Master Thesis U.S.E.

The Effect of the LDC Service Waiver on Service Exports of Landlocked LDCs

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June 30, 2023

Abstract

Because of their geographical remoteness, Landlocked Least Developed Countries (LLDCS) are facing significant challenges to participate in the GATS. With LLDCs categorized as the poorest countries globally, this underlines the need for support by the WTO. The operationalization of the LDC Service Waiver by the WTO in 2013 increased the opportunities for engagement in the GATS. This study empirically investigated whether the LDC Service waiver positively affected total service exports and outwards Mode 4 for LLDCs. The Synthetic Control Method and robustness checks with the Difference-in-Difference estimator on panel data have been executed. Insufficient support has been found for a positive effect of the LDC Service waiver on total service exports and outwards Mode 4 for LLDCs. This suggests that the institutional voids and low economies of scale are limiting the efficiency of the waiver and underline the need for additional support of the WTO. Future research is needed towards the long-term efficiency of the waiver, including sectorial analysis, in guidance for the extension after 2030.

Keywords: LDC Service Waiver; Landlocked Developing Countries; Synthetic Control Method

JEL-codes: C21, C23, F13, F14

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List of Abbreviations

Abbreviation	Definition
LDCs	Least Developed Countries
LLDCs	Landlocked Least Developing Countries
GVC	Global Value Chain
GATS	The General Agreement on Trade in Services
MC-8	The 8th Geneva Conference of the World Trade Organization
MC-9	The 9th Bali Conference of the World Trade Organization
TCs	Transit Neighbouring Countries
SCM	Synthetic Control Method
FE	Fixed Effects

1. Introduction

Due to their geographical remoteness, especially landlocked LDCs are dealing with significant difficulties in both their trade in goods and services. Landlocked Least Developed Countries (LLDCs instead of LLLDCs for simplicity) are facing difficulties towards their participation in the global trade in services, with limitations in infrastructure, access to finance and market access. Hence, these countries are dealing with a significant 'poverty trap' (Collier, 2007b). Furthermore, LLDCs are being categorized as the poorest economies globally. Thus, support is required from the WTO to foster economic growth. With two thirds of the global economy consisting of the trade in services (OECD, n.d.), the WTO needs to guide their poorest members towards the service economy; especially with the trend of premature deindustrialization in the last decades and less significance for manufacturing processes (Rodrik, 2016).

To provide support towards the least developed members of the WTO, the LDC service waiver has been implemented by the WTO at the 8th Ministerial Conference in 2011. Designed to increase the participation of the Least Developed Countries (LDC) members within the General Agreement of Trade in Services (GATS), with allowance for LDCs to deviate from the most-favoured-nation (MFN) principle (Carpio & Mir, 2014; Flentø & Ponte, 2017; WTO, n.d.-a). Before this implementation, the Most-Favoured-Nation (MFN) principle, established in 1995 with the creation of the WTO, did not allow for personal concession in the GATS (Dawar, 2015; Wang, 1996). The WTO further negotiated and reached consensus at the 9th Bali conference in 2013 (MC-9), when the waiver officially became operationalized (Flentø & Ponte, 2017; Rahman & Jahan, 2015; WTO, n.d.-a).

Earlier studies about the effect of the waiver on total service exports of Schloemann (2012), Narlikar and Priyadarshi (2014), Chanda (2015), Chanda and Raihan (2016), Mendoza et al. (2016), Gnangnon (2022a;2022b) are indicating that the waiver could provide a significant contribution for LLDCs with significantly lowering trade barriers and improving

market access. Hence, this could directly affect the levels of competitiveness of and increase both the regional and global cooperation of LLDCs in the GATS.

Because of the lack of available data, earlier findings about the effect of the waiver provided insufficient empirical support towards the effectiveness. So far, only studies of Gnangnon (2022a, 2022b) included empirical rationale to approximate the effect on the level of exports and export stability in the trade of services of LDCs. However, additional quantitative evaluation of the waiver is required, especially towards the effect on the least developed members of the WTO; LLDCs. With the approaching decision of the WTO to extend the waiver after 2030, additional empirical results are needed for guidance. With the increased opportunities for market access, lower regulatory barriers, and additional preferential treatment (Chanda, 2015; Mendoza et al., 2016), this could support LLDCs in increasing their levels of competitiveness and lead to improved participation in the GVC. Therefore, the following research question has been formulated:

Does the LDC Service Waiver contribute positively to the export of services in LLDCs?

Evaluating this research question will provide insights towards the capability of the waiver to support LLDCs in their participation in the GATS. With the waiver being one of the main allocations to support these economies in the trade of services, there is a high need for efficiency and effectiveness to increase their opportunities. To evaluate this question, earlier findings about the waiver, (service) trade liberalization and the specific challenges of LLDCs will be analysed in the literature review in chapter 2. Chapter 3 provides the theoretical framework based on the foundations of part 2. Then, chapters 4 and 5 elaborate on the used methods and results. Lastly, part 6 and 7 are providing the discussion and conclusion of this study.

2. Literature Review

This section examines and evaluates the current existing literature in the fields of the LDC services waiver by the WTO, the effect on trade liberalization (in services), and the significant challenges of LLDCs. These are the foundation of part 3, the theoretical framework.

2.1. The LDC Service Waiver

2.1.1. A Review of the Literature of the LDC Services Waiver

The UNCTAD (Mendoza et al., 2016) evaluated the potential level of operationalization of the waiver and estimated that the waiver exceeded the advantages of the 'Doha Development Agenda' (DDA). Especially with increased market access, competitiveness, export diversification, opportunities arise for the strengthening of the trade in services for LDCs. In addition, Schloemann (2012) noted that the waiver granted direct allowance for preferential entry to otherwise restricted sectors. The waiver allows for other nonmarket preferential treatments, such as domestic regulations, subsidies, and national treatment, but this requires approval by the WTO. Particularly with the direct allowance, countries should be able to face less regulatory barriers in the trade in services. Both studies touched relatively well on the possibilities and potential of the export and comparative advantage of the LDCs, however, underlined the necessity for empirical support.

Additional studies are supporting the findings of Mendoza et al. (2016) and Schloemann (2012). After the MC-9, Narlikar and Priyadarshi (2014) analysed the potential effects of the waiver and concluded that it will positively affect the overall market access for LDCs because of the enhancements in the international policy environment. Furthermore, Chanda and Raihan (2016) evaluated the potential effect of the waiver for Bangladesh and concluded that because of the high quantity of human resources in Bangladesh, the waiver lowering regulatory trade barriers could significantly increase outwards Mode 4 of supply. With Bangladesh having a competitive advantage in low-cost labour of the nursing and ICT sector, the waiver could stimulate the movement of natural persons with lower administrative

burdens (BASIS, 2010; Chanda & Raihan, 2016). This indicates the potential of the waiver for this study, with lower regulatory burdens affecting especially the outwards Mode 4 for LLDCs.

More importantly, especially in very low-income countries does the waiver seem to contribute positively on service exports (Gnangnon, 2022a). This form of service trade liberalization is best explained with the findings of the Mendoza et al. (2016), Nordås and Kox (2009) and Chanda (2015), which emphasized the potential for export diversification, increased market access and lower regulatory trade barriers. With more than 2000 preferences granted by the waiver (Mendoza et al., 2016), LDCs are facing increased trade liberalization; and lower trade restrictions with allowance of deviation from the MFN-principle. All these preferences affect the total overall transaction costs and competitiveness of these countries. Therefore, the waiver could help economies to lower their specific limitations such as high trade costs caused by their institutional voids (Chanda, 2015).

Concluding, earlier papers about the (potential) effects of the LDC service waiver are underlining the positive effects on service trade with improved market access, lower transaction costs and ability to exploit their comparative advantage with lower regulatory barriers. With both direct and indirect allowance of the deviation from the MFN-principle, the waiver lowers the overall trade barriers, and lead to increased service trade liberalization (Schloemann, 2012). As LLDCs are dealing with significant transaction costs because of their geographical limitations (Mackellar et al., 2000; Faye et al., 2004), the waiver could improve their international position.

2.1.2 Limitations of the LDC Service Waiver

There are also some major obstacles which are limiting the efficiency and usability of the waiver. Carpio and Mir (2014) emphasized the weak position of LDCs in the global trade in services - and evaluated the potential of the waiver from a legal perspective. Firstly, there is no legal obligation to provide preferential treatment to the LDC members of the WTO and this could lower the overall efficiency. A study of Mangeni (2003) also emphasized the significance of legal support for trade provisions by the WTO. Secondly, members of the WTO are allowed

to cancel their preferential treatment given to LDC countries at any given time (Carpio & Mir, 2014). This could limit the required stability and prosperity to properly exploit the advantages of the waiver for LDCs. Businesses are valuing long-term stability, and the potential of withdraw of the preferential treatment could reduce the willingness of foreign companies to engage in commercial presence. Furthermore, as mentioned by Chanda (2015), LDCs are dealing with significant institutional voids which could lower the efficiency of the waiver. For example, weak institutional systems, significant corruption, and low quality of government effectiveness. With 2000 preferences, the waiver is designed to lower the administrative burdens of these challenges. However, because of their institutional voids, challenges arise to optimally exploit the advantages of the waiver as trade flows are affected by institutional quality (Levchenko, 2007)

Additionally, with 86 percent of the preferences focussed on market access and more than one third on Mode 4, there is uncertainty for LDC members if the waiver has sufficient capabilities in affecting the different modes of supply. (Chanda, 2015; Mendoza et al., 2016). Potentially, this could decrease the efficiency of the waiver; with Mode 4 estimated to account for less than 5 percent of total trade in services globally (Magdeleine & Maurer, 2008; Shingal, 2022). However, Winters (2003) argues that even an increase in a relatively small percentage of temporary workers (Mode 4) could lead to significant economic gains, and therefore encourages for liberalization of Mode 4. In addition, the Mendoza et al. (2016) underlined the potential of Mode 4 with the difficulties for these economies to combine immigration policies with trade in services. Therefore, although there are some obstacles for the efficiency of the waiver with the lack of legal support and significant institutional voids, there should sufficient possibilities to utilize the waiver to their advantage.

2.2. Service Trade Liberalization in Developing Economies

Research in service trade liberalization showed that *"Free trade leads to a more economically rational market structure"* (Dornbusch, 1992, p. 75). Trade liberalization is defined as economies lifting trade restrictions, such as tariff and non-tariff barriers (Thirlwall, 2000;

Manni & Afzal, 2012) The impact of trade liberalization on the trade in services in developing countries has been widely studied (Briggs & Sheehan, 2019; Dornbusch, 1992; Mattoo et al., 2001; Robinson et al., 2002;). Dornbusch (1992) noted that trade liberalization is especially important for developing countries, whereby a closed economy with quotas and tariffs puts additional pressure on the nations exchange rate, and everything else held constant, decreases their level of competitiveness. Thus, for developing countries, this underlines the significance of trade liberalization provided by the waiver.

However, there are more arguments for trade liberalization in these economies. Mentioned by Chanda (2015), developing countries face certain institutional voids and this decreases their accessibility to enter developed markets. Requirements such as qualification, work experience, and language barriers are making it challenging to enter developed countries for especially outwards Mode 4. With the waiver lifting these regulatory burdens will increase the market access and lowers overall transaction costs for developing countries. This will not only affect the trade in services, but consequently, simultaneously increase the demand for goods (Robinson et al., 2002).

Importantly, especially low-income LDCs are benefitting from service trade liberalization and preferential treatment (Briggs & Sheehan, 2019; Gnangnon, 2022a). Lifting trade restrictions and stimulating developing countries to liberalize their economies could support them in achieving sustainable economic growth and positively affect their domestic income levels (Briggs & Sheehan, 2019. Similarly, this seems to be in line with studies about the effect of trade liberalization on economic development in developing economises such as Tanzania (Hamad et al., 2014), Nigeria (Olaifa et al., 2013), Sri Lanka (Herath, 2010) and Iran (Yavari & Mohseni, 2012). Therefore, service trade liberalization in developing countries has a positive impact on the nations' competitiveness and domestic economy. Liberalizing the economy in services leads to increased cooperation both regionally and globally, and hence, could lead to improved market opportunities for low-income LDCs (Briggs & Sheehan, 2019; Gnangnon, 2022a).

2.2.1. Spill Overs in Knowledge and Innovation

Mattoo et al. (2001) examined the effect of trade liberalization on the trade in services and economic growth and found strong evidence for a positive relationship between those factors. Especially the financial and telecom industry do benefit significantly from trade liberalization, with an increase in growth of 1.5 percentage points in these sectors. These sectors benefit from an open economy because of the knowledge spill overs and increased innovations by inwards FDI (Coe et al., 2009). In order words, with lifting trade barriers, MNE's could enter these domestic economies more easily and provide new unique innovations. This builds on the theory of Dornbusch (1992), and for a part explains why open economies perform relatively better than closed economies. Liberalizing the economy leads to new innovations and knowledge spill overs. Potentially, this could either lead to cost-saving or product improvements which are significantly boosting the level of competitiveness globally.

Trade is crucial to increase the overall levels of productivity and growth of an economy (Afonso, 2001; Busse & Königer, 2012; Singh, 2010). Especially for developing countries, there is presence of an inverted U-curve where increased levels of trade could significantly boost their economies and lead to economic growth (Zahonogo, 2016). Mentioned by Dornbusch (1992), service trade liberalization leads to an optimal market, and lowers the trade barriers which could lead to increased knowledge and innovation spill overs by firms from developed economies. Potentially, this leads to increased levels for economic development similarly as in other developing countries (Hamad et al., 2014; Herath, 2010; Olaifa et al., 2013; Yavari & Mohseni, 2012).

2.3. Challenges for Landlocked Countries

2.3.1. Geographical Challenges

Landlocked countries are facing significant economic challenges due to their geographical remoteness and the lack of a seaport. Especially in Africa, where one out of three countries are landlocked, the problem of being landlocked is important with almost no infrastructure between transit countries and low regional trade involvement (Collier, 2007a). This puts

landlocked countries in an economic 'trap', where it becomes increasingly difficult to enhance sustainable economic growth (Collier, 2007b).

Therefore, this leads to increased transaction costs with transporting through Transit Neighbouring Countries (TCs) (Mackellar et al., 2000; Faye et al., 2004). With the absence of transoceanic trade, landlocked countries are enforced to transport through TCs or via air (Faye et al., 2004; Mlepo, 2022). This affects the time of export significantly, with longer transportation times for landlocked countries compared to countries with a seaport (Kawai et al., 2011). To illustrate: African landlocked countries have more than twice the export costs in days compared to coastal countries (Arvis et al., 2010). Compared to coastal countries, landlocked countries are facing higher transactions costs, lower margins and hence, have lower levels of competitiveness compared to coastal countries.

2.3.2. Challenges in the Trade in Services

Besides the significant impacts of their geographical remoteness, the trade in services of landlocked countries is also affected in other ways. Transport services via air are relatively more restricted in African landlocked countries and this impacts their remoteness even further (Hoekman, 2017). Also, Both Mode 3 and Mode 4 are significantly affected by the institutional voids and the lack of infrastructure with significant challenges in infrastructure affecting the sector of tourism, transport, ICT, and finances according to the Mendoza et al. (2016). Karingi and Davis (2016) underlined the barrier of at least 55 percent of the African employees requiring a work permit or visa, affecting outwards Mode 4. This leads to higher transactions costs for the engagement in Mode 4, affect the international competitive position in services for LLDCs and emphasizes the potential of the waiver with lowering these administrative burdens.

Importantly, especially the quality of infrastructure is low in landlocked countries. With non-accessible public transport, lack of communication services and a low- electricity coverage ratio affecting all modes of supply in services. This is in line with the findings of Borchert et al. (2012), with the focus of the study on services that increases connectivity, such

as telecommunications and air transport, finding a higher Service Trade Restrictiveness Index (STRI) for landlocked countries in these specific sectors. Concluding, support is required for LLDCs. There is a high need service trade liberalization for LLDCs to increase their participations in the GATS and overcome issues such as low competitiveness and premature deindustrialization (Rodrik, 2016).

3. Theoretical Framework

3.1. The Gravity Equation

For the theoretical evaluation of the effects of the waiver on LLDCs, the Gravity model by Jan Tinbergen (1962) is applied. This model has been widely used in trade theories and policies (Bergstrand, 1985). The Gravity equation states that the cumulative levels of bilateral trade are positively related by their size in GDP (or GNP) and negatively related by their distance (Chaney, 2018; Tinbergen, 196).

$$Bilateral\ Trade\ between\ X, Y = \frac{(GDP_X)^i\,(GDP_Y)^j}{(Distance\ XY)^\theta} \quad (1)$$

The effect of the relative size of GDP is relatively straightforward, with GDP affecting the total level of import and exports of a specific economy. This leads to an elasticity of as close to one (Krugman, 1980; Chaney, 2018). However, the variable "*Distance*" consists of multiple covariates that describe the distance between two countries. Distance consists of the absolute geographical distance and the relative distance, and is affected by the costs of transportation and communication (Kimura & Lee, 2006):

$$BT_{XY} = E_X^{\beta 1} + E_Y^{\beta 2} + G_{XY}^{\beta 3} + R_Y^{\beta 4} + R_{XY}^{\beta 5} + \varepsilon_{XY} \quad (2)$$

With BT_{XY} = the levels of bilateral trade flows between country X and country Y, $E_X^{\beta 1}$ = the economic levels of country X, $E_Y^{\beta 2}$ = the economic levels of country Y, $G_{XY}^{\beta 3}$ = the geographical distance between country X and country Y, $R_Y^{\beta 4}$ = the relative distance of country Y, $R_{XY}^{\beta 5}$ = the relative distance of country X * Y, and ε_{XY} = the residuals/error term.

One would expect that the Gravity equation is only useful to estimate the effect on the trade in goods. However, according to a study from Kimura and Lee (2006) which evaluated the Gravity equation in the international trade of services, with a significance of 1% distance is getting of increased importance compared to the trade in goods. Similarly, Shepherd (2013) also evaluated the Gravity equation and found highly significant values for the effect of distance on the levels of service trade, thus suggesting that the model is still useful in predicting the levels of trade in services. Additionally, the Gravity equation seems to have a better predictability of the trade in services, compared to the trade in goods (Kimura & Lee, 2006). This could be explained by the fact that the presence of an individual by a service is more important than by a good, and that overall, the costs of transportation for a service are higher compared to those of goods. One thing to be noted, there is a high variety of services and transportation costs for each service, and this strongly depends on each specific industry.

3.2. The Contribution of the Waiver for LLDCs

As mentioned in part 2.2, service trade liberalization is especially important for developing and low-income economies (Briggs & Sheehan, 2019; Dornbusch, 1992; Gnangnon, 2022a). Increased service trade liberalization by the waiver could increase the ability of LLDCs to cooperate both regionally and globally. LLDCs are strongly affected by additional cross-border administrative and regulatory burdens, which affects their levels of competitiveness (Faye et al., 2004; Mackellar et al., 2000). Most LLDCs in the Sub-Sahara have other LDCs as TCs, however, without the waiver, no deviation from the MFN-principle was allowed and this decreases the overall efficiency in their negotiations. Therefore, trade liberalization caused by the waiver could lower the relatively high transaction costs that LLDCs are dealing with and lead to increased regional cooperation.

Multiple studies of Nordås and Kox (2009), Schloemann (2012), Narlikar and Priyadarshi (2014), Chanda 2015), Chanda and Raihan (2016), Mendoza et al. (2016), Gnangnon (2022a; 2022b) have evaluated the LDC service waiver and reported that the LDC service waiver positively contribute to the levels of service exports and outwards Mode 4. Therefore, this

study focusses on the effect of the waiver on total service exports and outwards Mode 4 for LLDCs.

3.2.1. The Effect on the Total Export in Services

With more than two thirds of the global economy consisting of the trade in services (Cattaeno et al., 2010; OECD, n.d.), opportunities arise for LLDCs to increase their levels of trade. According to Cattaneo et al. (2010) there have been assumptions that the trade in services could only benefit the well-developed economies. However, studies by Mattoo et al. (2001), and Mattoo and Payton (2007) underlined the potential of the trade in services, especially for developing countries.

The LDC service waiver could have a significant effect in helping LLDCs to increase their international position. Because of their long transportation times, costs of transport, weak infrastructure, and high transaction costs, the *Relative Distance* in the gravity equation for their trade in services increases (Kimura & Lee, 2006). This negatively affects the levels of bilateral trade flows between country *X* and *Y*, and hence, lowers the bilateral trade flows of LLDCs with the other economies. The absolute distance of the Gravity equation cannot be adjusted, this is a fixed variable (unless a country decides to move their capital, but this study does assume that this would not affect the outcome). Hence, to optimally support LLDCs, the LDC service waiver should be focused on the relative distance in the Gravity equation. The relative distance is consolidated with variables such as trade barriers, market access and levels of competitiveness.

The LDC service waiver has been implemented at the MC-9 to support these economies with their engagement in the GATS. The waiver has been mostly focused on increasing market access and national treatment for LDCs and lowering (regulatory) trade barriers (Chanda, 2015; Mendoza et al., 2016; Nordås & Kox, 2009). With both the direct allowance by the WTO to export to the otherwise restricted sectors, and the indirect allowance for preferential treatments in subsidies, domestic regulations, and national treatment, the LDC service waiver is providing unique opportunities for LLDCs (Schloemann, 2012). As mentioned in 2.1.2, some

limitations of the waiver are present such as the limited legislative support (Carpio & Mir, 2014). However, since the operationalization of the waiver, almost 800 preferences (preferential treatments which go beyond existing commitments) have been granted for Mode 1 and Mode 2, 500 preferences for Mode 3 and around 700 for Mode 4 of the supply in services (Mendoza et al., 2016). This indicates the significance and willingness of other members to make use of the waiver.

As explained in part 2.2, (service) trade liberalization leads to a more functional and rational market (Dornbusch, 1992). Service trade liberalization, in the form of the LDC service waiver, could significantly affect the regulatory barriers and market access for LLDCs. Furthermore, having fewer restrictions and trade barriers, economies of LLDCs could experience increased levels of productivity and innovation due to knowledge spill overs (Coe et al., 2009). As entry-barriers for LLDCs are lowered with the increased preferences for market access, this lowers their *Relative Distance* in bilateral trade in the Gravity equation. In addition, trade costs are significantly reduced because of the lower regulatory burdens and trade facilitation, lowering the transaction costs for each TC border passage. This further lowers the *Relative Distance* of LLDCs regionally. Lastly, the respective levels of competitiveness are affected because of the indirect allowance for other nonmarket preferences, such as subsidies and national treatment. Concluding, according to the Gravity equation, the waiver lowering the *Relative Distance* with other TCs and developed countries will increase the bilateral trade flows of LLDCs with other economies. This will lead to increased regional and global cooperation. Hence, the following hypothesis is established:

$\mathcal{H}1$: *The LDC Service Waiver has a positive effect on the total levels of service export of LLDCs.*

3.2.2. The Effect on Outward Mode 4

As highlighted by Mendoza et al. (2016), most of the preferences (>700) provided by the waiver are focussed on Mode 4 of the supply in services: *The temporary movement of human capital*. As reported in part 2.1, Chanda (2015) elaborated on the potential power of the waiver

on especially Mode 4. The labour forces of LDCs are facing barriers limiting their temporary movement, with significant requirements for the levels of education, qualification, work experience, language barriers (Karingi & Davis, 2016). Thus, it has been very costly and time consuming to attain work visas. Due to these trade barriers affecting the *Relative Distance* with other economies, it has been difficult for human capital to flow to other (developed) economies. This reduces their capability for optimally engagement in outwards Mode 4. Therefore, this paper focusses on the effect of the waiver on outward Mode 4 next to the total export in services.

With the implementation of the waiver, LLDCs could increase their focus on labour-intensive services that require the movement of human capital. Applying the Heckscher-Ohlin (H-O) model, which states that countries specialize in their abundant factors of production (Leamer, 1995), the waiver could support LLDCs utilize their relatively abundant factor in cheap labour and exploit this to their comparative advantage potentially (Chanda & Raihan, 2016). Especially economies with high surpluses of cheap labour could benefit from this and increase their levels of outwards Mode 4. Highlighted by Chanda (2015), the service waiver increases the market access for LDCs, but also acknowledges domestic institutions of LDCs, provides accreditation to qualifications, and lowers the regulatory barriers caused by work visas, permits and other cross-border requirements for human capital such as required tests or pre-conditions for wages. Hence, it is expected that the waiver significantly lowers the costs and time of transportation for outwards Mode 4. This increases the level of competitiveness of LLDCs and lowers their overall *Relative Distance*, as mentioned by Kimura and Lee (2006), in the Gravity equation. Hence, hypothesis 2 is established:

$\mathcal{H}$2: The LDC Service Waiver has a positive effect on the levels of outwards Mode 4 of LLDCs

4. Methodology

This section addresses the empirical approach to evaluate hypotheses *H1* and *H2*. To investigate the effect of the waiver on the dependent variables, data is required about service trade from LLDCs. Hence, this section elaborates on the used data and the techniques to evaluate both hypotheses.

4.1. Data Collection

To evaluate hypotheses H1 – H2, data regarding the outcome variables of total trade in service exports and outwards Mode 4 is required before, and after, the implementation at the MC-9 in 2013 for LLDCs. These data are acquired through desktop research and are predominantly secondary data from the WTO, OECD, and The World Bank. Firstly, to evaluate H1, data is used from the "BaTIS" dataset compiled by the WTO and the OECD. This dataset is the successor of the first edition from 1995 – 2012 and provides data from 2005 – 2021. The reported data in this dataset contains 95% of the global trade in services and are corrected to adhere to the international requirements of reporting by the WTO-OECD (Liberatore & Wettstein, 2021).

Secondly, to evaluate H2, data is used from the TiSMoS dataset, containing data of the different modes of services. This dataset is compiled by the UNCTAD, ITC and the WTO, and contains data between 2005 and 2017 (WTO, 2019). For countries without any available data about Mode 4, the WTO constructed gravity models and applied the Poisson Pseudo Maximum Likelihood (PPML) formula of Silva and Tenreyro (2006) to calculate the missing numbers. Techniques using three-year moving averages (MA) were applied for interpolation and forecasting (WTO, 2019).

4.2. Sample selection

The selection of countries is made based on the list of landlocked developing countries (UN, n.d.), the list of LDCs (UNCTAD, 2022) and the list of members of the WTO (WTO, n.d-c.). Afghanistan had to be removed of the sample because the country joined the WTO in 2016, three years after the implementation of the LDC service waiver at MC-9. Hence, besides the

political instability of the country, the effects on service trade could not be correctly estimated. The following countries have been included in our sample of this study:

Table 1. Sample of LLDCs

Country
Burkina Faso
Burundi
Central African Republic
Chad
Eswatini
Lao people's democratic republic
Lesotho
Malawi
Mali
Nepal
Niger
Rwanda
Uganda
Zambia

The waiver has been implemented in 2011 by the WTO at the MC-8. However, without any notifications of LDC members at the WTO of preferences granted until MC-9 (WTO, n.d.-a), similarly as in the studies of Gnangnon (2022a;2022b) this paper does not assume that 2011 was the official year of operationalisation. Especially in the run-up towards the MC-9, and at the MC-9, it has been stated by the WTO (n.d-a.) that the waiver became officially operationalised in 2013. Accounting for any anticipation effect in the months before MC-9, this paper assumes that the treatment period started in 2013. To evaluate potential earlier anticipation effects, additional tests will be executed to test for earlier anticipation effects before MC-9 in part 5.3.

4.3. Dependent Variable

To evaluate *H*1, the effect on the total service exports, the BaTIS dataset is used in the model to measure the effect of the waiver. These are reported in US dollars, millions. Furthermore, the values for the service code 'Total Services' are used with their partner set as world, filtered

on export. Similarly, to evaluate *H*2; the effect on outwards Mode 4, the value of Mode 4 of the TiSMoS dataset is used in the model. Also, all values are expressed in US dollars, millions. The values for the indicator of total services are used with their partner set as World, filtered on export.

4.4. The Synthetic Control Method

The treatment group is allocated according to the sample of Table 1 and consists of 14 countries which fit the criteria of being landlocked, LDC, and member of the WTO before MC-9. One of the main assumptions for the Difference-in-Difference method, the requirement of parallel trends (Bilinksi and Hatfield, 2018) among the treatment and the control group, was violated because of the significant differences in characteristics between LLDCs with other control groups. This has been a consequence of the fact that the control group could not contain any LDC countries, because these are either member of the WTO and could utilize the LDC service waiver; or are non-member of the WTO and could still deviate from the MFN-principle. The IMF provided a list of Low-Income Countries (LICS) with both LDCs and developing countries. However, this group still consists of mostly LDCs and furthermore, does not fulfil the parallel trend assumption for the Difference-in-Difference model.

To overcome these limitations, first, this paper applies the synthetic control method (SCM) (Abadie & Gardeazabal, 2003; Doudchenko & Imbens, 2016). The SCM has been widely used in multiple papers to evaluate the effect of policy interventions when there is a lack of proper control group. For example, Abadie et al. (2010) applied the SCM to estimate the effect of a control program of Tobacco in California, Born et al. (2019) used the SCM to evaluate the effect of the Brexit on the UK economy, and Gharehgozli (2017) used the SCM to assess the economic cost of recent sanctions on Iran. Compared to regression-based counterfactuals, the SCM does not include extrapolation, provides transparency of the fit, and are safeguarded against specification searches (Abadie, 2021). Therefore, with the lack of a proper control group, the SCM could be an appropriate model to evaluate the effect of the LDC service waiver on LLDCs. According to Doudchenko and Inbens (2016), the SCM provides the required

control group and the counterfactual:

$$\Upsilon_{t,post}^{(0)} = \mu + \sum_{i=1}^{N} \omega_i * \Upsilon_{i,T}^{obs} \quad (3)$$

With μ the constant for the changes in the averages between the treatment and the synthetic control group, and ω_i the different weights for the synthetic controls.

The SCM contains a composition of data from different countries, the donor pool, and estimates the counterfactual with a 'doppelganger'. This 'doppelganger' is estimated using covariates, selected, and matched on factors which are affecting the outcome variables; the total exports in services and outwards Mode 4. The synthetic control is the weighted average of selected countries from the donor pool, with weights that minimize through linear regressions the relative distance with the outcome variable (Born et al., 2019). The counterfactual in this paper is estimated using a similar data-driven approach as in the study of Born et al. (2019). The equation for evaluating the synthetic control (Abadie & Gardeazabal, 2003; Abadie et al., 2010; Abadie et al., 2015) is formulated below. In this equation, W represents each synthetic control and v_m represents the weight:

$$\sum_{v}^{k} v_m (\chi_1 - \chi_{0\ m} W)^2 \quad (4)$$

The treatment affect will be the value of the outcome variables of the LLDCs, subtracted by the weighted average of the synthetic controls valued by their weight. For the post-intervention estimation, with W the synthetic control, and Y_{jt} the estimator of the outcome of variables total export in services and Mode 4, the SCM is as follows (Abadie et al., 2010):

$$\pi_{1t} = Y_{1t} - \sum_{j=2}^{J+1} w_j * Y_{jt} \quad (5)$$

The effect of the LDC service waiver is significant when the group of treatment has a magnitude which strongly differs positively or negatively from the synthetic control group. According to Abadie et al. (2010), with Y_{1t} the outcome variable at the time of t (with $t > T_0$), the effect of the LDC service waiver can be evaluated with:

$$\pi_{1t} = Y_{1\ t}^{I} - Y_{1\ t}^{N} = Y_{1t} - Y_{1\ t}^{N} \quad (6)$$

4.4.1. The Covariates

To construct the synthetic control group that closely matches the characteristics of LLDCs, covariates are carefully selected to minimalize the Root Mean Square Percentage Error (RMSPE) between our treatment group and the synthetic control. For a good fit, it is recommended to include relatively many covariates in the SCM that affect the outcome variable (Abadie & Bastida, 2022). Where in linear regressions, the number of independent variables is limited by the degrees of freedom. This study follows the studies of Alvarez et al. (2018) and Levchenko (2007) that institutional quality affect trade flows. Furthermore, Choi (2010) underlines the importance of internet for service trade. Hence, the following factors are included in the SCM: the percentage of export in services of GDP, growth rate of GDP in percentage, the HDI, the measure of Political Stability and Absence of Violence, the Government Effectiveness, the Regulatory Quality, the Control of Corruption percentile rank, the GCI, Quality of Internet, and only for *H*2, the Population Size and the Level of Unemployment which significantly affect the level of Mode 4.

While most of the covariates were averaged from the whole pre-treatment period, only for the Quality of Internet and Population Size a different approach has been taken. First, data for the variable Quality of internet was not available before 2010. However, following the approach of Abadie (2021) to incorporate the substantial higher growth for internet penetration in developing countries reported by Chinn and Fairlie (2010) and the importance of internet on the trade in services (Choi, 2010); the covariate for quality of internet is averaged at the pre-treatment years 2010 to 2012 match the high development of internet penetration (in Africa). For *H*2, the variables 'Population Size' and Unemployment have been included to provide the best display of population size for the temporary movement of human capital of LLDCs. Lastly, as similarly applied by Abadie and Gardeazabal (2003), Abadie et al. (2010), Doudchenko and Imbens (2016) and Born et al. (2019), the lagged outcome variables of the total export in services for *H*1, and Outwards Mode 4 for *H*2 are used. To avoid overfitting of the pre-treatment period of the treatment group with the synthetic control, only three lagged outcome variables are included for 2005 (first year of the pre-treatment period), 2012 (last

year of the pre-treatment period) and the average of the lagged outcome variables of 2005-2012. These covariates should give the lowest number of differences in characteristics between the treatment and the control group and provide the counterfactual of the waiver. See Appendix A for the selected covariates with additional explanation and their source of data.

4.4.2. The Donor Pool

This paper critically selects the criteria for the countries in the donor pool to lower the risks of overfitting and interpolation biases (Abadie et al., 2010). Instead of using a relatively big donor pool of all developing countries, this paper carefully selects the donor pool out of countries that are relatively similar with the characteristics of LLDCs based on the literature in part 2.3. Therefore, the donor pool consists of countries which fulfil at least two of the following criteria:

I. Being landlocked.
II. Having similar economic proximities (*estimated in GDP)*.
III. Having similar levels of economic development (*estimated with the HDI*).
IV. Having similar levels of competitiveness (*estimated with the Global Competitive Index*).

Each country in the donor pool has been critically evaluated on matching above criteria, and significant outliers have been removed of the control group to lower the RMSPE to and provide a good pre-treatment fit. The full list of the donor pool including the fitted criteria has been listed in Appendix B. To be noted, the list of countries that optimally fit these criteria have been relatively small because of the restriction of not including LDCs. Potentially, this could have affected the pre-treatment fit and the RMSPE, and thus, this encouraged the use of the lagged outcome variables mentioned in 4.4.1.

4.4.3. Validation of Assumptions and Robustness

To effectively use the SCM, McClelland and Gault (2017) established three criteria that must be fulfilled. Starting, only the treatment group must be affected by the LDC service waiver and not the control countries in our donor pool. This assumption is satisfied, as the donor pool is carefully selected and contains strictly non-LDCs and members of the WTO; countries that

cannot deviate from the MFN-principle. Hence, we can assume that only our treatment group is affected by the waiver. Furthermore, the policy change should not have affected the treatment group before the treatment period of 2013. This assumption is also satisfied, as the waiver became officially operationalized at the MC-9 and no notifications of preferences have been established before this conference (WTO, n.d.-a). Potential anticipation effects of the operationalisation of the waiver at MC-9 are possible, however, as mentioned in 2.1, earlier studies are showcasing that the waiver was not recognized and utilized by the LDC members before 2013. Nonetheless, taking account for this, this paper executed in-time permutation tests similarly as Abadie et al. (2015). The last assumption of McClelland and Gault (2017) describes that the counterfactual must be approximated by a set combination of countries out of our donor pool. With evaluating the controls in the donor pool according to criteria I-IV, it is expected that the treatment and control group will fit. Therefore, all assumptions of McClelland and Gault for the SCM are satisfied.

As the synthetic control method is based on design rather than on sampling-based, this removes the issue of heteroskedasticity in this study. However, to assess the robustness of the results, for each outcome variable multiple placebo tests will be implemented following the methods of Abadie et al. (2015). To detect the causal effect of the waiver on LLDCs, the effect on our sample must have a higher magnitude than the effect on the controls in our donor pool. Using in-Stata programs from Wiltshire (2021) and the methods of Abadie et al. (2010), the post/pre-proposition (PPP)-ratio can be evaluated.

$$PPP - Ratio = \frac{Pre-Treatment\ MSPE}{Post-Treatment\ MSPE} \tag{7}$$

Based on this ratio, the effect of the waiver on the outcome variables can be evaluated and compared with the controls from the donor pool to estimate a potential causal relationship. Sorting each country i on the ratio for MSPE, provides the comparison for our study (Abadie et al., 2010). Having low values for pre-treatment MSPE; indicating a good fit, and high values for the post-treatment MSPE; indicating a large difference with the synthetic control, provides relatively high numbers of (7) for significant policy interventions. Ranking the placebo

outcomes of (7) for the treatment and control groups provides the estimation of the p-values of the treatment effect. To be noted, as our donor pool consists of 21 countries and our treatment group is consolidated to one, the highest p-value that can be achieved is 1/22=0.0455 (4.5%).

4.4.3.1. Difference-in-Difference estimation for robustness

Results from the SCM could sometimes suffer from overestimation, inaccuracy, and stability (Albalate et al., 2021). Therefore, this study follows the approach of Bilinksi and Hatfield (2018) and lifts the strict assumption of the parallel to perform additional robustness checks with the Difference-in-Difference model complementary to the SCM. The "One step up" technique of Bilinksi and Hatfield (2019) is used for potential differences between our treatment and control group. Therefore, the Difference-in-Difference model has been executed both including and without a linear differential time trend capturing the discrepancies between the two groups over time. A similar approach has been followed as for the SCM, with the year of treatment t = 2013. However, to reduce the potential problem of overfitting and reduced predictability of the model (Hawkins, 2004), there will be only controlled for the level of GDP to reduce the number of independent variables. The list of Low-Income Countries (LICs), countries which are eligible for Poverty Reduction and Growth Trust (PRGT) program by the IMF, have been used as the control group. LDCs are removed because they received the also received the benefits of the waiver. See Appendix C for the full list.

The Difference-in-Difference regression can be categorized as a unique Fixed Effects (FE) model and already captures the FE of individuals to a certain degree (Kezdi, 2003; Strumpf et al., 2017). However, additional consideration for FE will be taken to control for unobserved heterogeneity. Therefore, the following Difference-in-Difference model is established:

$$Total\ service\ exports_{it} = \beta_0 + \beta_1 Post + \beta_2 LLDC + \beta_3 DiD + \beta_4 GDP + \omega_c + \lambda_t + \varepsilon_{it}\ with\ i = 1 = 1{,}2 \ldots N\ ;\ t = 2005, \ldots 2019 \quad (8)$$

Where β_0 captures the constant, β_1 a dummy variable for the year of the operationalization of the waiver, β_2 a dummy variable for our treatment group, β_3 the DiD interaction of the year of treatment with the treatment group. β_4 is controlling for the levels of GDP, ω_c and λ_t are country and time FE, and ε is the error term.

5. Results

5.1. Constructing the Synthetic Control for the Total Export in Services

Using panel data from the BaTIS dataset from 2005-2019 to evaluate our first hypothesis, *H1*, whether the LDC service waiver had a positive impact on the total exports in services for LLDCs, the synthetic control for LLDCs was constructed.

Table 2. Nested Synthetic Control Weights for the LLDCs

Country	Synthetic Control Weight	Country	Synthetic Control Weight
Albania	0	Libya	0
Bolivia	0	Moldova	0
Botswana	0	Mongolia	0
Côte d'Ivoire	0	Mauritius	0
Cameroon	0	Nigeria	0
Cape Verde	0.311	Nicaragua	0
Algeria	0	El Salvador	0
Ghana	0	Tajikistan	0.472
Honduras	0	Tunisia	0
Kenya	0	Zimbabwe	0.218
Kyrgyz Republic	0		

N = 21 Controls in the Donor Pool.

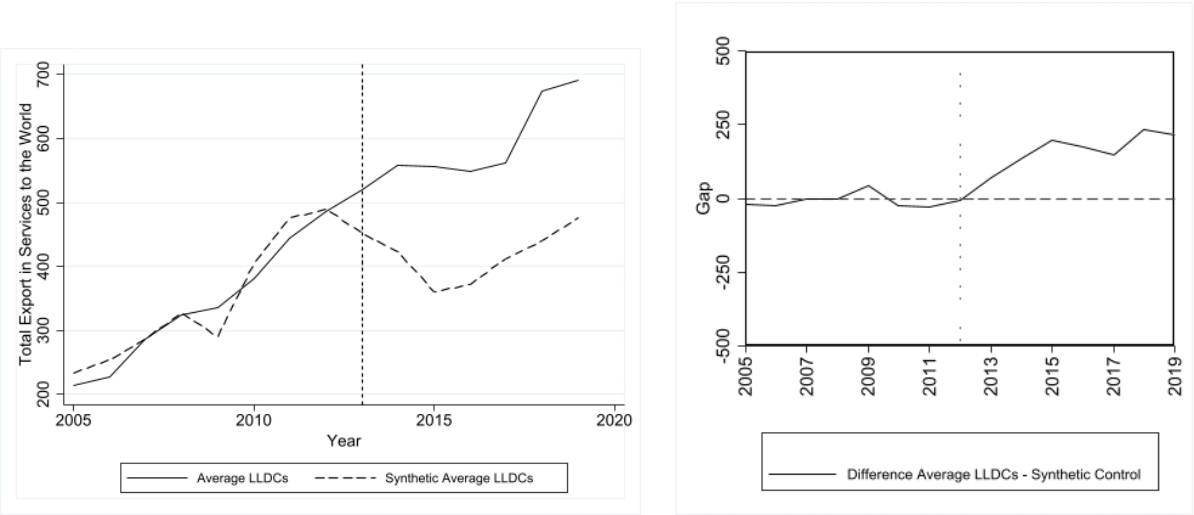
Table 2 displays the selected synthetic controls for the construction of the synthetic control group for the estimation of *H1*. The synthetic control group for LLDCs consisted of 31.1% of Cape Verde, 47.2% of Tajikistan and 21.8% of Zimbabwe with a RMSPE of 23.810. As explained in the methodology, these countries are selected within Stata through minimalization and application of formula (4).

Table 3. Predicator Means

Variables	Average LLDC	Synthetic LLDC	LICs
Export Percentage in Services	24.24	34.17	33.36
Global Competitiveness Index	3.32	3.44	3.56
Percentage growth in GDP	5.63	6.82	3.96
Human Development Index	0.44	0.60	0.62
Government Effectiveness	25.37	25.36	37.45
Regulatory Quality	28.57	22.88	39.63
Control of Corruption	31.08	29.31	33.66
Political Stability and Absence of Violence	29.78	33.80	38.90
Quality of Internet	11.46	13.31	36.87
Export in Services (2012)	486.21	488.71	862.08
Export in Services (2005)	213.76	233.89	1445.98
Export in Services	337.48	343.59	1144.80

Notes: All covariates are averaged between 2005 and 2012, except the Quality of Internet; these were averaged between 2010 and 2012. In addition, the lagged outcome variables of 2005 and 2012 are also not averaged.

Table 3 reflects the mean characteristics of our treatment group and the synthetic control. For comparison, the mean average of the LICs, excluding LDCs, has been included in the table. With the nested control weights assigned from Table 2, it seems that most of the covariates and lagged outcome variables are matched relatively well. Compared to LICs, the synthetic control provided more similarity with the provided covariates of LLDCs. However, Table 3 reports that there is a difference of the variable Export Percentage in Services with 10 percentage points compared with the synthetic control. Furthermore, there is a difference of 0.16 in the Human Development Index because LDCs could not be included in the donor pool, and this was predicted in part 4.4.2.



Panel 1. The Synthetic Control Estimation on the Total Service Exports for LLDCs and the difference of the two lines, the LLDCs and the Synthetic Control. Total exports are reported in US dollars, millions. The dotted line in the right figure reflects the last year of the pre-treatment period, as mentioned by Wiltshire (2021).

In Panel 1 are the trends plotted of the total export in services to the world. The panel shows a relatively good fit of the treatment group with the control group pre-treatment. Panel 1 shows that both groups lost their momentum after a sharp increase of 2005-2008. Also, around 2009 the synthetic control diverged with our sample, having slightly lower exports. From 2010 until 2012, both groups had almost parallel outcomes for total exports with both groups moving at a similar direction and magnitude. After the operationalization of the waiver at the MC-9 in 2013, the two groups continued to split up even further until around 2015. From 2015 until 2019, both groups did move in the same direction, but the LLDCs with a higher magnitude. Important to note is that after the treatment period t = 2013, the LLDCs never exported less than the synthetic control until the end of the post-intervention.

The figure at the right has been plotted to reflect the differences of both groups pre-treatment and post-treatment to increase the readability of the panel. As mentioned, the dotted line reflected the last year of the pre-treatment period required by Wiltshire (2021). The figure reports that before the treatment period t = 2013 the gap between the two groups was low, indicating a good fit pre-treatment. Compared to the pre-treatment period, the post-treatment

period of 2013 until 2019 was asymmetric in characteristics. Importantly, after t = 2013 the exports of LLDCs were almost only growing compared to our synthetic control. These figures are in line with *H1* that the waiver had a positive effect on the total service exports for LLDCs.

However, just before the MC-9 in 2013, both lines started diverging, with the LLDC group experiencing a growth and our synthetic control a negative growth. Potentially, this could indicate the inaccuracy or overestimation of the SCM. For better predictability of the effect of the waiver, both lines should have moved in the same direction after the operationalization. Just before the operationalization of the waiver at t = 2012, our synthetic control splits from the LLDCs. This underlines the necessity for additional robustness checks of the Difference-in-Difference and in-time permutations to test for potential anticipation effects.

5.2. Constructing the Synthetic Control for Outwards Mode 4

To evaluate the second hypothesis, *H2*, whether the LDC service waiver had a positive impact on outwards Mode 4 for LLDCs, the following synthetic control for LLDCs was constructed using panel data from the TiSMoS dataset of 2005-2017.

Table 4. Nested Synthetic Control Weights for the LLDCs

Country	Synthetic Control Weight	Country	Synthetic Control Weight
Albania	0.063	Libya	0
Bolivia	0	Moldova	0
Botswana	0	Mongolia	0
Côte d'Ivoire	0	Mauritius	0
Cameroon	0.049	Nigeria	0
Cape Verde	0.303	Nicaragua	0.026
Algeria	0	El Salvador	0
Ghana	0	Tajikistan	0.139
Honduras	0	Tunisia	0
Kenya	0.12	Zimbabwe	0.299
Kyrgyz Republic	0		

N = 21 Controls in the Donor Pool.

Table 4 displays the selected synthetic controls to construct the synthetic control group to estimate *H2*. Similarly, as in part 5.1, the synthetic control was mainly established of Cape

Verde (30.4%), Tajikistan (13.9%) and Zimbabwe (22.9%) but now also contained Albania (6.3%), Cameroon (4.9%), Kenya (12%) and Nicaragua (2.6%) with a RMSPE of 1.31. The lower value of RMSPE is explained by the difference in scales of the total exports in service and Mode 4.

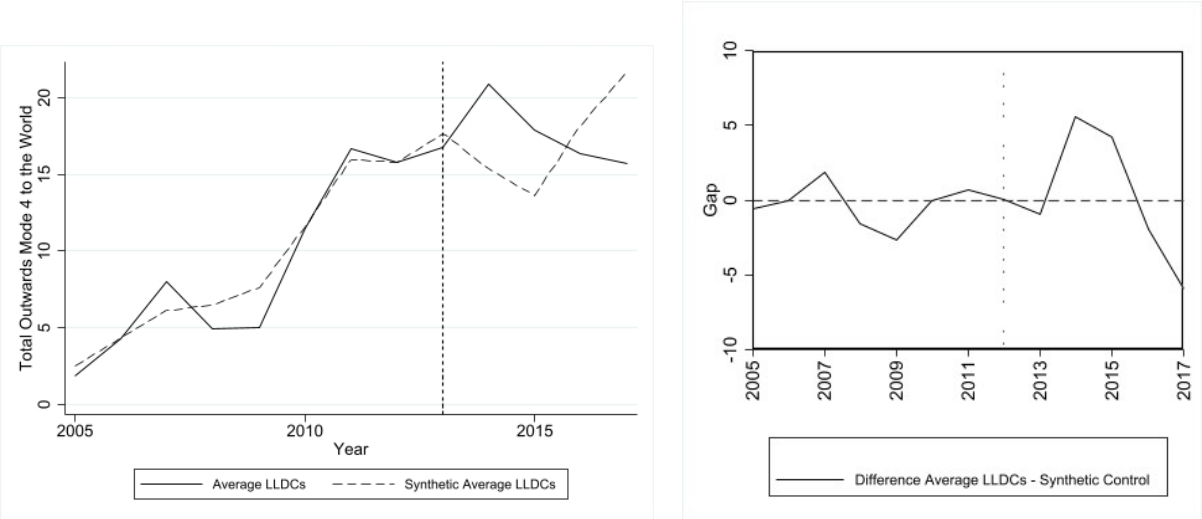
Table 5. Predicator Means

Variables	Average LLDC	Synthetic LLDC	LICs
Export Percentage in Services	24.24	31.88	33.36
Global Competitiveness Index	3.32	3.43	3.56
Percentage growth in GDP	5.63	4.94	3.96
Human Development Index	0.44	0.58	0.62
Government Effectiveness	25.37	28.45	37.45
Regulatory Quality	28.57	28.45	39.63
Control of Corruption	31.08	30.94	33.66
Political Stability and Absence of Violence	29.78	35.59	38.90
Quality of Internet	11.46	32.54	36.87
Level of Unemployment	7.26	7.98	7.26
Population Size (2012)	13.7M	11.9M	9.39M
Outwards Mode 4 (2012)	15.82	15.79	53.25
Outwards Mode 4 (2005)	1.87	2.48	6.70
Outwards Mode 4	8.51	8.79	22.85

Notes: All covariates are averaged between 2005 and 2012, except the Quality of Internet; these were averaged between 2010 and 2012. In addition, the lagged outcome variables of 2005 and 2012 are also not averaged.

With the nested control weights assigned in Table 4, most of the covariates and lagged outcome variables are matched relatively well. Again, the group of LICs have been included as comparison. Compared to Table 3, there is a better match with the covariates of the Export in Services and the HDI. However, it seems that the synthetic control could not optimally assign and match the weights for the covariate Internet with a difference of around 20 percentage points. Because of the importance of Internet on the trade in services (Choi,2010), the decision has been made to include this covariate for the internal validity of the findings. Lastly, a good

fit was found for the added covariates Level of Unemployment (7.98) and the Population Size in 2012 (11.9M).



Panel 2. The Synthetic Control estimation on total outwards Mode 4 for LLDCs and the difference of the two lines, the LLDCs and the Synthetic Control. Outwards Mode 4 is reported in US dollars, millions. The dotted line in the right figure reflects the last year of the pre-treatment period, as mentioned by Wiltshire (2021).

In Panel 2 is the trend plotted of total Outwards Mode 4 to the world for both the treatment and the synthetic control group. The left figure indicates that a relatively good fit pre-treatment with t = 2013 was found. Both the average of LLDCs as the synthetic control did move in the same direction and magnitude from 2009 until t = 2013, indicating a potential parallel trend. From 2010, both groups had similar levels of outwards Mode 4 until the waiver was operationalized at the MC-9. Important to note, t = 2013 was the moment when both lines diverged after moving in the same direction 4 years in a row from 2009, with our treatment group experiencing a sharp increase in outwards Mode 4, and the synthetic control a steep decrease in exports. This could indicate the short-term positive effects of the waiver. However, around 2014, LLDCs lost its momentum and from 2016 onwards exported less in Mode 4 compared to the synthetic control.

The figure at the right of Panel 2 reports the difference in Outward Mode 4 between our treatment group and the synthetic control. Before the implementation of the waiver both

groups had relatively small differences in their total exports in Mode 4, with only differences for 2007 and 2009. Exactly at the first post-intervention period t = 2013, a sharp positive difference for LLDCs has been noted until 2015. From then on, the synthetic control had an absolute advantage in their export growth in outwards Mode 4, which contradicts *H2*.

5.3. Robustness tests

To evaluate the credibility of the results in part 5.1 and part 5.2, additional tests have been executed to assess the robustness and probability of the findings. Following the approach by Abadie et al. (2010), this paper applied placebo tests to evaluate if our results are either driven by causality or by chance. Furthermore, additional estimations for robustness of the total service exports have been executed using the Difference-in-Difference method.

5.3.1. Placebo tests

In our series, all controls in the donor pool received an in-time placebo to evaluate if there was a causal effect of the waiver on both total service exports and outwards Mode 4.

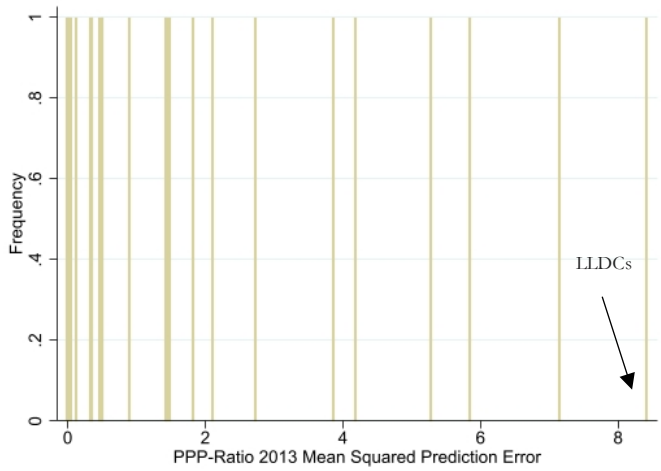


Figure 1. The ratio of the post/pre-proposition MSPE for the total exports in services in 2013.

Figure 1 displays the histogram for the PPP-ratio of (7) the MSPE in 2013, the first year of the operationalization of the waiver. For all the donor countries in the pool, including the treatment group with $N = 22$, placebo runs have been executed to evaluate the causal effect of the waiver. The histogram shows that with the ratio of MSPE of 8.42, the treatment group

received the highest ratio of (7) compared to the other controls. Most controls were skewed between a ratio of 0 and 2. Potentially, this indicates that the waiver had a significant effect on the total exports in services for LLDCs with a P-value of 1/22=0.045 (4.5%) following the approach of Abadie et al. (2010). Using this method, the placebo runs have been executed for all the treatment years and evaluated using the synthetical control command by Wiltshire (2021).

Table 6. Results of the Placebo Runs and Ranked RMSPE for the Total Export in Services

Year	Gap	RMSPE	Rank RMSPE	P-value	N	Unique W
2012	3.82	.	.	.	22	1
2013	71.19	8.41	1	0.045**	22	1
2014	134.24	19.18	1	0.045**	22	1
2015	190.95	32.98	3	0.136	22	1
2016	170.36	36.79	2	0.091*	22	1
2017	141.08	36.04	2	0.091*	22	1
2018	224.59	44.00	2	0.091*	22	1
2019	200.43	47.25	2	0.091*	22	1

Notes: T = 2013 is the year of treatment.

* Significant at 10% level.

** Significant at 5% level.

*** Significant at 1% level.

Table 6 reports the outcomes of the placebo runs for the LLDCs. As mentioned above, the first year of the waiver with t = 2013 is significant at a 5% level with p=0.045 and a gap of 71.19 with the synthetic control. Furthermore, 2014 is significant at a 5% level, and the years 2016-2019 are significant at a 10% level. Only in 2015, 2 controls did better than LLDCs in the placebo runs, and thus, no causality has been found for this year. Apart from 2015, these findings of the SCM support *H1*.

To evaluate the robustness of the results for *H2,* a similar approach has been executed where all the controls from the donor pool received the same treatment as the

LLDCs. Nigeria had to be dropped because of being an extreme outlier with a ratio of (7) 2000 times as high as that of LLDCs.

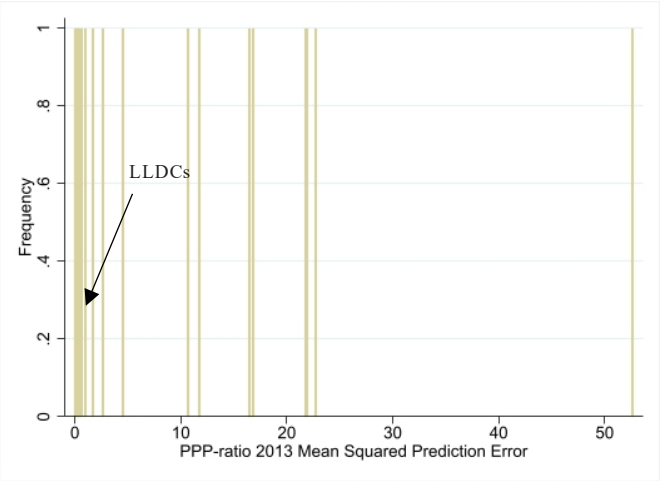


Figure 2. The ratio of the post/pre-proposition MSPE for outwards Mode 4 in services in 2013.

As Figure 2 reports, at the treatment period t = 2013 LLDCs had a ratio of (7) of 0.49. Most controls from the donor pool were skewed to the left and had a ratio between 0 and 5. Furthermore, Figure 2 reports that there was one outlier with a PPP-ratio higher than 50.

Table 7. Results of the Placebo Runs and Ranked RMSPE for Outwards Mode 4

Year	Gap	RMSPE	Rank RMSPE	P-value	N	Unique W
2012	0.04	.	.	.	21	1
2013	-.92	.49	14	0.667	21	1
2014	5.57	9.30	8	0.381	21	1
2015	4.25	9.72	11	0.524	21	1
2016	-1.91	7.82	12	0.571	21	1
2017	-6.0	10.40	12	0.571	21	1

Notes: T = 2013 is the year of treatment.

* Significant at 10% level.

** Significant at 5% level.

*** Significant at 1% level.

In Table 7 the results of the placebo runs are displayed. At t = 2013, the other controls performed better than the LLDCs and hence, no significance has been found with a p-value of 0.667. Furthermore, as mentioned in 5.2, in 2014 and 2015, LLDCs experienced growth in

their Outwards Mode 4, but these are insignificant with a p-value of 0.381 for 2014 and 0.524 for 2015. The results after 2015 remained insignificant and this indicates that *H2* is not supported.

5.3.2. In-time permutations

Following the approach by Abadie et al. (2015) to test for in-time permutations and the potential anticipation effect of the waiver, the year of treatment has been moved to t = 2011 when the waiver was announced at the MC-8. Potentially, there was an anticipation effect that could have affected the results where LLDCs benefitted from the announcement by the waiver, or that external factors influenced the total exports. Because only *H1* has been supported by the SCM, in-time permutations tests were only executed on the total exports in services to assess the credibility of the placebo runs in 5.3.1.

Table 8. Results of the in-time Permutation of t = 2011 for the Total Exports in Services

Year	Gap	RMSPE	Rank RMSPE	P-value	N	Unique W
2010	-17.28	.	.	.	22	1
2011	-24.72	0.88	12	0.545	22	1
2012	2.66	0.45	17	0.773	22	1

Notes: T = 2013 is the year of treatment.

* Significant at 10% level.

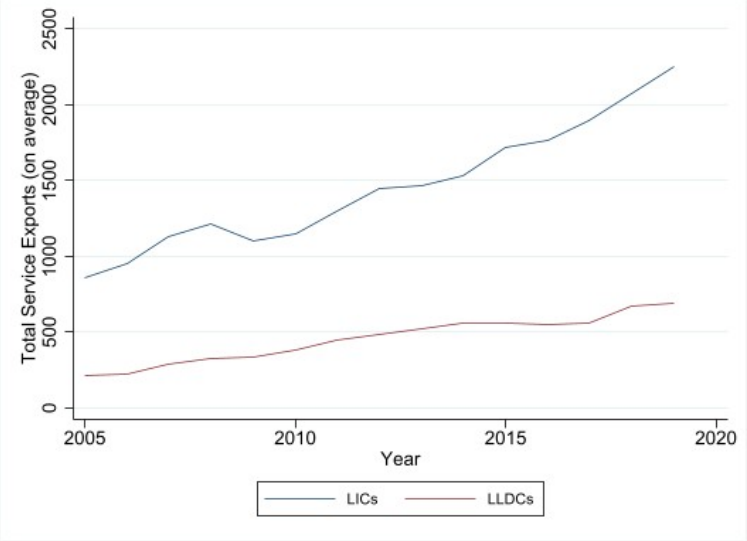
** Significant at 5% level.

*** Significant at 1% level.

Table 8 reports the in-time permutation with the treatment year set at 2011, the implementation of the waiver at the MC-8. LLDCs had a larger gap in exports in services in 2011 compared to 2010. As mentioned in 5.1, from 2012 the exports for LLDCs started to rise above those of the synthetic control. However, this gap was not significant with a p-value of 0.773. This indicates that there has been no significant anticipation effect of the LDC service waiver and that the treatment period t = 2013 is robust for our SCM model.

5.3.3. Robustness checks with the Difference-in-Difference

As reported in 5.1, Panel 1 reflected that for total service exports both lines are diverging just before the operationalization of the waiver in 2012 and 2013. This could indicate that either the SCM method of Abadie et al. (2010) was overestimating or that external factors had a negative effect on the total service exports for our controls. Because only *H1* has been supported by the SCM, additional Difference-in-Difference regressions are executed to test for the robustness of these results only on total service exports. As our data is not randomly sampled and not consist of a small sample of the population, random effects are not appropriate. Furthermore, the Difference-in-Difference model is a type of FE model (Kezdi, 2003; Strumpf et al., 2017). Hence, FE are incorporated in the regressions. The Breusch-Pagan and modified Wald test (Appendix D) for autocorrelation indicated that the residuals are not homoscedastic with a p-value of 0.000. The Wooldridge test (Appendix E) for autocorrelation indicates serial correlation. Therefore, robust standards errors are included in the regression.



Panel 3. Total Service Exports (averaged, millions in US Dollars) of LICs and LLDCs.

Table 9. Results of the Difference-in-Difference regressions

Variables	**(1)**	**(2)**	**(3)**
Post (Year >= 2013)	299.90	294.46	248.40
	(140.46)**	(138.52)**	(122.17)**
LLDC	-877.01	.	.
	(286.08)***	.	.
DiD	-366.72	-365.93	-88.72
	(215.14)*	(213.61)*	(124.99)
Log_GDP	733.74	744.49	835.70
	(183.33)***	(222.28)***	(278.24)***
Differential Time Trend	.	.	-36.06
	.	.	(23.76)
Constant	-15299.93	-15913.55	12766.57
	(4000.981)***	(5041.313)**	(14397.4)
Fixed Effects	No	Yes	Yes
Observations	495	495	495
R-Squared	0.4513	0.3746	0.1111

* Significant at 10% level.

** Significant at 5% level.

*** Significant at 1% level.

Panel 3 reports the values for the Difference-in-Difference regressions of total service exports for LLDCs. The control group consists of LICs excluding LDCs. With LICs having a higher magnitude in export growths compared pre-treatment compared to LLDCs in model (1), this could indicate the need to include a differential time trend to capture heterogeneity between the two groups (Bilinksi & Hatfield, 2018). Also, Post indicated that LICs had a significant difference compared to LLDCs from 2013. Table 9 reports the results from the Difference-in-Difference regressions. Because of the inclusion of FE in model (2) and (3), LLDC was excluded by Stata because of multicollinearity with ω_c. The results are reporting that the log of GDP in all models was significant on explaining total service exports. Importantly, our main variable of interest, the Difference-in-Difference indicator, has been found slightly significant for a negative magnitude in model (1) and (2) with a 10% level. However, after following the approach of Bilinksi and Hatfield (2018) and including the differential linear time trend, this leads to an insignificant result and lower standard errors. This could indicate that the

differential linear time trend captured the differences over time between LICs and LLDCs. Model (3) indicates that compared to our control group of LICs, the comparative difference in service exports for LLDCs was not positively significant post-treatment. Therefore, model 1-3 are not lending support for *H1* and the findings of our SCM in part 5.1.

Table 10. Landlocked LDCs versus non-landlocked LDCs

Variables	**(1)**	**(2)**
Post (Year >= 2013)	204.88	59.44
	(127.36)*	(119.09)
LLDC	-394.27	.
	(158.49)**	.
Comparative Difference with LDCs from t = 2013	-192.01	-169.90
	(165.77)	(158.79)
Log_GDP	548.90	834.94
	(115.82)***	(179.09)***
Constant	-11622.45	-18109
	(2586.17)***	(4020.37)***
Fixed effects	No	Yes
Observations	673	673
R-Squared	0.4022	0.3613

* Significant at 10% level.

** Significant at 5% level.

*** Significant at 1% level.

Lastly, the differential effect of the waiver on LLDCs, compared with LDCs, has been estimated in Table 10. Compared with LDCs, the results are showing that LLDCs did have significant lower values pre-treatment for total service exports with a significance of 5%. However, the interaction term of the difference after t = 2013 did not capture any significant improvement or a reduction of the gap after the operationalization of the waiver of LLDCs with LDCs in both model (1) and (2).

6. Discussion

6.1. The effect of the waiver

This study evaluated whether the LDC service waiver contributed positively to the export of services for LLDCs. Using the synthetic control method of Abadie et al. (2010), and data from the BaTIS and TiSMoS dataset, *H1*, the waiver positively contributed to the total exports in services and H2, the waiver positively contributed to outwards Mode 4, have been examined. Furthermore, placebo runs, and the Difference-in-Difference model have been executed to assess the causality and credibility of the results. To exclude potential anticipations effects, in-time permutations have been executed for 2011; the time of implementation at the MC-8.

The results of the synthetic control method in Panel 1 are showing an asymmetrical difference, where LLDCs experienced a positive gap for their total exports in service since the operationalization of the waiver at MC-9 compared with the synthetic control. First, a significant effect of the waiver on total service exports for LLDCs for 2013 and 2014 with p=0.045 has been found. Furthermore, for 2016-2019, a significance of p=0.091 has been found. These findings are in line with our theory that the LDC service waiver affects the *Relative Distance* in the gravity equation and positively contributes to the total level of exports for LLDCs. Only for 2015, no significant effect has been found. However, with our treatment group and synthetic control diverging around t = 2012, one year before the operationalization of the waiver, this could have indicated that the SCM was inaccurate or overestimating the effect of the waiver. Therefore, additional Difference-in-Difference regressions have been executed to test the effect compared to LICs. These regressions contradicted the results from 5.1, lending no support for *H1*, a positive effect of the waiver on total service exports.

Furthermore, results were attained for outwards Mode 4, with a sharp increase in the export of Mode 4 between 2013 and 2016. However, according to the placebo checks there is insufficient evidence to assume that these are significant. Controversially, from 2016, LLDCs exported less of Mode 4 compared to the synthetic control. Therefore, the results of the SCM are indicating that the waiver could not make a significant positive difference for LLDCs since

the MC-9 and provide insufficient evidence to support *H2*, a positive effect of the waiver on outwards Mode 4.

6.2. Implications

As Panel 1 reports, from 2013, LLDCs have exported increasingly more compared to before the operationalization of the waiver. These findings are in in line with the studies of Schloemann (2012), Narlikar and Priyadarshi (2014), Chanda (2015), Menodoza et al. (2016), Gnangnon (2022a, 2022b), and could indicate that the waiver has been successful in increasing the total exports in services for LLDCs between 2013 and 2019. However, our Difference-in-Difference model is contracting these results as reported in Table 9. Potentially, the SCM overestimated the results or external factors influenced the decrease in service exports of the synthetic control.

With the SCM and the Difference-in-Difference providing contradicting results, implications of both models must be evaluated carefully. First, this paper acknowledges the signs that the SCM has been overestimating the effect for total service exports, with both lines diverging before the operationalization in 2013 in Panel 1. However, for outwards Mode 4, Panel 2 reported a better pre-treatment fit with both groups moving almost parallel. However, also in this model both groups seem to have different magnitudes after 2013. More importantly, the results of the Difference-in-Difference model also need careful interpretation, with Panel 3 underlining the violation of the parallel trend assumption. Potentially, there are other external factors, for example higher levels of service trade liberalization mentioned by Dornbusch (1992) or institutional quality (Levchenko, 2007), which are explaining the higher trend in total service outputs for LICs. Without controlling for these external factors, this could have affected the results.

According to these results, this study acknowledges that there is insufficient evidence to assume that the waiver had a positive effect on total service exports. Lifting the parallel trend assumption and following the Difference-in-Difference model, these results did not lend support for *H1*. Model (1) and model (2) are implicating that the difference with LICs only

increased. However, with including the linear time trend this became insignificant. These findings contradict earlier studies of Schloemann (2012, Narlikar and Priyadarshi (2014), Chanda (2015), Menodoza et al. (2016), Gnangnon (2022a; 2022b). With the lack of empirical support in these studies, the contradicting results could be explained that those studies were mainly based on predictions and qualitative approaches. Also, these studies had insufficient focus on LLDCs. Furthermore, the lack of legal obligation of the waiver could provide insufficient stimulation for the implementation by developing economies, thus limiting the long-term stability of the waiver (Carpio & Mir, 2014; Mangeni, 2003).

Additionally, it seems that the significant limitations in infrastructure and institutional voids of LLDCs are having a stronger weight on their level of competitiveness and limits the efficiency of the waiver (Borchert et al., 2012; Mendoza et al., 2016). Table 10 reports the structural differences in output of LLDCs compared to LDCs before the waiver. Limitations in infrastructure and development all affects the capability of LLDCs to exploit the increased advantages of market access and preferential treatment. Therefore, it seems that the waiver is just a drop in the ocean for all their structural problems affecting their *Relative Distance* in the Gravity equation. As mentioned by Collier (2007b), LLDCs are dealing with structural challenges which have a significant impact on their relative distance in terms of competitiveness. This is in line with the results of our study, where LLDCs had structural lower levels for total service exports compared to LDCs with a significance of 5%. Although the increased opportunities of the waiver for lowering the *Relative Distance* with lower trade barriers and transaction costs, no improvement has been found for the gap in service exports of LLDCs with LDCs after MC-9 in Table 10.

Contrary to the studies of Chanda (2015), Mendoza et al. (2016) and Chanda and Raihan (2016), the results of Panel 2 are not supporting *H2* that the waiver had a positive effect on Outwards Mode 4 for LLDCs. With roughly one third of the preferences (>700) focussed on Mode 4 (Mendoza et al., 2016) and reducing the regulatory barriers of the temporary movement of human capital, it was expected that the findings in this study were

supporting the relevance of the waiver for Mode 4 of supply. Panel 2 shows a sharp increase in 2013 in Outwards Mode 4 for LLDCs compared to the synthetic control, however, insufficient evidence has been found to assume causality by the waiver. This could be explained by the theory that the infrastructure and limitations in quality of human capital of LLDCs are having a relatively stronger weight on relative distance than the reduced trade barriers (Arvis et al., 2010; Kimura and Lee, 2006;). The low levels for schooling could have significantly affected the capability of LLDCs to utilize the waiver and specialize in the abundant factor of (cheap) labour. Furthermore, LLDCs had insufficient economies of scale and lacked their infrastructure in logistics and transports for outwards Mode 4 potentially (Borchert et al., 2012; Chanda & Raihan, 2016). This could have affected the overall level of competitiveness of LLDCs and reduced the effectiveness of the waiver to lower trade barriers in the *Relative Distance* in the Gravity equation.

Hence, this emphasizes the need for the WTO to further increase service trade liberalization in these economies besides the allowance for market access, subsidies, and national treatment. Especially for LLDCs, where additional trade liberalization is important for economies with low levels of development (Briggs & Sheehan, 2019; Dornbusch, 1992; Gnangnon 2022a) to enhance the industry spill overs mentioned by Coe et al. (2009). Furthermore, besides trade liberalization, additional support for LLDCs is required from the WTO and UN to overcome their limitations in infrastructure, institutional voids, competitiveness, and the poverty trap of Collier (2007b).

6.3. Limitations and recommendations

The generalizability of these findings for *H1* and *H2* are limited by a couple of limitations in this study. Firstly, relatively few observations for both hypotheses could have been included because of the lack of data for the total exports in services and outwards Mode 4. Therefore, especially data from the TiSMoS dataset were limited with 2017 the last year of post-intervention. Potentially, the negative trend of 2016 for outwards Mode 4 was reduced with utilizing the preferences, emphasizing the need for additional data of 2018 and 2019.

Furthermore, as data about the export in services for low developing countries is often missing or incomplete, both the BaTIS as the TiSMoS dataset had to be corrected with estimations by the WTO, OECD, and the World Bank. Possibly, this affected the reliability of the data and therefore are not fully representative of the true values of the export in services. These factors could have affected the quality of the data.

In addition, as mentioned in 4.4.3, this study experienced challenges in compiling the donor pool which could have led to the inaccuracy of the SCM for *H1*. As mentioned by Abadie et al. (2010) to avoid interpolation biases, the efficiency of the SCM depends on the criteria of carefully drafting the required donor pool. With LLDCs being categorized as the least developed economies globally (Collier 2007b), the requirement to find countries that equals the same levels of development was not sustainable as reported in Table 3 and Table 5. Preferably, additional landlocked countries that match the other criteria would have been included in the donor pool to better match the main characteristics of the treatment group. Furthermore, because of the absence of data about the quality of infrastructure for LLDCs between 2005 and 2019, these could also not be included as a covariate in the SCM. To construct the synthetic control that closely matches the characteristics of LLDCs, this was preferred by this study (Borchert et al., 2012; Hoekman, 2017).

Although some limitations exist, this study contributes with valuable insights and empirical evidence about the effects of the LDC service waiver on total service exports and outwards Mode 4 of LLDCs. This study continues to build on earlier studies from Schloemann (2012), Narlikar and Priyadarshi (2014), Chanda (2015), Menodoza et al. (2016) and Gnangnon (2022a; 2022b) regarding the effect of the waiver. Potentially, the insights of this paper could provide a signal to the WTO that this intervention is insufficiently supporting their poorest members, LLDCs. Therefore, this study emphasizes that additional support for these countries is required to increase their participation in the GATS.

Further research is needed about the effects of the waiver. Especially little contributions have been established about the effect of the waiver on Mode 1, Mode 2, Mode

3. Furthermore, additional studies are required to estimate the differences in covariates affecting the service exports of LLDCs with LICs for the justification and inclusion of additional control variables in future research. Also, it is suggested that further research is required about the effect of the waiver on outwards Mode 4 after 2017. Lastly, additional quantitative studies are required for the long-term effect of the waiver, including sectorial analysis, to support the WTO with sector specific improvements for the potential extension of the waiver after 2030.

7. Conclusion

This paper empirically evaluated the research question whether the LDC Service waiver positively contributed to the exports of services in LLDCs. Based on earlier literature about the effect of the waiver and the Gravity equation of Tinbergen (1962), the focus of this study was whether the waiver had a positive effect on total service exports and outwards Mode 4 for LLDCs. Careful interpretation of the results of the SCM of Abadie et al. (2010) and the Difference-in-Difference model provided insufficient support that the waiver positively contributed on total service exports and outwards Mode 4 for LLDCs. Therefore, it seems that additional measures by the WTO are required to lower the relative distance of LLDCs with other economies to increase their participation in the GATS. These measures should be focused on the significant limitations of LLDCs in infrastructure (Borchert et al. 2012) and institutional quality. Additionally, further measures are required for outwards Mode 4. Potentially, LLDCs had insufficient economies of scale and lacked their infrastructure in logistics and transports to utilize the waiver towards their advantage (Chanda & Raihan, 2016). Lastly, additional scope for the legal perspective of the waiver could be required for increased stability (Carpio & Mir, 2014).

This study acknowledges some limitations that could limit the generalizability of the results. First, there were insufficient data from the TiSMoS dataset to calculate the effect for outwards Mode 4 of 2018 and 2019. Second, as data of LLDCs is often incomplete, part of the data were based on estimations instead of the true values. Third, because of the restrictions of

no inclusion of LDCs in the donor pool in the SCM, an imperfect match was established with the synthetic control for the level of HDI. Fourth, because of the lack of data for the quality of infrastructure, this could not be used as a covariate in the SCM.

Despite some limitations, this study strongly contributes to earlier research about the effect of the waiver of earlier studies (Chanda, 2015; Chanda & Raihan, 2016; Gnangnon 2022a,2022b; Mendoza et al., 2016; Narlikar & Priyadarshi, 2014; Schloemann, 2012) . With most studies based on qualitative approaches, this study added empirical evaluation towards the efficiency of the waiver for LLDCs. Nonetheless, future research is needed towards the effect on the waiver on Mode 1, 2, and 3. Furthermore, the long-term effect of the waiver needs to be empirically evaluated as a guidance for the decision of the WTO to extend the waiver after 2030. With this evaluation, extensive focus on sectorial analysis is recommended to assess if additional measures are required.

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Appendix A

Selected Covariates for the SCM

Variable name	Explanation	Source
ExportPerc	*The percentage of exports in services of GDP in %*	Exports of goods and services (% of GDP) – World Bank Data
GDPPerc	*Annual GDP growth in %*	GDP growth (annual %) – World Bank Data
hdi_	*The Human Development Index*	Human Development Reports - United Nations
pvr	*Political Stability and Absence of Violence percentile rank*	The Worldwide Governance Indicator – World Bank Data
ger	*Government Effectiveness percentile rank*	The Worldwide Governance Indicator – World Bank Data
rqr	*Regulatory Quality percentile rank*	The Worldwide Governance Indicator – World Bank Data
ccr	*Control of Corruption percentile rank*	The Worldwide Governance Indicator – World Bank Data
GCI	*Global Competitiveness Index*	The Global Competitiveness Index Historical Dataset – World Economic Forum
Internet	*Secure Internet Servers per 1 million people*	Secure Internet Servers – World Bank Data
Unemployment	*Total of Unemployment in % of total labour force*	Unemployment, total (% of total labor force) (modeled ILO estimate) – World Bank Data
PopS	*Population estimates and predictions*	Population, total – World Bank Data

Appendix B

The Donor Pool

Country	Country Code	Criteria matched
Albania	ALB	II, IV
Bolivia	BOL	II, IV
Botswana	BWA	I, II, II
Côte d'Ivoire	CIV	II, IV
Cameroon	CMR	II, IV
Cape Verde	CPV	II, IV
Algeria	DZA	III, IV
Ghana	GHA	III, IV
Honduras	HND	II, IV
Kenya	KEN	III, IV

Kyrgyz Republic	KGZ	I, II, IV
Libya	LBY	III, IV
Moldova	MDA	I, II
Mongolia	MNG	I, II, IV
Mauritius	MAU	II, IV
Nigeria	NGA	III, IV
Nicaragua	NIC	II, IV
El Salvador	SLV	II, IV
Tajikistan	TJK	I, II, III
Tunisia	TUN	II, IV
Zimbabwe	ZWE	II, III, IV

N = 21 countries.

Appendix C

The Control Group of LICs of the IMF (excluding LDCs)

Country
Cameroon
Cabo Verde
Cote D'Ivoire
Dominicana
Ghana
Grenada
Guyana
Honduras
Kenya
Kyrgyz Republic
Maldives
Moldova
Nicaragua
Papa New Guinea
St. Lucia
St. Vincent and the Grenadines
Tajikistan
Tonga
Zimbabwe

N = 19 countries.

Appendix D

The Breusch-Pagan/ Cook-Weisberg test for heteroskedasticity and the Modified Wald test.

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of Totalexports

         chi2(1)      =   516.65
         Prob > chi2  =   0.0000

.
```

```
Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model

H0: sigma(i)^2 = sigma^2 for all i

chi2 (33)  =   88906.54
Prob>chi2 =      0.0000
```

Appendix E

Wooldridge test for autocorrelation in panel data.

```
Linear regression                               Number of obs     =        462
                                                F(3, 32)          =       5.07
                                                Prob > F          =     0.0055
                                                R-squared         =     0.0286
                                                Root MSE          =     296.71

                                   (Std. Err. adjusted for 33 clusters in CountryCode_num1)
------------------------------------------------------------------------------
D.           |               Robust
Totalexports |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        time |
         D1. |  -8.544139   55.18773    -0.15   0.878    -120.9579    103.8696
             |
        LLDC |
         D1. |          0  (omitted)
             |
         DiD |
         D1. |   41.01341   63.76513     0.64   0.525    -88.87191    170.8987
             |
     log_GDP |
         D1. |   343.3439   107.5879     3.19   0.003     124.1946    562.4932
------------------------------------------------------------------------------

Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,      32) =     83.613
           Prob > F =      0.0000
```