Liberalizing global trade in Mode 5 services: how much is worth?

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Abstract

As indicated in a series of recent papers, the growing role of embedded services in manufacturing exports ("services in boxes") led to a proposal for a new modality of exporting services (mode 5 services), beyond the four modes of supply envisaged in GATS. For the vast majority of WTO members, the significance of mode 5 services is considerable, both in exports and imports. Furthermore, mode 5 services activities are a main driving factor in the trade-jobs nexus, particularly in the new services areas poised to play a greater role as a result of technological progress. However, unlike traditional GATS services trade, mode 5 services "in boxes" pay tariffs. Against this background, the current paper estimates the global gains that could be achieved from liberalizing mode 5 services at multilateral level. Using the latest data available on the share of embedded services in goods exports, the paper uses a CGE model to simulate a global mode 5 liberalization scenario. The paper also tries to capture the interplay between mode 5 services trade and the growing importance of future technological developments (software, digitalisation, Internet of Things, etc).

Our preliminary set of results show the relevance to deal with Mode 5 in trade agreements not just because of its positive impact on global trade flows but also for the growing content of domestic services in goods exports. In our scenarios, global trade increase for all countries and, at the same time, the domestic share of services embodied in goods increase. The economic impact of a mode 5 multilateral initiative is considerable and can build a platform for a more inclusive set of trade rules for both developed and developing countries interested in promoting synergies between international trade rules and technical progress. For the latter, Mode 5 is a strong opportunity for economic growth since it is a driver for pushing investments in human capital.

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1. Mode 5 services: definition and importance

Services inputs (engineering, design, banking, software, logistics) play an increasingly important role in global manufacturing as a direct contributor to the value-added incorporated in manufacturing products. As indicated in a series of papers (see Cernat and Kutlina-Dimitrova 2014, Cernat and Mavroidis (2014), Cernat and Sousa (2015)), embedded services in manufacturing exports has become an important feature of the global economy. Spurred by global supply chains and technological progress, the role of services inputs as part of manufacturing exports has increased considerably in recent years, notably for a number of industrial sectors such as motor vehicles, electronics, but also many other more traditional sectors such as processed food and textiles. The WTO-TiVA database shows that between 1995 and 2009, for instance, the share of embedded services as a percentage of total manufactured exports has witnessed double digit growth, with diverse set of countries such as Finland, United States, Turkey, Poland, China witnessing the largest increases in their share of embedded services. For large majority of countries the share of embedded services ranges around one third of the total value of their manufactured exports, with many OECD countries such as France, Germany, Belgium, Italy, Spain having among the highest absolute shares of embedded services in their manufactured exports in 2009.

Several authors suggested that service inputs affect firms' export capabilities positively and that buying-in more services is linked to higher export intensity for firms in some industries (Lodefalk 2014) as well as to total factor productivity growth especially in the high-skilled intensive industries (Wolfmayr 2008).

The importance of this trend has also triggered attention among international trade policy-makers, leading to a proposal for a new modality of exporting services, beyond the four traditional modes of supply envisaged in the WTO General Agreement on Trade in Services (GATS) and adopted widely also as part of hundreds of bilateral free trade agreements (FTAs).[2]

In line with the existing GATS terminology, this new mode of supply was labelled "mode 5 services". Mode 5 services can be simply defined as the services content embodied in goods exports. Typical mode 5 services include, *inter alia*, design, engineering and software that are incorporated and traded as part of manufactured products. For the vast majority of WTO members, the significance of mode 5 services is considerable, ranging from 27.5% to 41%. Mode 5 services represent not only a growing share of global trade in goods but also an important economic activity that support tens of millions of jobs worldwide. For instance, Cernat and Sousa (2016) estimated that over 8 million jobs in Europe (1 out of 4 jobs supported by trade) are actually mode 5 services jobs.

The coverage of mode 5 services, as used and further modelled in this paper, reflects production services which are embodied i.e. an inseparable part of the production process of a manufacturing good. As an example, in order to produce a car there is a need for engineering, consulting and design services as well as electricity and logistics services in order to operate the car factory and to purchase necessary inputs. Consequently, services covered under mode 5 represent a subset of '*servicification*' i.e. those services which form part of the value of the good *before* it is exported. In a nutshell, mode 5 services exports are intermediate services inputs that

[2] For a definition of four GATS modes of supply see for instance https://www.wto.org/english/tratop_e/serv_e/cbt_course_e/c1s3p1_e.htm

are incorporated in one country's merchandise exports. Mode 5 services do not include services that can be sold separately and are not part of the production process, e.g. distribution services, after-sales, maintenance, etc. This distinction is important to avoid the overlap with the traditional GATS modes, since Such services can be supplied internationally through other modes (e.g. mode 1, 2, 3 and 4) and hereby clearly distinguishable from the mode 5 services concept.

Another simple rule of thumb to think about mode 5 services is through the lens of the GATT rules that are currently applicable to embedded services in merchandise trade: if the value-added of a service element is included in the value of a product that would be subject to customs duties, then that service can be considered mode 5 service.[3]

2. Technological progress and the growing importance of mode 5

Several mode 5 services such as product design, R&D, engineering and IT services are high-value added and intrinsically linked to technology. Their importance for securing competitive advantages in manufacturing trade and especially in the context of global production networks is indisputable not just for advanced manufacturing but also for more traditional products, including primary sectors like agriculture or mining and processed food.

The importance of mode 5 services is paramount in the automotive sector. The car industry has been at the forefront of the global supply chain revolution, and this was noticed by policy makers early one. One clear illustration is offered by Robert Reich, a former US Labour Secretary, with his Pontiac example:

> When an American buys a Pontiac Le Mans from General Motors, for example, he or she engages unwittingly in an international transaction. Of the $20,000 paid to GM, about $6,000 goes to South Korea for routine labor and assembly operations, $3,500 to Japan for advanced components (engines, transaxles, and electronics), $1,500 to West Germany for styling and design engineering, $8,000 to Taiwan, Singapore and Japan for small components, $500 to Britain for advertising and marketing services, and about $100 to Ireland and Barbados for data processing. (Reich 1991: 113)

While disentangling the value of mode 5 services embodied in the GM Pontiac Le Mans is not straightforward, it was clearly much lower than in today's cars. Both statistical data and anecdotal evidence points to the growing share of mode 5 services (notably software) in today's cars. In 2010, the Chevy Volt model (another GM brand) was dubbed as one of the most software-intensive manufactured product on earth, with 10 million of lines of software codes and the value of its software and electronic components amounting to around 40% of the total value of the car, compared to some 5% in 1980s (CBS, 2010). Everything from the usage of the electric battery to engine controls, powertrain and motion sensors, plus plenty of other features in the Volt all depended on software. Nowadays, just a few years later, Volt is part of a long history of automotive progress. The headlines are made by Tesla, a new comer in the automotive industry, which has just surpassed Ford and GM in April and became the most valuable US automaker, despite having a tiny market share in the US market compared to other direct

[3] As mentioned, this is a simple, conceptual rule of thumb since in reality the specific customs valuation rules and dutiable treatment of products is more complex, as the discussion in subsequent sections will show.

competitors. Industry analysts claim that one of he secrets for Tesla's ascent lies in the value of its software and the synergies the company build between traditional automotive engineering and the new embedded software-driven technological developments (Sparks, 2015). Tesla makes many components of its cars, from batteries to self-driving software, in house. Its roots in Silicon Valley led business analysts and the Wall Street to believe that the Tesla software will give its upper hand against traditional companies. Software will have an even more critical role if (or rather when) self-driving cars will become a reality.

But mode 5 services do not make headlines just in the automotive industry. Take Caterpillar and the Internet of Things (IoT), for instance. In the case of Caterpillar, it's actually the internet of big, yellow things. Running earth-moving machines in remote, hard duty environments is costly if such equipment breakdowns often and in unpredictable ways, making the repair process long and difficult. By introducing remote sensors and IoT technology in its machines and by applying predictive software analytics, Caterpillar has managed to reduce the typical cost of 900 hours of downtime and $650,000 in repair costs to less than 24 hours and only $12,000.

Just like mining, traditional agriculture is also set to increase its mode 5 services content, notably in terms of digital technologies. Galicia is famous, among other things, for its high quality Rias Baixas white Albariño wines. A new "smart viticulture" project used sensors to measure temperature, ambient humidity, soil moisture and leaf wetness, in real time. This "internet of wine" project launched in 2012 has quickly proved to be a success. The region's wine growers were able to reduce phytosanitary treatments such as fertilizers and fungicides by more than 20 percent, and improve growing productivity by 15 percent, a welcome outcome on both counts. It has made the wineries more profitable, but also more eco-friendly (Martinez, 2014).

3. The economic impact of a multilateral initiative on mode 5: CGE estimates

3.1 Model and scenario

To evaluate the possible impact of a multilateral agreement on Mode 5 liberalization, Computable General Equilibrium models are suited tools.

The CGE framework builds on general equilibrium theory and rests on consistent microeconomic foundations in which intersectoral linkages, resource constraints and policy distortions are the main focus. The main advantages of the CGE approach are its solid micro-theoretical underpinning and its economy-wide scope, as well as its complete and consistent coverage of all bilateral trade flows. Furthermore, changes in welfare can be traced back to the different sectors by performing a welfare decomposition exercise to identify what is generating the gains and losses. Hence a CGE model is an appropriate tool when the policy changes being analysed simultaneously affect many countries and many sectors and have effects on terms-of-trade, factor prices and income.

GTAP is a perfectly competitive comparative static general equilibrium computable framework (Hertel,1997). The structure of demand and supply, which is homogeneous across regions and products, is built upon the Social Accounting Matrices of individual

countries and regions, while parameters are mostly drawn from the literature and calibrated on the reference database period.

The model assumes the presence of representative consumers and producers together with a government sector, and all incomes are assumed to accrue to a single "regional" household. Therefore, all distributional aspects are overlooked, and all consumers are assumed to purchase all goods. By the same token, government costs and revenues do not need to balance, as it is assumed that any discrepancy accrues directly to the households (i.e. the single "regional" household). Government's consumption behaviour is endogenous, while policies are exogenous (Hertel, 1997).

Substitutability among primary factors and with intermediate consumption is modelled through a set of nested Constant Elasticity of Substitution systems, while the production of final goods is aggregated through a fixed coefficient function of the Leontief type. On the demand side the representative agent allocates his income among savings, government and private consumption through a Cobb-Douglas utility function, while allocation within different private goods is modelled through a Constant Difference of Elasticity demand system. Bilateral trade flows are modelled through product differentiation on the demand side, with the assumption of imperfect substitutability between similar goods produced in different countries and regions (Armington, 1969). Transaction costs are also accounted for in the model, as transport services are explicitly considered among the activities in the economy.

The most recent available database version – known as version 9.2 – includes data on up to a maximum of 141 regions and countries, 57 industries and 8 endowments, and is referred to 2011 as a base period. In general, there are two groups of data which are of particular relevance for global models: those on border protection, and those on bilateral trade flows. The GTAP database is built from the COMTRADE data, supplied by the United Nations Statistical Office, through an ad hoc reconciliation procedure based on a reliability indicator of the information supplied by each importing and exporting country. Trade policy data are retrieved from the MacMaps database (http://www.macmap.org/), while data on domestic support in agriculture is based on the OECD Producer Support Estimates (PSE). Export subsidies are directly derived from countries' notifications to the WTO.

Baseline is built by shocking macro variables, GDP, population and labour supply, from 2011 till 2025 and introducing all the policy changes that could be relevant for the purpose of the analysis, like FTAs agreements, the Russian BAN, etc.

Geographical and sectoral aggregation is showed in the following table,

Geographical and sectoral aggregation		
Countries/regions	*Sectors*	*Factors*
EU28	Raw milk	Land
EU neighbours	Primary	Natural resources
EFTA	Fishing	Capital
Turkey	Forestry	Skilled labour
Russia	Processed Food	Unskilled labour
Australia	Other food	Agriculture labour
New Zealand	Textile	
USA	Wood Paper	
Canada	Energy	
Brasil	Chemicals	
Mexico	Electronic Equipment	
Rest South America	Metals	
China	Ferrous metal	
India	Motorvehicles	
Japan	Other manufactures	
Korea	Transport	
ASEAN	Communication	
LDC	Trade	
Rest of World	Finance	
	Business	
	Construction	
	Other Services	
	Public Services	

Due the relevance of capital in the production of services, for the specific purpose of this wok we have used the GTAP-Dyn model. This model extends the comparative static framework of the standard GTAP model developed by Hertel (1997) to the dynamic framework by incorporating international capital mobility and capital accumulation. The dynamic GTAP model allows international capital mobility and capital accumulation, while it preserves all the features of the standard GTAP, such as constant returns to production technology, perfectly competitive markets, and product differentiation by countries of origin, in keeping with the so-called Armington assumption. At the same time, it enhances the investment theory by incorporating international capital mobility and ownership. In this way it captures important FTA effects on investment and wealth that are missed by a static model (Ianchovichina and McDougall, 2000). In the dynamic GTAP model, each of the regions is endowed with fixed physical capital stock owned by domestic firms. The physical capital is accumulated over time with new investment. This dynamics are driven by net investment, which is sourced from regional households' savings. The savings in one region are invested directly in domestic firms and indirectly in foreign firms, which are in turn reinvested in all regions. The dynamics arising from positive savings in one region is related to the dynamics from the net investment in other regions. Overall, at the global level, it must hold that all the savings across regions are completely invested in home and overseas markets. To sum up, dynamics of investment and capital accumulation and also for saving and wealth accumulation are key features distinguishing GTAP-Dyn from the static version of model.

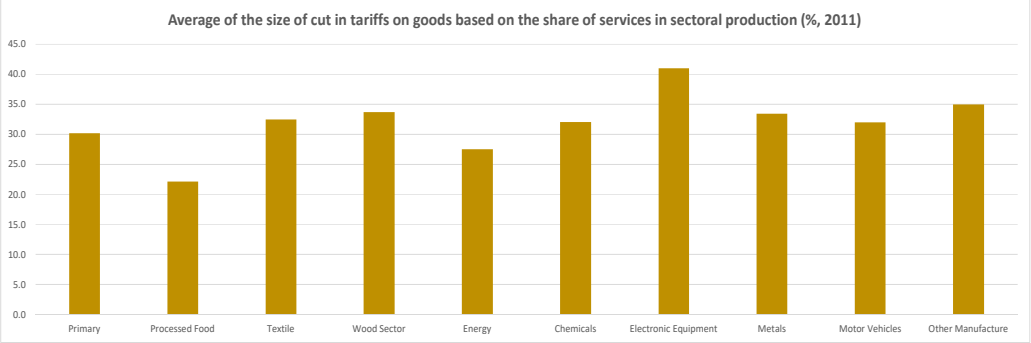
With respect to the standard framework, we introduced an option to include endogenous labour productivity following the idea that wages and productivity are correlated

(Hellwig and Irmen, 2001; Ciuriak and Xiao, 2016). Further, we depart from the standard framework of GTAP model introducing a positive value for the elasticity of substitution among intermediates, which is usually set to 0 (Hertel, 1997), starting from the assumption used in the Mirage model (http://www.cepii.fr/anglaisgraph/models/mirage.htm).

3.2. Scenario

Between 2020 and 2025 the multilateral agreement on Mode 5 liberalization is introduced. To design the scenarios we first computed the services input shares in manufacturing goods. We refer to the services content, i.e. the amount of valued of services embodied in a "physical" good which could be exempted of paying tariffs. Then, starting from the GTAP database, we calculated for each sector the share of services used as intermediates which turns to be the "size" of the tariff reduction. In other word, if a good is taxed at the border by "*% ad valorem tariffs*", a cut by each "*% share*" of the services content is applied. Since we are simulating a multilateral agreement, these cuts are gained for each country, according to their services shares, on their export to all countries.

It turns that the size of cuts is, on world average,



We assume that a cut in tariffs, linked to the content of services, should increase the services trade among countries by improving common standards, i.e. reducing non tariffs barriers. However, for services, trade barriers are not explicit. Yet many of these trade costs are not explicitly in the data base too. Following Hertel et al. (2001) we use the technical coefficient AMS as proxy of such unobserved trade costs, which is equal to one in initial equilibrium. Changes in its value capture the impact of non-tariff measures on the price of imports from a particular exporter. Thus an increase in AMS ensures a fall in the effective domestic price of good i exported from country A to country 'B.

4. Thinking ahead

This analysis leaves little doubt that mode 5 has become an important part of cross-border exchanges of services. From a trade policy perspective this leads to a paradox: when traded 'in boxes', as part of products, mode 5 services pay duties and are subject to a different set of non-tariff trade barriers compared to the same services when traded under GATS rules. However, this is a reality that has gone largely under the radar of rulemaking. Only a small subset of mode 5 services (e.g. design, engineering originating in the country of importation which was exported under GATS as an intermediate input and is reimported as part of a final good under GATT) is already covered by specific WTO rules (Article 8 of the WTO Customs Valuation Agreement) which offers them duty-free treatment under certain conditions. As a result most mode 5 services pay duties when crossing borders as part of goods, even though the same service could be delivered separately (e.g. via mode 1) and subsequently incorporated duty-free after importation into the final product. This is the case for example for software despite it being a key services input in nowadays increasingly digital economy.

One implication of this fact is that tariff cuts and regulatory cost reductions for manufactured products could have a direct positive impact on services exports. However, such benefits can be reaped only if current rules affecting mode 5 services are made more coherent and in line with global value chains. Products are designed in one country, software is produced in another, and assembly may be carried out in a different continent, with engineering and technological solutions belonging to firms registered in multiple countries. In this process mode 5 services are subject to both GATS and GATT-related rules that are not fully adapted to the way in which design, R&D, software, and other business services are embedded in goods traded internationally.

The outcome is that current trade rules are suboptimal: instead of facilitating services trade along global supply chains, they may stifle them. The best example that illustrates the inconsistencies of current trade rules when it comes to mode 5 services trade is the fact that the same service (e.g. software) can be traded internationally under GATS (e.g. under mode 1) without paying any customs duties, whereas if the software is embedded in a car or industrial equipment it will be subject to the duty rates applicable to that product.

Such inconsistencies could be addressed by refining the existing trade rules, either at the multilateral or bilateral level. For instance, WTO customs valuation rules allow already for duty-free preferential treatment of certain domestic 'mode 5' services exports (e.g. design, artwork, etc.) when re-imported as part of foreign products. However, mode 5 software services are not part of that list, probably since software did not really have an important role when the WTO Customs Valuation Agreement was drafted. This inconsistency may become more problematic as recent advances in 3D printing, robotics, and the Internet of Things will increase the software intensity and the R&D content of manufacturing, and thus increase the share and importance of 'mode 5' in world trade.

Trade rules are enshrined in international treaties set to last forever but the rest of the world is more dynamic. Both at multilateral and bilateral level, we need to ensure that trade rules will remain in line with technological changes and business realities. The mode 5 services example

provides a good opportunity to further reflect on how GATT and GATS rules operate when it comes to 21st century technology-intensive manufacturing sectors.

The obvious question is then how could we start to address this? For instance, could the existing WTO rules covering mode 5 be extended and included as part of various policy proposals (e.g. services trade facilitation, e-commerce, etc.) in the lead up to the 11th WTO Ministerial? Should mode 5 services feature specifically in plurilateral negotiations, like TISA? Alternatively, can a more ambitious set of coherent mode 5 rules be agreed in a bilateral context as part of deep and comprehensive FTAs?

The answer is less obvious though as it involves a number of important trade policy considerations, both at multilateral and bilateral level. However, the existing evidence clearly shows that mode 5 services have outgrown by far the narrow trade rules currently governing them.

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