. In comparison Denmark has gone much further in the liberalisation process, transferring all capacities into private hands and thereby obtaining a score of 0.

At this stage it is natural to explain how the RIS is adjusted to take account of the changes implied by the different scenarios. This is done in Box 2.1. The possibility to asses the barrier level of hypothetical scenarios is another distinguishing factor of this study.

Box 2.1: How scenarios imply changes in the barrier levels

The scenarios considered in this study imply changes in a wide set of rules not only for Switzerland, but the full range of European countries. In particular, the high impact scenario considers continued liberalisation in the EU-countries combined with Switzerland introducing "best practice" rules. Thus, every country is thought to change specific regulations thereby altering the scores in both the subcategories and the aggregated barrier index.

Suppose "best practice" in the telecommunications sector implies full private ownership of all capacities as stated by table 2.3, where Switzerland formerly has been characterised by "mixed ownership" implying a score of 0.5. The switch to complete private ownership reduces the category RIS to 0, such that multiplied by the weight of the "ownership-category" (0.20) we would observe a decrease in the aggregated RIS of (0-0.5)*0.20 = -0.10 as a result of this particular liberalisation. An analogous exercise has to be performed for all categories, sectors and countries throughout all scenarios.

Because the exact value of the barrier index is the primary input when calculating the economic effects of the different scenarios a possibly important subtlety should be mentioned at this stage. The question is whether to focus on Switzerland obtaining a certain (minimum) index value by allowing retro gradation of highly liberalised areas or to focus exclusively on the areas where the scenarios imply more liberalisation. As an example, Switzerland could already have liberalised the ownership in the telecommunications industry to an extent not matched by the best practice country, e.g. suppose the answers were reversed between Switzerland and Denmark. When this is left unchanged liberalising other categories will result in pronounced decreases and in this way the barriers of the best practice country puts an upper, not a lower, boundary on the new barrier level.

A practical problem that arises is how to interpret the notions "continued liberalisation" and "minimum EU-compatibility"; i.e. which objective questions are touched and which are not by these concepts? The solution chosen here is to use the Services Directive as proposed by the European Commission wherever applicable and supplement with other existing – if not yet implemented – and proposed EU directives. A complete list is given in appendix E.

Source: Copenhagen Economics.

We stress that implementing the scenarios in this way directs the focus towards liberalisation policies. But when changing regulation to the provision of services, there could be both a liberalisation effect as well as a harmonisation effect. The latter arises, because foreign firms are now operating under circumstances similar to those in their respective "home countries". The harmonisation effect can naturally also be negative if legislation changes to something unfamiliar for the majority of foreign firms. In particular, we should notice, that policy liberalisation and harmonisation can work in either the opposite or the same direction depending on the situation.

We believe, that the harmonisation effect will in many cases be limited compared to the liberalisation effect, since much of the regulation considered in this study is concerned with protection of domestic firms. A German firm operating in, say a protected German market and a liberalised Swiss environment, would probably not gain much if Swiss regulation was harmonised, i.e. made more protective. The German firm is simply standing on different sides in the German and Swiss markets respectively. In this particular case the liberalisation effect is all that matters. The harmonisation effect would be much more relevant if the study considered other barriers like production standards.

On the other hand, there might be a somewhat stronger case for the presence of harmonisation effects when we consider Switzerland against EU15 member states, simply because the EU has – at least sought to – harmonise regulation across member states.

The argument of harmonisation effects can be extended to regulations not covered by the RIS questionnaires, but again it is questionable whether these have any significant size and whether the heterogeneity is of any relevant magnitude. Kox and Lejour (2005) study the OECD regulation database and find no significant heterogeneity between Switzerland and the EU member states. There are even cases of member states whose services regulation differ more from the EU average than Switzerland does.[8]

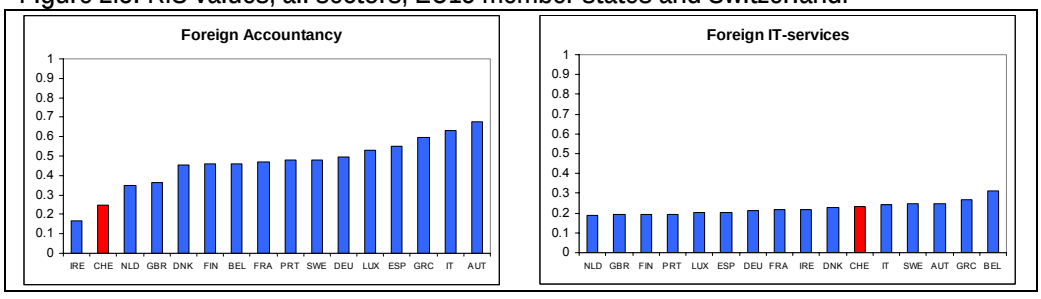
Altogether, our index methodology with its two sub-frameworks provides a reliable and flexible framework incorporating most of our scientific and economic requirements. The obtained index values are directly comparable between countries whether one uses RIS values at the subcategory, category or sector level.

2.3. Comparing the RIS across countries

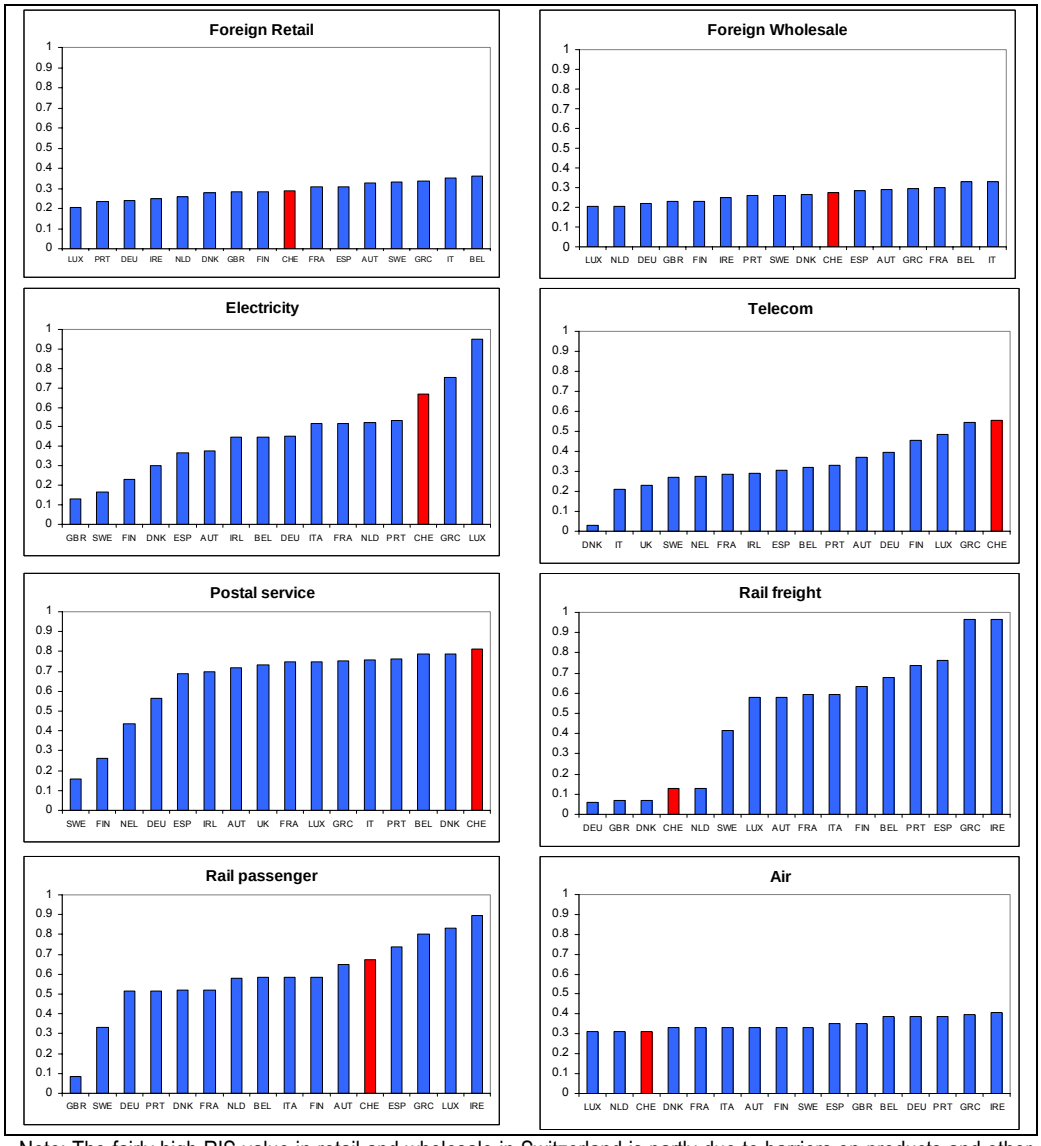
This section compares the Swiss barrier level and barrier composition to the EU15 countries using the RIS. In general, the existence of a marked difference between Switzerland and the EU countries is straightforward to interpret, whereas small differences should give rise to more caution. This is due to the fact that two countries may attain the same RIS value by fulfilling its respective different half of barriers in the questionnaires. The two countries may therefore be quantitatively similar, but qualitatively dissimilar. Thus, while focusing on the aggregated index the richness of information in the total of all the categories and subcategories should not be forgotten. In the following we present results on level and then composition effects.

The results of the aggregated RIS for all sectors are presented in Figure 2.3. The questionnaires are as far as possible answered according to the state of affairs in 2001. This is a natural choice since both the econometric and CGE modelling use economic data from 2001.

Figure 2.3: RIS values, all sectors, EU15 member states and Switzerland.



[8] Swiss regulations are relatively close to EU average as "euro-compatibility" is usually checked when a new Swiss law or regulation comes into force. Also, many EU regulations are adopted in Switzerland (with some delay) "autonomously". This means, that they are not formally acknowledged, but incorporated in Swiss law.



Note: The fairly high RIS value in retail and wholesale in Switzerland is partly due to barriers on products and other areas that *affect* retail and wholesale, without specifically targeting retail and wholesale.
Source: Copenhagen Economics

The more detailed information of all sub indices are summarised in Table 2.4.

Table 2.4: RIS values decomposed, EU15 average and Switzerland.

Foreign	Cat. 1	Cat. 2	Cat. 3	Cat. 4	Cat. 5	Cat. 6	Cat. 7	Cat. 8
Account.	Establish-ment	Uses of input	Promotion	Distribution	Sales of services	After sales activities	Non-legal barriers	
EU15	0.61	0.48	0.28	0.37	0.17	0.04	0.5	
CHE	0.14	0.48	0	0.02	0.22	0	0.53	
IT	Establish-ment	Uses of input	Promotion	Distribution	Sales of services	After sales activities	Non-legal barriers	
EU15	0.18	0.18	0.38	0.07	0.06	0.04	0.5	
CHE	0.11	0.38	0.29	0.06	0.03	0	0.53	
Retail	Establish-ment	Uses of input	Promotion	Distribution	Sales of services	After sales activities	Non-legal barriers	
EU15	0.3	0.18	0.38	0.16	0.32	0.06	0.51	
CHE	0.2	0.38	0.42	0.12	0.22	0	0.53	

Foreign	Cat. 1	Cat. 2	Cat. 3	Cat. 4	Cat. 5	Cat. 6	Cat. 7	Cat. 8
Wholesale	Establish-ment	Uses of input	Promotion	Distribution	Sales of services	After sales activities	Non-legal barriers	
EU15	0.25	0.18	0.38	0.1	0.31	0.04	0.51	
CHE	0.18	0.38	0.42	0.06	0.19	0	0.55	
Electricity	Free choice of supplier	Unbundling	Network access	Tarification mechanism	Ownership (generation)	Wholesale trading model	Congestion management	
EU15	0.31	0.53	0.07	0.73	0.7	0.53	0.44	
CHE	0.80	0.73	0.75	1	0.75	0	1	
Telecom	Degree of choice	Unbundling	Third Party Access (TPA)	Regulation of TPA	Ownership			
EU15	0.02	0.37	0.32	0.46	0.43			
CHE	0	1	0.28	1	0.50			
Air	Regional airports	Freedom Access	Ownership	Setting Air Fares	Ground handling			
EU15	0	0.17	0.62	0	0.26			
CHE	1	0.17	0.33	0	0.25			
Rail freight	Functional separation I	Functional separation II	Privatisation of rail stock	Network access	Network pricing	Public con-trol of prices	De facto access	
EU15	0.52	0.6	0.73	0.53	0.47	0.27	0.53	
CHE	0.4	0	0	0	0.5	0	0	
Rail pass.	Functional separation I	Functional separation II	Privatisation of rail stock	Network access	Openness to tendering	Network pricing	Liberalisa-tion form	Compensa-tion
EU15	0.4	0.87	0.93	0.67	0.89	0.43	0.1	0.37
CHE	0.5	1	1	0.67	0.95	0.5	0.25	0.5
Postal	Unbundling	Letter post	Third party access	Ownership	Regulation of entry			
EU15	0	0.7	0.8	0.72	0.31			
CHE	0	0.86	1	0.75	0.25			

The table presents the category RIS-values for each sector. It should be noted that the RIS-values only include the barriers to services. In some sectors like retail there will also be barriers to products, but these are not included in the RIS-value.
Source: Copenhagen Economics

The first notable difference is found in *accountancy*, where Switzerland is placed among the most liberal countries only surpassed by Ireland.[9] The low level of Swiss barriers primarily stem from liberalised establishment, promotion and distribution rules. On the other hand, non-legal barriers seem to be slightly more unfortunate in Switzerland. It is also noteworthy that accountancy is the only one out of the business services and distribution sectors with high and dispersed barriers.

For *IT-services*, *retail* and *wholesale* – where the EU-dispersion is much lower – Switzerland obtains a score close to the EU-average. Interestingly, in IT-services the Swiss score is attained by having quite different regulatory setup compared to the EU-countries according to most restrictiveness criteria (objective questions), but this is not always reflected in the category values of Table 2.4, i.e. the qualitative differences disappear when aggregating to the category level. In retail and wholesale, some differences from the EU-pattern can be found in

[9] It should, though, be noticed that most of the new EU-members such as Hungary, the Czech Republic, Poland, Estonia and Lithuania all seem to fall in the same category as Switzerland and Ireland.

establishment and sales of services respectively. An EU-pattern could not be found in all cases.

In retail it is questionable whether true barriers in Switzerland are actually higher than what the calculated aggregate RIS-values reflect. For example in the category "Use of inputs" one could argue that Switzerland has much higher barriers than we see them in the results. This is because Switzerland does not participate in the tariff union and has not implemented the so called "Cassis-de-Dijon" principle allowing the product standards of one member country to apply in all other member countries. In this way, Switzerland can have many restrictions on specific products complicating the life of retailers. We stress that the study never intended to include regulations on goods, but only on services and this probably accounts for the low RIS-values. Moreover a different weighting scheme could result in higher aggregate barrier values.

Turning to the infrastructure sectors, Switzerland is now placed among the most restrictive countries in Europe.

Starting with *telecommunications*, Switzerland is the most restrictive country, but this is mainly due to the absence of local loop unbundling and restrictive regulation of third-party access. Beyond this, the regulation of the Swiss telecommunication sector displays much affinity with the EU. Local loop unbundling has a prominent position in the questionnaire because it is seen as an important feature in the year 2001, where the barrier information is collected since many competing networks were not a reality at that time.

In the *electricity* sector, Switzerland is much more regulated than its European neighbours, which is reflected in practically all of the different restrictiveness criteria, except the wholesale trading model. Important to remember, though, is the unique combination of nuclear and hydro energy generation not matched by any other European country which hypothetically could enforce stricter regulation of the electricity sector in a hypothetical economic optimum.

Postal services are generally highly restricted throughout Europe with Switzerland being the most regulated country. It is likely that the high degree of regulation reflects particular features such as significant economies of scale and political difficulties. Alternatively, one could state that postal services have not witnessed the same technological improvements supporting liberalisation in other infrastructure sectors.

Compared to the EU-average, the regulation of the Swiss *rail* sector is quite asymmetric according to the object of transportation, i.e. the freight segment is almost fully liberalised whereas the passenger segment has relatively high barriers with the pattern of restrictions diverging somewhat from the EU15. The high degree of openness in freight is mainly due to the relatively high degree of competition and relatively high availability of rail stock.

The *air transport* industry is characterised by high commitment to international liberalisations which is reflected in very similar index values across countries. In this respect, it is quite surprising to observe some departures from the EU-average in the Swiss air industry. We also notice that Doove et al (2000) find significantly higher Swiss barriers, but much of this discrepancy can be explained by measurement at different points in time, i.e. Doove et al (2000) computes barriers for the year 1996.

2.4. Limitations to the RIS methodology

In the contemporary literature, the RIS belongs to the most extensive and refined methods of measuring barriers, c.f. Holmes and Hardin (2000), Warren (2000) and Dee (2003). A comparison across studies would generally just highlight the high quality of the RIS; that it has a unique coverage, several levels and a precise scope for each sector. But despite all

advantages it is still not a *perfect* measure of barriers. Therefore, a critical assessment should rather aim at more general short-comings of the index-methodology.

The first point to notice is that non-tariff barriers are very complex themselves and are working in an even more complex environment. Moreover, barriers and environment can differ widely across countries. Thus, it is a challenging task to select criteria and sub-criteria covering all *relevant* aspects of non-tariff barriers and still being comparable across countries. The selection is further restricted by availability of information on specific areas. One should therefore not expect the set of criteria to be exclusive. This study excels in its broad coverage and is therefore not severely affected by this criticism.

Further, we seek to measure *actual* barriers, but normally, comparable information only exists on *formal* barriers. Unfortunately, these two can be quite distinct. A country can pass several acts on liberalisation, but choose to have very lax reinforcement, so that actual barriers are much higher than formal ones. A more complicated example; the implementation of the electricity directive 2003/54/EE. According to the directive, Distribution System Operators (DSOs) have to be separated along several lines *if* the DSO serves more than 100,000 households. Some countries have mainly large distributor firms, e.g. Germany, whereas others have much smaller ones, e.g. Switzerland, so even if Switzerland implemented the EU-directive along with Germany to obtain the same formal barriers, *actual* barriers would most certainly diverge. This study primarily focuses on formal barriers, but where credible information is available, it aims at actual barriers. For example, we include call termination charge scores based on true prices in telecommunications.

A practical problem often arising when covering a large number of countries is to get the *right* answers – or to get an answer at all. The questions are formulated so that they can be answered by yes or no, but legislation differs widely across countries and in many cases the correct answer would be "partly". In other words: When we want to measure barriers in one dimension we must sometimes conclude that several countries can only be judged along another dimension. Even more severe, is the problem of missing information. Normally, when searching for answers to a specific question, nothing will be found if the barrier does not exist. On the other hand, when one does not find an answer one could simply have cut off the search process to early. Therefore, this leaves a certain ambiguity of the unanswered questions. In our case, the problem only appeared in the questionnaire-methodology of Copenhagen Economics (2005). This is because the questionnaires were extremely long. Adding more questions increases the likelihood of missing answers, but at the same time also reduces the severity of any missing answers, because each question becomes less important at the aggregate level. It is therefore not clear how much missing answers could influence our results.

An important issue is the choice of *scores* and *weights*. The actual calculations depend crucially on the scores and weights, but since it is practically impossible to estimate these, the process includes some degree of guessing. Typically, one would use a priori arguments derived from economic theory to qualify these guesses, but essentially the scores and weights will reflect how one weighs different economic theories against each other. This study seeks to minimise the ambiguity of the scores and weights by deploying advanced statistical techniques such as factor analysis. Also, we seek to qualify the weights by empirical evidence. Compared with other studies this is an important step forward, although we only eliminate part of the ambiguities.

A final point concerns what we will denote "horizontal policies". The barriers included in the RIS aim directly at specific regulation policies, but do not incorporate more general regulative policies like taxes and competition policies. These are horisontal policies affecting firm performance in positive or negative directions – similar to the included regulations and which are often also experienced as barriers by the services providers. It is obvious that changes in

horizontal policies are indeed very important for economic efficiency – not only for services – but lack of comparable and objective data on e.g. competition policies in different countries make it fruitless to pursue this avenue and could distort the results. Additionally, analysing such polices would remove the focus from the scope of the study.

Notice, that when we calculate the economic effects in the following chapters we are likely to implicitly include some of the performance effects induced by horizontal policies to the extent these are correlated with the specific regulation policies included in the RIS. The problem of excluding horizontal policies naturally applies to all countries in this study.

Chapter 3 Estimating the impact of barriers on price and cost

In this chapter we use the RIS values to obtain econometric estimates of the impact on firm performance from trade barriers. The key results of the chapter are the so-called tax equivalents, i.e. hypothetical taxes – implying a similar effect on firms' performance such as the barriers captured by the RIS. In other words, the tax equivalents can be thought of as theoretical taxes computed to create economic effects that are equivalent to the economic effects of the actual barriers. These tax equivalents are the inputs to the economic modelling in the succeeding chapter, because only tax equivalents and not RIS values may enter the applied economic model, the Copenhagen Economics Trade Model (CETM).

In order to calculate the tax equivalents we first set up econometric models attempting to capture all relevant effect but still being consistent with the available data. The main idea of the models is to estimate the link between the RIS and sector prices and costs. This link will be reflected in coefficient estimates; the higher the estimates, the more influential are the barriers.

Secondly, we translate the RIS values to tax equivalents by using the obtained coefficient estimates. The functional form of the translation will depend on the model, but irrespective of this, higher RIS implies higher tax equivalents.

We apply three approaches to obtain tax equivalents. (i) For business services and distribution we take advantage of the econometrical estimates from Copenhagen Economics (2005) and combine these with the RIS values which are similar to the barrier values used in that study. (ii) For electricity and telecommunications, we use publicly available data and our RIS-values to set up econometrical models to find empirical estimates of the link between barriers and sector performance. These are then transformed into tax equivalents. (iii) For the sector rail transport (of freight and passengers), air transport, postal services and banking services we find empirical estimates in the literature, and qualify and transform these allowing us to calculate tax equivalents from our RIS-values.

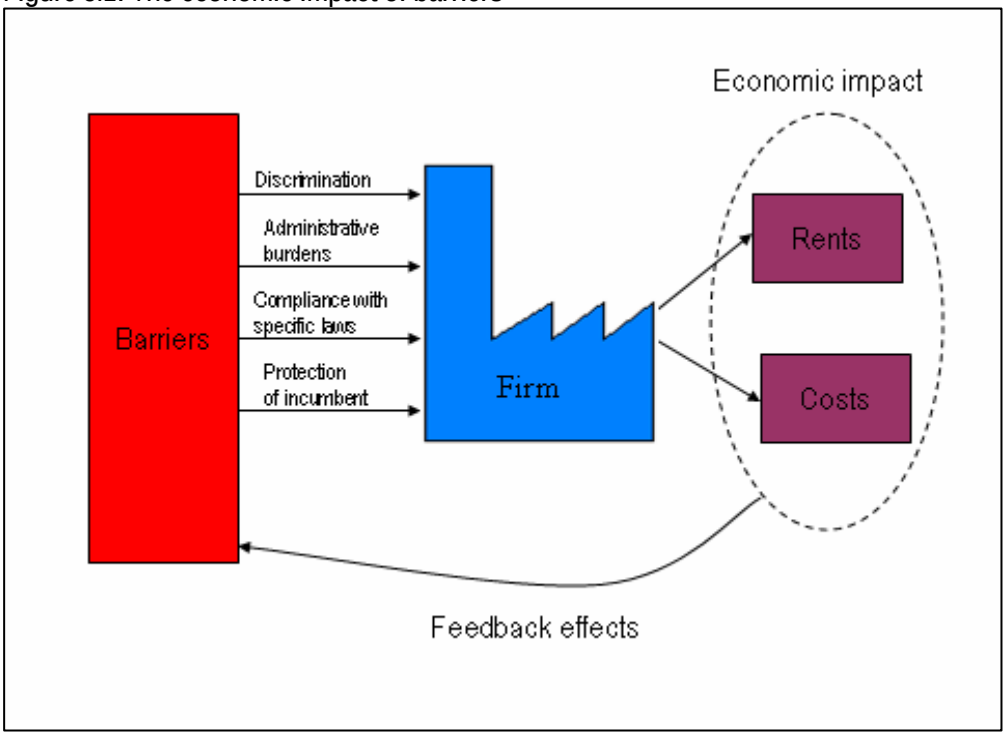
The rest of the chapter is organised as follows: In section 3.1 we set up a framework explaining how barriers to trade in services might influence firm performance, section 3.2 presents the econometric results and section 3.3 explains how the econometric coefficient results are transformed to tax equivalents. Finally, in section 3.4 we present a short critique of the econometrical model.

3.1. The link between barriers and firm performance

Barriers serve to influence the market outcome of a sector; consequently the barriers affect firm performance. Since the barriers are of multidimensional nature, the inter-linkages with firm performance are complex and many-sided.

The first and most intuitive way to think about the effects of barriers to trade in services is that of protecting domestic service providers from competition abroad, thereby allowing for higher prices. In some cases the barriers are of such a nature that even domestic competition is hampered, as e.g. the case of monopolies in the infrastructure sectors. One important effect of trade barriers is higher prices, but many others exist. Figure 3.1 give a stylised picture of a more general model linking barriers and economic effects.

Figure 3.1: The economic impact of barriers



Source: Copenhagen Economics

The multidimensional nature of the barriers are represented by a set of arrows each having its distinctive influence on the firm. The list in Figure 3.1 is non-exhaustive; one could think of many other and more detailed influences on the firm. The main point though, is that different parts of the value chain are touched by different barriers. This is also reflected in the structure of the RIS questionnaires starting with establishment and ending with after-sales services and non-legal barriers. For example, barriers that aim to complicate establishment protect existing firms all over the spectrum, whereas barriers to the use of inputs raises costs of operations directly influencing production.

Further, these influences have economic impacts that can be summarised in two categories: Creation of costs and creation of rents. A barrier can potentially have both cost and rent creating influences, but a rent creating *impact* cannot also be cost creating and vice versa. Thus, the two categories are mutually exclusive. Basically, this is the way the majoritity of researchers have approached the issue theoretically, see Deardoff and Stern (1985) and Findlay and Warren (2000) for two of the most extensive reviews of non-tariff barrier impacts.

We also notice that both impacts should be reflected in higher prices, but that the relation is not direct and not proportional. If we consider the administrative burdens, these will typically increase overhead costs, but marginal costs are most likely unaffected, and the spill over in prices will not be absolute. Similarly, the protection of a monopolistic incumbent might increase both rents and costs – the latter being due to lax handling of resources. Thus, it is not only difficult to establish a single link to prices, but also to determine what kinds of barriers influence

only costs (or only rents). On the other hand this does not prohibit a formalised division at the aggregate level.

The model also points to potential feedback effects from the economic impacts to barriers of service trade. If firms exploit their market, power policy makers would most likely become aware of the losses incurred by the consumers and therefore move to change legislation – i.e. reduce barriers. This gives a dynamic setup where barriers and economic impacts are simultaneously determined. A somewhat more farfetched linkage can be found if the firms start to appraise the barriers as the sources of their economic rents and attempt to reinforce barriers through lobbyism.

Finally, the complex and multidimensional nature of the relationship covers an important point: Where complete regulation has harmful effects on consumers through extreme rent and cost creation, a complete absence of regulations might also result in an unfavourable economic outcome. E.g. in the telecommunications industry we would most likely be witnessing so called "raisin picking" - where only areas exceeding a certain density of population would be served with copper networks – if there are no regulations on this issue.[10] In general the infrastructure networks could hardly be governed by purely competitive markets. Thus, in the model of figure 3.1 there exists a unique mix of trade barriers maximizing economic efficiency. In other words we should think of a nonlinear relationship between barriers and impacts. Too strict regulation precludes the positive gains from competition and too loose might also have adverse effects, so that we can imagine the barriers-efficiency relation as a curve with its maximum somewhere between the two extremes. A further aspect concerns the timing and speed of possible liberalisation policies. For example slow and inconsistent liberalisations may not lead to many advances.

The above discussion revealed three issues deserving attention when modelling barriers and economic performance. The first and main point is that barriers can influence both costs and rents. Second, there are potential feedback effects, and thirdly the overall relation may be non-linear. Changing the focus to a specific econometric model, some choices and simplifications have to be made concerning these and other issues.

The first choice concerns dividing the impacts in cost and rents. Most similar studies estimating the economic impacts, e.g. Doove et al (2000) and Dee (2003), simplify the mechanism and focus solely on prices, but as inputs to a CGE-model we take up the challenge to separate cost and rent creating barriers. This is done because the two have quite asymmetrical effects on the overall economic outcome.

Second, the issue of feedback effects has been excluded from this analysis. We believe that these effects are of minor importance compared to the direct effects, but acknowledge the potential endogeneity in the econometric models. To our knowledge no other study has incorporated feedback effects.

Thirdly, the mixing and nonlinearity arguments are only treated indirectly. The index methodology can account for mixing and nonlinearity effects when scores and questionnaires are constructed carefully. As an example, the "network pricing" category in the questionnaires to rail freight weight average cost pricing higher than marginal cost pricing. The latter is viewed to be too liberal, as it generally will not cover the high amount of fixed costs. On the other hand, we do not specify any nonlinear econometric model. This is due to the few observations available combined with too little in-sample variation. If there is no data covering the extremes,

[10] Raisin picking could also be economically efficient, but still undesirable from a societal point of view.

a non-linear relation is hardly possible to detect, and a more flexible non-linear model might lead to counter-intuitive results.[11]

3.2. Econometric modelling

In the econometric modelling we apply three approaches. First, for electricity and telecommunications we use publicly available data and the RIS-values in setting up econometrical models to find empirical estimates of the link between barriers and sector performance. Using the empirical estimates we transform the RIS-values into tax equivalents. Second, in IT-services, accountancy and distributive (retail and wholesale) trade we use the econometrical estimates from Copenhagen Economics (2005) to transform the RIS values into tax equivalents. Copenhagen Economics (2005) focuses exactly on these three sectors. Third, for the sectors railway transport (freight and passenger), air transport, postal services and banking services we utilise the estimates from acknowledged empirical studies, and qualify and transform these allowing us to transform our RIS-values into tax equivalents. In the following, we treat the most important aspects of each econometric specification starting with a thorough examination of the new regressions for telecommunications and electricity.

Electricity and Telecommunications

For electricity and telecommunications we set up econometric models using publicly available data. We estimate two separate equations in order to distinguish cost and rent creating effects. The section proceeds by presenting the model specification and data issues followed by the results and a comparison with other studies.

Standardised cost figures across sectors and countries are only available to a very limited extent, but since costs arise due to the use of inputs we seek to model how efficient a firm operates instead. In particular we take advantage of the fact that using fewer inputs to produce the same amount of services (or goods) must be captured by higher productivity.[12] Thus, the starting point for the cost creating model is a Cobb-Douglas production function which after taking logarithms can be written:

Model 3.1 $$\ln(Y) = \gamma_K^v \ln(K) + \gamma_L^v \ln(L) + \ln(A)$$

where Y is value added, A is exogenous technological changes, K is the value of capital input and L is the value of labour input. "ln" is the natural logarithm and γ_K^v, γ_L^v are the estimated capital and labour shares in the value added model respectively. Now, the measure of productivity is the Solow-residual, $\ln(A)$, and including more variables on the right hand side of model 3.1 simply means that we are trying to explain the variation in productivity. Alternatively, the model can be modified to include a productivity measure directly.

In our context the most important of the control variables is the RIS. We expect the RIS coefficient to be negative implying that production is less efficient, i.e. more costly, when barriers are high. To avoid biases other control variables are included as well. Unfortunately, many relevant control variables are simply not available and when available only through the use of proxies.

Equivalently, the rent creating model is:

Model 3.2 $$\ln(P) = \gamma_K^p \ln\left(P^K \frac{K}{Y}\right) + \gamma_L^p \ln\left(P^L \frac{L}{Y}\right) + \eta$$

[11] Also, preliminary analyses with nonlinearities resulted in uncertain estimates that were hard to interpret.

[12] Moreover, it is consistent with the CETM to measure the impact directly on productivity and not on costs.

where P^K is the price, or user cost, of capital and P^L is the price of labour. P is simply the price of electricity/telecommunication services. Notice, how rents emerge as prices (left hand side) minus costs of capital and labour inputs (right hand side). Hence, the residual is simply a measure of rents. If we augment the equation by control variables we therefore obtain their influence on rents, i.e. by including the RIS our regression directly estimates how barriers influence rents.[13]

Because the RIS variable enters the equation without a log-transformation the obtained coefficient can be interpreted as a semi-elasticity, i.e. it gives the percentage change in the left hand side variable due to a unit change in the RIS. Since the RIS is only defined on the interval [0;1], the coefficient can be interpreted as the percentage increase in rents (or decrease in productivity) when a country moves from complete liberalisation to full regulation.

We use publicly available data for all estimations. To be consistent with the CETM we estimate equations based on 2001 data. The sample consists of Switzerland and EU15, so that a maximum of 16 observations are available. The proxy for productivity in the electricity sector is capacity utilisation (yearly basis). The control variables are rain volume and net-exports. We use industry prices for medium-sized firms to present general electricity prices, but all end-user electricity prices have an extremely high correlation. For control variables we use the ratio of nuclear to total capacity and net-exports. All electricity-data were taken from Eurostat and complemented by Swiss figures (various sources). In telecommunications the dependent variable in the cost-creating model is labour productivity and the control variable is number of access lines. The price model uses a price-basket and the equation is augmented by new entrants' share of access lines and volume of public telecommunication investments. All telecommunication-data were taken from OECD-reports.

In Table 3.1 we find coefficient estimates of the four regressions.[14] First, we see that all coefficients have the right sign; barriers tend to lower productivity (increase costs) and increase rents. Moreover, the magnitudes seem plausible and in line with other empirical evidence, e.g. Copenhagen Economics (2005) and Doove et al (2000). Both sign and magnitude were relatively stable over a range of specifications.

Table 3.1: RIS coefficient estimates

	El cost	El rent	Telecom cost	Telecom rent
RIS coefficient	-0.23	0.62	-0.38	0.21
Bootstrap P-values	[0.455]	[0.114]	[0.300]	[0.390]

Source: Copenhagen Economics

Table 3.1 also reveals that all coefficient estimates are insignificant at any reasonable level. Due to the low number of observations we find it more appropriate to apply bootstrap methods to the (asymptotical pivotal) t-statistics, but this does not alter any conclusions.[15] Since the estimates are not remarkably low from an economic point of view, the statistical uncertainty as captured by t-statistics must be attributed to large standard errors.

We believe that the large standard errors can be explained by a number of factors. First, the sample is small. Second, the in-sample variation is also limited, i.e. we estimate on a set of homogenous countries all using similar technologies and having similar barriers. Other studies normally include more Asian and American countries which increases the variation. Third,

[13] Precisely, the RIS coefficient estimate is the partial derivate on prices conditioned on the relation between barriers and input prices (costs).

[14] Complete summary statistics are given in appendix C. All equations were estimated using OLS.

[15] We applied the pairs bootstrap and the wild bootstrap as both accounting for heteroscedasticity. The pairs bootstrap gave results lying between the t-distribution and the wild bootstrap so here we only present the wild bootstrap results. For a short introduction to bootstrap methods see Davidson and MacKinnon (2004).

focusing on a single year increases the sensitivity of the results to business cycle fluctuations, which give rise to further uncertainty. Fourth, all specifications rely crucially on possessing the right left hand side variables and the right input measures – capital and labour. The former is easily found in official statistics, but the latter is generally not available. Instead we use proxy variables and the quality of these is another source to the uncertainty of the estimates. Fifth, the RIS is a weighted sum of variables having quite different – and potentially even opposing – economic impacts. Though the index is constructed to capture barriers with adverse economic effects the removal of barriers must be seen in a wider economic context. For instance, the privatisation of a monopolistic incumbent is likely to have increased adverse effects on rents if a competitive environment does not emerge. Thus, the RIS could be a sum of different positive and negative influences which simply increase the standard errors of the estimated coefficient. Finally, the low number of observations increases the likelihood of multicollinearity[16] between explanatory variables. In particular, one could suspect capital and labour to correlate and therefore increase standard errors. To assess the importance of multicollinearity we compute the conditioning number and applied Ridge-regression techniques. [17] There are signs of severe multicollinearity in two cases: The rent and the cost equation in telecommunications and the Ridge-regressions suggested a marginally lower cost estimate and a higher rent estimate, which also seems economically plausible.

Despite the fundamental uncertainty of the estimates there seems to be no reason to choose other specifications, regression methods etc.[18]. Important to remember, is that our context does not imply testing the *presence* of effects, but measuring the *size* of the effect. Thus, the econometric focus is on obtaining the maximum amount of information on the true impacts from the data, which gives rise to a working methodology very similar to that of an econometric forecaster. If the effect of a variable is uncertain, the forecaster would still appreciate the estimate as the most likely size of the effect given the available data.[19] Only in the case of rent-creating barriers in electricity we are worried that the coefficient estimate might be too high. Consequently, this estimate was adjusted – see below.

To validate the obtained estimates we compare our results with other empirical evidence. Differences to our estimates are incorporated in the sensitivity analysis.

The effects from trade barriers on telecommunication prices were investigated by Doove et al (2000) building on the econometric work of Boylaud and Nicoletti (2000). Doove et al (2000) extend the Boylaud and Nicoletti sample to 47 economies and use 1997 as the base year for the calculations. Since many European reforms were implemented between 1997 and 2001 (notably 1998), we expect the impacts to provide upper bounds for the potential impacts in 2001, which are our main interest. Indeed, Doove et al (2000) find price impacts two to four times higher than those used in this study. We believe that much of this large discrepancy can be explained by the different time foci and the fact that Doove's estimates are price, not rent, impacts. With this in mind, both estimates seem reasonable. Nonetheless, the effects are significantly higher so when setting up the sensitivity analysis more weight is placed on the upper bound.

Price impacts of liberalisation in electricity were also treated in Doove et al (2000). The sample covers 50 economies with the vast majority of observations being based on 1996-figures. Interestingly, in contrast to telecommunication the period 1996-2001 was characterised by very few liberalisation initiatives in all member countries, so that the impacts obtained in Doove et al

[16] Multicollinearity is when explanatory variables are correlated which, among other things, inflate standard errors.
[17] See Theobald (1974) for an introduction to Ridge-regressions.
[18] Of course the estimation procedure included several specifications, testing and sensitivity analysis in order to obtain a favoured model, which is the one presented here.
[19] Notice that the OLS-estimate equals the maximum-likelihood estimate for normal distributed errors. Also the OLS-estimate can be shown to be "best linear unbiased" – the so called Gauss-Markov theorem.

(2000) are directly comparable with those obtained in this study.[20] A comparison reveals that the two studies suggest somewhat different impacts from trade barriers, with our figures pointing to more than twice the size of the impacts compared to Doove et al (2000). At the same time, a divergence in the cross-country dimension can be found, i.e. a few countries have high impacts in this study and low impacts in Doove et al (2000) and vice versa, which must be attributed to more general differences in the measurement of barriers.

Our coefficient estimate is admittedly quite high; therefore we incorporate the impacts of Doove et al (2000) to form an average. The studies are weighted equally and the new, qualified estimate amounts to 0.44 instead of 0.62. This seems to be quite a reasonable value. It is practically impossible to present standard errors of this estimate.

Accountancy, IT-services and distributive (retail and wholesale) trade
For accountancy, IT-services, retail and wholesale we use the estimates from Copenhagen Economics (2005). This study belongs to the newest and most extensive one on barriers to service trade using a sample of more than 275 thousand observations to measure the economic impacts. Apart from the impressive number of observations, another advantage of the study is the refined method of aggregating the restrictiveness index using factor analysis. The factor analysis resulted in two, rather than just one, indices with the weights determined by the data.

The model is adopted on firm level where firms within the same country are affected equally by the specific country's barriers, i.e. each firm's profit margin is explained both by data on firm level and economy-wide information. At the firm level, each firm's profitability is affected by several factors specific to that firm and the econometric model control for these. Most importantly, at the economy-wide level each country's barriers as represented by the two factors are included to measure the direct impact on firms' performance. The regression is repeated for domestic and foreign barriers respectively. Essentially, this is the same setup as presented above for electricity and telecommunications only now directly at firm level.

If the obtained coefficient estimate on either of the factor reduced barriers is positive, i.e. barriers increase price-cost margins, they are interpreted as rent creating. Similarly a negative effect on the price-cost margins from barriers is interpreted as indirect evidence that the barriers are cost creating. The drawback of this estimation strategy is that barriers cannot be rent and cost creating simultaneously because they eliminate each other, in order that the obtained estimates should be thought of as conservative.

The overshadowing advantage of using these econometric estimates is that there is absolutely no ambiguity as to how the barriers are calculated and how to transfer these numbers to tax equivalents.

Banking, air, post, railways (freight and passenger)
Kalirajan et al (2000) investigate the impact from trade restrictions on the net interest margins of *banks*. Applying a two-stage estimation procedure, a significant effect from the trade restrictiveness index is found using a sample of 694 banks from 27 countries with all variables based on late 1997 values. The regression model is essentially the same as Copenhagen Economics (2005) with the interest margin as proxy for the price-cost margin. The major difference is that only one restrictiveness index enters the equation and this results in a rent creating barrier. No cost creating barrier is measured. Since both the trade restrictiveness index and all coefficient estimates are made available, recalculations of the impacts on the

[20] To clarify: the barriers have hardly changed over the period, but the performance indicators such as value added and prices – which are used in the econometric modelling – probably have. In particular, if liberalisation influences performance with a lag our estimates would include this effect and point to higher impacts.

Table 2: Regions in the CETM

Name of region	
1. Switzerland	9. Ireland
2. Austria	10. Italy
3. Belgium[39]	11. Netherlands
4. Denmark	12. Portugal
5. Finland	13. Spain
6. France	14. Sweden
7. Germany	15. United Kingdoms
8. Greece	16. Rest of the world

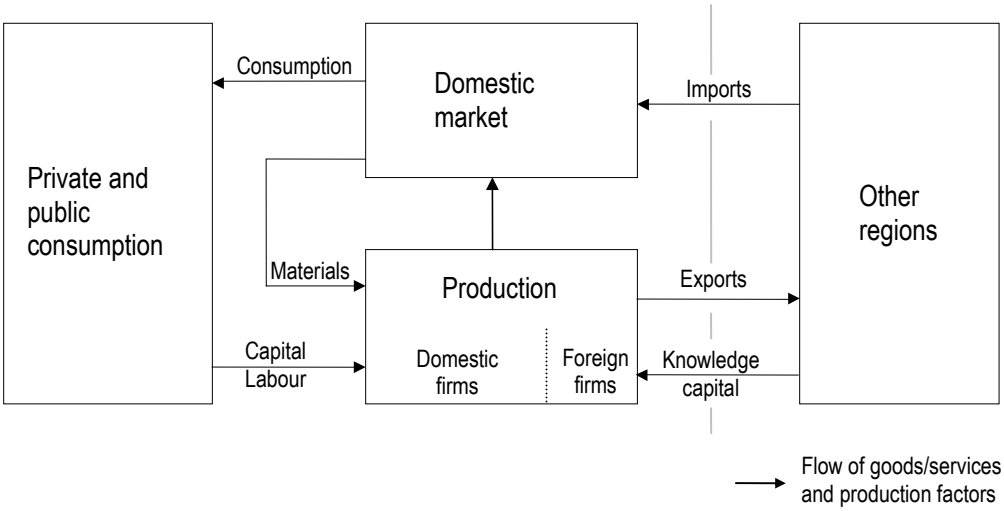
Source: CETM model – Copenhagen Economics

With these preliminaries, the following section lays out the theoretical foundations of the version of the CETM that is used for the analysis of a potential services agreement between Switzerland and the EU. The empirical implementation of the model is then described, including a documentation of the data sources that are used.

The theoretical foundations of the CETM

The current version of the CETM is an extension of the theoretical model by Markusen, Rutherford and Tarr (2000). The CETM represents state-of-the-art developments in modelling, especially of provision and trade of services. Figure 1 gives an overview of the markets, the agents and the flows of goods, services and factors of production in the model.

Figure 1: Overview of the Copenhagen Economics Trade Model (CETM)



Factors of production

There will be three primary factors available in each region: physical capital, labour and a factor called "knowledge capital". Both physical capital and labour are perfectly mobile across all sectors within a region [40], but immobile across regions. The supply of physical capital is fixed while the supply of labour is endogenously determined within the model. The production factor called knowledge capital is assumed to be used only by foreign firms. The factor represents for example specialized technical expertise, advanced technology or management expertise. Knowledge capital is internationally mobile and the use of this production factor will

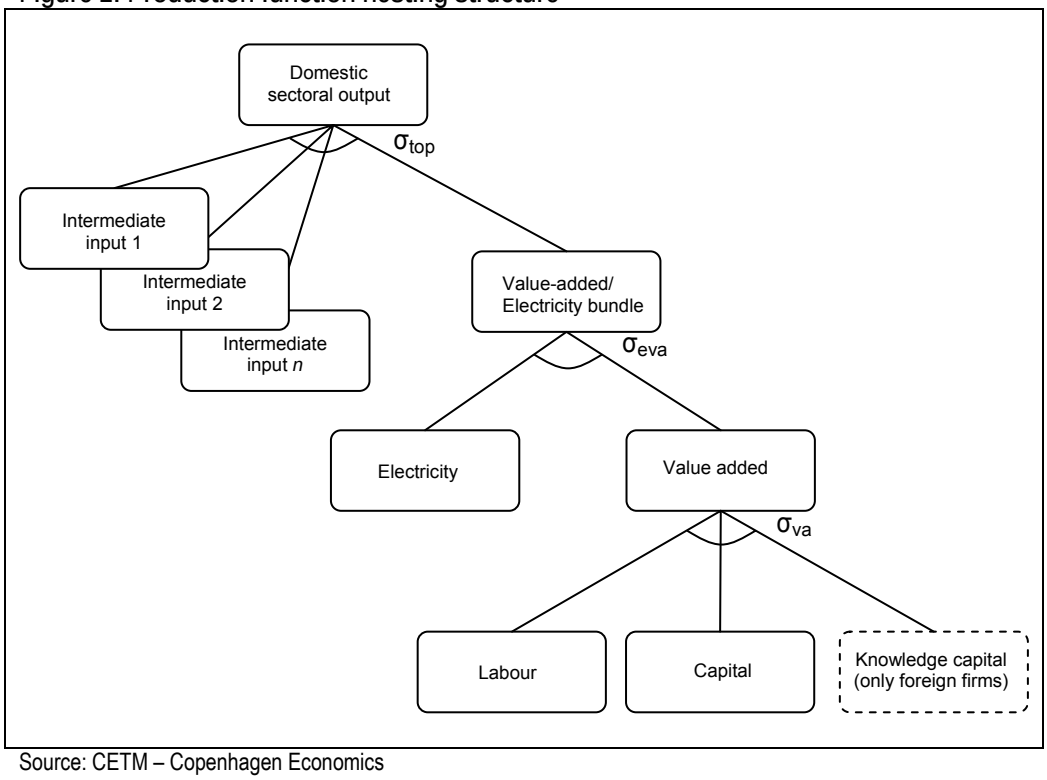
[39] Luxemburg is included in the Belgium figures.

[40] Except in the electricity sector, where capital is assumed to be sector specific.

thus be a key difference between domestic and foreign firms. All markets for primary factors are perfectly competitive.

Production of services and goods
In the production of all services and goods, non-electricity intermediate inputs are employed in a Cobb-Douglas function together with an aggregate of capital, labour and electricity. At the second level, a constant elasticity of substitution (CES) function describes the substitution possibilities between electricity and the value-added aggregate. Finally, at the third level, capital and labour factor inputs trade off with a constant elasticity of substitution. A schematic overview of the nesting structure is shown in Figure 2.

Figure 2: Production function nesting structure



Source: CETM – Copenhagen Economics

This way of nesting the production structure with respect to electricity or other energy aggregates is common among studies where production and consumption of energy is an important part of the analysis, see for example Böhringer and Loschel (2002), Böhringer and Rutherford (2002) and Babiker et al (2001).

There are two types of sectors. Firstly, there are perfectly competitive sectors in which output is produced under constant returns to scale and where price equals marginal costs. These include the production of what is labelled as "other services", and all goods production (sectors 10 and 11). Firms in these perfectly competitive sectors maximise profits taking market prices as given. Production is constant returns to scale and characterized by the nested CES production function described in Figure 2. The solution of the profit-maximisation problem yields the standard first-order conditions determining factor demands such that the value of the marginal product of a given input equals its price.

Secondly, there are imperfectly competitive sectors in which output is produced under increasing returns to scale and where price equals average costs. The imperfectly competitive sectors include all business-related services sectors (sectors 1–9). Unlike the perfectly competitive markets, the markets for business-related services are assumed to take the form of

large-group monopolistic competition. Each firm produces its own variety, which is a close, but imperfect substitute for similar services. An individual firm has only limited ability to influence its own output price, and it takes both total output and the composite price of their group as given. Hence, business-related services are produced by imperfectly competitive domestic and foreign firms.

Each firm produces its own variety, which is a close, but imperfect substitute for similar services. *ZD* denotes services provided by domestic firms, and *ZM* denotes services provided by foreign firms. *ZD* and *ZM* are CES aggregates of zd_i and zm_j respectively, which represent the output per variety produced by the individual domestic and foreign firms:

$$ZD = \left[\sum_{i}^{n_d} zd_i^{\delta} \right]^{1/\delta}$$

$$ZM = \left[\sum_{j}^{n_m} zm_j^{\varepsilon} \right]^{1/\varepsilon}$$

where n_d and n_m are the number of domestic and foreign varieties. The constant elasticities of substitution are represented by $\sigma_d=1/(1-\delta)$ and $\sigma_m=1/(1-\varepsilon)$.

Total domestic production in the business-related services sectors, D_r, is then a CES aggregate of services provided by domestic firms, ZD_r, and services provided by foreign firms, ZM_r,

$$D_r = (ZD_r^{\gamma} + ZM_r^{\gamma})^{1/\gamma}$$

The elasticity of substitution between output produced by domestic firms and output produced by foreign firms is $\sigma_z=1/(1-\gamma)$.

All firms of the same type are assumed to be symmetric. That is, all domestic providers within a given sector in a given region have identical cost structures. This assumption applies similarly to foreign providers. The cost functions for domestic providers, *CD*, and for foreign providers, *CM*, is given by:

$$CD\left(\tau^d, r, w, p_a, zd\right) = vd\left(\tau^d, r, w, p_a\right) * zd + fd\left(\tau^d, r, w, p_a\right)$$

$$CM\left(\tau^m, r, w, p_a, p_v, zm\right) = vm\left(\tau^m, r, w, p_a, p_v\right) * zm + fm\left(\tau^m, r, w, p_a, p_v\right)$$

where

vd is a cost function representing the unit variable cost of domestic providers,
vm is a cost function representing the unit variable cost of foreign providers,
zd is the output per domestic firm,
zm is the output per foreign firm,
fd is a cost function representing the fixed cost of domestic providers,
fm is a cost function representing the fixed cost of foreign providers,
τ^d represents barriers to domestic providers,
τ^m represents barriers to foreign providers,
r is the costs of capital,
w is the costs of labour,
p_a is the costs of different intermediate inputs (including electricity), and
p_v is the costs of knowledge capital.

As can be seen from above, domestic and foreign services providers use the same types of inputs, with one exception: only foreign firms use the factor representing internationally mobile

knowledge capital. The nesting of different inputs follows the structure laid out in Figure 2 both in the variable cost function and the fixed cost function. Barriers to trade in the business-related services sectors are represented through their impacts on τ^d and τ^m. If the barriers affect productivity, we assume that productivity changes. If the barriers create rents, we assume that the barriers take the form of an exogenous mark-up over total costs.

The assumptions above together with the assumption of profit maximisation yield the standard optimisation condition for firms: marginal revenue equals marginal cost, or

$$p_{zd}\delta = vd\left(\tau^d, r, w, p_a\right)$$
$$p_{zm}\varepsilon = vm\left(\tau^m, r, w, p_a, p_v\right)$$

where p_{zd} and p_{zm} are the (symmetric) prices received by all providers within their group. Thus, the ratio of price to marginal costs is constant and equal to $(1\text{-}1/\sigma_d)$ for domestic providers and $(1\text{-}1/\sigma_m)$ for foreign providers, where σ_d and σ_m are the elasticities of substitution between individual service varieties. The differences between output prices and marginal costs provide revenue to cover the fixed costs. The assumption of free entry and exit yields the standard equilibrium condition of zero profits:

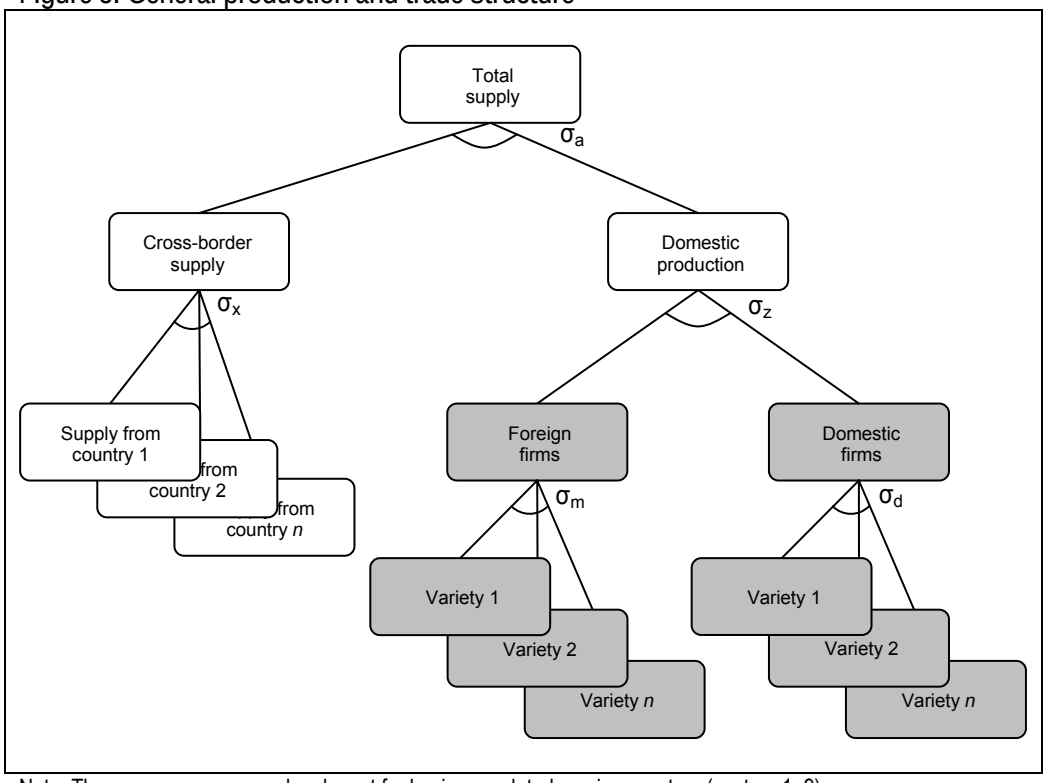
$$p_{zd} = vd\left(\tau^d, r, w, p_a\right) + fd\left(\tau^d, r, w, p_a\right)/zd$$
$$p_{zm} = vm\left(\tau^m, r, w, p_a, p_v\right) + fm\left(\tau^m, r, w, p_a, p_v\right)/zm$$

In other words, free entry and exit implies that prices equal average cost in equilibrium and hence the absence of true profits.

Aggregation of total supply

Figure 3 shows the general structure of the aggregation of domestic supply and trade. In all individual sectors, both in the business-related services sectors and in the perfectly competitive sectors, domestic supply consists of an aggregation of domestically produced output and services or goods produced abroad and provided via cross-border supply. The total demand for this aggregate supply arises both from final demand and from intermediate input demands by firms. As Figure 3 shows, the domestically produced goods and the goods provided via cross-border supply are aggregated into total supply through a CES function, with the constant elasticity of substitution σ_a. Thus, the model allows for imperfect substitution between domestically produced services or goods and services or goods produced abroad.

Figure 3: General production and trade structure



Note: The grey squares are only relevant for business-related services sectors (sectors 1–9).
Source: CETM – Copenhagen Economics

The sum of goods provided via cross-border supply, is in turn a CES aggregate of goods imported from different countries with the constant elasticity of substitution σ_x. This means that imported goods or services from different countries are not perfect substitutes for each other.

In the business-related services sectors (sectors 1–9), total domestic production consists of a CES aggregate of services provided by domestic firms and services provided by foreign firms, as indicated by the grey squares in Figure 3. The elasticity of substitution between output produced by domestic firms and output produced by foreign firms is σ_z. The total supply of services provided by domestic firms and services provided by foreign firms are in turn CES aggregates of the output per variety produced by the individual domestic and foreign firms respectively. The constant elasticities of substitution are represented by σ_d and σ_m. This CES aggregation captures the fact that each firm in the business-related services sectors produces its own variety, which is a close, but imperfect substitute for similar services.

Cross-border supply
Domestic firms by definition only produce services or goods within the borders but may provide the service or good abroad via cross-border supply. Foreign firms, on the other hand, are assumed to provide services locally only. That is, foreign firms establish commercial presence if they want to provide services in a given country.

The representative agent
A representative agent represents final demand. The agent's preferences are defined over both consumption of goods and services, *A,* as well as over leisure time¸ *T*. The consumer decides upon consumption of different goods and leisure depending on associated prices[41]. The consumption decision is characterised by a CES-utility function:

[41] However, 80 % of the private consumption of electricity is assumed to be exogenously determined.

$$U = (A^{\lambda} + T^{\lambda})^{1/\lambda}$$

where the elasticity of substitution, $\sigma_u=1/(1-\lambda)$, is calibrated to correspond to an uncompensated labour supply elasticity, ε, which is determined exogenously. Aggregate consumption, *A*, is a Cobb-Douglas aggregate of consumption of different goods and services.

The representative agent maximises his utility subject to his income-constraint, which consists of revenues from sales of his endowment of primary factors, the balance of payments, *B*, rents from barriers to services, *R*, expenses on a Cobb-Douglas aggregate of investment demand, *I*, and public demand, *G*:

$$INC = r\overline{K} + wL + e\overline{B} + R - p_i\overline{I} - p_g\overline{G}$$

A bar over a factor denotes an exogenous endowment of that factor, and a bar over a good or service denotes an exogenous demand for that good or service. *e* denotes the real exchange rate, p_i is the price of a unit of the investment good and p_g is the price of a unit of the public good.

The model is closed vis-à-vis the world market by assuming that the real exchange rate clears the market for foreign exchange. The market consists of proceeds from exports of EU production to the world markets and demand for imports to the EU from the world markets, including trade with the factor *V*. The balance of payments is exogenous in each country.

The empirical implementation of the CETM

The GTAP database, version 6, provides the majority of the data for the empirical implementation of the model (see Dimaranan and McDougall, 2005, for a detailed description of the database). The database provides internally consistent data on production, consumption and international trade by country and sector.

The database uses geography (countries) as its base for accounting and does not provide data on ownership. That is, no distinction is made between production under domestic and foreign control. The database has therefore been extended with data on ownership based on OECD (2001). The data shows multinationals' share of total turnover by sector of production and is based on data on inward investments in firms under majority foreign control. However, the OECD data does not include figures for Switzerland. Therefore, estimates from Seco, based on national employment figures collected from the Swiss National Bank and on information from the OECD study, have been used for Switzerland. The share data has been used to disaggregate both revenue and cost data uniformly. For example, if multinationals' share of total turnover is 15% in a given sector in a given country, then 15% of revenues and costs are allocated to multinationals in the database.

In some sectors, the aggregation of sectors in the GTAP database does not fit the purpose of this study. Therefore, additional sources have been used to adjust the data. Data on regulated (professional) business services is aggregated together with other business services in the GTAP database. Examples of regulated business services include legal, accounting, and auditing services. The database has therefore been extended with data on the share of value added from regulated business services based on Eurostat (2000). For Switzerland, the share of value added from regulated business services is assumed to be equal to the share in Germany. The share data has been used to disaggregate both revenue and cost data proportionally.

Furthermore, data on rail transport is aggregated together with other transport such as urban transport and land transport in the GTAP database. To separate out rail transport from other

transport, data from NERA (2003) on the size of the rail transport sector in the EU-15 countries and in Switzerland is used. The communication sector in GTAP includes both telecommunication and postal services. The communication sector has therefore been disaggregated, for the EU-15 countries by using data from OECD (2003) and for Switzerland, by using data from national sources. Again, both revenue and cost data are disaggregated proportionally.

The additional data sources are all almost complete. Unweighted averages of the data available have been used to complete the data sets. Reliable data on payments to knowledge capital (for example specialized technical expertise, advanced technology and management expertise) in multinationals is not readily available. The database therefore uses the assumption that 25% of the total value added accruing to capital is payments to knowledge capital.

The different elasticities discussed in the previous section are assigned values shown in Table 3 on the following page. Sensitivity analysis is used to examine the how the choice of elasticities affects the results.

Finally, the model is implemented in GAMS/MPSGE and solved with the PATH solver (see Rutherford, 1999, and Ferris and Munson, 2000).

Table 3: Elasticities

Elasticity	Parameter	Value
Uncompensated labour supply elasticity	ε	0.2
Business-related service sectors:		
Elasticity of substitution between individual service varieties	σ_d, σ_m	5
Elasticity of substitution between domestic and foreign services	σ_z	3
Elasticity of substitution between locally produced and imported services	σ_a	3[42]
Elasticity of substitution between imported services	σ_x	3
Elasticity of substitution between capital and labour	σ_{va}	1[43]
Elasticity of substitution between electricity and capital/labour	σ_{eva}	0.2
Elasticity of substitution between electricity/capital/labour and other intermediate inputs	σ_{top}	1
Sectors with perfect competition:		
Elasticity of substitution between locally produced and imported services or goods	σ_a	3
Elasticity of substitution between imported services or goods	σ_x	5
Elasticity of substitution between capital and labour	σ_{va}	1
Elasticity of substitution between electricity and capital/labour	σ_{eva}	0.2
Elasticity of substitution between electricity/capital/labour and other intermediate inputs	σ_{top}	1

Source: CETM – Copenhagen Economics

[42] Except in the regulated professions, business services and distributive trade sectors, where the elasticity between locally produced and imported services is set to 1.

[43] Except in the electricity sector, where the elasticity between capital and labour is 0.1, due to the long-lived type of capital used in this sector.

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Appendix C: Detailed results from the econometric analysis

Table C.1 below presents summary statistics o the regressions made for electricity and telecommunications.

Table C.1: Summary Statistics

	EL PROD		EL PRICE		TELE PROD		TELE PRICE	
Dependent Variable	PCAPUTI		PP1IND		PRODPTELE		PPTELE	
Control Variable 1	NET EXPORTS	0.0014191	COSTNUC	0.00450848	SATCL	0.0959354	TELINV	0.0294284
Control Variable 2	RAIN	-0.00252571	NET EXPORTS	-0.00675554			NEWACL	-0.776533
Constant	CNST	-0.564951	CNST	-2.73092	CNST	11.8329	CNST	5.95876
RIS	RIS	-0.230894	RIS	0.616541	RIS	-0.382941	RIS	0.206284
RIS P-Values*		[0.489], [0.482], [0.455]		[0.136], [0.134], [0.114]		[0.559], [0.542], [0.300]		[0.446], [0.446], [0.390]
R^2		0.169064		0.312334		0.1768		0.321065
Obs.		15		16		16		14
Normality		[0.305]		[0.747]		[0.777]		[0.005]
Heteroscedasticity		[0.780]		[0.999]		[0.862]		[0.942]
RESET		[0.371]		[0.944]		[0.694]		[0.853]
F_esclu*		[0.491], [0.596], [0.764]		[0.273], [0.284], [0.202]		[0.282], [0.280], [0.098]		[0.256], [0.255], [0.341]

All numbers in brackets are P-values.
*: We present three P-values: Asymptotic, pair bootstrap and wild bootstrap.

Table C.2: Variable description

Variable name	Explanation	More information	Unit	Source
PCAPUTI	Capacity utilization	Generation of electricity divided by capacity in MWH	Per cent	Eurostat
RAIN	Rainfall in Norway	Only positive for countries belonging to the same international pool (DEN, FIN and SWE)		
PP1IND	Electricity prices for industry incl taxes	For industry (Ie) with annual consumption: 2 000 MWh; maximum demand: 500 kW; annual load: 4 000 hours	PPS Purchasing Power Parities, All taxes included, KWH Kilowatthours	Eurostat, theme 8, Energy, Energy statistics
COSTNUC	Cost of nuclear capacity	Share of nuclear capacity out of total capacity	Per cent	Eurostat, theme 8, Energy, Energy statistics
NET EXPORTS	Total exports of electricity- Total imports of electricity	(Moutexp-Moutimp)/1000		Eurostat
PRODPTELE	Labour productivity	Labour productivity total telecom divided by price index	Million US Dollars per employee	OECD
SATCL	Standard analogue telecommunication access lines		Number of	OECD
PPTELE	Composite basket of telecommunication services		PPP	OECD
TELINV	Public telecommunication investments		Million US Dollars	OECD
NEWACL	New entrants market share of access lines		Per cent	OECD

Appendix D: Tax equivalents used in the CETM

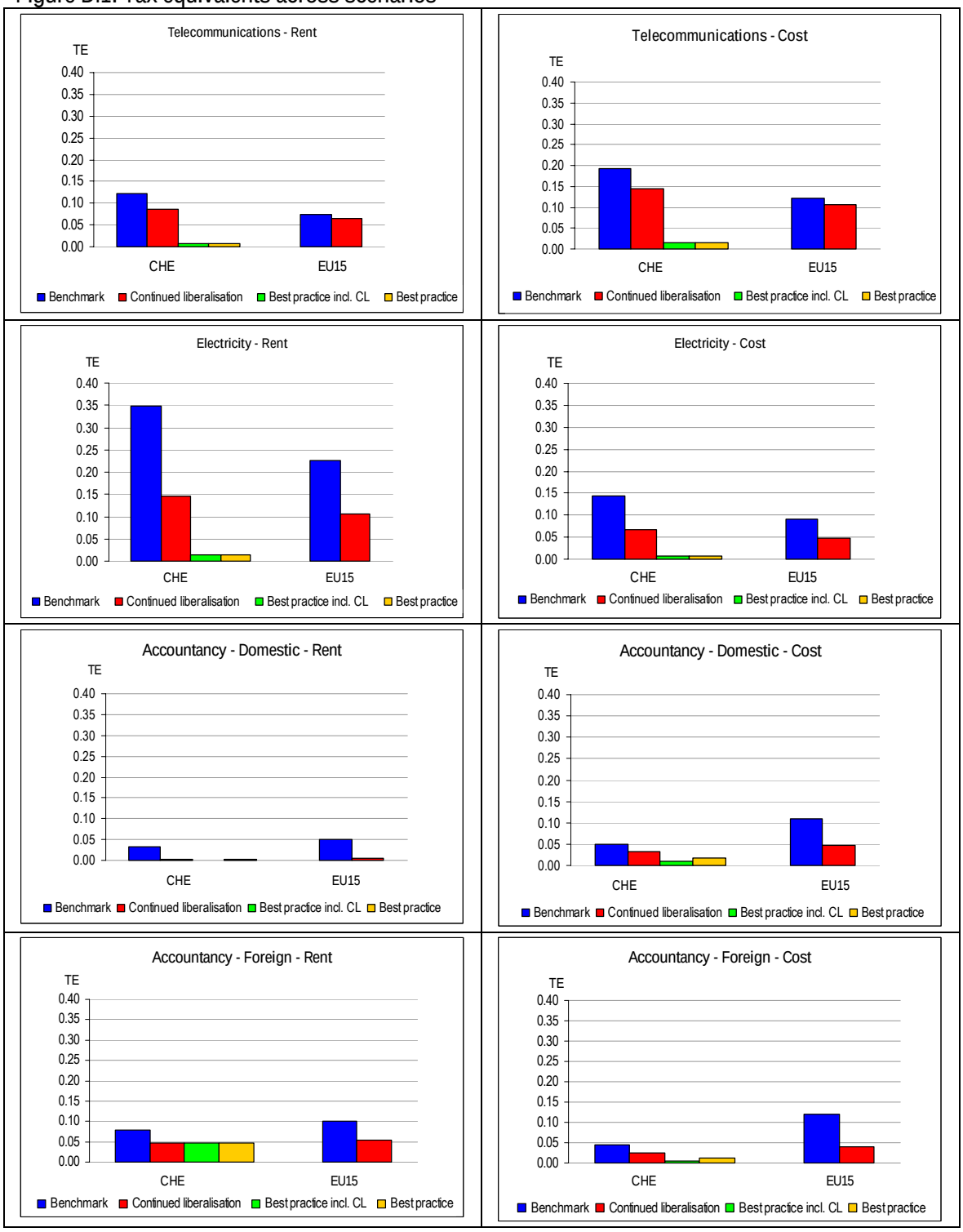
Table D.1 and Figure D.1 summarise the tax equivalents. The EU-figures are simple averages. Table D.2 shows the different values of tax equivalents in benchmark in Switzerland used in the systematic sensitivity analysis.

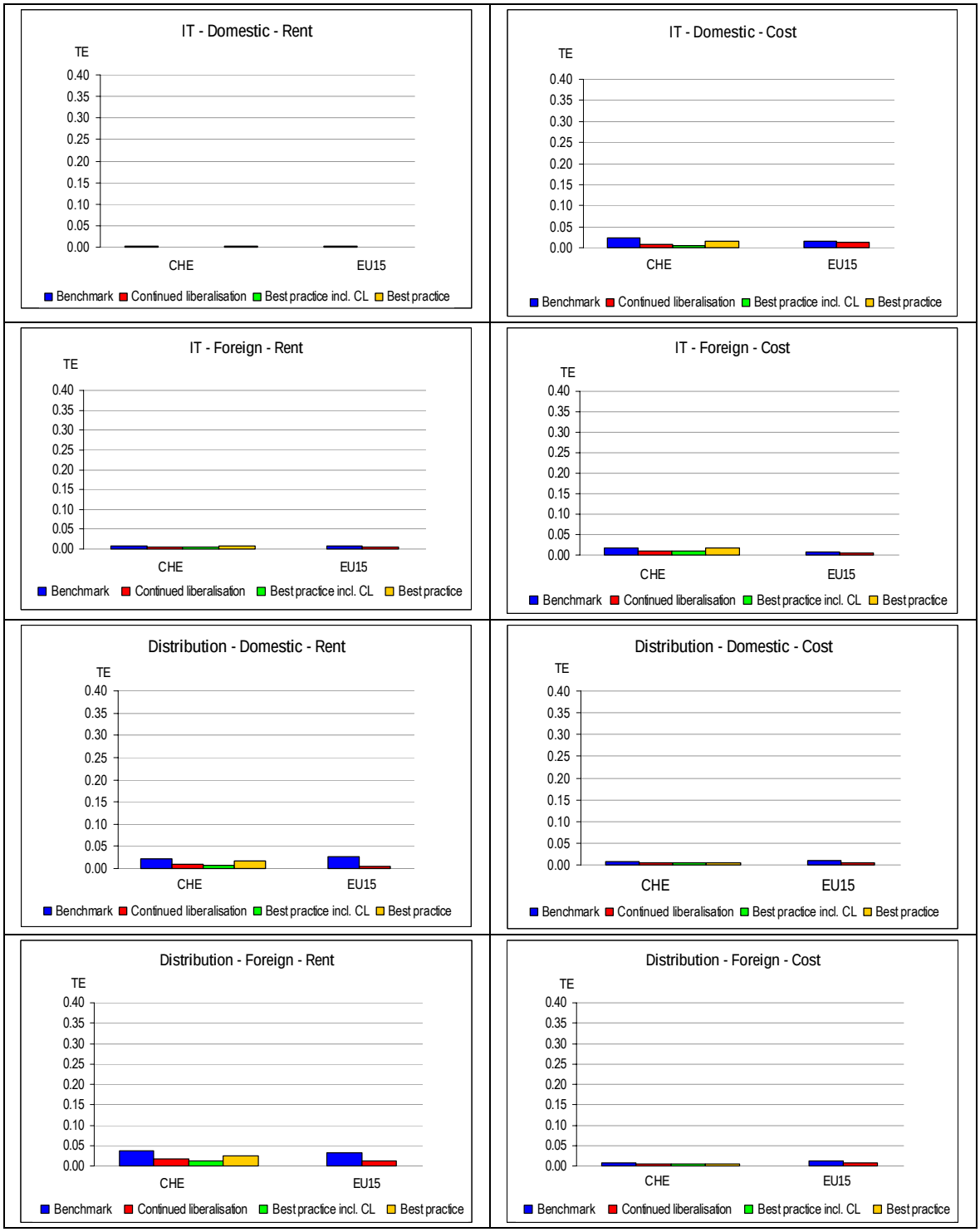
Table D.1: Tax equivalents across scenarios

Tariff equivalents	Telecom		Electricity		Accountancy				IT services				Distribution			
	Rent	Cost	Rent	Cost	Rent	Cost	Rent	Cost	Rent	Cost	Rent	Cost	Rent	Cost	Rent	Cost
					Domestic		*Foreign*		*Domestic*		*Foreign*		*Domestic*		*Foreign*	
CHE																
Benchmark	0.12	0.19	0.35	0.14	0.03	0.05	0.08	0.05	0.00	0.02	0.01	0.02	0.02	0.01	0.04	0.01
Continued liberalisation	0.09	0.14	0.14	0.07	0.00	0.03	0.05	0.02	0.00	0.01	0.00	0.01	0.01	0.01	0.02	0.01
Best practice incl. CL	0.01	0.01	0.01	0.01	0.00	0.01	0.05	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.00
Best practice	0.01	0.01	0.01	0.01	0.00	0.02	0.05	0.01	0.00	0.02	0.01	0.02	0.02	0.00	0.02	0.00
EU15																
Benchmark	0.07	0.12	0.23	0.09	0.05	0.11	0.10	0.12	0.00	0.01	0.01	0.01	0.03	0.01	0.03	0.01
Continued liberalisation	0.06	0.11	0.11	0.05	0.00	0.05	0.05	0.04	0.00	0.01	0.00	0.01	0.01	0.01	0.01	0.01

Tariff equivalents	Air transport		Rail transport		Postal services		Banking	
	Rent	Cost	Rent	Cost	Rent	Cost	Rent	Cost
CHE								
Benchmark	0.21			0.06	0.18	0.27	0.06	
Continued liberalisation	0.19			0.06	0.16	0.24	0.04	
Best practice incl. CL	0.18			0.03	0.03	0.06	0.02	
Best practice	0.18			0.03	0.03	0.06	0.05	
EU15								
Benchmark	0.22			0.07	0.14	0.21	0.05	
Continued liberalisation	0.21			0.05	0.12	0.19	0.04	

Figure D.1: Tax equivalents across scenarios




IT - Domestic - Rent
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CHE
EU15
Benchmark
Continued liberalisation
Best practice incl. CL
Best practice
IT - Domestic - Cost
TE
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0.35
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0.25
0.20
0.15
0.10
0.05
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CHE
EU15
Benchmark
Continued liberalisation
Best practice incl. CL
Best practice
IT - Foreign - Rent
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CHE
EU15
Benchmark
Continued liberalisation
Best practice incl. CL
Best practice
IT - Foreign - Cost
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Benchmark
Continued liberalisation
Best practice incl. CL
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Distribution - Domestic - Rent
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EU15
Benchmark
Continued liberalisation
Best practice incl. CL
Best practice

Table D.2: Distributions and bounds used in the systematic sensitivity analysis of policy shocks

		Analysed range			
	Type	Lower bound[44]	Central estimate	Upper bound	Distribution
Regulated professions					
Domestic	Price	2.7	3.2	3.7	Normal
	Productivity	4.1	5.0	5.8	Normal
Foreign	Price	6.1	7.9	9.8	Normal
	Productivity	3.7	4.5	5.4	Normal
Business services					
Domestic	Price	0	0.2	1.4	Normal
	Productivity	1.0	2.3	3.6	Normal
Foreign	Price	0	0.8	1.8	Normal
	Productivity	0.3	1.8	3.3	Normal
Distributive trade					
Domestic	Price	3.0	3.3	3.6	Normal
	Productivity	0.6	0.7	0.8	Normal
Foreign	Price	3.4	3.8	4.3	Normal
	Productivity	0.8	0.9	1.0	Normal
Electricity					
	Price	17.5	34.9	51.1	Uniform
	Productivity	7.3	14.3	27.6	Uniform
Telecommunication					
	Price	1.3	12.1	18.9	Uniform
	Productivity	7.5	19.1	31.8	Uniform

Note: The table shows the different values of tax equivalents in benchmark in Switzerland used in the systematic sensitivity analysis. In the electricity and telecommunication sectors, there are no specific foreign and domestic barriers.
Source: CETM – Copenhagen Economics.

[44] For the normal distributions, the upper and lower bounds represent the 95 % confidence intervals.

Appendix E: EU directives used in scenario design

The following legislative sources were used in the scenario design in order to define standards for "continued liberalisation" and "minimum EU-compatibility":

- Directive 2002/21/EC of the European Parliament and of the Council
- Regulation (EC) No 2887/2000 of the European Parliament and of the Council
- Communication from the Commission COM(2004)140 final
- Directive 91/440/EC on the development of the Community's railways
- Directive 97/67/EC of the European Parliament and of the Council and supplements (2000/C 337 E/36)
- Directive 2003/54/EC of the European Parliament and of the Council
- Services of general interest in Europe [Official Journal C 281 of 26.09.1996]
- Communication from the Commission COM(2004)140 final
- Working Paper, Proposal for a Directive amending Directive 91/440/EEC
- Council Directive 91/440/EEC
- Commission White Paper 2001: "European Transport Policy for 2010"
- COM(2002)632; Ctcon (2001)
- EU com 1st/2nd/3rd benchmarking reports
- Council Regulation (EEC) No. 2407/92, Council Regulation (EEC) No. 2408/92
- Council Directive 96/97/EC