

Empirical Paper

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General, high-tech, and mid-tech regional trade introversion indexes as measures of trade integration within RTAs

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Abstract:

In this paper, we analyze the regional trade introversion indexes (RTIIs) for regional trading arrangements (RTAs) with various numbers of differently developed participants and different depths of economic integration. The analyzed RTAs stem from all inhabited continents. We compare three types of indexes: (1) the general RTII calculated for trade in all goods (“general RTII”), (2) its modification called “high-tech RTII,” including exclusively high technology manufactures, and (3) “med-tech RTII,” including goods classified as medium technology manufactures. The aim of the article is to answer the research question whether “high-tech RTIIs” and “med-tech RTIIs” are higher than “general RTIIs.” Our study does not provide a simple and unequivocal answer to the research question, but we do confirm that in general the regional trade introversion measured by RTIIs is stronger for medium technology manufactures than for all goods, while for high technology manufactures the picture is more complicated.

Keywords: economic integration, extra-RTA trade, intra-RTA trade

JEL Classification: F14, F15

1 Introduction

As the prospects for global cooperation and success of the following round of multilateral negotiations under the auspices of the World Trade Organisation (WTO) are unclear, many countries and groups of countries are looking for alternative forms of unconstrained international cooperation in the framework of regional trading arrangements (RTAs). The number of regional groups has been growing, reaching the impressive number of 360 RTAs now in force (see <https://rtais.wto.org/UI/charts.aspx#>, accessed on July 22, 2023). One possible result is the strengthening of close economic ties on a regional rather than a global basis. The pandemic, disadvantages of long distance economic cooperation, and digitization of production processes seem to additionally reinforce regionalization and weaken globalization.

In this paper, we analyze the regional trade introversion indexes (RTIIs) for RTAs with various numbers of differently developed participants and different depths of economic integration. The analyzed RTAs stem from all inhabited continents, indirectly showing the globalization of regionalization. Thus, we analyze the European Union (EU), the United States-Mexico-Canada Agreement (USMCA), the Australia New Zealand Closer Economic Agreement (ANZCERTA), Mercado Común del Sur (MERCOSUR), the Association of

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Southeast Asian Nations (ASEAN), Communauté Économique et Monétaire de l'Afrique Centrale (CEMAC), and the Southern African Customs Union (SACU).

The analysis covers the period 2001–2022, which we believe is a sufficiently long time to indicate potential development trends. We check whether participation in RTAs is accompanied by a technological improvement of exports. We compare three types of indexes. The first one is a general RTII calculated for trade in all goods (“general RTII”) as proposed by Iapadre [2006]. The second one is its modification called “high-tech RTII,” including exclusively high technology manufactures (Lall [2000]; for the full list of goods assigned to all groups differing in technological advancement, see https://unctadstat.unctad.org/en/Classifications/DimSitcRev3Products_Ldc_Hierarchy.pdf). Since we are particularly interested in catching-up economies joining the most developed RTAs, we additionally introduce the third type of index, called “med-tech RTII,” which includes goods classified as medium technology manufactures. The third type of goods often precedes production and export of high-tech goods.

The research aims to answer the question whether “high-tech RTIIs” and “med-tech RTIIs” are higher than general RTIIs. We expect both sectoral indexes (high-tech RTIIs and med-tech RTIIs) to be higher than the general RTIIs, especially for RTAs with the most developed member states. This is mainly because of the advanced manufactures’ production of these countries, high income driving consumption, and the high propensity of their citizens to buy foreign goods, including foreign varieties of differentiated goods subject to intra-industry trade. We also think that institutional integration in the form of RTAs goes together with technological progress, especially in the case of catching-up economies joining the groups of the most developed countries. Even though RTIIs only provide constrained knowledge about trade integration, we try to comment on values and changes in indexes based on general information about the analyzed RTAs and their members.

Simultaneously, we are aware that the results, especially in the case of the high-tech RTIIs, might be misleading, as the analyzed indexes are relative measures. As a result, RTAs with less developed members poorly participating in world trade might have high values of all RTIIs, giving a false impression of their deep trade integration. To study this effect, we compare the values of internal and external trade of the RTAs in question with the values of trade of the EU and USMCA as RTAs with the most developed member states. To conclude, we show that the main disadvantage of RTIIs is their relativities.

2 Literature review

More than 20 years ago, Lall [2000] proposed a classification of exports based on factor intensity and technological advancement of traded products, which includes primary products, resource-based manufactures, low technology manufactures, medium technology manufactures, high technology manufactures, and other goods. Lall’s classification seems quite precise, as the distinctions are clear and there are no overlaps between categories. A few years ago, United Nations Conference for Trade and Development (UNCTAD) incorporated this classification into its statistical database, thus popularizing Lall’s approach.

There are some studies (e.g., Trindade and Pereira de Oliveira [2017], Sampath and Vallejo [2018], Bagaria and Ismail [2018], Czarny et al. [2020], Folfas and Szarek-Piaskowska [2022], Radło and Szarek-Piaskowska [2022], Zapata, Arrazola and de Hevia [2023]) in which the authors analyzed the structure of exports using Lall’s classification. However, the number of such studies is still relatively small and their subject matter is constrained to a single country or a group of countries. There is a lack of studies scrutinizing worldwide trade using Lall’s classification, the gap that we fill focusing on intra- and extraregional trade in general, as well as – in more detail – in medium and high technology manufactures. Our analysis covers the most important RTAs coming from all continents (EU, USMCA, ANZCERTA, MERCOSUR, ASEAN, CEMAC, and SACU).

As mentioned in the introduction to our research, we check whether participation in RTAs is accompanied by a technological improvement of exports. In this context, it is worth mentioning the study carried out by Martinez-Zarzoso and Chelala [2021]. They claim that their study is the first paper to analyze a global sample of countries in terms of how trade agreements that include technology-related provisions impact exports of goods, and how this impact differs depending on the technology content of the goods. The main results indicate that RTAs that contain technology provisions generate a significantly higher volume of trade than

RTAs that do not. For countries that ratify RTAs that include such provisions, it is exports of technology-intensive goods that increase the most.

The global crisis in 2008–2009 and the post-crisis stagnation triggered a “new normality” characterized by protection (closeness) rather than by openness, which was fully experienced in the second decade of the 21st century. Under this new normality, value chains are becoming more regional in scope, more knowledge and human-capital intensive, as well as relying more and more on services – especially professional and innovative. This was proved by Baldwin and Lopez-Gonzalez [2013], Miroudot and Nordström [2015], De Backer and Miroudot [2013]; Hanzl-Weiss et al. [2018], McKinsey Global Institute [2019], Meng et al. [2019], Folfas and Odrobina [2020], and Folfas [2021, 2023].

A growing number of digital solutions have supplemented or even replaced real production processes, with medium and high technology manufactures consequently becoming crucial. With the increasing regionalization of international value chains, focusing on RTAs seems reasonable. Moreover, slowbalization – meaning the noticeable slowdown of globalization, together with the COVID-19 pandemic, has boosted regional production processes. Thus, comparing trade inside RTAs with external trade of the member states has once again become an important issue, particularly in the context of technological progress.

3 Data and methods

We use Lall’s classification consisting of six main categories: primary products, resource-based manufactures, low technology manufactures, medium technology manufactures, high technology manufactures, and other goods. We are particularly interested in the correlation of RTAs and technological upgrading of the catching-up members, which is why we pay the most attention to medium and high technology manufactures.

Lall’s category “medium technology manufactures” includes goods whose production is strongly fragmented: transport equipment, machineries, rubber, plastics, chemicals, and chemical products. We add med-tech RTIs to our research, as many countries joining RTAs consisting of developed members start their technological upgrading with this type of goods. We are especially interested whether Central and East European countries’ accession to the EU will be visible in this context.

The category “high technology manufactures” encompasses knowledge and human-capital intensive goods such as electrical and optical equipment, pharmaceuticals, telecommunications equipment, and automatic data processing machines. All statistics concerning international trade in goods used in our study were extracted from the UNCTAD’s database.

We use the RTII proposed by Iapadre [2006] and developed by Hamanaka [2015] to study the trade orientation of RTAs. This index enables measurement of the relative intensity of regional trading versus trading of the RTA with the rest of the world. The RTII index is independent of the size of the RTA, as it applies relative values. It is sensitive to the differences among the partners in one RTA. Relatively high values are expected in the RTAs containing countries with similar economic potentials. If the potential of one member state dominates, the small partners cannot reach trade intensity expected for big participants, which pulls the index down.

RTIs can range from –1 to 1. The index rises (falls) if the intensity of intraregional trade grows more (less) rapidly than that of extraregional trade. If the index is equal to zero, then the RTA’s trade is geographically neutral: it grows similarly in the intraregional and extraregional terms. If the index is a positive number, the RTA’s trade has an intraregional bias. In the extreme case of $RTII = 1$, all RTA’s trade is intraregional. If the RTII is less than zero, then the RTA’s trade has an extraregional bias. If $RTII = -1$, all trade of the analyzed RTA is extraregional. The formula for the RTII is as follows:

$$RTII_i = \frac{HI_i - HE_i}{HI_i + HE_i}, \text{ with: } HI_i = \frac{\frac{T_{ii}}{T_i}}{\frac{T_{oi}}{T_o}} \text{ and } HE_i = \frac{1 - \frac{T_{ii}}{T_i}}{1 - \frac{T_{oi}}{T_o}}.$$

where

$RTII_i$ – RTII of the region (RTA) i

T_{ii} – exports of RTA i to RTA i plus imports of RTA i from RTA i ,

T_i – total exports of RTA i to the world plus total imports of RTA i from the world,

T_{oi} – exports of RTA i to outsiders plus imports of RTA i from outsiders,

T_o – total exports of outsiders plus total imports of outsiders.

4 General, med-tech, and high-tech trade integration of selected RTAs

First, we scrutinize RTAs consisting of developed countries (EU and ANZCERTA consist of only industrialized countries as USMCA includes two developed and one developing country). Second, we study the trade orientation of RTAs consisting of developing countries (MERCOSUR, ASEAN, CEMAC, and SACU).

All analyzed RTAs have fixed sets of member states as at 2022. Thus, for example Slovakia is a member of EU for the whole period of analysis (2000–2022) and the United Kingdom does not belong to the EU during this period.

4.1 EU

Data presented in Table 1 show that the RTII of the EU was steadily increasing till 2021 (from 0.67 in 2001 to 0.75 in 2021). The decreases were recorded only in the years 2008 (the world financial crisis), 2019, and 2022. The RTII did not change in the year 2004, when 10 countries became new members, nor in the years of the next EU enlargements. The probable reason for the 2004 outcome is, preceding membership, gradual liberalization of trade between the old and the new member states as an increase of the RTII had occurred already in 2003. In contrast, in the case of both other enlargements (2007 and 2014), an important reason is the low trade potential of the new members.

The EU RTII never exceeded 0.75. Taking into consideration that the EU as a non-completed economic and monetary union is the most integrated RTA in the world, we assume that values of the RTII around 0.7 represent an optimal or close to optimal level of integration.

The EU RTII for medium technology manufactures shows a smaller amplitude of fluctuations than the general RTII. The minimal value of med-tech RTIIs was reached in 2004 (0.68), repeated during the global financial crisis (2007–2008) and in the year of the unprecedented collapse of world trade (2009). The low value in 2004 probably resulted from full liberalization of trade with newcomers from Central and Eastern Europe (CEEC), which were economically weaker than the old EU, supplying the EU market at the time mainly with labor- and raw material-intensive goods, such as agricultural products. The index achieved the maximal value (0.73) in the last 2 years of our study. This index, however, did not present a clear trend of change, as increases were interspersed with decreases. A tendency to increase could only be observed since 2017 and could be the result of substitution of global value chains with the regional ones following disappointment in long-distance cooperation, particularly during the pandemic.

It is also worth noting the same or similar value of the EU RTII and its med-tech RTII over the entire study period, which seems to indicate a strong impact of trade in medium-technology products on total trade. However, we observed that until 2012, the med-tech RTII was not lower than the general RTII, while in the years 2013–2021 the opposite is true. However, the last trend was reversed in 2022.

RTII for high technology manufactures exhibits the strongest upward trend (increase from 0.55 in 2001 to 0.68 in 2022). The difference between this index and both other indexes becomes smaller, even if the high-tech RTII is still the lowest. In 2001, the high-tech RTII was 0.12 below the general RTII and 0.15 below the med-tech RTII. In 2022, the respective differences were equal to -0.04 and -0.05 . This shows the increasing importance of high-tech manufactures in trade among the EU member states, and it is also an indirect proof of the increasing importance of such goods in member states' production. It also seems to confirm the spread of technological progress among the EU members.

Table 1. The RTII of the EU in the years 2001–2022*

Year	All goods	Medium technology manufactures	High technology manufactures
2001	0.67	0.70	0.55
2002	0.67	0.70	0.57
2003	0.68	0.69	0.60
2004	0.68	0.68	0.58
2005	0.68	0.70	0.58
2006	0.68	0.69	0.60
2007	0.68	0.68	0.61
2008	0.67	0.68	0.60
2009	0.68	0.68	0.61
2010	0.69	0.70	0.63
2011	0.70	0.70	0.63
2012	0.70	0.70	0.65
2013	0.71	0.69	0.66
2014	0.71	0.70	0.67
2015	0.72	0.71	0.67
2016	0.72	0.71	0.65
2017	0.72	0.70	0.65
2018	0.72	0.71	0.66
2019	0.71	0.71	0.64
2020	0.73	0.72	0.69
2021	0.75	0.73	0.70
2022	0.72	0.73	0.68

*The EU consists of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden for the whole period of the analysis.

Source: Own calculations based on UNCTAD statistics, <https://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx>, accessed on July 11, 2023.

EU, European Union; RTII, regional trade introversion index.

Our study reveals that first EU member states concentrated more on mutual trade, rather than on exchange with the rest of the world. This is not surprising, with more neighbor countries becoming connected in the integrated region. Second, with time EU members became increasingly engaged in reciprocal trade with high-tech goods, albeit this is still less intraregionally oriented than trade with all goods and with med-tech goods. However, the values of the high-tech RTII are noticeably higher than 20 years ago, whereas the med-tech RTII's values remain almost unchanged. The success of the EU as a common market is undebatable, even if the data from the year 2022 do not confirm a long-term upward trend.

4.2 USMCA

The (USMCA; formerly NAFTA - North American Free Trade Agreement)) also has relatively high and quite stable RTIIs (Table 2). The values of the RTII for trade with high technology manufactures are lower than for trade with all goods. The opposite is true for USMCA RTII values for trade with medium technology manufactures: they are noticeably higher than for trade with all goods.

Data in Table 2 show that the USMCA general RTII and med-tech RTII were relatively stable throughout the whole research period. An increase in their amplitude of change did not increase during the recent global economic crisis nor during the COVID-19 pandemic. The maximal value of RTII equal to 0.71 was observed in 2013 and 2014 and the minimal value (0.67) was seen in 2001, 2002, 2016, and 2020. This means

Table 2. The RTII of the USMCA (formerly NAFTA) in the years 2001–2022

Year	All goods	Medium technology manufactures	High technology manufactures
2001	0.67	0.77	0.37
2002	0.67	0.77	0.36
2003	0.69	0.80	0.39
2004	0.70	0.80	0.46
2005	0.69	0.79	0.44
2006	0.68	0.78	0.36
2007	0.69	0.79	0.38
2008	0.69	0.77	0.39
2009	0.69	0.80	0.46
2010	0.69	0.80	0.46
2011	0.70	0.80	0.46
2012	0.70	0.78	0.46
2013	0.71	0.79	0.47
2014	0.71	0.79	0.46
2015	0.68	0.77	0.44
2016	0.67	0.78	0.42
2017	0.68	0.78	0.42
2018	0.69	0.78	0.44
2019	0.68	0.78	0.44
2020	0.67	0.78	0.42
2021	0.68	0.78	0.41
2022	0.69	0.77	0.39

Source: Own calculations based on UNCTAD statistics, <https://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx>, accessed on July 11, 2023.

RTII, regional trade introversion index; USMCA, United States-Mexico-Canada Agreement.

that the maximal difference between the RTII values was 0.04. In the case of the med-tech RTII, the changes were even smaller (0.3), with the maximal value equal to 0.8 observed in the years 2003–2004 and 2009–2011, and minimal (0.77) in the years 2001–2002, 2008, 2015, and 2022. Data in Table 2 show that the med-tech RTII was higher than the general RTII during the whole analysis period. The high-tech RTII was the most instable and lowest index, with a minimal value equal to 0.36 (2002 and 2006). The highest value of 0.47 was observed in 2013.

4.3 ANZCERTA

The ANZCERTA has a relatively high intraregional trade orientation, although it has been weakening since 2017 (Table 3). This change is quite likely connected with the stronger extra-RTA bias of ANZCERTA members, especially toward China, and is more visible for trade with all goods and with medium technology manufactures than for high technology manufactures. It is also worth noticing that the values of ANZCERTA's med-tech RTII throughout the study and the high-tech RTII since 2005 are higher than the general RTII, and are also more stable, even if all the indexes showed a downward trend.

At the beginning of the analysis period, the high-tech RTII had similar value in ANZCERTA as the general RTII. Since the global crisis (2008), both indexes went separate ways: the general RTII dropped and the high-tech RTII stayed relatively stable, or even increased in some years.

Table 3. The RTII of ANZCERTA in the years 2001–2022

Year	All goods	Medium technology manufactures	High technology manufactures
2001	0.75	0.81	0.75
2002	0.76	0.80	0.73
2003	0.77	0.81	0.76
2004	0.76	0.80	0.73
2005	0.74	0.79	0.74
2006	0.71	0.79	0.73
2007	0.72	0.78	0.72
2008	0.66	0.74	0.70
2009	0.63	0.73	0.71
2010	0.60	0.72	0.69
2011	0.58	0.74	0.67
2012	0.54	0.64	0.66
2013	0.54	0.68	0.69
2014	0.56	0.69	0.69
2015	0.58	0.66	0.71
2016	0.59	0.69	0.68
2017	0.52	0.66	0.68
2018	0.51	0.68	0.66
2019	0.48	0.70	0.67
2020	0.48	0.69	0.69
2021	0.40	0.65	0.72
2022	0.31	0.59	0.63

Source: Own calculations based on UNCTAD statistics, <https://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx>, accessed on July 11, 2023.

ANZCERTA, Australia New Zealand Closer Economic Agreement; RTII, regional trade introversion index.

4.4 MERCOSUR

Values of the RTII of MERCOSUR were surprisingly high throughout the study (see Table 4), though their changes showed a downward trend. In 2001, the MERCOSUR general RTII was equal to 0.91, which was its highest value across this sample. The lowest value was achieved in the last year of the study (2022: 0.78). The med-tech RTII was at all times considerably higher than the general RTII. Even if during the study its value decreased from 0.93 in 2001 to 0.88 in 2022, it still remained very high, and its decrease was smaller than the decrease of the general RTII (–0.05 versus –0.13). Moreover, it did not fall below 0.9 in any but the last year of the study. The values of the high-tech RTII were much lower than both the mentioned RTIIs, albeit they revealed a decreasing trend just like both other indexes (its change was equal to –0.11). Only in 2005 did the high-tech RTII reach the value of the general RTII (0.89), which was the highest value of this indicator in the sample. The lowest high-tech RTII was reached in 2012 (0.62).

Weakening trade integration of MERCOSUR seems to prove that this group already fulfilled its role, leading to an increase in the international competitiveness of goods from the member states. As a consequence, MERCOSUR countries increasingly intensified their trade with the rest of the world, particularly with China and other fast-growing Asian economies. As a consequence, their interest in exchange within MERCOSUR declined. MERCOSUR seems to exhaust the possibilities of further trade integration.

Table 4. The RTII of MERCOSUR in the years 2001–2022

Year	All goods	Medium technology manufactures	High technology manufactures
2001	0.91	0.93	0.79
2002	0.89	0.92	0.74
2003	0.90	0.93	0.84
2004	0.89	0.94	0.86
2005	0.89	0.93	0.89
2006	0.89	0.93	0.86
2007	0.89	0.94	0.84
2008	0.86	0.92	0.80
2009	0.87	0.93	0.81
2010	0.85	0.93	0.79
2011	0.84	0.92	0.75
2012	0.83	0.91	0.65
2013	0.83	0.92	0.64
2014	0.82	0.92	0.62
2015	0.83	0.92	0.68
2016	0.86	0.93	0.73
2017	0.86	0.94	0.68
2018	0.85	0.92	0.70
2019	0.82	0.90	0.67
2020	0.82	0.90	0.68
2021	0.81	0.90	0.64
2022	0.78	0.88	0.68

Source: Own calculations based on UNCTAD statistics, <https://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx>, accessed on July 11, 2023.

MERCOSUR, Mercado Común del Sur; RTII, regional trade introversion index.

4.5 ASEAN

The representative of Asia in our study is the ASEAN. Due to the relatively low level of its economic integration and the priority of political and not economic objectives, we do not expect either high or increasing rates of regional trade introversion of this group measured with our three types of RTIIs.

At the beginning of our study, the general RTII of ASEAN was relatively high (0.7 in 2001), but was systematically decreasing (Table 5) to only 0.6 in 2022. Throughout the period covered by the study, the med-tech RTII was higher for trade as a whole. However, the med-tech RTII has showed some decline from 2007. Overall, between 2001 and 2022, its value decreased from 0.77 to 0.63. This decrease was therefore greater than for the general RTII.

ASEAN's high-tech RTII was much lower than both other indicators (0.52 in 2001 and 0.3 in 2022). In 2001, the high-tech RTII was 0.17 lower than the general RTII and 0.24 lower than the med-tech RTII. In 2022, these differences were even higher and equal to 0.3 and –0.33, respectively. We assume that the main reason for such weak trade links in high-tech goods is the ASEAN member states' focus on global, or at least international, production cooperation beyond its own RTA.

4.6 CEMAC

Communauté Économique et Monétaire de l'Afrique Centrale (CEMAC) is the most trade-integrated among the RTAs we have examined so far (see Table 6). None of its RTIIs fell below 0.9 in any year covered by the study,

Table 5. The RTII of ASEAN in the years 2001–2022

Year	All goods	Medium technology manufactures	High technology manufactures
2001	0.70	0.77	0.53
2002	0.70	0.78	0.53
2003	0.72	0.79	0.51
2004	0.73	0.81	0.54
2005	0.74	0.81	0.57
2006	0.73	0.82	0.56
2007	0.74	0.81	0.53
2008	0.74	0.80	0.56
2009	0.72	0.79	0.53
2010	0.70	0.77	0.52
2011	0.70	0.76	0.53
2012	0.69	0.74	0.51
2013	0.69	0.75	0.49
2014	0.69	0.75	0.49
2015	0.67	0.74	0.48
2016	0.66	0.73	0.46
2017	0.64	0.72	0.42
2018	0.64	0.71	0.41
2019	0.63	0.70	0.38
2020	0.59	0.66	0.34
2021	0.59	0.64	0.34
2022	0.60	0.63	0.30

Source: Own calculations based on UNCTAD statistics, <https://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx>, accessed on July 11, 2023.

ASEAN, Association of Southeast Asian Nations; RTII, regional trade introversion index.

which implies an almost complete inward orientation of the member states. Moreover, it is also the first of the RTAs made up of developing countries surveyed to record deepening trade integration as measured by all three RTIIs.

The general RTII of CEMAC ranged between 0.92 in 2001 and 0.95 in 2022, showing growth at high levels of the indicator. The minimal value of the general indicator (0.9) was recorded in 2005–2006, the early years of the study. In contrast, the maximal value of 0.95 was reached in 2016, 2017, 2020, and 2022 – the final years of the study. This means that before the financial crisis, the CEMAC countries traded somewhat more intensively with the outside world than afterward. After the crisis, the CEMAC countries only briefly tried to return to trade with the rest of the world in 2012–2015, later resuming an almost exclusive intra-RTA exchange.

CEMAC countries' trade with third countries in medium- and high-technology products was even more limited, with the ITS RTII for medium-technology products ranging from 0.92 in 2001 to 0.98 in 2022. The level of this indicator was minimal in the first year of the survey (and in 2015) for the entire sample. The maximal value was recorded between 2008 and 2011 and in 2018 (0.99). The CEMAC high-tech RTII was, for most of the period under review, slightly less than the med-tech RTII, although its value never fell below 0.91, showing an upward trend at the end of the period, leading to an increase in both sectoral indexes. We can approximately say that trade in medium- and high-technology goods was exclusively internal.

The story about internal trade in CEMAC is not, in our view, a success story of trade integration of developing countries, as we assume that the CEMAC members suffered from insufficient competitiveness

Table 6. The RTII of CEMAC in the years 2001–2022

Year	All goods	Medium technology manufactures	High technology manufactures
2001	0.92	0.92	0.91
2002	0.94	0.95	0.96
2003	0.94	0.96	0.98
2004	0.92	0.97	0.96
2005	0.90	0.96	0.98
2006	0.90	0.94	0.96
2007	0.93	0.98	0.98
2008	0.93	0.99	0.96
2009	0.93	0.99	0.97
2010	0.93	0.99	0.95
2011	0.94	0.99	0.97
2012	0.92	0.98	0.95
2013	0.93	0.97	0.96
2014	0.91	0.94	0.92
2015	0.92	0.92	0.94
2016	0.95	0.96	0.96
2017	0.95	0.98	0.94
2018	0.94	0.99	0.95
2019	0.93	0.98	0.95
2020	0.95	0.98	0.96
2021	0.93	0.98	0.96
2022	0.95	0.98	0.98

Source: Own calculations based on UNCTAD statistics, <https://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx>, accessed on July 11, 2023.

CEMAC, *Communauté Économique et Monétaire de l'Afrique Centrale*; RTII, regional trade introversion index.

on the world market. The partners from the group might be the only counterparties willing to buy products from this RTA's members.

4.7 SACU

The SACU achieved high values of RTII, but they were lower than those of CEMAC. All three RTIIs in 2022 were higher than those in 2001 (Table 7), and all the RTIIs rather increased than decreased in the years 2009–2020. They later collapsed in 2021, to grow again in 2022.¹

In the first year of our analysis, the general RTII was equal to 0.9, while in the last year it was 0.93. The dominant trend throughout the period of study was an increase. In 2001, the med-tech RTII was equal to 0.91, while in 2022 it was 0.96. In the years 2006–2020, we observed a general upward trend of the med-tech RTII, with values ranging from 0.87 to 0.97. Moreover, throughout the study period, the med-tech RTII was not lower than the general RTII (with the exception in 2005).

The high-tech RTII of SACU, as both other RTIIs of this RTA, is very high, even if in numerous years of the study it was lower than both others. This indicator was the most instable one throughout the study, although the fluctuation amplitudes of all three indicators varied slightly. The value of the high-tech RTII ranged from 0.83 in 2006 and 2007 to 0.95 in 2020 (by comparison: the value of the general RTII varied from

¹ It shows that the outcome of the survey strongly depends on the sampling. If we had finished our study in 2021, we would conclude that the last year's result did not confirm the long-term trend.

Table 7. The RTII of SACU in the years 2001–2022

Year	All goods	Medium technology manufactures	High technology manufactures
2001	0.90	0.91	0.92
2002	0.91	0.92	0.91
2003	0.90	0.92	0.91
2004	0.90	0.90	0.89
2005	0.87	0.86	0.86
2006	0.84	0.87	0.83
2007	0.84	0.87	0.83
2008	0.87	0.88	0.84
2009	0.90	0.91	0.90
2010	0.94	0.95	0.94
2011	0.92	0.94	0.93
2012	0.93	0.95	0.93
2013	0.94	0.94	0.93
2014	0.94	0.95	0.94
2015	0.95	0.95	0.94
2016	0.95	0.95	0.94
2017	0.94	0.96	0.94
2018	0.94	0.96	0.93
2019	0.94	0.96	0.94
2020	0.94	0.97	0.95
2021	0.87	0.90	0.84
2022	0.93	0.96	0.93

Source: Own calculations based on UNCTAD statistics, <https://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx>, accessed on July 11, 2023.

RTII, regional trade introversion index; SACU, Southern African Customs Union.

0.84 to 0.95 and the value of the med-tech RTII varied from 0.86 to 0.97). The reason for the high- and med-tech RTII values might be the relatively low trade volumes and the large impact of individual transactions on the value of the indicators. We elaborate on this issue in the next section.

Interestingly, in 2021, the values of all three RTIIs decreased considerably. This decline could be the result of constrained trade contacts, especially during and after the pandemic.

5 Shortcomings of the RTII

In our opinion, the unusually high values of all three RTIIs of RTAs consisting of developing countries confirmed the main shortcoming of not only the RTII, but also – more generally – all relative measures. Such measures do not take into account the absolute values, the base for their calculation. Their values do not depend on size of intra- and extra-RTA trade, or on the number and characteristics of their members. As a result, we compare big streams of exchange in the EU with single transactions or bundles of transactions in African RTAs. To show the importance of this fact, we compare the values of internal and external trade (export and import) of the analyzed RTAs (Table 8).

We look at trade values in the studied RTAs, paying special attention to the trade of RTAs consisting of developing and catching-up countries (ASEAN, MERCOSUR, CEMAC, and SACU), and compare their trade with the respective values achieved by the EU and USMCA. We conduct this analysis with regard to not only all the trade but also trade with medium- and high-technology goods, where the shortcomings of RTIIs are

Table 8. Internal and external trade of the analyzed RTAs in 2022 (in billions of USD, current prices, and exchange rates)

	Internal trade	External trade
All goods		
EU	8,131.44	6,240.42
USMCA	3,106.07	4,673.70
ANZCERTA	24.63	796.39
MERCOSUR	93.54	753.21
ASEAN	831.74	2,998.68
CEMAC	1.91	52.70
SACU	31.39	242.12
Medium technology manufactures		
EU	2,648.21	1,676.78
USMCA	1,142.15	1,190.92
ANZCERTA	5.69	136.59
MERCOSUR	38.27	178.48
ASEAN	163.11	646.45
CEMAC	0.49	8.29
SACU	6.86	55.99
High technology manufactures		
EU	1,297.98	1,250.25
USMCA	391.50	1,131.71
ANZCERTA	2.31	72.22
MERCOSUR	2.83	73.02
ASEAN	170.44	865.14
CEMAC	0.04	2.27
SACU	1.43	17.28

Source: Own calculations based on UNCTAD statistics, <https://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx>, accessed on July 11, 2023.

ANZCERTA, Australia New Zealand Closer Economic Agreement; ASEAN, Association of Southeast Asian Nations; CEMAC, Communauté Économique et Monétaire de l'Afrique Centrale; EU, European Union; MERCOSUR, Mercado Común del Sur; RTAs, regional trading arrangements; SACU, Southern African Customs Union; USMCA, United States-Mexico-Canada Agreement.

particularly visible. As we will illustrate the current differences between RTAs, we limit the analysis to 2022 data only.

In 2022, the last year of our empirical research, the unquestionably highest internal trade potential was observed by the EU (see Table 8, with trade more than 2.6 times higher than the respective level of trade of the USMCA. The aggregated internal trade of all RTAs other than the EU and USMCA was more than three times smaller than the respective turnover of the USMCA, and more than eight times smaller than that of the EU. Internal trade of the EU was almost 87 times higher than the respective trade of MERCOSUR, around 259 times higher than the internal trade of SACU, and 4,257 times more than the trade in CEMAC. These comparisons confirm the co-occurrence of the value of internal trade among RTA members with their incomes and wealth, as well as with the scope of integration. This is also evidenced by much smaller differences between the EU, the USMCA, and the other RTAs in their external trade (EU external trade was only US\$252.2 billion more than the respective trade of six other RTAs).

Additional proof of the correlation of depth of integration and intensity of internal trade of an RTA is shown in a comparison of values of internal and external trade of the analyzed RTAs. Only in the case of the EU, which is the most integrated, does internal trade exceed external. The opposite is true in other cases. It is also worth noting that, except in the case of the USMCA, this difference is high. Thus, in ANZCERTA

external trade is more than 32 times higher, and in CEMAC it is more than 27.6 times higher than internal. Simultaneously, streams of external trade differ less (e.g., external trade of the EU is only 34% higher than similar trade in the USMCA, around 118 more than the external trade of CEMAC, and almost 26 times higher than the external trade of SACU). This means that, compared to these streams, RTIIs relativity is less important.

Our investigation also shows a high disparity in the commercial potentials of the studied RTAs, which means a different weight of information contained in the values of the RTIIs. In general, the RTAs, consisting of developing countries, have both a relatively low extent of integration and level of development. Even if they are characterized by the differences in the number of member states and importance of individual participants of the RTA, in each case the strong trade integration seems to stem from the lack of marketability of goods produced by their members outside their own RTAs. Of course, we are not underestimating the success of CEMAC and SACU, as without these RTAs their members would probably have been completely excluded from international trade. However, their commercial inability is also proved by the low external trade values of these RTAs.

Examining the trade integration of RTAs consisting of economically less developed members using the RTII reveals a huge flaw in this measure. As a relative measure, the RTII does not show the basis of the study. It thus equates the results for large, economically strong and open RTAs with those that are economically weak and fairly autarkic. In the case of RTAs composed of least developed countries (LDCs), the basis for calculation of the RTII is negligible streams of trade. These streams determine the size of the individual RTII, and even a single large transaction could have been responsible for their changes. It is therefore useful to complement the analysis of these indexes with detailed information on the volumes of trade underlying their calculation, as shown in Table 8.

As we are interested not only in the general trade introversion of the studied RTAs, but also in the trade introversion in the exchange of med- and high-tech goods we also analyzed trade in these sophisticated products. Now, the shortcomings of RTIIs as measures of regional trade introversion are even more visible. For illustration, we use data concerning internal trade with high-tech products. In 2022, EU internal trade with these products was equal to almost US\$1,298 billion, and in CEMAC only US\$0.04 billion. This means that the value of internal EU trade was 34,450 times higher than that of CEMAC. A comparison of internal EU trade with high-tech goods with corresponding trade of SACU gives a similar result: intra-EU trade was almost 908 times higher than that of SACU. As a result, we properly calculated all three RTIIs, but the weight of information on the importance of internal trade of RTAs contained in these indexes appeared low, making this indicator only relatively useful for the analysis of trade integration of RTAs and its comparisons. In our opinion, RTIIs gain more informative value if they are supplemented with additional data, e.g., on the value of internal and external trade of the RTA (region), as shown in Table 8.

6 Conclusion

Our study does not provide a simple and unequivocal answer for the research question. We prove that the regional trade introversion measured by the RTIIs is generally stronger for medium technology manufactures than for all goods (exceptions are the EU and MERCOSUR).

For high technology manufactures, the picture is more complicated. In the case of RTAs consisting of developed economies, the values of high-tech RTIIs are usually lower than for all goods (exception is ANZCERTA-RTA which is much smaller than the others included in the study). It may be that developed economies, which are the world leaders in innovations and high-tech export, cause the extra bias of the RTAs to which they belong.

In our opinion, the reasons for the high values of all three RTIIs of RTAs with developed and developing member states are quite different. Developed members have relatively diversified production, particularly of manufactured goods, including high-tech goods, whereas developing members are economically lagging behind. Lack of capital and human capital prevents them from diversifying and modernizing their production. Consumers from developed countries have high incomes and sublime needs, encouraging them

to buy goods in their own RTAs well as in the global market. The residents of developing countries, on the other hand, have low incomes, often not sufficient to satisfy their basic needs. As a result, they do not buy luxury or even normal goods in the global market and are satisfied with cheap, low-quality varieties from their RTA's partners. In African RTAs, the values of high-tech RTIIs are extremely high (over 0.9) and often exceed the values of general RTIIs. Unfortunately, it does not illustrate remarkable successes of economic integration, rather a proof of the fact that developing countries are not competitive enough to sell goods outside their own region (here RTAs). Moreover, they cannot afford goods imported from the rest of the world. These reasons are indirectly confirmed by their low volume of trade, particularly in high-tech goods. To make things worse, countries belonging to such RTAs often lack the infrastructure necessary to conduct exchange with the whole world. They lack airports, ports, rail networks, or sometimes even roads. They are also technologically excluded, especially digitally, which prevents them from participating in global trade of innovative products and in modern forms of exchange (e.g., e-commerce). They are forced to rely on export to their RTA's partners and faced with a lack of foreign currencies to import from them.

However, we should bear in mind that in our simple setting we did not show many differences between the analyzed RTAs and recognize institutional differences and resulting missing trade (similar to Anderson and Marcouiller, 2002). In this context, trade of RTAs, especially those with less developed members, may be restricted due to, e.g., theft, corruption, or imperfect contract enforcement because of improper legal systems and failed public institutions (Anderson and Marcouiller [2002, p. 542] wrote about hidden transaction costs). It could restrict internal trade more than external trade, as the latter could be controlled by the developed partners and the former could include restrictions on both sides: exporter and importer. The same argument can cause a relative increase in trade of the RTAs with developed members – in this case, the volume of missing trade would be lower.

In summary, employing Lall's classification for the study on regional trade introversion brings ambiguous and partly misleading results. There is, therefore, motivation for further studies concerning the intensity of integration for different categories of commodities.

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