

**Trade in Services:
Protection Levels and Performance
Creating a New Taxonomy of Industries
on the Basis of Barriers to Trade in
Services**

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Marianne Schöberl**

Research assistance: Irene Langer, Eva Sokoll,
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Abstract

The services sector not only is the largest and most important sector in developed economies, but in producing intermediate inputs for many sectors it influences the productivity, competitiveness and performance of large parts of the economy. Trade liberalisation and deregulation in the service sector is seen as one of the most important driving forces for the efficiency and productivity performance of the sector as well as the economy as a whole.

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TRADE IN SERVICES: PROTECTION LEVELS AND PERFORMANCE

Creating a New Taxonomy of Industries on the Basis of Barriers to Trade in Services

1. Introduction, Motivation

The service sector in the developed economies comprises about 70% of total employment and is thus the largest and most important sector of an economy. In addition, many services – financial, telecommunications and transport – are among the key sectors of any economy because they are used as inputs in almost all sectors and thus can significantly influence productivity and growth in many other sectors of the economy as well.

Despite its great importance, the service sector has remained fundamentally underresearched and characterised by a lack of comprehensive and adequate data and a long-time neglect in theory-building.

The concept of international trade in services is relatively new as well. Unlike the bulk of agricultural and industrial production, services have long been considered not to be tradable across borders or, more generally, over distance. The only significant exceptions have been services directly related to the exchange of goods, such as transport, and to tourism. The generally low level of trade in services has been attributed to institutional, administrative and/or technical constraints, such as the existence of public monopolies, strict access regulations and controls and the need for direct physical contact between suppliers and consumers. However, in an increasing number of sectors such constraints have diminished or even disappeared. Global economic integration, technological developments and liberalisation have led to a continual expansion of the volume and range of traded services. The development of new communication technologies, including the Internet, has helped to reduce distance-related barriers to trade. Structural reforms and

deregulations as well as a general reconsideration of governments in their role in the provision of services in some service sectors (telecommunications), have presented new opportunities for private participation, both domestic and foreign.

Mirroring these trends, services are becoming increasingly prominent in trade agreements. Most importantly, the General Agreement on Trade in Services/GATS entered into force in 1995 and has since been providing the multilateral framework for the liberalisation of international trade in services. Yet, this first round did little towards liberalisation and opening the market by way of reducing the regulatory superstructure, but at least WTO members have committed themselves to the progressive liberalisation of services and thus produced a consensus to take further action in the next rounds. In conformity with this "built-in" agenda in the Agreement, the GATS-2000 round initiated new steps. A new round of services negotiations was launched in the context of the round of multilateral negotiations agreed at Doha, Qatar, in November 2001.

From the perspective of governments, knowledge of what are the major barriers to services trade, as well as their level and impact on trade in services and economic growth is vital. It is this quantitative information that enables governments to evaluate the relative positions, to evaluate negotiating progress and to set objectives. Such understanding feeds into the development of negotiation priorities and facilitates ongoing negotiations in an area where there is only little empirical work. Amongst all the possible factors influencing the results of empirical studies into the gains from services trade liberalisation, the estimation of actual services restrictions represents one of the most critical areas (*Dihel, 2003A*). The major difficulties arise from the heterogeneity of the service industries and from the specific conceptual challenges determined by the special characteristics of services. Thus, due to the generally intangible and often non-storable nature of supply many services require the direct physical interaction between producers and consumers. Therefore, trade in services includes not only cross-border delivery as in goods trade, but also the movement of consumers to a supplier's country of residence (consumption abroad), the establishment of subsidiaries at the customer's location (commercial presence) and the temporary movement of people to the consumer's residence for the purpose of providing a service (presence of natural persons). This requires the identification and

quantification of restrictions affecting the four different modes of supply, as well as complementarities between modes of supply.

Furthermore, given that trade in services does not usually involve cross-border trade but rather transactions occurring within one country or the other, impediments to services trade normally take the form of non-tariff trade barriers rather than border measures such as tariffs. Government regulations, licensing or certification requirements or other measures that effectively limit the access of foreign services suppliers to the domestic market are examples of barriers to services trade. As a result, account needs to be taken of a much larger diversity of barriers including non-discriminatory market access restrictions (measures that apply to both foreign and domestic service providers), such as the amount of firms allowed to enter the market. Additionally, it is necessary to determine whether regulations actually constitute barriers, as one cannot simply equate regulations with barriers (*Dihel, 2003A*)

In identifying and measuring barriers to trade in services therefore, qualitative information about policy measures must be converted into comparable quantitative information. This process is a complex issue and may involve various dimensions. With this complexity and multidimensionality it has proven to be difficult to establish a comprehensive picture of barriers across countries and/or sectors and modes of supply.

Pioneering work in the measurement of barriers to services trade was undertaken by *Hoekman (1995)*. He bases his calculations on GATS Individual Country Schedules, which comprise all legally binding commitments made by WTO members concerning trade-related measures in individual service sectors and modes of delivery. More recent studies draw on more comprehensive qualitative databases of measures affecting trade in services and use weighting methods for assessing the restrictiveness of different measures taking into account the type of barriers and their likely relative economic impact. However, these are constrained to either one mode of supply (*Hardin – Holmes, 1997*) or to one industry (*Findlay – Warren, 2000*;

Dihel – Kalinova, 2004) or a subset of countries (*OECD, 2003A*) which constrains comparability across sectors and consequently, the scope of application¹⁾).

Against this background we will present a new way of analysing regulations across the various dimensions. Specifically, elaborating on the methodology in *Hoekman (1995)* and based on the GATS specific schedules we will apply statistical cluster analysis to build categories of industries according to the relative restrictiveness of policy regimes across countries pertaining to the specific services industries as reflected by the willingness of countries to submit full or partial commitments under the GATS. The cluster analysis is based on the methodology presented in *Peneder (2001, 2003, 2005)*.

The motivation to create new industry classifications originates in the observation of the diverse and contingent nature of competitive behaviour, where a firm's performance depends on the capability to match its organisation and strategy to the technological, social and economic restrictions imposed by the business environment. For this reason, analytically based industry classifications are frequently applied in empirical studies on competitive performance, technological development, international trade, and industrial economics.

Two general approaches to the quantitative identification of individual observations into classes can be distinguished. The "cut-off" procedure by which a certain discriminatory edge is defined exogenously by the researcher is the more frequently applied method. The sole advantage of this approach lies in its simplicity. The choice not to use more powerful statistical tools, implies that the underlying structure within the data is more or less presumed, rather than explored. Although this approach can be defended as long as the classifications are built upon one or two variables only, it is generally inept for the categorisation of a data profile of larger dimensions. Statistical cluster analysis is the obvious alternative. It is specifically designed for classifying observations on behalf of their relative similarities with respect to a

¹⁾ See *Dihel (2003A, 2003B)* and *Chen – Schembri (2002)* for a comprehensive survey on the various methods used to measure barriers to services trade.

multidimensional array of variables. It is a powerful tool for the creation of sectoral taxonomies and therefore applied in this paper.

For the first time, we also convert the sectoral information from the GATS specific schedules, based on the GNS/W/120 Services Sectoral Classification list, to the NACE 3 digit as well as the NACE 2-digit industry classification and to the ISIC Categories for Foreign Affiliates (ICFA) respectively, facilitating the link to other data sources on services (for example, value added, employment, and also foreign trade data derived from I-O tables or other sources). This involved elaboration of detailed correspondence tables between the WTO GNS/W/120 list of sectors, version 1.0 of the Central Product Classification, and the NACE/ISIC classification of industries. The lack of concordance in statistical classifications has been a major problem facing the empirical analysis of services.

The paper starts with a summary of the main elements and disciplines of the GATS in Section 2. Section 3 summarises prior empirical work on GATS and evaluates the achievement of GATS from an overall perspective. Section 4 describes the main steps and difficulties encountered in constructing an analytical database on restrictions on the basis of the GATS specific schedules and further delineates the methodology employed to derive quantitative indicators on policy regimes across countries, sectors and modes of supply. Section 5 describes the methodology and main analytical steps of cluster analysis in general terms, summarizes the main results from applying statistical cluster analysis to trade-related restrictions in services and applies the new industry taxonomy to Austrian service sector sales data. Section 6 concludes.

2. Structure and Disciplines of GATS

The GATT Uruguay Round (1986–1994) was the first to include the services sector in its multilateral negotiations on liberalisation of the trade regime. One of the outcomes of these negotiations was the GATS (General Agreement on Trade in Services), which has since provided the general multilateral framework for liberalising trade in services.

The GATS has three core components:

- the regulatory framework containing the general regulations governing trade (and investment) in services and the core principles of GATS;
- the protocols and annexes that augment rules found in the framework and contain detailed regulations on specific service sectors (financial services, telecommunication, sea transport) and modes (Mode 4), and allow for MFN exceptions and
- the schedules of commitments and list of MFN exemptions stating sector specific limitations and rules.

2.1 The Regulatory Framework

The regulatory framework of the GATS agreement addresses general obligations and disciplines. The core principles among these obligations are the most favoured nation clause (MFN; Article II), regulatory transparency (Article III) and "reasonable, objective, and impartial" domestic regulation (Article VI).

The most favoured nation clause stipulates that any WTO member state must not give more favourable treatment to some WTO countries than it does to others. At the time of WTO accession, each country is given an opportunity to identify a list of MFN exemptions which, as a rule, may not apply for more than ten years and must be reviewed within 5 years.

The general principle of transparency requires all WTO member states to promptly promulgate any changes or additions to regulations, to notify them to the WTO

Council for Trade in Services in Geneva at least once a year and to set up general information points to provide specific information concerning any regulations, laws or administrative procedures and practices. The obligation of transparency has been born out the specificity of the services sector with its extremely dense network of regulations covering a multitude of businesses, which may constitute a major trade barrier to third-party providers from abroad even if they are granted market access. In order to succeed in its host country, the foreign provider must be able, to obtain information on the applicable laws and rules.

According to the Article governing domestic regulations, the application of national measures must, as a rule, be reasonable, objective and non-partisan, and, particularly, qualification requirements and methods, technical standards and acceptance criteria must not constitute any unnecessary barriers to the trade in services (*European Communities, 1998, p. 32*).

Other elements of the framework address issues such as the recognition of authorization, licensing and certification standards and procedures, safeguards on monopoly or oligopoly supply of services as well as subsidies, dispute settlement and enforcement.

2.2 Annexes and Protocols

The GATS contains eight annexes. The most important of these contain detailed regulations on specific service sectors (financial services, basic telecommunication, maritime transport) and modes (Mode 4), and allow for MFN exceptions. Negotiations on financial services, basic telecommunication and maritime transport were not concluded during the Uruguay Round, but provisions were then made in the annexes for them to continue. Although MFN is a general obligation, an annex was attached to the GATS ("Annex on Article II Exemptions") which allows countries to add a list of MFN exemptions to their schedules of commitments. The need for an annex on MFN exceptions largely reflected concerns regarding "free-ridership", particularly in the financial and basic telecommunications industry (*Hoekman, 1995*). Free-ridership in this context concerns countries enjoying beneficial conditions of trade, without granting any beneficial access regulations to others on their own market. MFN exemptions were submitted by about two thirds of all GATS members,

most of them concerning the audio-visual sector, the financial services sector and the transportation sector.

2.3 National Schedules of Commitments

Industry-specific Commitments

GATS revolves around sector-specific commitments which are listed by the member states for each of the altogether 155 service sectors and which are distinguished by four possible channels of delivery or "modes of supply" and two areas of application (market access and national treatment). The box on the "Definition of trade in services within GATS" describes each of the modes in more detail. The GATS explicitly lists six types of market access restrictions that are in principle prohibited. These are limitations on (1) the number of service suppliers allowed, (2) the value of transactions or assets, (3) the total quantity of service output, (4) the number of persons that may be employed, (5) the type of legal entity through which a service supplier is permitted to supply a service, and (6) participation of foreign capital. National treatment refers to the principle of non-discrimination and is defined as treatment of foreign supply no less favourable than that accorded to like domestic services or service providers. As *Hoekman (1995)* stated, market access obligations overlap with the national treatment requirements, as market access restrictions may be discriminatory as well as non-discriminatory.

Each member is free to determine the service sectors in which it is ready to take steps towards liberalisation ("positive listing approach") and to name those measures which it intends to retain within the sectors to be liberalised. This "positive listing" approach is a key feature of GATS, which offers flexibility not just by the fact that WTO member states can choose whether or not to enter into a commitment in any one sector; they can also define quantitative restrictions and discriminatory sector regulations within the frame of national treatment and market access.

Definition of Trade in Services within GATS

The negotiations to establish a multinational agreement on trade in services have furnished a very wide definition of services which breaks down such trade into four modes:

- Cross-border deliveries (Mode 1): referring to services which do not require the simultaneous physical presence of provider and consumer and which are mailed, electronically transmitted, or otherwise transported across national borders.
- Consumption abroad (Mode 2): which adverts to services demanded and consumed abroad. This implies a temporary migration or travel of the consumer – a tourist or a student - across national borders to the provider.
- Commercial presence (Mode 3): which refers to services which require the presence of the provider on site. This mode is characterised by the establishment of a foreign based subsidiary or branch office, joint venture or partnership.
- Presence of natural persons (Mode 4): wherein the service provider (or the employ of the service provider) crosses the border solely for the purpose of rendering the service and afterwards returns to his/her country of origin. In actual practice, Modes 3 and 4 are often linked because Mode 3 does not include the movement of natural persons.

For each sector, mode of supply and area of application basically three types of entries are possible. With an entry of "none", a country commits itself to guarantee free market access and/or full national treatment on any type of trade-related activity. It creates the most liberal trading environment and represents a "full commitment". On the other hand, countries giving "partial commitments" communicate and list all restrictions violating against market access and/or national treatment that are kept in place. These restrictions, however, are "bound", in the sense, that subsequent aggravation of restrictions and discriminations against market access or national treatment are banned. Finally, an entry of "unbound" indicates the absence of a commitment. The fourth option, as indicated above, is to not list a sector at all. For service sectors not listed in the national schedules any trade-related restrictions remain unbound – new and additional restrictions may be imposed in the future for this industry. In some cases, countries made the entry "unbound due to

technical infeasibility" or "unbound*" to identify modes of supply that are "technically infeasible" (e.g. cross-border supply of hair-dressing).

Horizontal (cross-industry) Commitments

Besides industry-specific commitments, national schedules of commitments contain cross-industry commitments, referred to as "horizontal" commitments in the GATS. These usually address policies pertaining to a specific mode of supply, independent of the specific sector involved. Most of the horizontal commitments refer to measures related to investment, taxation, government subsidies, real estate, and the temporary entry and stay of natural persons and thus are most common for Mode 3 (commercial presence) and Mode 4 (presence of natural persons). The co-existence of industry-specific commitments and horizontal commitments introduces another complexity into the GATS national schedules and as will be shown later creates the potential for confusion and misinterpretations. To get a full picture of the commitments undertaken, industry-specific limitations have to be read and interpreted together with horizontal commitments.

2.4 Co-ordination Process within GATS Negotiations for Austria and other EU Countries

Within the EU, GATS negotiations are co-ordinated at three levels: national, EU-wide and at WTO level (*Kronberger – Wolfmayr, 2005*).

National Co-ordination in Austria

The position taken by the Republic of Austria on the GATS and WTO negotiations is co-ordinated by the Federal Ministry for Economics and Labour. For the purpose of formulating opinions and positions, preliminary discussions are held at regular intervals between ministries, comprising representatives from the relevant ministries, selected interest groups and representatives of the regional and local authorities, generally prior to the "Article 133 Services Committee meetings" in Brussels. At this committee, the federal position is advanced by a representative of the Federal Ministry of Economics and Labour.

EU-wide Co-ordination

The European Commission generally tables proposals for offers or demands regarding liberalisation which are either accepted or rejected by the Member States. As a rule, trade policy is an EU matter, so that, in formal terms, unanimous decisions are required only in a few subsectors (audiovisual, health care and educational services). Otherwise, decisions on trade agreements are subject to a qualified majority.

WTO Negotiations

For the WTO negotiations in Geneva, the European Commission has a mandate to negotiate with other WTO members the position adopted by the Council²⁾. The GATS negotiations are only one part of the Doha Round; it is thus possible, at least in theory, to grant an additional opening in the agricultural sector in exchange for a liberalisation in the services sectors ("single undertaking"). This makes it even more difficult to predict the progress in liberalising the services markets by the end of the Doha Round.

²⁾ This is the outcome of the WTO expert opinion produced by the European Court of Justice on November 15, 1994, after conclusion of the Uruguay Round (Breuss, 2003, p. 325). This negotiating power granted to the Commission does not apply to trade in cultural and audiovisual services, educational services, social and health care services. In these areas, the negotiation and conclusion of trade agreements is within the mixed competence of the Community and its Member States (EC Treaty, Title IX, "Common Trade Policy").

3. Achievements of the GATS and New Offers during the Doha Round

At its structural level, the GATS displays a number of distinguishing elements and instruments that clearly reflect the specific features of services and characteristics of international services transactions on the one hand, and the multiple conflicts of interest clashing before and during the actual negotiations. One of these features is the broad definition of what constitutes trade in services, including four modes of delivery (across the border, consumption abroad, commercial presence, and temporary movement of labour). Another is the list of sector-specific commitments, allowing for great flexibility not only in determining what kind of restrictions should be kept in place but also in choosing what kind of sectors should be included in the list. It allows for liberalisation "à la carte" (Hoekman – Sauv , 1994), which clearly contrasts the straightforward (quantitative) liberalisation formulae governing the efforts to ensure free trade in products (GATT).

As the kind of regulations governing the service sector are manifold, and intended or unintended act as trade-diverting, these very structural elements of the GATS have led to a high degree of complexity in the commitments, making it difficult to derive a quantitative index signalling the overall restrictiveness implied by the schedules of commitments. Regulatory trade barriers in the services sector are much more non-transparent and difficult to grasp and quantify than were the original customs barriers in the goods sector under GATT.

International trade in services accordingly is faced with problems that are similar to those confronting the trade in goods from non-tariff trade barriers but additional complexities are introduced by an extremely large spectrum of barriers as account needs to be taken of non-discriminatory market access restrictions and the possible complementarities between modes of supply. Additionally, since the focus is on regulatory measures, including non-discriminatory access restrictions, liberalisation must not simply be equated with reducing restrictions. Often regulations on services are designed to meet market failures (e.g. asymmetric information problems) and a range of policy objectives (social objectives; consumer protection, as many services are experience or credence goods; safety considerations, important in the field of transportation; quality considerations, especially concerning many professional

services; or, stability considerations concerning many financial service; etc.). This raises questions concerning the most efficient regulatory instrument and the optimal level of regulation (McGuire, 2003).

All these aspects made it difficult to reach progress in the services negotiations, a fact that is confirmed in the empirical analysis of the GATS sector-specific commitments (Hoekman, 1995; Langhammer, 2003; Kronberger – Wolfmayr, 2005; Adlung – Roy, 2005). The general perception there is, that the 1995 agreement has produced little progress towards liberalisation but achieved an increase in transparency about which kind of trade impeding regulations are in place and a degree of success in binding current policies ("binding of the status quo"). In other words, most countries submitted standstill commitments; i.e. a listing of current policies coupled with the promise not to impose additional or new trade restrictions in the future. While this cannot do much for liberalisation, it can establish benchmarks that identify trade impediments and in addition enhance transparency of existing regulations.

The empirical studies in place further reveal that there is a clear tendency to discriminate against services delivery by the temporary movement of labour (mode 4), reflecting the political sensitivities associated with migration. This applies to all groups of countries and particularly to the High-income Countries (HICs), reflecting their fears that their migration laws might be circumvented. Most countries grant concessions by a few sharply defined exceptions: strictly limited groups of persons (such as senior executives, specialists not available at home), migration of workers within a corporation, for natural persons staying less than three months, and for the transfer of workers within a corporation from two to five years. Many of the "Mode 4-commitments" are tied to the existence of corporate branch offices in the country (trade in services by way of commercial presence) and refer to highly qualified staff only (OECD, 2002; Adlung – Roy, 2005). Most full-scale commitments (implying free trade) concern the trade in services through consumption abroad. The level of liberalisation is generally more advanced with regard to the commercial presence abroad (Mode 3) than in cross-border delivery (Mode 1).

Comparing commitments across groups of countries broken down by per-capita income reveals, that HICs are, on average, more liberal vis-à-vis the commercial

presence mode and – as mentioned above – most restrictive regarding the presence of natural persons. The lowest-income countries (LDCs) tend to enter more frequently into unrestricted commitments regarding cross-border delivery.

The greatest differences between HICs and LDCs, however, are found in the number of sectors included in the respective lists of commitments. Considering that the choice of sectors is left to the discretion of each WTO member state, an analysis of the number of sectors actually listed provides information on the sectoral application of the commitments made. This application generally has rather narrow confines, and particularly so in the LDCs: on average, they have accepted only about 24 sectors (about 15 percent) in their lists of commitments, compared to 106 or about two thirds of all sectors on average for the HICs (*Adlung – Roy, 2005*).

Overall, the sectors with most listings across countries include tourism, financial services, a wide array of business services including computer, and information services and telecommunications. Most countries have been reluctant to bind services related to health, education, media, and other cultural services, distribution as well as construction (*Kronberger – Wolfmayr, 2005*).

Services Liberalisation During the Doha Round

Viewed from an overall perspective, GATS thus produced little progress towards liberalisation, even though – in economic terms – the readiness to disclose restrictions and the commitment not to further deteriorate the status quo raises the expectation of positive effects by an increase of transparency and predictability. GATS shows obvious defects in the narrow sectoral application and in the quality of liberalisation offers which are usually subject to major restrictions and in some cases even fail to come up to the legal or regulation-defined status quo. In line with the built-in agenda of GATS, the GATS 2000 round initiated new steps and specified some further opening of the trade in services as its objective for the current round ("Doha Round").

An insight into possible results of this round is provided by an analysis of the initial (preliminary) offers made within the course of the "request offer proceedings"

(Adlung –Roy, 2005). By mid-March 2005, 51 WTO members had presented their initial offers. From early June, the first revised lists were received by the WTO³):

- Most lists of commitments remain narrow in their sectoral application; they mostly concern changes in initial concessions.
- The preliminary offers show hardly any changes in their sectoral structure vis-à-vis previous commitments. The new commitments concentrate on sectors that already comprise most of the previous commitments: business services, financial services, telecoms and tourism. An increase in offers is found only in the transport sector. The other sectors, particularly health care, education, culture and recreation, continue to have few offers also in this current round.
- The type of new offers is hardly likely to produce any strong liberalisation effect: the proportion of unrestricted commitments (with the exception of Mode 2) continues to be low. The share of "non-committed" is particularly high in the cross-border deliveries (43.5 percent).

Seen against the offers on the table, the current GATS round is not likely to accelerate market opening. It still does not focus on liberalisation but rather on perpetuating existing access options. But the negotiations are not yet completed. It was only in January 2005 that the European Commission deposited its revised demands, and on 2 June that it submitted a revised offer (see also the box on "*Demands and offers by the EU to WTO third-party countries*").

The new round will keep the key instruments and structures of GATS, which are defensive in their nature. The positive list of commitments in particular (no obligation to liberalise in sectors not included in the list) allows the WTO member states to maintain their control over their liberalisation offers down to the last detail and prevents any formulae-bound liberalisation steps as modelled by the GATT. Furthermore, GATS does not prescribe any specific volume of liberalisation.

³) The lists analysed in this paper refer to offers as by mid-March 2005, when 51 WTO members had presented their initial offers. From early June, the first revised lists were received by the WTO.

In the last analysis, it is difficult to distinguish between regulations that pursue chiefly protectionist goals and those that are designed to repair a market failure or to pursue general economic policy goals. In these two cases, it would be necessary to have different negotiation strategies (Kox – Lejour, 2004). It is widely agreed that only a change of these structures would substantially increase liberalisation of trade (Hoekman, 1995, Langhammer, 2003, Kox – Lejour, 2004, Mattoo – Wunsch, 2004, Adlung – Roy, 2005).

Demands and Offers by the EU to WTO Third-party Countries

On January 25, 2005 the EU deposited its revised demands for liberalisation to 103 WTO third-party countries. On its web site, it provides a summarised document to meet the desire for transparency, voiced especially by the NGOs. The demands made to the LDCs regarding environmental services (water supply, etc.) were in part retracted and given a more precise context. Thus, the option was offered to retract from services rendered by public private partnerships (PPPs) and return to exclusive public control and performance. The EU aims at concessions for consulting services in the environmental field and for participation in public tenders (e.g. for licences).

The 103 WTO member states are divided into three groups: developed industrialised states (e.g. USA; Group 1); emerging markets (e.g. Morocco; Group 2) and less developed countries (e.g. Angola; Group 3). The EU directs its most comprehensive requests at Group 1 countries – some of them even exceed the level of the EU's offer. Its wish for access to privately financed educational institutions (higher education service), the health care sector and the market in audiovisual services is restricted to the US. To the Group 3 countries, the EU grants the option of choosing two of the five to six sectors proposed. In the telecoms, mail and courier services sectors, energy utilities and computer services, reference proposals were for the first time included. The EU also makes demands in the business services, construction services, financial services, distribution, transport, tourism and news agencies sectors.

On April 29, 2003 the European Commission deposited the EU's GATS offer at the Geneva office of the WTO. In it, the EU member states offer further liberalisation in the legal services, mail and courier services, sea transport, airport services (ground handling, airport management). Regarding Mode 4 (presence of natural persons), several additional sectors are proposed for opening in the categories of "contractual service suppliers/employees of legal entities" and "contractual service suppliers/self-employed"; the modalities of quota management and the quota level within the EU co-ordination process still need to be clarified. On June 2, 2005 the European Commission deposited a revised EU offer which, from Austria's point of view, made for only minor changes vis-à-vis the initial offer. A key feature of both the demand of January 2005 and the offer of June 2005 is that they were for the first time made within the frame of the EU-25.

4. Creating an Analytical Database on GATS Commitments

4.1 Data Source and Methodology

As to information on barriers to trade in services, the general lack of a comprehensive, centralised source of information is a major problem. The GATS Individual Country Schedules to date offer the most comprehensive information on barriers to trade in services. However, GATS schedules do not catch all barriers which are in place. Market access restrictions mainly concentrate on the 6 types of restrictions listed under the Agreement⁴⁾, other possibly relevant regulations pertaining to tax regimes, or labour legislation, land availability, competition policy are examples of measures or policies that are insufficiently reflected in the schedules. Therefore, some studies (summarised in *Dihel*, 2003A, 2003B and *Findlay – Warren*, 2000) supplemented the information from GATS schedules with other sources of information. However, these are constrained to either one mode of supply (*Hardin – Holmes*, 1997) or to one industry (*Findlay – Warren*, 2000; *Dihel – Kalinova*, 2004) or to only a subset of countries (*OECD*, 2003A) which constrains comparability across sectors and consequently, the scope of application⁵⁾. The major advantage of using GATS schedules – especially if analysis is to be made across sectors and across countries – is, the use of the same information source for all sectors and countries and the somewhat greater objectiveness concerning the selection of the types of barriers to be included in the list of possible barriers.

As our main data source we used the online WTO services database (pre-defined reports page⁶⁾) which allows one to download all specific commitments and horizontal commitments for each country and mode of supply. The database contains national schedules of 133 countries. There are 155 sectors distinguished in

4) See the chapter on the "Structure and disciplines of GATS".

5) See *Dihel* (2003A, 2003B) and *Chen – Schembri* (2002) for a comprehensive survey on the various methods used to measure barriers to services trade.

6) The link is: <http://tsdb.wto.org/wto/Public.nsf/FSetPredefinedReport3?OpenFrameSet>, including all national schedules as of March 20, 2005.

the GNS classification list (GNS/W/120) that may be listed for each of the four modes of supply.

As already noted, for any sector included in its Schedule, a country may specify a commitment within a spectrum whose opposing ends are guaranteed market access/national treatment without limitations (full commitments with the entry "none") and the denial of any such guarantees (no bindings; "unbound"). Thus, as a first step, and for the purpose of making the individual schedules comparable across countries/industries/modes, we classify the sectoral commitments into five different categories. The related empirical work has proceeded in much the same way, but by building only three groups (none, bound, unbound), provided for lesser detail (Hoekman, 1995; WTO, 1999; Langhammer, 2003; Adlung – Roy, 2005). The five categories built in our work are:

(1) "None", implying free market access and/or full national treatment;

(2) "None+", referring to entries in which countries generally guarantee free market access and full national treatment, but some exceptions to the general rule are listed. These exceptions mostly refer to one of the subsectors within the general sector of the GNS list, or to restrictions that have some expiring date. In yet other instances, explicit reference is made to the horizontal section (cross-industry section) of the country's schedule. Examples of entries are: "None, except as indicated in the horizontal section (in the cross-industry commitments)", or "None, except for cabotage", or "None, except companies must reinsure 20% of their risk until 1. January 2008" would fall into this category.

(3) "Bound", summarizes all partial commitments or bound limitations and thus includes all instances where specific restrictions or limitations are listed for a sector/mode of supply.

(4) "Unbound+", in a similar way as "None+" refers to entries in which countries in general are unwilling to bind a sector/mode, but include exceptions, for certain subsectors, or refer to the horizontal section of commitments.

(5) "Unbound", implying that no policies are bound.

In addition, we keep the records on entries of: "Unbound due to lack of technical feasibility", indicating that some mode may be irrelevant because of technological reasons.

For the analysis to be done, it is important to note that – with the exception of full commitments ("none") where binding relates to free trade – the categories at hand, do not directly reflect any information on the actual restrictiveness of policy measures maintained. They were rather built on the perception that the readiness to disclose restrictions and the commitment not to further deteriorate the regulative status quo has economic value by creating benchmarks and raising transparency and predictability, no matter how restrictive the policies that are maintained. In that sense each of these categories of commitments reflects a different degree of countries' willingness to bind restrictions and can be scaled accordingly. As suggested by *Hoekman* (1995) "willingness to bind" in turn can be taken as an indicator of the relative restrictiveness of *policy regimes* pertaining to service industries. The more liberal the policy stance pursued, the more willing a government might be expected to bind policies for a sector/mode. As such, an entry of "none" reflects instances where binding relates to "free trade". Sectors/modes with a high share of "none" entries for a sector/mode across countries therefore might be interpreted as the most liberal, unregulated markets. "None+" entries are somewhat more restrictive as full commitments, however, the restrictions listed are more confined as compared to commitments classified as "bound". On the other hand, commitments classified as "unbound+" list exceptions that grant some degree of market access or national treatment, under certain conditions specified. These entries therefore reflect a somewhat higher willingness to bind and as such are less restrictive than "unbound" entries that provide for no exemptions.

With these interpretations in mind, simple frequency shares were calculated for each of the five categories by service sector, mode of supply and areas of application (market access and national treatment) by dividing the number of entries (count) across countries by the maximum possible (133, as this is the number of signatories to the GATS as of March, 2005)

4.2 Difficulties Inherent in Examining the GATS

Before we proceed, it is important to note, that precise interpretation of some of the entries made was at times very difficult and involved personal judgement. Difficulties also arose from the fact, that the national schedules have not always been constructed in a uniform manner, which imposes an important limit to cross-country or cross-sectional comparisons. The following discussion highlights some of the major difficulties encountered in categorizing commitments along the five groups identified above and describes how these difficulties were resolved.

Cross-industry Commitments

Besides industry-specific commitments, national schedules of commitments contain cross-industry commitments, referred to as "horizontal" commitments in the GATS. Commitments in the horizontal section automatically are applicable to all sectors listed in the sector specific schedule with full or partial commitments (even without explicit reference to cross-industry commitments).⁷⁾ On the other hand, sectors that are unbound in the specific section of the schedule are only affected by the rules of the horizontal section if explicit reference is made to the horizontal section. In such cases the entry usually reads: "unbound, except as indicated in the cross-industry section." These entries have been recorded as "unbound+".

Therefore, any analysis based on GATS sector specific schedules has to take account of measures listed in the horizontal section. As a first step then, the cross-industry commitments of individual WTO signatories by mode of supply were classified along the same lines as indicated for the sector-specific commitments. As already indicated, most of the horizontal commitments refer to measures related to investment, taxation, government subsidies, real estate, and the temporary entry and stay of natural persons and thus are most common for Mode 3 (commercial presence) and Mode 4 (presence of natural persons). Then, the list of horizontal

⁷⁾ Several times countries have made entries like: "none, except as indicated in the horizontal section". This brings more transparency into the schedules, but apart from this, reference to the horizontal section, is not necessary, as cross-industry commitments are always applicable in the case of full or partial commitments.

commitments was combined with the database on sector specific commitments, reclassifying sector specific entries per country and mode according to the various possible combinations of entries in the two parts of the national schedules. In this process we applied the rule that the more restrictive entry "wins". For example, combinations of entries classified as "unbound+" in the horizontal section with entries of either "none" or "none+" or "bound" in the sector-specific section, classify an industry as "unbound+" in this specific mode of supply.

Treatment of Austria, Finland and Sweden

In 1995, Austria, Sweden and Finland filed commitments as separate WTO member states. With their accession soon afterwards it is required that their commitments be incorporated into the EU schedule to form a harmonized document. Austria made commitments in about 120 service sectors, which were rather similar to those of the then EU12. The same is true for Finland and Sweden, with the major differences occurring in maritime, legal, and audiovisual service industries.

In 2003, the European Commission deposited a "consolidated list" combining the commitments made by the EU12 with those of the three member states Austria, Finland and Sweden. Austria's commitments were slightly more comprehensive than those of the EU and should have been revoked. But before the WTO member states had an opportunity to agree on accepting this amended list, the EU was enlarged by another ten members, which further changed the list of commitments (*Kronberger – Wolfmayr, 2005*).

Currently, the revocation of commitments resulting from the consolidated list of the EU25 is the subject of "Article XXI consultations". For Austria, Sweden and Finland, as well as all other new members, the lists of commitments as filed as separate WTO members 1995 still apply, even though this list still refers to all those countries as WTO member states "in their own right". Protocols, that have been signed after the conclusion of the Uruguay Round such as on financial services, basic telecom services and temporary movement of persons (Mode 4), however, directly replace the original commitments in these areas of the EU12 as well as of Austria, Sweden and Finland from 1995.

Thus, without the final acceptance of the "consolidated lists" for all EU25 members, the individual schedules initially submitted by all the new members since 1995 were analysed instead of a consolidated list. For Austria, Sweden and Finland, as well as in the EU12 schedule, however, the protocols on financial services, basic telecommunication and Mode 4 replaced the original commitments in these fields.

Treatment of Countries with a Federal Structure (USA, EU and Canada)

The EU, the Canadian as well as the US schedule list many commitments that only apply to one or some of the sub-federal entities (states, provinces). Thus, besides country-wide commitments, provinces or individual states have added commitments that usually are more restrictive. This complicates the examination of the schedules as there are several options how to derive an aggregate picture for the nations as a whole. *Hoekman (1995)* simply assumed that once a commitment has been added by a sub-federal entity, the limitation applies to the whole nation; the "worst case" is recorded. Another possibility is to only record nation wide entries and ignore additional restrictions added by individual states or provinces. This in turn would refer to a "best case" scenario.

We proceeded as follows:

In a first step, the schedules of countries with a federal structure were split up to record each individual entry of any province or state. Thus, out of one nation wide schedule, we built individual schedules for all sub-federal entities. For instance, the Canadian schedule of commitments, was split up into 13 individual schedules, to end up with a separate schedule for each one for the 13 Canadian provinces. Then, each of the schedules was examined separately, and commitments categorised according to the six groups identified earlier.

Then, in a next step the lists at the sub-federal level were re-aggregated, thereby taking account of nation wide entries as well as all types of restrictions added to the national schedules, by using the share of a specific entry in total entries. An example might clarify our procedure and its difference to the other procedures applied. For example, the EU schedule identifies a full commitment to market access for telecommunication service providers that wish to establish a commercial presence in

the European Union (Mode 3). However, Portugal, Spain and Italy have added a partial commitment. Under the worst case scenario, the EU15 records a partial commitment ("bound") due to the three country's additional restriction. Under the best case scenario, the EU15 records a full commitment ("none"). Following our procedure, we recorded this case as "bound" only if more than 50% of EU members had listed an additional restriction, in the specific case exemplified, with only three countries listing exemptions, we recorded a "none+" entry for the EU15.

Treatment of Entries in Financial Sector Services Referencing to the "Understanding"

Some countries have made their specific commitments in accordance with the Understanding of Commitments in Financial Services. The Understanding is an optional text, containing a "formula" approach to the scheduling of commitments in the financial service sector. It contains a series of explicit commitments that bear directly on the interpretation of the content of the schedules. Thus, it was necessary to reformulate the content of the Understanding into a hypothetical schedule, again categorizing each entry into one of the six groups, and based on this, reinterpret the entries for the individual service sectors listed in the specific schedules. A similar problem arose, with respect to "sector-horizontal" measures that many countries included into their schedules, applying to all financial services or to major subgroups, in addition to the all-sector horizontal section.

Miscellaneous Service Groupings

The GATS Services Sectoral Classification list (GNS/W/120) builds the principal basis for the sectoral listings in the national schedules. Some miscellaneous groups have been included in this list to offer some discretion for WTO members to broaden their offers or include sectors not specifically mentioned in the list. In the strict sense, commitments scheduled for miscellaneous groupings are not comparable as the composition changes across individual schedules. This has to be taken into account when interpreting outcomes for some of these miscellaneous groupings.

Commitments on Sectors Not Individually Mentioned in the GNS Classification and Sectoral Classifications Diverting from WTO-GNS Classifications

Countries sometimes made commitments on sectors that are not individually recorded in the GNS list of sectors and thereby specified restrictions on a more detailed aggregation level as implied by the GATS-GNS list of sectors. It has been necessary to match these with the GNS classification. Thereby we sometimes ended up with several different entries for one sector, which had to be aggregated to allow comparison across countries. This is a similar problem as encountered with countries with a federal structure. Thus, for the industries involved, we applied the same aggregation procedure as indicated under the heading "treatment of countries with a federal structure".

Overlap Between Commitments on Market Access and National Treatment

Article XX:2 of the GATS agreement states, that restrictions that violate against both, market access and national treatment should be inscribed in the market access column of the schedule. This overlap creates confusion as to the interpretation of the entries made in the national treatment column especially in such cases where the entry in the market access column is inconsistent with the national treatment entry. Thus, an entry of "none" in the national treatment column would have to be re-interpreted if market access limitations also constitute limitations on national treatment. On top of this, it is not always clear from the entries in the market access column which measures simultaneously constitute limitations on national treatment and which do not. With this ambivalence, entries in the market access column and the national treatment column have been interpreted independently from each other. National treatment entries were recorded on the basis of actual entries, independently from measures scheduled in the market access column.

Some More Difficulties of Interpretation (None – Unbound)

In some of the national schedules commitments pertaining only to a subset of a GNS-item or sub-sectors of the GNS item or exclude them from the overall commitment are listed. Often such entries combine a "none"-entry with an "unbound"-entry. Examples are entries like: "None, except for access to subsidies: Unbound", or "Unbound for brokerage. Other, none." This made careful interpretation of the listings

necessary. For both examples illustrated, the interpretation was quite straightforward; they were recorded as "none+". On the other hand, an entry like: "Unbound except for mail order: none" has been recorded as "unbound+"

5. Cluster Analysis

5.1 The General Taxonomy

Statistical cluster analysis is defined as "the art of finding groups in data" (Kaufmann –Rousseeuw, 1990) such that the degree of "natural association" (Anderberg, 1973) is (i) high among members within the same class (*internal cohesion*) and (ii) low between members of different categories (*external isolation*). In practice, internal cohesion and external separation are not definite requirements, but rather general objectives. Their fulfilment is a matter of degree and depends on the nature of the data as well as the clustering techniques applied. Cluster analysis offers a sophisticated statistical tool for the exploration and classification of multivariate data, but it is important to acknowledge that it remains a heuristic method, which requires the researcher to make a number of choices that critically affect the final outcomes. The most critical question, to begin with, is the choice of variables. Aiming to preserve as much information as possible from the initial database which only comprised qualitative information, for each industry the status of each country has been encoded as a binary number ('yes' or 'no') into one of five mutually exclusive codes that represent an ordinal scale ranging from 'full-' to 'no commitment' to market liberalisation. Counting frequencies and calculating relative shares for each code finally allowed us to arrive at interval scaled data, whereby the relative country-shares for each code became independent variables to be used in the statistical cluster analysis. Before that, however, we also standardised the data to avoid any implicit differential weighting of the variables according to differences in their mean size or variability.

For the general classification, we thus ran the cluster algorithms on all of the five variables, for both market access and national treatment, in each of the four modes. This means that a total of 40 variables simultaneously shaped the resulting partition of industries. Within each pair of mode and either 'market access' or 'national treatment', the variables have been linearly independent (i.e. to say that each country can only be counted once in either of the five different codes). Between the records on market access and national treatment as well as between the four

different modes this linear independence does not apply, but the high symmetry between the apparent correlations justifies their joint use.

Once the variables were chosen, the clustering procedure started with a given data matrix of $i = 1, \dots, n$ observations for which characteristic attributes x are reported for $j = 1, \dots, p$ variables. The initial data set of the dimension $n \times p$ is then transformed into a symmetric (dis)similarity matrix of dimensions $n \times n$ observations with d_{ih} being the coefficients of (dis)similarity for observations x_i and x_h .

Applying the same notation, the familiar *Euclidean distance* e_{ih} is defined as follows:

$$(2) \quad d_{ih} = euc_{ih} = \sqrt{\sum_{j=1}^p (x_{ij} - x_{hj})^2} \quad 0 \leq euc_{ih} < \infty$$

Operating with the squared differences, the Euclidean measure is sensitive to outliers. Alternatively, the closely related Manhattan or *city block distance* prescribes equal importance to any unit of dissimilarity:

$$(3) \quad d_{ih} = cityb_{ih} = \sum_{j=1}^p |x_{ij} - x_{hj}| \quad 0 \leq cityb_{ih} < \infty$$

When we are interested in the 'shape' of objects rather than in the absolute size of differences, alternative measures can be more helpful. The following two measures of similarity, called *angular separation* in (4) and the *correlation coefficient* in (5), are most frequently used:

$$(4) \quad d_{ih} = ang_{ih} = \frac{\sum_{j=1}^p x_{ij} x_{hj}}{\sqrt{\sum_{j=1}^p x_{ij}^2 \sum_{j=1}^p x_{hj}^2}} \quad -1,0 \leq ang_{ih} \leq 1,0$$

$$(5) \quad d_{ih} = corr_{ih} = \frac{\sum_{j=1}^p x_{ij} x_{hj} - (1/p)(\sum_{j=1}^p x_{ij} \sum_{j=1}^p x_{hj})}{\sqrt{\left[\sum_{j=1}^p x_{ij}^2 - (1/p)(\sum_{j=1}^p x_{ij})^2 \right] \left[\sum_{j=1}^p x_{hj}^2 - (1/p)(\sum_{j=1}^p x_{hj})^2 \right]}} \quad -1,0 \leq corr_{ih} \leq 1,0$$

Both angular separation and the correlation coefficient measure the cosine of the angle between two vectors. The essential difference between the two is that the former is based on deviations from the origin, whereas the latter operates with deviations from the mean of the variables of an observation. As a consequence, the correlation coefficient is unaffected by mere size displacements and therefore less discriminating. *Peneder* (2005) presents a numerical example and geometric visualisation that demonstrates how the choice among the above measures affects the values of the final (dis-)similarity matrix \mathbf{D}_{nn} .

The next crucial step concerns the choice of how to group objects into separate categories, i.e. we must choose what clustering algorithm to use. Again a variety of approaches is possible⁸⁾. Among the clustering algorithms that are most widely used, we must distinguish between two general approaches. The first is the *partitioning* method, which breaks objects into a distinct number of non-overlapping groups. The most common of them is the so called *k-means* technique. The second approach is the *hierarchical cluster analysis*, which is either divisive or agglomerative, i.e. dividing or combining hierarchically related objects into clusters.

In the current analysis, we apply a two-step approach that combines *k-means* and agglomerative hierarchical methods. The *k-means* method produces a first partition, which reduces the large initial data sets to better use in the second step of hierarchical clustering. The *k-means* method also has the advantage that the initial assignments of cases remain reversible during the course of iterations. In this first step, we only use the Cityblock distance measure.

For the *k-means* method, the set of observations is divided by a pre-defined number of clusters k . For example, k nearly equal-sized segments can be formed as an initial partition. Cluster centres are computed for each group, which are the vectors of the means of the corresponding values for each variable. The objects are then assigned

⁸⁾ *Anderberg* (1973, p. 23) remarked, that "one of the most striking things about the many methods in the literature is the high degree of redundancy when applied to a set of data. The ideal would be to have a small stable of algorithms minimally duplicative among themselves but collectively representative of all the general types of classifications that might be produced by all other algorithms put together."

to the group with the nearest cluster centre. After this, the mean of the observations are recomputed and the process is repeated until convergence is reached. This is the case, when no observation moves between groups and all have remained in the same cluster of the previous iteration.

With this method, one critical and potentially very manipulative choice is the initial number of clusters k . For reasons of internal consistency with prior publications, we have applied the following self-binding rule-of-thumb: "*Choose the lowest number k that maximises the quantity of individual clusters l which include more than 5% of the observed cases*". In our case, the 5% benchmark for the 154 industries recorded by the GNS classification implies that we first need to determine the lowest number k that maximises the quantity of individual clusters which include at least 8 observations. Running the k -means algorithm on a dissimilarity matrix made up of Cityblock distances between any pair of observations for all values of k ranging from 2 until 35, the lowest number which fulfils the above rule turns out to be $k = 13$ with $l = 9$.

For the purpose of further refinement, the resulting cluster centres are redefined as objects for the following hierarchical agglomeration clustering method. In contrast to the k -means method, *hierarchical* cluster analysis enables us to determine the boundaries between clusters at different levels of (dis)similarity. Preserving a higher degree of complexity in the output produced, hierarchical techniques require a heuristic interpretation of the surfacing patterns. Dendrograms (or 'cluster trees') support this by means of graphical representation. As with k -means cluster analysis, any of the above measures of distance can be applied. When groups with more than one object merge, various methods differ in the way they determine what the (dis)similarity between groups precisely is. The most popular and intuitively appealing choice is the *average linkage* method, whereby the average (dis)similarity between all the observations is compared for any pair of groups. Alternatively, the *complete linkage* method compares the (dis)similarity between the observations which are farthest apart, whereas the *single linkage* method takes the (dis)similarity of the nearest neighbours in any pair of groups into account.

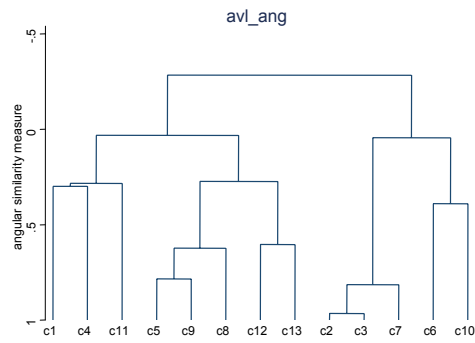
The choice between the different linkage methods directly relates to the objectives of internal cohesion and the external isolation of clusters (mentioned at the

beginning of this section). Single linkage aims only for *external isolation*, implying that any observation is more similar to some other object within the same cluster than to any other objects outside. Due to this property, single linkage methods frequently fail to reveal much structure within the data. The reason is that observations tend to join one common and expanding cluster, which leads to undesirable 'chaining' effects. Conversely, the complete linkage method aims at *internal cohesion*. This leads to compact classes, which, however, need not be externally isolated. The average linkage method avoids both extremes and seeks a compromise between the aims of internal cohesion and external isolation.

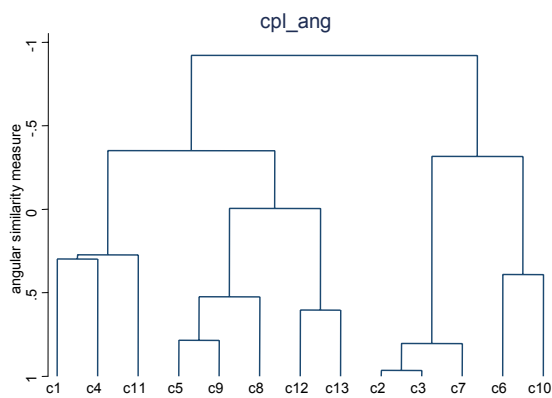
In the present analysis, we want to focus on the relative shape of the frequency distribution across the variables, but nevertheless want the process to remain sensitive to differences in overall reporting behaviour (i.e. total coverage by GATS schedules). The best choice, then, is the *angular separation* (dis-)similarity function, which we apply to each of the three agglomeration methods. Inspection of the major regularities in the respective dendrograms in Figure 1 then leads to the synthesis of the final classification ("general classification"), which is reported in the first column of Table 1. We complemented the general classification by a series of *k*-means clustering algorithms, that we applied separately on each of the four different modes (i.e. only with 10 variables instead of 40), arbitrarily choosing a desired number of $k = 5$ clusters. We then characterised these according to the relative distribution of GATS commitments. These outcomes of the individual classifications by each of the four modes are also recorded in Table 1 (column 4 – 7) and give an indication of how robust the general taxonomy is with respect to the more specific differences within individual modes. The overall patterns are very consistent, but the results also show that for some individual industries important differences within single modes exist, that in the general taxonomy were dominated by the overall similarities across all the 40 variables.

Figure 1: Cluster Dendrograms: GNS Using Angular Separation Dissimilarity Measure

(a) Average Linkage Method



(b) Complete Linkage Method



(c) Single Linkage Method

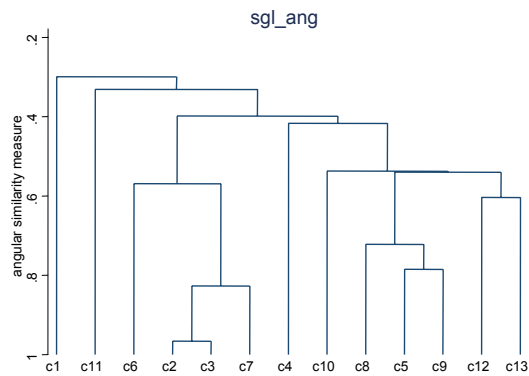


Table 1: The GNS Sector Classification of GATS Commitments

Cluster	GNS	Name of sector	Mode 1	Mode 2	Mode 3	Mode 4
Very liberal market access and no discrimination						
Cluster 1	1Aa	Legal services	lib/ndc	lib/ndc	reg/dsc	lib/med
Cluster 1	1Ab	Accounting, auditing and bookkeeping services	lib/ndc	lib+/ndc+	lib+/ndc	lib/med
Cluster 1	1Ad	Architectural services	lib/ndc	lib+/ndc+	lib+/ndc	lib/med
Cluster 1	1Ae	Engineering services	lib/ndc	lib+/ndc+	lib+/ndc	lib/med
Cluster 1	1Ba	Consultancy services related to computer hardware	lib/ndc	lib/ndc	lib+/ndc	lib/med
Cluster 1	1Bb	Software implementation services	lib/ndc	lib/ndc	lib+/ndc	lib/med
Cluster 1	1Bc	Data processing services	lib/ndc	lib/ndc	lib+/ndc	lib/med
Cluster 1	1Bd	Database services	lib/ndc	lib/ndc	lib+/ndc	lib/med
Cluster 1	1Fc	Management consulting service	lib/ndc	lib/ndc	lib+/ndc	lib/med
Cluster 1	2Ca	Voice telephone services	bnd/ndc	lib+/ndc+	bnd	lib/med
Cluster 1	2Cb	Packet-switched data transmission services	bnd/ndc	lib+/ndc+	lib+/ndc	lib/med
Cluster 1	2Cc	Circuit-switched data transmission services	bnd/ndc	lib+/ndc+	lib+/ndc	lib/med
Cluster 1	2Cd	Telex services	bnd/ndc	lib+/ndc+	lib+/ndc	lib/med
Cluster 1	2Ce	Telegraph services	bnd/ndc	lib+/ndc+	lib+/ndc	lib/med
Cluster 1	2Cf	Facsimile services	bnd/ndc	lib+/ndc+	lib+/ndc	lib/med
Cluster 1	2Cg	Private leased circuit services	bnd/ndc	lib+/ndc+	lib+/ndc	lib/med
Cluster 1	2Ch	Electronic mail	bnd/ndc	lib+/ndc+	lib+/ndc	lib/med
Cluster 1	2Ci	Voice mail	bnd/ndc	lib+/ndc+	lib+/ndc	lib/med
Cluster 1	2Cj	On-line information and database retrieval	bnd/ndc	lib+/ndc+	lib+/ndc	lib/med
Cluster 1	2Ck	Electronic data interchange	bnd/ndc	lib+/ndc+	lib+/ndc	lib/med
Cluster 1	2Cl	Enhanced/value added facsimile services	bnd/ndc	lib+/ndc+	lib+/ndc	lib/med
Cluster 1	2Cm	Code protocol conversion	bnd/ndc	lib+/ndc+	lib+/ndc	lib/med
Cluster 1	2Cn	On-line information and/or data processing	bnd/ndc	lib+/ndc+	lib+/ndc	lib/med
Cluster 1	2Co	Telecommunications: Other	bnd/ndc	lib+/ndc+	lib+/ndc	lib/med
Cluster 1	9A	Hotels and restaurants (incl. catering)	lib/ndc	lib+/ndc+	bnd	reg/med
Cluster 1	9B	Travel agencies and tour operators services	lib/ndc	lib+/ndc+	lib+/ndc	reg/med
Cluster 1	9C	Tourist guides services	med	lib/ndc	lib+/ndc	reg/med
Liberal market access and little discrimination						
Cluster 2	1Ag	Urban planning and landscape architectural services	med	lib/ndc	lib/med	med
Cluster 2	1Be	Other computer and related services	med	lib/ndc	lib/med	med
Cluster 2	1Cb	R&D services on social sciences and humanities	med	med	lib/med	med
Cluster 2	1Ec	Relating to other transport equipment	med	lib/ndc	reg/dsc	med
Cluster 2	1Ed	Relating to other machinery and equipment	med	med	lib/med	med
Cluster 2	1Fa	Advertising services	lib/ndc	lib/ndc	lib+/ndc	med
Cluster 2	1Fb	Market research and public opinion polling services	med	lib/ndc	lib/med	med
Cluster 2	1Fd	Services related to management consulting	med	med	lib/med	med
Cluster 2	1Fe	Technical testing and analysis services	med	lib/ndc	lib/med	med

Cluster	GNS	Name of sector	Mode 1	Mode 2	Mode 3	Mode 4
Cluster 2	1Fh	Services incidental to mining	med	med	lib/med	med
Cluster 2	1Fm	Related scientific and technical consulting services	med	med	lib/med	med
Cluster 2	1Fn	Maintenance and repair of equipment	med	lib/ndc	lib/med	med
Cluster 2	2B	Courier services	med	lib/ndc	lib/med	med
Cluster 2	3A	General construction work for buildings	med	lib/ndc	lib+/ndc	lib/med
Cluster 2	3B	General construction work for civil engineering	med	lib/ndc	lib+/ndc	lib/med
Cluster 2	3C	Installation and assembly work	med	lib/ndc	reg/dsc	lib/med
Cluster 2	3D	Building completion and finishing work	med	lib/ndc	reg/dsc	med
Cluster 2	3E	Other construction and related engineering services	med	lib/ndc	reg/dsc	med
Cluster 2	4A	Commission agents' services	med	med	lib/med	med
Cluster 2	4B	Wholesale trade services	med	lib/ndc	lib/med	med
Cluster 2	4C	Retailing services	med	lib/ndc	lib/med	med
Cluster 2	4D	Franchising	med	med	lib/med	med
Cluster 2	5D	Adult education	med	med	lib/med	med
Cluster 2	6A	Sewage services	med	lib/ndc	lib/med	med
Cluster 2	6B	Refuse disposal services	med	lib/ndc	lib/med	med
Cluster 2	6C	Sanitation and similar services	med	lib/ndc	lib/med	med
Cluster 2	6D	Other environmental services	med	lib/ndc	lib/med	med
Cluster 2	10A	Entertainment services	med	med	reg/dsc	med
Cluster 2	10D	Sporting and other recreational services	med	lib/ndc	reg/dsc	med
Cluster 2	11Cd	Maintenance and repair of aircraft	med	lib/ndc	reg/dsc	med
Cluster 2	11Fa	Passenger transportation	lco	med	lib/med	med
Cluster 2	11Fb	Freight transportation	lco	med	lib/med	med

Intermediate with open market access in Mode 3

Cluster 3	1Ai	Veterinary services	med	med	reg/dsc	med
Cluster 3	1Ca	R&D services on natural sciences	med	med	lib/med	med
Cluster 3	1Cc	Interdisciplinary R&D services	med	med	lib/med	med
Cluster 3	1Ea	Renting/leasing services: relating to ships	med	med	lco	lco
Cluster 3	1Eb	Renting/leasing services: relating to aircraft	med	med	lco	lco
Cluster 3	1Fg	Services incidental to fishing	med	med	reg/dsc	lco
Cluster 3	1Fi	Services incidental to manufacturing	med	med	lib/med	lco
Cluster 3	1Fk	Placement and supply services of personnel	med	med	lco	lco
Cluster 3	1Fo	Building-cleaning services	lco	med	lib/med	med
Cluster 3	1Fp	Photographic services	med	med	lib/med	med
Cluster 3	1Fq	Packaging services	lco	med	lib/med	med
Cluster 3	1Fr	Printing, publishing	med	med	lib/med	med
Cluster 3	1Fs	Convention services	med	med	lib/med	med
Cluster 3	1Ft	Other business services: other	med	med	lib/med	lco
Cluster 3	11Fd	Maintenance and repair of road transport equipment	lco	med	reg/dsc	med
Cluster 3	11Ha	Cargo-handling services	lco	med	lib/med	med
Cluster 3	11Hb	Storage and warehouse services	lco	lib/ndc	lib/med	med

Cluster	GNS	Name of sector	Mode 1	Mode 2	Mode 3	Mode 4
Cluster 3	11Hc	Freight transport agency services	med	med	lib/med	med
Cluster 3	11Hd	Other services auxiliary to all modes of transport	med	med	lib/med	med
Low overall coverage						
Cluster 4	1Aj	Services provided by midwives, nurses, ...	lco	lco	lco	lco
Cluster 4	1Ak	Other professional services	lco	lco	lco	lco
Cluster 4	1Da	Real estate services involving own or leased property	lco	lco	lco	lco
Cluster 4	1Db	Real estate services on a fee or contract basis	lco	med	lco	lco
Cluster 4	1Ee	Other rental/leasing services	lco	lco	lco	lco
Cluster 4	1Fj	Services incidental to energy distribution	lco	lco	lco	lco
Cluster 4	1Fl	Investigation and security	lco	lco	lco	lco
Cluster 4	2A	Postal services	lco	lco	lco	lco
Cluster 4	2Da	Motion picture/video production & distribution services	lco	lco	lco	lco
Cluster 4	2Db	Motion picture projection services	lco	lco	lco	lco
Cluster 4	2Dc	Radio and television services	lco	lco	lco	lco
Cluster 4	2Dd	Radio and television transmission services	lco	lco	lco	lco
Cluster 4	2De	Sound recording	lco	lco	lco	lco
Cluster 4	2Df	Other audiovisual services	lco	lco	lco	lco
Cluster 4	4E	Other distribution services	lco	lco	lco	lco
Cluster 4	5E	Other education services	lco	lco	lco	lco
Cluster 4	7C	Other financial services	lco	lco	lco	lco
Cluster 4	8B	Other human health services	lco	lco	lco	lco
Cluster 4	8C	Social services	lco	lco	lco	lco
Cluster 4	8D	Other health related and social services	lco	lco	lco	lco
Cluster 4	9D	Other tourism and travel related services	lco	lco	lco	lco
Cluster 4	10B	News agency services	lco	med	lco	lco
Cluster 4	10C	Libraries, archives, museums and other cultural services	lco	lco	lco	lco
Cluster 4	10E	Other recreational, cultural and sporting services	lco	lco	lco	lco
Cluster 4	11Ac	Rental of vessels with crew	lco	lco	lco	lco
Cluster 4	11Ad	Maintenance and repair of vessels	lco	lco	lco	lco
Cluster 4	11Ae	Pushing and towing services	lco	lco	lco	lco
Cluster 4	11Af	Supporting services for maritime transport	lco	lco	lco	lco
Cluster 4	11Ba	Passenger transportation	lco	lco	lco	lco
Cluster 4	11Bb	Freight transportation	lco	lco	lco	lco
Cluster 4	11Bc	Rental of vessels with crew	lco	lco	lco	lco
Cluster 4	11Bd	Maintenance and repair of vessels	lco	lco	lco	lco
Cluster 4	11Be	Pushing and towing services	lco	lco	lco	lco
Cluster 4	11Bf	Supporting services for internal waterways transport	lco	lco	lco	lco
Cluster 4	11Ca	Air transport - passenger transportation	lco	lco	lco	lco
Cluster 4	11Cb	Air transport - freight transportation	lco	lco	lco	lco
Cluster 4	11Cc	Rental of aircraft with crew	lco	lco	lco	lco
Cluster 4	11D	Space transport	lco	lco	lco	lco

Cluster	GNS	Name of sector	Mode 1	Mode 2	Mode 3	Mode 4
Cluster 4	11Ea	Rail transport - passenger transportation	lco	lco	lco	lco
Cluster 4	11Eb	Rail transport - freight transportation	lco	lco	lco	lco
Cluster 4	11Ec	Rail transport - pushing and towing services	lco	lco	lco	lco
Cluster 4	11Ed	Maintenance and repair of rail transport equipment	lco	med	lco	lco
Cluster 4	11Ee	Supporting services for rail transport services	lco	lco	lco	lco
Cluster 4	11Fc	Rental of commercial vehicles with operator	lco	lco	lco	lco
Cluster 4	11Fe	Supporting services for road transport services	lco	lco	lco	lco
Cluster 4	11Ga	Transportation of fuels	lco	lco	lco	lco
Cluster 4	11Gb	Transportation of other goods	lco	lco	lco	lco
Cluster 4	11I	Other transport services	lco	lco	lco	lco
Cluster 4	12	Other services not included elsewhere	lco	lco	lco	lco
Intermediate, but mostly unbound on Mode 3						
Cluster 5	1Ac	Taxation services	med	lib/ndc	lib/med	med
Cluster 5	1Af	Integrated engineering services	med	med	reg/dsc	med
Cluster 5	1Ff	Services incidental to agriculture, hunting and forestry	med	lib/ndc	reg/dsc	med
Cluster 5	5A	Primary education services	med	med	reg/dsc	med
Cluster 5	5B	Secondary education services	med	med	reg/dsc	med
Cluster 5	5C	Higher education services	med	med	reg/dsc	med
Cluster 5	11Aa	Maritime transport services - passenger transportation	med	med	reg/dsc	med
Cluster 5	11Ab	Maritime transport services - freight transportation	med	med	reg/dsc	med
Cluster 5	11Ce	Supporting services for air transport	med	lib/ndc	reg/dsc	med
Strongly regulated (with partial commitments on Mode 3)						
Cluster 6	1Ah	Medical and dental services	med	lib/ndc	reg/dsc	med
Cluster 6	7Aa	Life, accident and health insurance services	reg/dsc	reg/dsc	bnd	reg/med
Cluster 6	7Ab	Non-life insurance services	reg/dsc	reg/dsc	bnd	reg/med
Cluster 6	7Ac	Reinsurance and retrocession	bnd/ndc	reg/dsc	bnd	reg/med
Cluster 6	7Ad	Services auxiliary to insurance	reg/dsc	reg/dsc	bnd	reg/med
Cluster 6	7Ba	Acceptance of deposits/repayable funds from public	reg/dsc	reg/dsc	bnd	reg/med
Cluster 6	7Bb	Lending of all types	reg/dsc	reg/dsc	bnd	reg/med
Cluster 6	7Bc	Financial leasing	reg/dsc	reg/dsc	bnd	reg/med
Cluster 6	7Bd	All payment and money transmission services	reg/dsc	reg/dsc	bnd	reg/med
Cluster 6	7Be	Guarantees and commitments	reg/dsc	reg/dsc	bnd	reg/med
Cluster 6	7Bf	Trading for own account or for account of customers	reg/dsc	reg/dsc	bnd	reg/med
Cluster 6	7Bg	Participation in issues of all kinds of securities	reg/dsc	reg/dsc	bnd	lib/med
Cluster 6	7Bh	Money broking	med	reg/dsc	bnd	lib/med
Cluster 6	7Bi	Asset management, such as cash or portfolio management	reg/dsc	reg/dsc	bnd	reg/med
Cluster 6	7Bj	Settlement and clearing services for financial assets	reg/dsc	reg/dsc	bnd	lib/med
Cluster 6	7Bk	Other auxiliary financial services	reg/dsc	reg/dsc	bnd	reg/med
Cluster 6	7Bl	Provision of financial information, related software	reg/dsc	reg/dsc	bnd	reg/med
Cluster 6	8A	Hospital services	med	med	reg/dsc	med

5.2 Cluster Validation

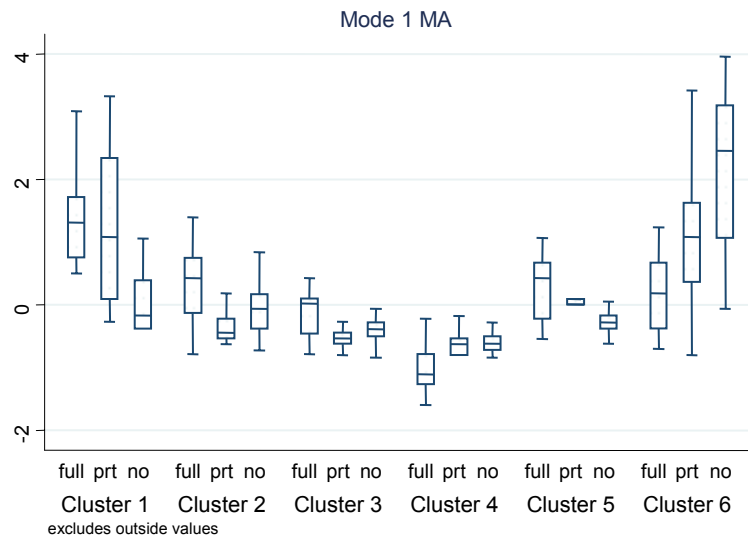
The box plot charts in Figure 2 to Figure 5 simultaneously display information about the shape and dispersion of the types of commitments between various types of industry and are therefore particularly useful for the interpretation and validation of the resulting clusters. The Figures are easily understood. The box itself comprises the middle 50 percent of observations. The line within the box is the median. The lower end of the box signifies the first quartile, while the upper end of the box corresponds to the third quartile. In addition, the lowest and the highest lines outside the box respectively indicate the minimum and maximum values.

The box plot charts help to understand, what it is that makes the resulting six clusters distinctive. While all five codes were used for identifying the groups, the three different categories indicating partial commitments ("none+", "bound" and "unbound+") are aggregated for the purpose of a more simple illustration.

Across all the four modes, *Cluster 1* is the group of sectors with the most liberal regimes in terms of both market access and national treatment. Typical examples are the various business related services, such as "accounting, auditing and bookkeeping", "engineering services", and a number of services related to information and communication technologies (ICT). *Cluster 2* is comprised of sectors with a relatively liberal regime with little discrimination, especially with respect to Modes 2 and 3, while taking an intermediate position in Modes 1 and 4. Examples are "advertising" and "market research", "scientific and technical consulting", construction, or wholesale and retail trade. A relatively small group of sectors with mostly intermediate values but a pronounced liberal market access in Mode 3 is to be found in *Cluster 3*. Examples are "R&D services on natural sciences", "services incidental to manufacturing", "printing and publishing", or "cargo-handling services". Conversely, *Cluster 5* is much more restricted in terms of market access and discriminating in terms of national treatment for Mode 3, but otherwise also takes an intermediate position. The most outstanding examples within this class are "primary", "secondary", and "higher education".

Figure 2: Box Plots of Distribution over GNS Sectors for Mode 1 (standardised values)

(a) Market Access



(b) National Treatment

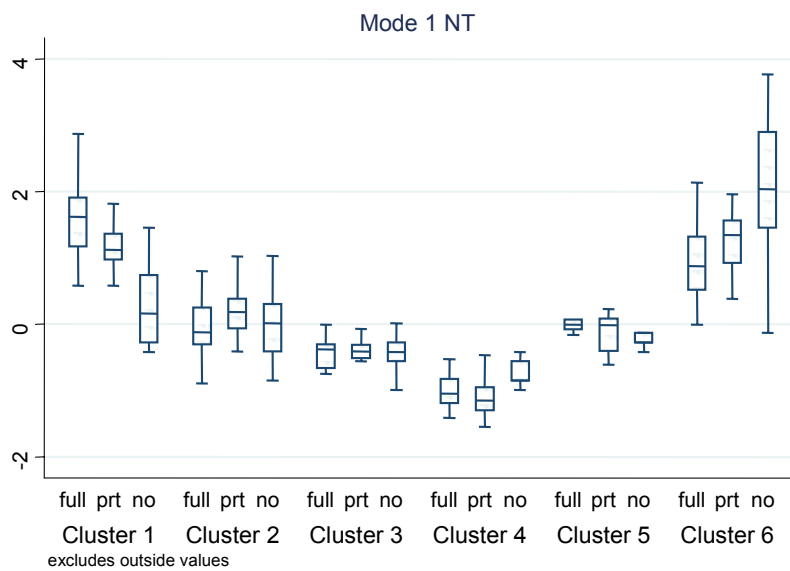
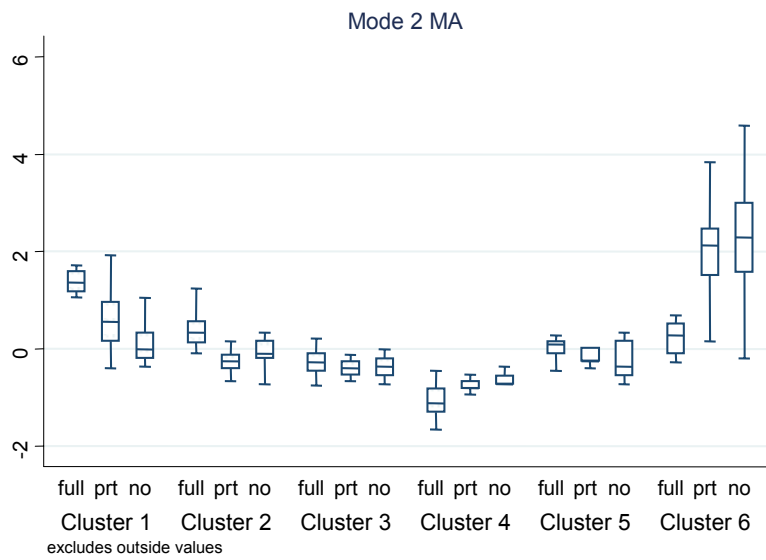


Figure 3: Box Plots of Distribution over GNS Sectors for Mode 2

(a) Market Access



(b) National Treatment

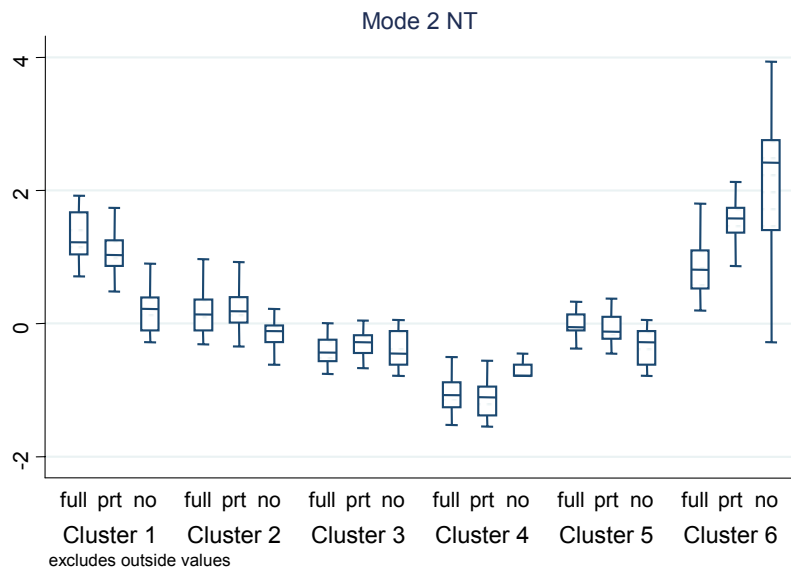
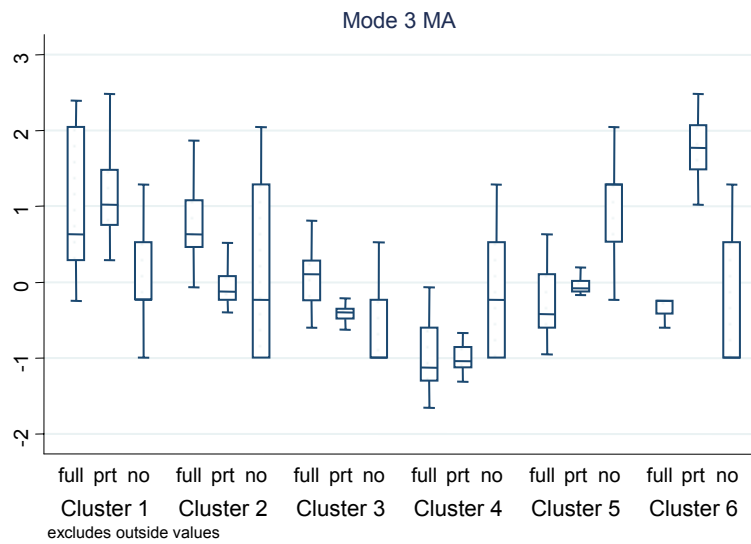


Figure 4: Box Plots of Distribution over GNS Sectors for Mode 3

(a) Market Access



(b) National Treatment

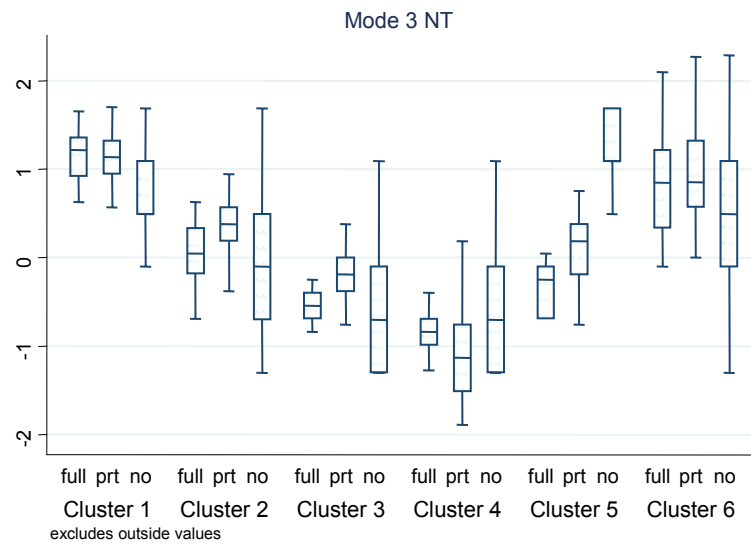
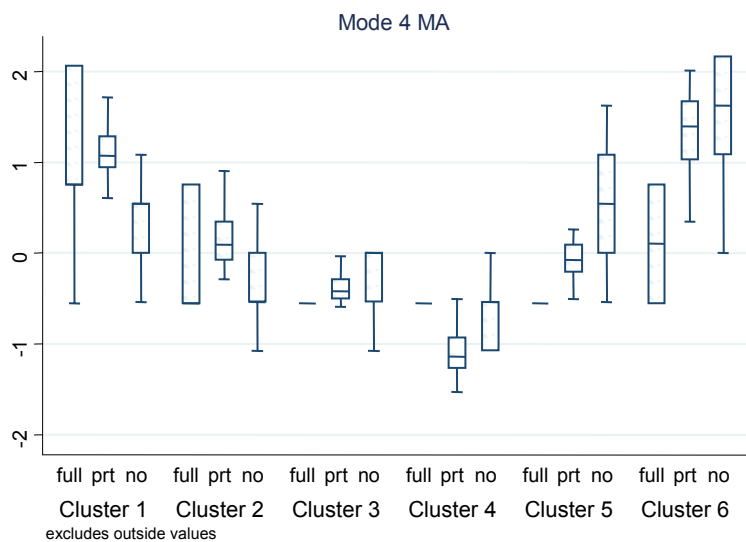
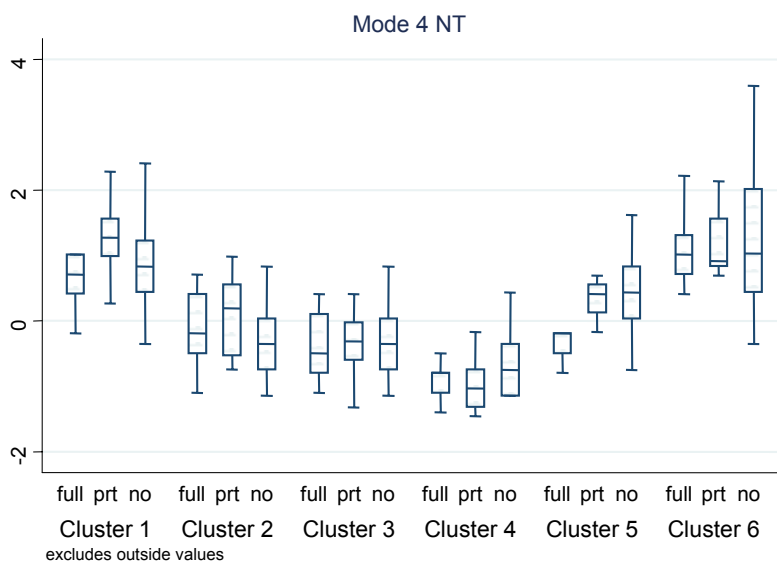


Figure 5: Box Plots of Distribution over GNS Sectors for Mode 4

(a) Market Access



(b) National Treatment



The most characteristic observation on industries within *Cluster 4* is their low overall coverage within the GATS system. As argued before, a low overall coverage indicates a certain reluctance to include these sectors in the GATS process and their visual representation by box plots does indeed confirm this interpretation. In the case of *Cluster 4*, the share of countries with "no commitment" is generally much higher than the share of countries with "full commitment". Typical examples are sectors such as "services incidental to energy distribution", "postal services", "radio and television", and a number of transport services. Similarly, *Cluster 6* is comprised of sectors with rather restrictive regulatory regimes, albeit with a pronounced tendency for an explicit non-commitment to liberalisation. Within this type we identified, for instance, "medical and dental services", "hospital services", and a number of insurance and other finance related services.

Going beyond mere visual validation, the analysis of variance (ANOVA) and simple OLS regressions on the share of country commitments to the five different codes in the various categories of industry classification more strictly test the discriminatory power of the new taxonomy. Clearly, the F-statistics, which confirm that for all variables the taxonomy indeed discriminates significantly between observations, are not the issue. This result would be trivial, since the taxonomy was created explicitly for that purpose. More importantly, R-squared and the F-value⁹⁾ show us which variables the taxonomy explains more or less successfully. Overall, the taxonomies are very successful in explaining a large part of the total variation across all of 154 GNS industries by distinguishing only between five or six different categories within the new classification.

⁹⁾ F is the ratio of the sum of squares explained by the model to the residual sum of squares (both of them divided by its degrees of freedom, which results in the respective "mean squares" or estimated variances).

Table 2: Results from the ANOVA Regressions on GATS Schedules

Variable*	Taxonomy**	F-value	R ²
Mode 1			
m1ma1	General	80,61	0,7314
m1ma2	General	48,97	0,6233
m1ma3	General	26,18	0,4694
m1ma4	General	47,12	0,6142
m1ma5	General	70,60	0,7046
m1nt1	General	171,11	0,8525
m1nt2	General	82,77	0,7366
m1nt3	General	52,94	0,6414
m1nt4	General	17,63	0,3733
m1nt5	General	66,79	0,6929
m1ma1	M1	143,36	0,7938
m1ma2	M1	85,11	0,6956
m1ma3	M1	185,27	0,8326
m1ma4	M1	96,31	0,7211
m1ma5	M1	111,25	0,7492
m1nt1	M1	264,70	0,8766
m1nt2	M1	127,57	0,7740
m1nt3	M1	68,48	0,6477
m1nt4	M1	26,25	0,4134
m1nt5	M1	100,77	0,7301
Mode 2			
m2ma1	General	150,47	0,8356
m2ma2	General	71,43	0,7070
m2ma3	General	62,98	0,6803
m2ma4	General	83,11	0,7374
m2ma5	General	80,73	0,7317
m2nt1	General	152,64	0,8376
m2nt2	General	122,66	0,8056
m2nt3	General	39,56	0,5720
m2nt4	General	25,50	0,4628
m2nt5	General	91,32	0,7552
m2ma1	M2	174,36	0,8240
m2ma2	M2	130,10	0,7774
m2ma3	M2	89,20	0,7054
m2ma4	M2	213,87	0,8517
m2ma5	M2	159,00	0,8102
m2nt1	M2	179,05	0,8278
m2nt2	M2	207,94	0,8481
m2nt3	M2	42,82	0,5348

m2nt4	M2	48,41	0,5651
m2nt5	M2	179,63	0,8282
Mode 3			
m3ma1	General	50,49	0,6304
m3ma2	General	146,39	0,8318
m3ma3	General	112,42	0,7916
m3ma4	General	62,41	0,6783
m3ma5	General	3,63	0,1093
m3nt1	General	65,40	0,6884
m3nt2	General	189,46	0,8649
m3nt3	General	98,57	0,7691
m3nt4	General	12,12	0,2906
m3nt5	General	16,07	0,3519
m3ma1	M3	43,42	0,5382
m3ma2	M3	158,09	0,8093
m3ma3	M3	169,08	0,8195
m3ma4	M3	88,92	0,7048
m3ma5	M3	30,56	0,4507
m3nt1	M3	78,65	0,6786
m3nt2	M3	239,69	0,8655
m3nt3	M3	157,20	0,8084
m3nt4	M3	17,91	0,3248
m3nt5	M3	39,58	0,5152
Mode 4			
m4ma1	General	11,14	0,2734
m4ma2	General	31,05	0,5119
m4ma3	General	34,52	0,5384
m4ma4	General	204,83	0,8737
m4ma5	General	30,96	0,5113
m4nt1	General	35,19	0,5432
m4nt2	General	42,47	0,5893
m4nt3	General	35,81	0,5475
m4nt4	General	185,63	0,8625
m4nt5	General	37,72	0,5603
m4ma1	M4	20,39	0,3538
m4ma2	M4	53,00	0,5872
m4ma3	M4	63,16	0,6290
m4ma4	M4	302,06	0,8902
m4ma5	M4	59,39	0,6145
m4nt1	M4	75,24	0,6689
m4nt2	M4	70,50	0,6543
m4nt3	M4	42,93	0,5354
m4nt4	M4	252,17	0,8713
m4nt5	M4	65,03	0,6358

5.3 Application to Austrian Performance Data

The high discriminatory power of the new taxonomies with respect to those variables that it was built upon, confirms the choice of appropriate techniques and overall quality of the classification process. Its success has become manifest in the condensation of a large and extremely multifaceted data profile into a few categories that focus only at its most pronounced edges, thereby producing relatively sharp, i.e. significant and economically meaningful, discriminations between industries.

A different way to validate the results is to test for its general usefulness when applied to other data, which were not part of the clustering process. In a sense, it helps to assess whether the initial rationales that lead to the construction of the new classification were appropriate and the whole exercise worth the effort. At this stage, however, our problem is the very specific nature of the GNS nomenclature applied by the GATS system, which gives us little opportunity to relate them, for example, to sectoral data on economic performance, general exposure to international trade, etc. One attempt, to apply the same methodology to higher aggregate NACE 2-digit service industries only produced modest results. The sectoral classification turned out to be very sensitive to the level of disaggregation as too much information got lost in making the correspondence from 155 GNS industries to 59 NACE 2-digit sectors. The resulting taxonomy by NACE 2-digit industries is represented in the Annex.

So the major future challenge in applying the new classification is to arrive at performance data that can be linked to the GNS industry nomenclature. To give an example, we have done so by applying Austrian sectoral sales data derived from the Austrian value-added tax statistic. This statistical source provides data on sales at the very detailed NACE 3-digit level which gives us the major advantage of a closer correspondence to the GATS GNS classification of service industries to which the sales data is transformed.

To test for the discriminatory power of the new classifications in terms of the average growth in turnover between 1995 and 2004, we ran ANOVA regressions analogous to those reported before, but displayed with more details in Table 3. To begin with the

general classification, Cluster 6, which is characterised by rather strongly regulated international regimes with little or no commitments to bind existing regulations, serves as the comparison group. Relative to that group, Clusters 3 and 5, which both represent an intermediate profile (with characteristic differences in Mode 3, however) perform significantly better. The really outstanding group is Cluster 1, comprised of industries with very liberal market access and little or no discrimination in terms of national origin, the growth performance of which is by far superior to all the other groups.

We observe similar patterns when we condition the annual growth of turnover on the specific taxonomies for each mode, instead of the general classification. Relative to the comparison group of industries with "no commitment and high discrimination" those with a "low coverage" by the GATS system show no significant differences. Conversely, sector classes with an intermediate or liberal profile tend to perform significantly better. If we further rank the groups in terms of the size of their coefficient, it is always the one with the most liberal/non-discriminating trade regime that is on top. The patterns are very similar across the different modes, even though the growth rates are conditioned on distinct classifications that were produced in separate processes. The only exception is the classification on Mode 3, where the discriminatory power in terms of the rates of turnover growth is generally lower, but the results are still very clear for the one group with "full commitment and no discrimination".

Table 3: ANOVA Regression on Annual Growth of Turnover (Austria, 1995 – 2004)

GNS Sector Clusters	Coeff.	t	P>t	
<i>General Classification (F-value: 12.49; R² = 0.323)</i>				
Constant	0.0218	0.74	0.463	
Cluster 1: Very liberal market access and no discrimination	0.2569	6.61	0.000	***
Cluster 2: Liberal market access and little discrimination	0.0473	1.27	0.207	
Cluster 3: Intermediate with open market access in Mode 3	0.0776	1.88	0.063	*
Cluster 4: Low overall coverage	0.0446	1.23	0.220	
Cluster 5: Intermediate, but mostly unbound on Mode 3	0.1301	2.32	0.022	**
Cluster 6: Strongly regulated (partial commitments on Mode 3) c.g.				
<i>Mode 1 classification (F-value: 19.79; R² = 0.375)</i>				
Constant	0.0190	0.59	0.557	
Low coverage	0.0475	1.29	0.201	
Intermediate	0.0737	2.04	0.044	**
Full commitment/ no discrimination	0.1208	2.55	0.012	**
Partial commitment/ no discrimination	0.3477	7.64	0.000	***
No commitment / discrimination	c.g.			
<i>Mode 2 classification (F-value: 14.89; R² = 0.311)</i>				
Constant	0.0109	0.35	0.731	
Low coverage	0.0533	1.39	0.166	
Intermediate	0.0962	2.53	0.012	**
Full commitment / no discrimination	0.0837	2.17	0.031	**
Full commitment (+) / no discrimination (+)	0.2985	6.87	0.000	***
No commitment / discrimination	c.g.			
<i>Mode 3 classification (F-value: 10.98; R² = 0.250)</i>				
Constant	0.0361	1.16	0.247	
Low coverage	0.0318	0.85	0.397	
No commitment / discriminating	0.0554	1.28	0.204	
Full commitment / Intermediate discrimination	0.0567	1.48	0.141	
Full commitment (+)/ No discrimination	0.2260	5.54	0.000	***
Partial commitment	c.g.			
<i>Mode 4 classification (F-value: 13.24; R² = 0.286)</i>				
Constant	0.0006	0.02	0.985	
Low coverage	0.0685	1.82	0.071	*
Intermediate	0.1114	2.15	0.034	**
Intermediate	0.0903	2.37	0.019	**
Full commitment / Intermediate discrimination	0.2556	6.34	0.000	***
No commitment / Intermediate discrimination	c.g.			

Note: * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

6. Summary and Conclusions

The services sector not only is the largest and most important sector in developed economies, but in producing intermediate inputs for many sectors it influences the productivity, competitiveness and performance of large parts of the economy. Trade liberalisation and deregulation in the service sector is seen as one of the most important driving forces for the efficiency and productivity performance of the sector as well as the economy as a whole. Amongst all the possible factors influencing the results of empirical studies into the gains from services trade liberalisation, the estimation of actual services restrictions represents one of the most critical areas (*Dihel, 2003A*). The difficulties arise not only from the qualitative nature of most of the barriers to services trade but also from the large diversity of policy measures potentially affecting trade in services. As a consequence relatively little empirical work, measuring restrictions on services and their economic impacts is available. This paper adds to this literature, by applying statistical cluster analysis to data on trade-related measures for individual services and modes of delivery derived from the GATS Individual Country Schedules. Employing this methodology, we are able to transform a large and extremely multifaceted data profile into a few categories with significant and economically meaningful discriminations between industries. In this process, we derive a new taxonomy of industries comprising six different categories with each reflecting a different degree of openness to services trade as reflected by the willingness of countries to submit full or partial commitments under the GATS.

In applying the new classification to Austrian sales data running ANOVA regressions on the growth of sectoral turnover in Austria between 1995 and 2002, we find a generally superior growth performance in those service sectors that are characterised by liberal market access and non-discrimination. While this positive association of growth and liberal trade regimes is fully consistent with the economic rationales driving the process of trade liberalisation, one must be very careful, at this stage of the analysis, about causal inferences. For example, the above results arise at least in part from the extraordinary growth performance of the business services, especially those related to the new information and communication technologies

(ICT), which also happen to be characterised by liberal trade regimes. Whether their success is primarily a story about an emerging new technology or of liberal trade can be disputed. However, there should be no doubt that open and non-discriminating market access is a decisive force to foster the benefits from emerging new technology and related services.

7. Literature

- Adlung, R., Roy, M., "Turning Hills into Mountains? Current Commitments under the GATS and Prospects for Change", WTO Staff Working Paper, 2005, (ERSD-2005-01), http://www.wto.org/english/res_e/reser_e/ersd200501_e.doc.
- Anderberg, M. R., Cluster Analysis for Applications, Academic Press, New York, 1973.
- Breuss, F., Reale Außenwirtschaft und Europäische Integration, Peter Lang, Europäischer Verlag der Wissenschaften, Frankfurt am Main, 2003.
- Breuss, F., "WTO Dispute Settlement: An Economic Analysis of Four EU-US Mini Trade Wars, A Survey", Journal of Industry, Competition and Trade, Bank Papers, 2004, 4(4), pp. 275-315.
- Chen, Z., Schembri, L., Measuring the Barriers to Trade in Services: Literature and Methodologies, Department of Foreign Affairs and International Trade, Canada, 2002.
- Dihel, N. (2003A), "Quantifying Costs to National Welfare from Barriers to Trade in Services: A Review of the Literature.", Chapter 5 in Organisation for Economic Co-operation and Development (OECD), Quantifying the Benefits of Liberalising Trade in Services, Paris, 2003.
- Dihel, N. (2003B), "Quantification of the Costs to National Welfare of Barriers to Trade in Services: Scoping Paper.", Chapter 6 in Organisation for Economic Co-operation and Development (OECD), Quantifying the Benefits of Liberalising Trade in Services, Paris, 2003.
- Dihel, N., Kalinova, B., "Services Barriers and their Economic Impact: Examples of Banking and Telecommunications Services in Selected Transition Economies", OECD Trade Directorate, OECD Trade Policy Working Paper, 2004, (7).
- European Communities, GATS 2000: Öffnung der Dienstleistungsmärkte, Luxemburg, 1998.
- Europäische Kommission, Grünbuch zu Dienstleistungen von Allgemeininteresse, KOM(2003) 270 endgültig, Brüssel, 2003.
- Europäische Kommission, Weißbuch zu Dienstleistungen von Allgemeininteresse, KOM(2004) 374, Brüssel, 2004.
- European Commission, IMF, OECD, UN UNCTAD, WTO, "Manual on Statistics of International Trade in Services", UN Statistical Papers, Series, 2002, (M86), http://www.wto.org/english/res_e/statis_e/its_manual_e.pdf.
- Findlay, C., Warren, T. (eds.), Impediments to Trade in Services: Measurement and Policy Implications, Routledge, London and New York, 2000.
- Gordon, A. D., Classification, 2nd ed., Chapman & Hall, Boca Raton, 1999.
- Hardin, A., Holmes, L., Services Trade and Foreign Direct Investment, Industry Commission Staff Research Paper, AGPS, Canberra, 1997.

- Hoekman, B., "Assessing the General Agreement on Trade in Services", in Martin, W., Winters, L. A. (Hrsg.), "The Uruguay Round and the Developing Economies", The World Bank, Discussion Papers, 1995, (307).
- Hoekman, B., Braga, P., "Protection and Trade in Services: A Survey", The World Bank, Policy Research Working Paper, 1997, (1747).
- Hoekman, B., Sauv e, P., "Liberalizing Trade in Services", The World Bank, Discussion Papers, 1994, (243).
- Karsenty, G., Just How Big are the Stakes? An Assessment of Trade in Services by Mode of Supply, Statistics Division, World Trade Organization, Genf, 1999.
- Kaufmann, L., Rousseeuw, P. J., Finding Groups in Data. An Introduction to Cluster Analysis, Wiley, New York, 1990.
- Kox, H., Lejour, A., "A Different Approach to WTO Negotiations in Services", CPB Discussion Paper, 2004, (36).
- Krancke, J., "Liberalisierung des Dienstleistungshandels: Die Konturen de GATS", Die Weltwirtschaft, 1998, (4), pp. 404-420.
- Kronberger, R., Wolfmayr, Y., "Liberalisierung des Dienstleistungshandels im Rahmen des GATS", WIFO-Monatsberichte, 78(6), 2005, pp. 443-402.
- Langhammer, R. J., "Das GATS: Noch kein Liberalisierungsmotor f ur den internationalen Dienstleistungshandel", Die Weltwirtschaft, 2003, 54(2), pp. 166-179.
- Mattoo, A., Wunsch, S., Securing Openness of Cross-Border Trade in Services: A Possible Approach, Center for International Development at Harvard University, 2004, www.cid.harvard.edu/cidtrade/Papers/mattoo-wunsch.pdf.
- McGuire, G., "Methodologies for Measuring Restrictions on Trade in Services.", Chapter 2 in Organisation for Economic Co-operation and Development (OECD), Quantifying the Benefits of Liberalising Trade in Services, Paris, 2003.
- OECD, "Service Providers on the Move: A Closer Look at Labour Mobility and the GATS", Working Party of the Trade Committee Working Paper, 2001, (TD/TC/WP(2001)26/Final).
- OECD, GATS: Pl doyer f ur offene Dienstleistungsm rkte, Paris, 2002.
- OECD, (2003A), "Barriers to trade in services in South Eastern European (SEE) Countries – How much do they matter?", OECD Forum on trade in services in South Eastern Europe, Centre for co-operation with non-members, Trade Directorate Working Paper, 2003, (CCNM/TD/SEE(2003)/FINAL).
- OECD, (2003B), "Services Liberalisation: Identifying Opportunities and Gains. Part 2: Modelling the Economic Benefits of Services Trade Liberalisation", Trade Directorate, 2003, (TD/TC/WP(2003)23/PART2).
- Peneder, M., Entrepreneurial Competition and Industrial Location, Edward Elgar, Cheltenham, UK, 2001.

Peneder, M., "Industry Classifications. Aim, Scope and Techniques", *Journal of Industry, Competition and Trade*, 2003, 3(1-2), pp. 109-129.

Peneder, M., "Creating Industry Classifications by Statistical Cluster Analysis", *Estudios de Economica Aplicada*, 2005, 23(2), pp. 451-463.

Walmsley, T. L., Winters, L. A., "Relaxing the Restrictions on the Temporary Movement of Natural Persons: A Simulation Analysis", *CEPR Discussion Paper*, 2003, (3719).

WTO, *Structure of Commitments for Modes 1, 2, and 3*, Background Note by the Secretariat, S/C/W/99, March 3, 1999.

WTO, *Dispute Settlement: The Disputes Chronologically*, Genf, 2005, http://www.wto.org/english/tratop_e/dispu_e/dispu_status_e.htm.

Annex: A Tentative Taxonomy by NACE 2-digit Industries

For the purpose of better international comparability, we also tried the analogous clustering process on 59 industries classified according to the European NACE nomenclature. The results are displayed in Table A.1. Despite of applying precisely the same methods and steps of analysis, the resulting patterns are relatively blurred and more difficult to interpret than in the previous case. The most likely reason is the loss of precision through the necessary aggregation of the original information linked to detailed GNS codes into the fewer number of NACE industries. This outcome once more teaches us about a general lesson in constructing industry classifications: The identification of distinct sectoral regimes becomes the more meaningful and robust, the more narrowly defined the industries are. Applying statistical cluster analysis to the GNS codes, this study has greatly benefited from the very detailed breakdown of services within the GATS system of records. In this paper we therefore focus on the results that were derived from the GNS industry classification.

Table A1: The NACE Sector Classification of GATS Commitments

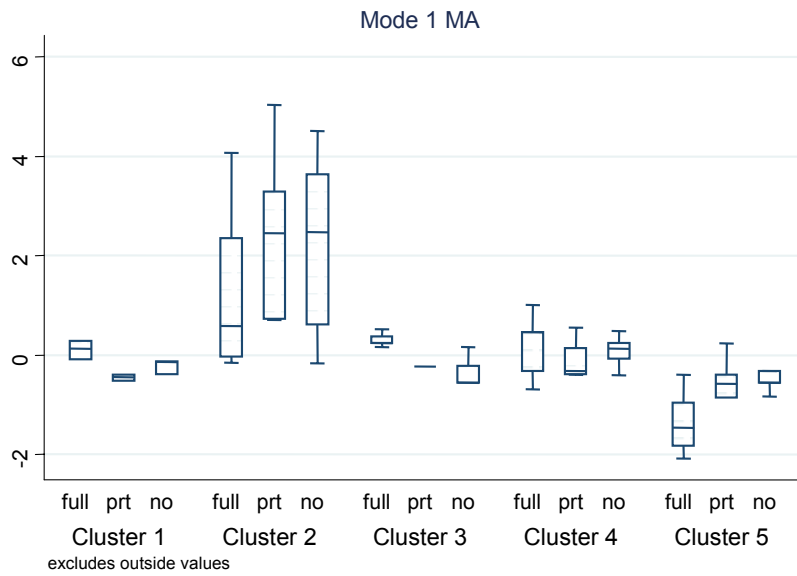
Cluster	NACE		Mode 1	Mode 2	Mode 3	Mode 4
Intermediate degree of commitments						
Cluster 1	22	Publishing, printing, recorded media	med	med	med	lco
Cluster 1	71	Renting of machinery and equipment	med	med	med	lco
Cluster 1	73	Research and development	med	med	med	med
Heterogenous group, missing a common interpretable pattern						
Cluster 2	55	Hotels and Restaurants	reg/dsc	lib/ndc	bnd	bnd
Cluster 2	64	Post and telecommunications	med	lib/ndc	med	med
Cluster 2	65	Financial intermediation	reg/dsc	reg/dsc	bnd	bnd
Cluster 2	66	Insurance and pension funding	reg/dsc	reg/dsc	bnd	bnd
Cluster 2	67	Auxiliary financial intermediation	reg/dsc	reg/dsc	bnd	bnd
Cluster 2	72	Computer and related services	med	lib/ndc	med	med
Intermediate degree of commitments						
Cluster 3	15	Food products and beverages	med	med	med	med
Cluster 3	16	Manufacture of tobacco products	med	med	med	med
Cluster 3	17	Manufacture of textiles	med	med	med	med
Cluster 3	18	Wearing apparel; dressing and dyeing of fur	med	med	med	med
Cluster 3	19	Lather and footwear	med	med	med	med
Cluster 3	20	Wood and products of	med	med	med	med
Cluster 3	21	Manufacture of pulp, paper and paper products	med	med	med	med
Cluster 3	23	Coke, petroleum products and nuclear fuel	med	med	med	med
Cluster 3	24	Manufacture of chemical and chemical products	med	med	med	med
Cluster 3	25	Manufacture of rubber and plastic products	med	med	med	med
Cluster 3	26	Manufacture of other non-metallic mineral products	med	med	med	med
Cluster 3	27	Manufacture of basic metals	med	med	med	med
Cluster 3	28	Fabricated metal products	med	med	med	med
Cluster 3	29	Manufacture of machinery and equipment n. e. c.	med	med	med	med
Cluster 3	30	Office machinery and computers	med	med	med	med
Cluster 3	31	Electrical machinery & apparatus	med	med	med	med
Cluster 3	32	Audiovisual apparatus	med	med	med	med
Cluster 3	33	Medical, precision and optical instruments	med	med	med	med
Cluster 3	36	Manufacture of furniture; manufacturing n. e. c.	med	med	med	med
Cluster 3	37	Recycling	med	med	med	med
Cluster 3	51	Wholesale trade	med	med	med	med
Cluster 3	52	Retail trade	med	med	med	med
Intermediate, but mostly unbound on Mode3						
Cluster 4	01	Agriculture, hunting and related service activities	med	med	reg/dsc	med
Cluster 4	02	Forestry, logging and related service activities	med	med	reg/dsc	med
Cluster 4	05	Fishing and related service activities	med	med	reg/dsc	med
Cluster 4	10	Mining of coal and lignite; extraction of peat	med	med	reg/dsc	med
Cluster 4	11	Extraction of crude petroleum and natural gas	med	med	reg/dsc	med
Cluster 4	12	Service activities incidental to oil and gas extraction	med	med	reg/dsc	med
Cluster 4	13	Mining of metal ores	med	med	reg/dsc	med
Cluster 4	14	Other mining and quarrying	med	med	reg/dsc	med
Cluster 4	34	Motor vehicles	med	med	reg/dsc	med
Cluster 4	45	Construction	med	med	med	med
Cluster 4	50	Sale and repair of motor vehicles; retail sale of automotive fuel	med	med	reg/dsc	med
Cluster 4	63	Auxiliary transport; travel agencies	med	med	med	med
Cluster 4	74	Other business activities	med	med	med	med
Cluster 4	80	Education	med	med	reg/dsc	med
Cluster 4	90	Sewage and refuse disposal, sanitation and similar activities	med	med	med	med

Strongly regulated (with partial commitments on Mode 3)

Cluster 5	35	Other transport equipment	reg/lco	med	reg/dsc	lco
Cluster 5	40	Electricity, gas, steam and hot water supply	reg/lco	lco	reg/dsc	lco
Cluster 5	41	Collection, purification and distribution of water	reg/lco	lco	reg/dsc	lco
Cluster 5	60	Land transport; transport via pipelines	reg/lco	lco	reg/dsc	lco
Cluster 5	61	Water transport	reg/lco	lco	reg/dsc	lco
Cluster 5	62	Air transport	reg/lco	lco	reg/dsc	lco
Cluster 5	70	Real estate activities	reg/lco	med	reg/dsc	lco
Cluster 5	85	Health and social work	med	med	reg/dsc	med
Cluster 5	91	Activities of membership organizations n. e. c.	reg/lco	lco	reg/dsc	lco
Cluster 5	92	Recreational, cultural and sporting activities	med	lco	reg/dsc	lco
Cluster 5	93	Other service activities	reg/lco	lco	reg/dsc	lco
Cluster 5	95	Private households with employed persons	reg/lco	lco	reg/dsc	lco

Figure A1: Box Plots of Distribution over NACE Sectors for Mode 1

(a) Market Access



(b) National Treatment

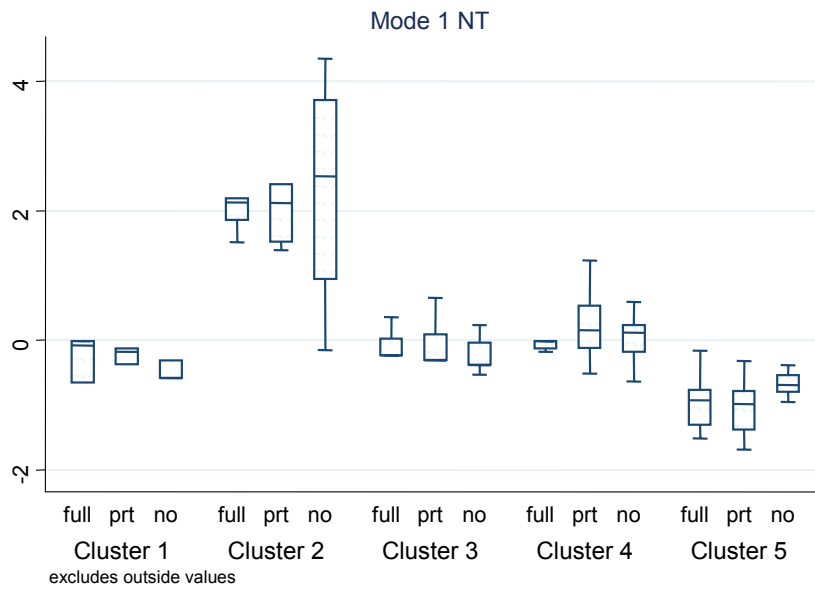
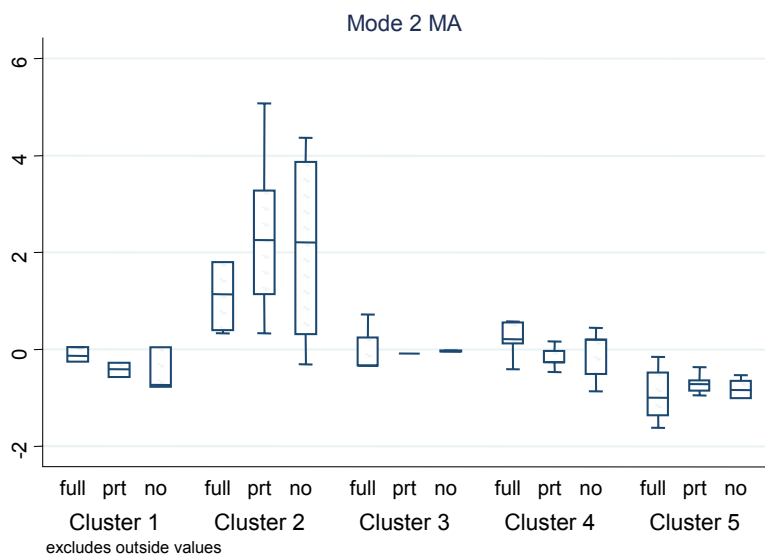


Figure A2: Box Plots of Distribution over NACE Sectors for Mode 2

(a) Market Access



(b) National Treatment

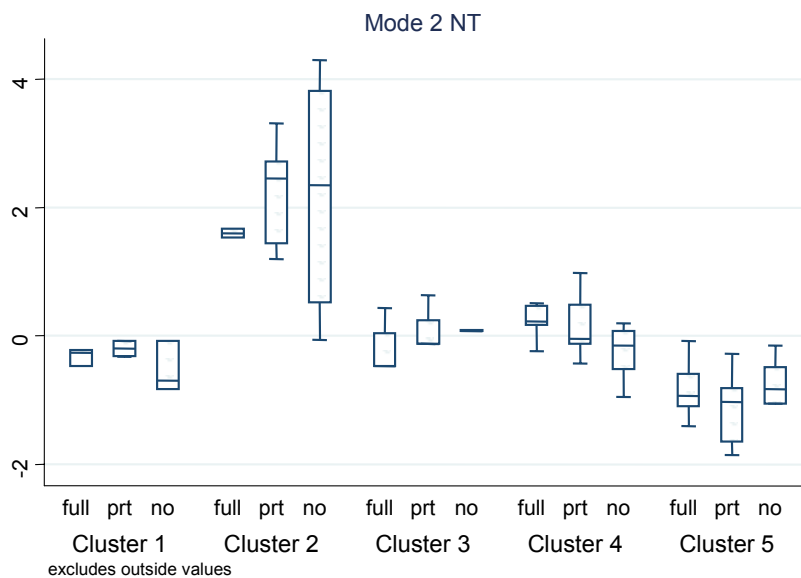
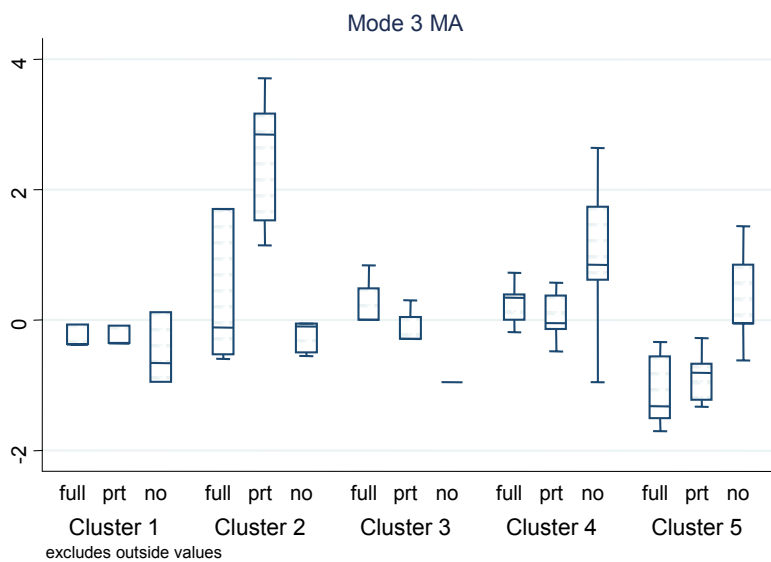


Figure A3: Box Plots of Distribution over NACE Sectors for Mode 3

(a) Market Access



(b) National Treatment

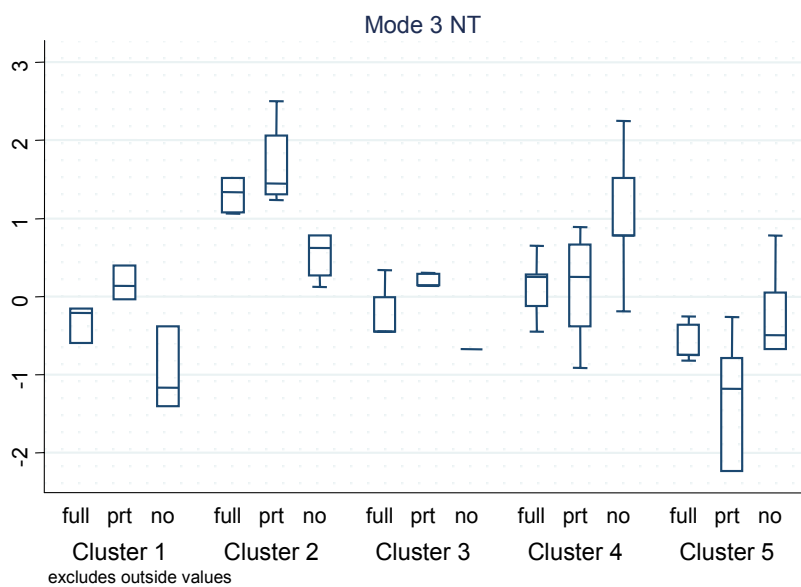
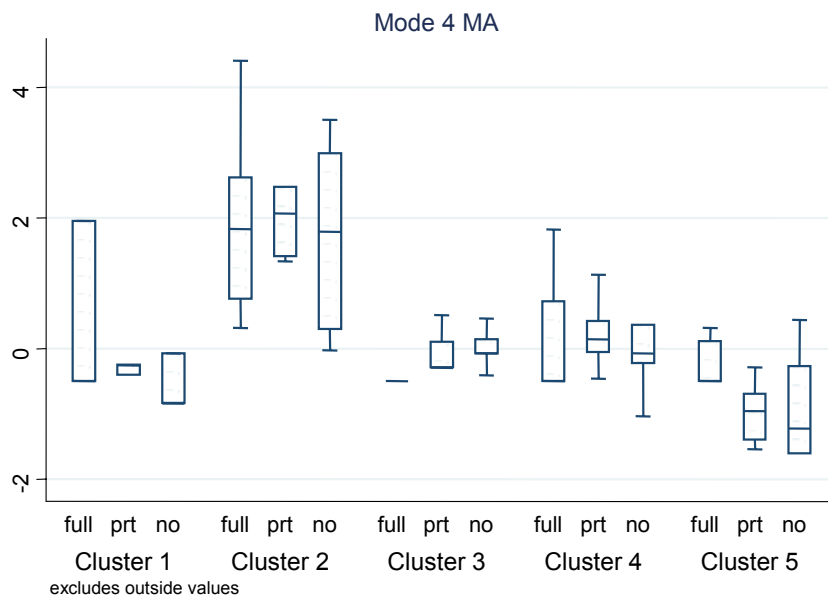


Figure A4: Box Plots of Distribution over NACE Sectors for Mode 4

(a) Market Access



(b) National Treatment

