Testing a methodology to split a national SAM and compute intra-national trade flows: an application for the Russian regions

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Abstract

In this work we develop a parsimonious methodology to break a national SAM into its sub-country regional SAMs and derive the intra-national trade flows. To achieve this goal we make use of a modified version of the Simple Location Quotients which take into account the so-called border effect. We compare the intra-national trade flows calculated using our methodology against trade data for the eight Districts of the Russian Federation. The methodology can provide reasonable results to represent the overall intra-national trade structure which can be useful if the focus of the analysis is on multi-regional assessment and shocks propagation through trade mechanisms, substitution effects and relative prices across all the regions within the country. However, the proposed approach seems unsuitable to represent the economy and the trade of a single region and should not be used in studies which focus only specific sub-country units.

1. Introduction

A growing demand for sub-country multi-regional economic and policy assessment is coming from both public and private institutions. The derivation of sub-national databases is a prerequisite to conduct this kind of analysis but detailed information at the sub-national level is often limited or even missing. For this reason non-survey methodologies have been developed to regionalize a national database. Until now regional economic studies have focused on the evaluation of the methodologies to produce sensible Input-Output (I-O) coefficients and multipliers (Lehtonen & Tykkyläinen, 2014; Flegg & Tohmo, 2016; Bonfiglio & Chelli, 2008).

IO analysis is suitable to evaluate how much economic activity or employment is activated by the different components of the autonomous demand (public spending or investments) in a context where prices are exogenous and the supply of primary endowments reacts immediately to the demand-driven shocks. However other types of impacts require a longer time horizon and the examination of trade specialization, factor relocation and in general substitution effects which are driven by endogenous relative prices. This is particularly true for climate/environmental impacts and policies which can be implemented in a Computable General Equilibrium (CGE) model (Carrera et al, 2015; Pérez-Blanco & Standardi, 2019; Standardi et al., 2017). The inter-connections taking place between sub-national units within a country would deserve more research effort devoted to the derivation of intra-national trade flows. In this work we propose a methodology exactly to obtain a measure of the *sub-national domestic demand and bilateral trade flows* between regions and evaluate their closeness to observed data.

To achieve this objective we develop a parsimonious methodology which uses only the regional shares of national sectoral value added and the road distance between the capital cities of each couple of sub-national regions. The case study is the Russian intra-national trade because this country presents a good record of this type of information and we want to take advantage of it.

It is important to stress that our approach computes not only the intra-national trade but also all the regional Social Accounting Matrices (SAMs) within the country. The approach reconciles the regional SAMs in such a way they are consistent with the national accounts. This means that the national SAM can be broken and re-aggregated in a flexible manner according to the chosen aggregation scheme. The methodology can be routinely applied to any country in the world.

In the construction of the regional SAMs we refer to Horridge (2011) in three main aspects:

1) the parsimonious use of information,
2) the application of a gravitational criterion and a RAS procedure to scale the bi-lateral trade flows between regions,
3) the standardization of the method which can be easily adapted to other countries.

Compared to the approach of Horridge (2011) our method is different because it introduces the Location Quotients for the derivation of the regional imports in the intra-national trade. This choice is due to the fact that we want to minimize the data requirements in order to make the approach applicable to the highest possible number of countries, both developed and developing.

The structure of the paper is as follows. Section 2 describes the data we have used to regionalize Russia and to evaluate the difference between observed and computed trade flows. Section 3 presents the methodology. Section 4 examines results. Section 5 concludes.

2. Data

Our starting point is the Global Trade Analysis Project (GTAP) 9 database (Aguiar et al, 2016). GTAP is a series of SAMs for 140 countries or group of countries and 57 sectors covering all the economic system. The SAMs are linked each other via the international trade of goods and services at the bi-lateral level and the investment flows. The sectors and regions in the GTAP database can be dis- and re-aggregated very easily consistently with the research question under examination. The reference year is 2011.

We focus on the SAM of Russia available in the GTAP database and apply our methodology to the eight Districts of the Russian Federation: 1) Central, 2) North West, 3) South, 4) North Caucasus, 5) Volga, 6) Urals, 7) Siberian and 8) Far Eastern. The Federal Districts are displayed in Figure 1.

To regionalize the SAM we use data on sectoral value added from the Federal State Statistics Service (FSSS) of the Russian Federation (FSSS, 2018). The sectoral breakdown is not detailed as only 15 sectors are considered:

1. Agriculture, hunting and forestry,
2. Fisheries, fish-breeding,
3. Mining operations,
4. Processing industries,
5. Production and distribution of electricity, gas and water,
6. Construction,
7. Wholesale and retail trade; Repair of motor vehicles, motorcycles, household products and personal items,
8. Hotels and restaurants,
9. Transport and communication,
10. Financial activities,
11. Real estate transactions, rental and provision of services,
12. Public administration and military security, social insurance,
13. Education,
14. Health care and provision of social services,
15. Provision of other communal, social and personal services.

To perform the comparison between computed and observed intra-national trade flows we refer to data stemming from the Sophist Database (HSE, 2017). A potential source of bias in the databases using the physical amount of carried goods is that they record movements to and from transport nodes. These nodes could not correspond the real origin and destination but rather intermediate points. This is the case detected in some sectors of the Commodity Flow Survey (CFS) data released by the US Census Bureau. As a consequence of this hub issue the estimates stemming from such databases for inter-regional trade could not be appropriate (Wittwer, 2017). The Sophist database is built upon information about the delivery of products (goods) from the FSSS of the Russian Federation. Small, medium and big firms fill a questionnaire following the instructions of the FSSS. The collected data present two good points to avoid the potential bias arising from using physical amount of carried goods. First firms provide data in rubles making use of invoices for the sale of products. Second to avoid double counting, organizations engaged in wholesale trade include only data on the sale of products purchased by them from manufacturers located in the same territory of a constituent entity of the Russian Federation. From the Sophist database we derive information on *sub-national domestic demand and bilateral trade flows* for three macro-economic sectors:

1. Agriculture, hunting and forestry,
2. Mining operations,
3. Processing industries.

For each one of the three macro-economic sectors we have a square 8x8 matrix which inform us about the structure of the intra-national trade. This structure will be tested against that we will derive by using our methodology. It is important to note that our methodology is applied to the national SAM of Russia in the GTAP database where all monetary values are expressed in 2011 million $. This implies that the regionalization according to the district shares of the national sectoral value added in our approach will produce eight regional SAMs expressed in 2011 million $. We assume that the Russian SAM in GTAP is reliable and can be used to obtain the intra-national trade flows because it has been calibrated on data from FSSS (Aguiar et al., 2016). The computed and the observed structure of the intra-national trade will be presented in percentage terms for the comparison purpose. This is for two reasons. First it allows us to compare two different monetary values (rubles in the Sophist database and dollars in GTAP). Second it allows to reduce the distortions between monetary values of GTAP and Sophist database even after converting them in the same currency. Different factors can cause these distortions. In GTAP for example the use of not updated I-O coefficients or the re-balancing procedure to adjust the global database can change the monetary value of some economic flows with respect to the official data of FSSS. In the Sophist database some missing values or data collection issues can do the same thing. Using the structure of the intra-national trade in percentage terms can contribute to have a broader comparative vision rather than focusing on the monetary values.

Figure 1: Federal Districts of Russia

3. Methodology

Our methodology takes place in two steps. In the first step we split the national valued added and apply the Location Quotients to derive the sub-national domestic and imported demand. In the second step we use the distance between the capital cities of each couple of regions to get the bi-lateral trade flows and balance the regional SAMs and the bi-lateral trade flows by implementing a RAS procedure (Bacharach, 1970).

3.1 Value added and domestic/imported demand

The first operation consists in mapping the 57 GTAP sectors in the 15 sectors of the FSSS and splitting the value added across the Russian districts. In GTAP the sectoral value added is the remuneration of the primary factors (labour, capital, land, natural resources). In each sector the regional shares of value added are used to distribute labour, capital, land and natural resources across the sub-national units in the corresponding national GTAP data. Regional shares are retrieved from FSSS database.
Factor land is used in the agricultural sectors only. Natural resources are used in the mining, forestry and fishing sectors. Labour and capital are used in all the sectors. By definition the remunerations of the primary factors are generated in the region and accrue to the income of that region. No interregional flow on these primary remunerations is assumed, such as remittances or interests on the capital assets.

A challenging task in the database construction is the derivation of the sub-national domestic demand and trade with other regions within the country. This is because these data are often missing and need to be computed using different techniques. To compute the domestic sub-country demand and the demand from other Districts we rely on the Locations Quotients (*LQs*) (Bonfiglio & Chelli, 2008; Flegg & Tohmo, 2016; Miller & Blair, 2009). The *LQs* are usually used in I-O analysis to derive input regional coefficients and multipliers. They give a measure of the regional specialization in the economic activity comparing the sectoral economic weight in the region and in the country. Different formulas can be found in the literature (Flegg & Tohmo, 2013; Bonfiglio & Chelli, 2008). We use the Simple Location Quotients (*SLQs*):

$$SLQ_{i,r} = \frac{X_{i,r}/X_r}{X_{i,c}/X_c} \quad (1)$$

where i is the sector and X the value added, r and c represent the regional and national indexes, respectively.
A common problem with the *SLQs* and other conventional *LQs* is the underestimation of imports from other regions (Flegg & Tohmo, 2013; Bonfiglio & Chelli, 2008). This is not surprising because it is established that $SLQ = 1$ when $SLQ \geq 1$ and the region will be able to satisfy the local demand completely. This prevents cross-hauling flows from taking place which is in contrast with the empirical evidence. The Flegg Location Quotient (*FLQ*) has been proposed to overcome this problem (Flegg et al, 1995). The *FLQ* takes into account the relative size of the supplying and purchasing sector and also the regional size of the economy. In general the *FLQ* works better than the other conventional *LQs* in the derivation of the I-O tables. However its performance depends much on the calibration of a parameter which determine the size of the inter-regional imports (Flegg & Tohmo, 2013; Flegg & Tohmo, 2016).

Our research focus is more on the intra-national trade flows rather than the I-O tables. Moreover, in the construction of the database we need to make the regional SAMs mutually consistent through the flows of exports and imports. Therefore, we have decided to use a modified version of the *SLQs* which is easier to implement in a multi-regional framework and at the same time allows for cross-hauling trade taking into account the size of supplying/purchasing sector and the regional size of the economy.
We start from the Eq. (1). Two extreme cases are possible: absence of the economic activity and perfect specialization. In the first case we have $X_{i,r} = 0$ and $SLQ_{i,r} = 0$. This means that the region will need to import intermediate and final goods from other regions.
In the other extreme case we have $X_{i,r} = X_{i,c}$ and $SLQ_{i,r} = X_c / X_r$. This means that the region will tend to export the good for intermediate or final consumption.
Finally in the case of $X_{i,r} / X_r = X_{i,c} / X_c$ the sub-national demand structure will follow exactly the national one and the share of domestic and imported demand will be the same. In almost all the cases the *SLQ* values will be in between the two extreme cases and not equal to the last one.
Compared to the standard application of the *SLQs* we do not assume $SLQ = 1$ when $SLQ \geq 1$. The sub-country shares of domestic and imported demand will be given by multiplying the national shares times *SLQs* and then normalizing these shares, as illustrated in the following equations:

$$Shrdom_{i,r} = Shrdom_{i,c} \cdot SLQ_{i,r} \quad (2)$$

$$Shrimp_{i,r} = Shrimp_{i,c} \cdot 1/SLQ_{i,r} \quad (3)$$

$$Shrdom^{*}_{i,r} = Shrdom_{i,r} / \ (Shrdom_{i,r} + Shrimp_{i,r}) \quad (4)$$

$$Shrimp^{*}_{i,r} = Shrimp_{i,r} / \ (Shrdom_{i,r} + Shrimp_{i,r}) \quad (5)$$

where *ShrImp* and *ShrDom* are the not normalized shares of domestic and imported demand and *ShrImp** and *ShrDom** the normalized ones. In the extreme case of no economic activity in the sub-country region we assume $ShrImp = 1$ and $ShrDom = 0$ to avoid the infinite numbers in Eq. (3).

The share coefficients in Eqs. (4) and (5) are adjusted to take into account the so-called border effect which states the trade within a country is bigger than trade between countries given the same distance (Anderson & Wincoop, 2003; McCallum, 1995). Essentially we multiply the Shrimp by a 1.25 factor based on the fact that national borders can reduce trade between industrialized countries by 20-50 percent (Anderson & Wincoop, 2003). This can be seen as a different way to calibrate the parameter which determine the size of the inter-regional imports in the *FLQ* formula.

In order to implement the share coefficients we need to distribute the national domestic demand in each sector across the Russian districts. The national domestic demand in GTAP is divided by intermediate and final consumption. As we do not have data on sectoral consumption at the sub-national level we use the sectoral value added share of the purchasing sector to split the intermediate national consumption in that sector. This is consistent with the Leontief technology between value added and intermediate goods usually adopted in CGE modelling. This also means that if the regional value added of the purchasing sector is small/big also the intermediate regional consumption will be small/big. When we distribute the intermediate consumption of the purchasing sector across the districts we use the share coefficients in Eqs (4) and (5) to determine the domestic and imported intra-national intermediate consumption. In this case we consider the regional specialization in the supplying sector through the share coefficients.

Finally we include the influence of the region's economic size by multiplying the domestic final consumption in each sector of the country for the GDP regional share. Then we split these values between domestic and imported intra-national final consumption still using the coefficients in Eqs. (4) and (5).

3.2 Bi-lateral trade flows and balancing process

The second step consists in calculating the bilateral trade flows across the sub-national regions and in balancing the regional SAMs. To achieve the first objective we follow a gravitational approach based on the kilometric road distance between the capital cities of the origin and destination regions. Once we have split the Russian intra-national trade between domestic trade and intra-national imported trade for each Russian region through our modified *SLQs* we are able to compute the bi-lateral flows by applying the gravitation equation. The gravitation approach split the total intra-national imports for each District using the sectoral value added share of the exporting region and the kilometric road distance between the capital cities of the exporting and importing district.

However, the regional SAMs we have computed using the coefficient shares in Eqs. (4) and (5) need to be adjusted because in some sectors and districts total costs, domestic sales, exports and imports can be not consistent with the basic regional accounts. For example, total costs minus domestic sales and international exports can be negative implying negative intra-national exports. In this case we adjust the *SLQs* to avoid negative intra-national exports.

Moreover, the aggregate intra-national exports and imports we have calculated for each region using the coefficients shares are generally not equal to the aggregate intra-national exports and imports calculated using the gravitation method. Therefore, we balance the bi-lateral trade flows across the sub-national regions to make the trade flows consistent with the aggregate intra-national exports and imports obtained through Eqs. (4) and (5) which represent our targets. This last objective is achieved through the application of a RAS procedure.

Once we have applied the gravitation criteria we get a square matrix ***A*** representing all the bilateral flows within the country. The RAS method attempts to find a new matrix ***B*** such that:

$$\sum_r b_{r,s} = M_s \qquad (6)$$

$$\sum_s b_{r,s} = E_r \qquad (7)$$

where $b_{r,s}$, e_r and m_s are, respectively, the general element of matrix ***B***, vector ***E*** and vector ***M***. Vector ***E*** and ***M*** represent the targets of the new matrix ***B*** and are equals to the aggregate intra-national exports and imports computed using the modified *SLQs*.

The new matrix $\boldsymbol{B}$ is related to the original $\boldsymbol{A}$ via the iterative procedure:

$$b_{r,s}=rm_r\cdot cm_s\cdot a_{r,s} \tag{8}$$

where rm_r is the RAS multiplier of row r and cm_s is the RAS multiplier of column s.

It is also worth noting that in order to compute the targets we need to split the inter-national exports and imports for each Russian District. In doing so we use the sectoral sub-national share of value added to split international exports. For international imports we use an index which takes into account both the sub-national GDP share and the *SLQs*.

4. Results

This work wants to give a contribution on the derivation of the intra-national trade flows useful for a multi-regional assessment. Forecasting the single bi-lateral trade flow is beyond our capacity because the model is parsimonious in terms of processed information and is not suitable to produce such detailed trade output. We are interested in having a reasonable representation of the overall intra-national trade structure because the complete picture of all trade relationships within the country is important to evaluate the shock propagation in a multi-regional assessment rather than the single trade flow. To clarify this point we propose five indexes to compare the estimated intra-national trade structure and the observed one:

$$TradDiff_{r,s}= \left|\left(\frac{Trad_{r,s}^{Estim}}{(Dom_{Russia}^{Estim}+Imp_{Russia}^{Estim})}-\frac{Trad_{r,s}^{Obser}}{(Dom_{Russia}^{Obser}+Imp_{Russia}^{Obser})}\right)\cdot 100\right| \tag{9}$$

$$NatDomDiff_r= \left|\left(\frac{Dom_r^{Estim}}{(Dom_{Russia}^{Estim}+Imp_{Russia}^{Estim})}-\frac{Dom_r^{Obser}}{(Dom_{Russia}^{Obser}+Imp_{Russia}^{Obser})}\right)\cdot 100\right| \tag{10}$$

$$NatImpDiff_r= \left|\left(\frac{Imp_r^{Estim}}{(Dom_{Russia}^{Estim}+Imp_{Russia}^{Estim})}-\frac{Imp_r^{Obser}}{(Dom_{Russia}^{Obser}+Imp_{Russia}^{Obser})}\right)\cdot 100\right| \tag{11}$$

$$RegDomDiff_r= \left|\left(\frac{Dom_r^{Estim}}{(Dom_r^{Estim}+Imp_r^{Estim})}-\frac{Dom_r^{Obser}}{(Dom_r^{Obser}+Imp_r^{Obser})}\right)\cdot 100\right| \tag{12}$$

$$RegImpDiff_r= \left|\left(\frac{Imp_r^{Estim}}{(Dom_r^{Estim}+Imp_r^{Estim})}-\frac{Imp_r^{Obser}}{(Dom_r^{Obser}+Imp_r^{Obser})}\right)\cdot 100\right| \tag{13}$$

where *Trad* is the bi-lateral trade flow from region *r* to region *s*, *Dom* and *Imp* are the domestic trade and imported trade excluding international imports, *Estim* and *Obser* represent the estimated and observed values.

We focus on three sectors (Agriculture, Mining and Industry) as trade in services and other sectors is not available. In Tables 1-3 we report the measures for the indexes in formula (9). Formula (9) gives the overall picture of the trade structure in each sector compared to the total intra-national trade in Russia.

Clearly *TradDiff* formula presents some drawbacks. For instance they can give the same results under very different relative perturbations (e.g. (11/100-1/100)*100=10 and (60/100-50/100)*100 = 10). In both cases difference is 10%, but in the first case trade flow is overestimated by 10 times, whereas in the second case it is overestimated by only 1.2 times. The previous example tells us that the two differences are weighted by their importance in the overall intra-national trade structure and for this reason the small trade flows are less relevant in the determination of the index. This make sense if the main objective of the method is the multi-regional trade composition within the country. In addition, taking the percent relative difference with respect to each trade flow could produce infinite numbers in case of zero trade flows and this would complicate the construction of the index.

Tables 1-3 show that the biggest differences are in the main diagonal (grey colour). This is consistent with the fact that in general the main diagonal represents the domestic regional trade and accounts for a big share of the total intra-national trade. Some sectors (agriculture and industry) are better predicted than others (mining). In the industry sector no absolute value of the relative differences is more than 5% while in the mining sector they are six. In general, the results seem to be good especially for the small economic regions such as Far East and North Caucasus. Clearly the index in formula (9) is influenced by the size effect which tends to make the trade flows in the small regions less relevant.

In order to analyse to what extent taking the entire intra-national trade as a reference masks the discrepancies existing at the regional we build the other four indexes. Formulas (10) and (11) provide an evaluation of the domestic and imported trade still compared to the intra-national trade while formulas (12) and (13) do the same job compared to the regional trade comprehensive of domestic demand and imports from other regions (but not from other countries). By construction indexes in Formulas (12) and (13) are equal. The indexes are shown in Table 4 and 5.

In Tables 4 and 5 we can immediately notice that mining remains the worst sector in terms of proximity to the observed data both taking regional and national trade as denominator. Industry is still the best predicted sector if we take the sum of the *NatDomDiff* and *NatImpDiff* Formulas in the last grey row but agriculture performs better if we consider only the *NatImpDiff* Formula. However, the most important result is that taking the regional trade as denominator will results in much higher total differences. This is the natural consequence of increasing the spatial resolution for the comparison. The difference become striking if we examine the results for the single small regions such as North Caucasus and Far Eastern. The cells in purple colours signals a very strong increase in the absolute value of the relative differences moving from national to the regional trade denominator. This suggest that our approach can give reasonable results when we refer to the overall intra-national trade structure but makes a poor job when we refer to a single region, especially if the region is economically small.

Table 1: TradDiff (**Agriculture**)

From-to	Central	NorthWest	South	NorthCauc	Volga	Urals	Siberian	FarEast
Central	11.36%	0.66%	1.11%	0.00%	0.13%	0.09%	0.16%	0.02%
NorthWest	0.68%	1.60%	0.01%	0.00%	0.04%	0.07%	0.02%	0.01%
South	0.39%	1.63%	6.74%	0.76%	0.30%	1.55%	0.38%	0.21%
NorthCauc	0.42%	0.87%	0.36%	0.88%	0.36%	1.00%	0.23%	0.13%
Volga	2.88%	0.89%	0.29%	0.03%	3.28%	0.95%	0.21%	0.08%
Urals	0.12%	0.06%	0.01%	0.00%	0.20%	4.25%	0.05%	0.01%
Siberian	0.84%	0.24%	0.12%	0.02%	0.21%	0.07%	0.08%	0.29%
FarEast	0.25%	0.18%	0.02%	0.01%	0.07%	0.22%	0.16%	3.42%

Table 2: TradDiff (**Mining**)

From-to	Central	NorthWest	South	NorthCauc	Volga	Urals	Siberian	FarEast
Central	6.58%	0.36%	0.10%	0.01%	1.48%	1.04%	0.36%	0.00%
NorthWest	0.32%	1.38%	0.01%	0.00%	0.18%	0.25%	0.05%	0.00%
South	0.30%	0.02%	0.04%	0.06%	0.01%	0.00%	0.00%	0.00%
NorthCauc	0.02%	0.00%	0.00%	0.09%	0.00%	0.00%	0.00%	0.00%
Volga	0.63%	0.03%	0.01%	0.06%	14.28%	0.22%	0.03%	0.00%
Urals	2.17%	3.00%	2.55%	0.82%	0.53%	5.15%	0.39%	0.04%
Siberian	4.11%	1.17%	0.03%	0.02%	0.98%	5.28%	7.02%	0.38%
FarEast	6.87%	1.54%	1.02%	0.33%	0.77%	0.11%	0.04%	0.27%

Table 3: TradDiff (**Industry**)

From-to	Central	NorthWest	South	NorthCauc	Volga	Urals	Siberian	FarEast
Central	1.61%	0.60%	0.19%	0.25%	0.64%	1.26%	0.09%	0.83%
NorthWest	4.63%	2.77%	0.14%	0.10%	0.55%	0.13%	0.06%	0.38%
South	1.00%	0.25%	0.35%	0.17%	0.23%	0.04%	0.05%	0.06%
NorthCauc	0.30%	0.03%	0.10%	0.28%	0.06%	0.01%	0.00%	0.03%
Volga	0.62%	1.18%	0.69%	0.11%	2.63%	0.63%	0.42%	0.51%
Urals	0.41%	0.42%	0.20%	0.06%	0.89%	2.92%	0.18%	0.39%
Siberian	0.29%	0.05%	0.10%	0.10%	0.15%	0.41%	1.66%	0.44%
FarEast	0.01%	0.03%	0.04%	0.02%	0.04%	0.17%	0.16%	1.00%

Table 4: comparison of regional domestic trade

From-to	**RegDomDiff** (Agr)	**NatDomDiff** (Agr)	**RegDomDiff** (Min)	**NatDomDiff** (Min)	**RegDomDiff** (Ind)	**NatDomDiff** (Ind)
Central	12.00%	11.36%	18.63%	6.58%	10.78%	1.61%
NorthWest	27.37%	1.60%	12.03%	1.38%	21.97%	2.77%
South	3.03%	6.74%	49.33%	0.04%	12.40%	0.35%
NorthCauc	28.45%	0.88%	44.50%	0.09%	3.87%	0.28%
Volga	0.58%	3.28%	51.54%	14.28%	9.38%	2.63%
Urals	9.22%	4.25%	26.78%	5.15%	5.38%	2.92%
Siberian	7.23%	0.08%	3.11%	7.02%	5.64%	1.66%
FarEast	53.80%	3.42%	10.18%	0.27%	37.74%	1.00%
Tot	141.68%	31.61%	216.10%	34.82%	107.17%	13.22%

Table 5: comparison of regional imported trade

From-to	**RegImpDiff** (Agr)	**NatImpDiff** (Agr)	**RegImpDiff** (Min)	**NatImpDiff** (Min)	**RegImpDiff** (Ind)	**NatImpDiff** (Ind)
Central	12.00%	1.46%	18.63%	4.97%	10.78%	7.26%
NorthWest	27.37%	3.20%	12.03%	3.06%	21.97%	2.40%
South	3.03%	1.11%	49.33%	3.43%	12.40%	1.18%
NorthCauc	28.45%	0.71%	44.50%	1.08%	3.87%	0.25%
Volga	0.58%	0.22%	51.54%	1.33%	9.38%	1.20%
Urals	9.22%	3.81%	26.78%	6.66%	5.38%	1.31%
Siberian	7.23%	0.89%	3.11%	0.79%	5.64%	0.16%
FarEast	53.80%	0.18%	10.18%	0.34%	37.74%	2.65%
Tot	141.68%	11.58%	216.10%	21.66%	107.17%	16.41%

5. Conclusions and further research

This work proposes a methodology to split a national SAM and compute intra-national trade flows. The methodology has been applied to the eight Russian Districts. The approach is parsimonious in terms of required information and can be applied routinely to any country, even developing countries where data can be scarcer.

Results suggest that as long as the focus is on multi-regional assessment and shocks propagation through trade mechanisms the methodology can provide reasonable results to represent the overall intra-national trade structure within the country. For instance, the multi-regional database can be useful if the experiment consists in implementing climate/environmental impacts and policies which are uneven across the sub-national regions and involve substitution effects via relative prices and trade. These are typical in CGE models.

However, it is worth noting that the proposed approach seems unsuitable to represent the economy of a single region and should not be used in studies which consider only one or few specific sub-national units within a country. The methodology appears not appropriate for I-O analysis, such as the evaluation of investment projects.

This is only a preliminary check and we need to understand better the sources of differences between observed and estimated data. We should further examine how much these differences depend on sectoral and transport peculiarities, not updated input-output coefficients or the use of our modified *SLQs*. Further investigation will allow us to identify the driving factors and to improve the methodology and predictability. One possible line for future research could be to calibrate by sector the parameter which takes into account the so called “border effect” (Anderson & Wincoop, 2003; McCallum, 1995).

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