Developing a Rural-Urban Social Accounting Matrix for Northern Ireland

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Abstract

This paper indicates the Northern Ireland (NI) rural areas' contribution to the whole NI economy, studies NI rural and urban different economic structures, and examines interdependencies within and between rural and urban economy. A rural-urban Social Accounting Matrix for NI (NISAM) is built through a systematically spatial division methodology, as well as a sectoral disaggregation of the predominantly rural based agri-food industries. The developed bi-regional NISAMis further used as a basis for the SAM multiplier analysis. The output multiplier results demonstrate the closely relationships between NI rural and urban industries, especially NI agri-food industries linkages with the wider economy.

Keywords: bi-regional social accounting matrix, agri-food industries, multiplier analysis

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1. **Introduction**

Rural development has been a key component of economic development in Northern Ireland (NI) and supported by a set of agricultural and rural policies. In Northern Ireland, as for 2010, the predominantly rural based agriculture sector account for the largest shares (1.19%) of regional value added among all UK regions, accordingly, its downstream industries, food processing also take a much larger share (3.76%) compared to the national average (1.58%) (Regional Account). The important role of agri-food sectors in NI implies that policy shocks in the sectors will have economy-wide implications. From an economic perspective, due to interconnections between all economic agents, an agricultural or rural development policy shock will not only have direct impact on the sector in rural areas, but also have far reaching impacts on other parts of the economy and urban areas. Within this context, in an attempt to provide ex ante evaluation evidence, this paper is intended to develop a benchmark framework for an economy-wide impact analysis in Social Accounting Matrix (SAM) multiplier analysis and future computable general equilibrium modelling.

A Social Accounting Matrix is a square matrix recording all transactions between economic agents. In this matrix, each economic account is represented by a row and a column, corresponding to its income and its expenditure, respectively (Pyatt and Round, 1985). Consequently, any circular flow of income or expenditure in an economy is displayed through a cell in the matrix showing the payment from the account of its column to the account of its row. Therefore, for every income flows in the framework, there exists a corresponding expenditure and their totals are equal (Löfgren, et al., 2002). As a particular strength of SAM is its ability to capture all complex linkages among all economic accounts, the construction and use of SAM models tailored to agricultural industries have been increasingly applied to analyse the effects of Common Agricultural Policy (Dixon and Matthews, 2006, Psaltopoulos, et al., 2012).

However, due to data limitations, few spatial analysis within the region have attempted at regional level. Roberts 1998 (Roberts, 1998) used an inter-regional SAM to examine the rural-urban spill over effects in Grampian, Scotland. Psaltopoulos 2006 (Psaltopoulos, et al., 2006) constructed a bi-regional model to evaluate the impacts of the CAP in Greece. Nina (Hyytiä and Kola, 2013) recently built and utilized a regional rural-urban SAM model as a tool to examine Finish tourism policies. In spite of the above spatial studies analysed policy shocks entering local economies, their constructions of bi-regional SAM frameworks methodologically diverse and are specific to the case study area. In terms of the existing regional models with description of agri-food sectors, such as, CAPTIGTAP (Törmä, et al., 2010), AgroSAM (Müller, et al., 2009), and AEZ-EF (Plevin, et al., 2014), to the author's knowledge, the most applicable for Northern Ireland spatial analysis is at NUTS 2 level, which still treat Northern Ireland as a whole and neglect the differences between NI rural and urban areas. In sub-regional models, either the agricultural sectors are represented as one single industry in the datasets (Psaltopoulos, et al., 2011) or the model is not a completely separation of rural and urban regions (Balamou and Psaltopoulos, 2007).

Against this background, this paper introduces a generic methodology to construct a bi-regional (rural-urban) SAM framework. Taking account of the important roles of agri-food industries in NI, this bi-regional framework is based on a previous NISAM work with disaggregated agri-food sectors to enhance rural development policy analysis. The NISAM with sectoral disaggregation is concisely recapitulated in Section 2. Section 3 describes the spatial disaggregation methodology of the NISAM. Section 4 illustrates the evaluation of the spatial division results. Section 5 presents and the usage of the bi-regional SAM for multiplier analysis. The paper ends with conclusions and discussions.

2. Agri-Food NISAM

A 2010NISAM is constructed to serve as a snapshot of the NI economy with all transaction flows between economic accounts. Rooted from NI Supply and Use table (NISUT) 2010 (NISRA, 2014), the industrial classification in NISAM is based on UK Standard Industrial Classification of Economic Activities 2007 (SIC) (ONS, 2009), and the commodities follow the activity-based products classifications. In particularly, to meet the needs of the evaluation of rural development policy, an extended NISAM with detailed agri-food industries (Agri-Food NISAM) is developed. The Agri-Food NISAM contains 120 activities producing 120 commodities, factors of production accounts (labor and capital), institutions (households, enterprises, government, 5 types of taxes, investment, rest of the UK, Republic of Ireland, Rest of EU, and rest of world).

The Agri-Food NISAM is built through four stages. Stage 1 involves the disaggregation of agri-food industries from NI supply table utilizing secondary information. Specifically, the single activity Agriculture in NISUT is disaggregated into ten sub sectors while food processing sectors are adjusted into twelve sectors regarding to more precise sectoral statistics. The high level output and value added disaggregation is reconciled with Statistical Review of Northern Ireland Agriculture (DARD, 2012) and Size and Performance of Northern Ireland's Food and Drink Processing Sectors (DARD, 2013). Stage 2 mainly involves the estimation of agri-food sectors intermediate consumptions and final demands. In reallocating the intermediate inputs to agricultural subsectors, this research employs a bottom-up method based on the Farm Business Survey (DARD, 2012), it creates a novel mapping programme by Java and Oracle to automatically match different cost items in FBS to Standard Industrial

Classification (SIC), and it allocates inputs correspondingly to sub sectors on the basis of the mapping results. In Stage 3, information of transfers between institutions are retrieved through a varieties of data resources in both national and NI level. Finally, the Agri-Food NISAM is balanced by a cross entropy method in GAMS software, subject to the constraint that row and column totals should be equal (Löfgren, et al., 2002).

3. Bi-Regional Agri-Food NISAM

The NISAM with disaggregated Agri-Food sectors developed in the last section is essential for obtaining accurate measurements of the impact of policy focusing sectoral development. The sectoral approach measuring policies concerns the significant role of Agri-food in the production chain of NI economy, however, the economic changes in NI rural regions are not only induced by Agri-Food policy reform, but also by the enhancement of the role of rural development policies lying in other economic activities in all rural areas (DARD, 2012). Previous NI evidence (Patterson and Anderson, 2003)of manufacturing industry shows that even within in the same industry, there are significant differences between firms in rural and urban areas. As such, it proves that, alongside the sectoral based analysis, there is a need to have a spatial separation of NISAM to represent correspondingly rural and urban industrial structures and characteristics. Therefore, to access the full economic activities in NI rural areas, this section aims at establishing a methodology of a spatial division of NISAM table. It is concerned with building up a bi-regional Agri-Food NISAM to portray the structural characteristics of the NI rural and urban economy.

Regarding to the definition of rural and urban areas, while different countries have a variety of criteria to define rural and urban settlement, as this study specifically focuses on capturing the pattern of economic flows between different parts in NI economy, the framework developed here uses the Northern Ireland Statistics and Research Agency's definition (NISRA, 2005) of rural and urban settlements as the criteria to make the spatial division. This guideline clarifies boundaries of NI rural and urban areas based on postcodes, which are provided by a database Central Postcode Directory (CPD) (NISRA, 2014). The advantages of employing postcodes to make the spatial division include:

- Exhaustive and exclusive of rural and urban boundaries
- Consistent with other data resources, as postcodes are the basic geographic units of census or surveys
- Easy and accurate to aggregate into a higher administrative geographic level, e.g, Local Government District, NUT3, etc.

For a relative small and open regional economy, such as NI, the commodity markets are highly integrated, it is reasonable to assume that commodities produced by rural and urban industries are homogenous and identical. Thus, the key step of compilation a bi-regional SAM is to make spatial division of production activities and institutions. A practical bi-regional SAM generated in this section is through a two-stage progress. Firstly, a methodology is developed to make a spatial disaggregation of NI production activities. As one aim of the proposed methodology is to provide a generic spatial division approach for bi-regional SAM models, a widespread survey taking in most countries and regions, named Annual Business Inquires/Surveys is adopted. This type of survey normally provides the most accurate and reliable measurement of the roles of industries in local economies. Another advantage of this methodology is proved by previous reviews that survey-based methods to distinguish rural from urban is relatively accurate than non-survey techniques(Mules, 1983, Riddington, et al., 2006).Secondly, by using a common used type of household budget survey, different consumption patterns of rural and urban households can be captured.

3.3.1Methodology of Activities Spatial Division

The division between rural and urban industries is based on the statistics of the enterprise location by industries and regions, as well as information on workplaces by industries and municipalities. As discussed, NI rural and urban industries producing the same commodity are regarded as two different activities, which imply that production inputs allocation and output in rural and urban are different.

Similar as the UK and most European countries, industrial information from NIABI is used in the compilation of the NISUT. Besides the value of the economic activity that businesses generated and the associated expenditure across the main industrial sectors in NI, this integrated survey also provides detailed businesses location information which can be used to make the spatial division of NI production activities. This distinguishing of rural and urban businesses allows taking account of the diverse pattern of production and consumption in different areas.

As NIABI provides the feasibility to make the spatial division of NI industries, the sample frame of NIABI is reliant on the Inter Departmental Business Register (IDBR), which receiving accurate and timely updates and providing a true reflection the NI business population (NISRA, 2013). It is feasible to adopt NIABI to split NI activities into rural and urban.

Firstly, the research estimates all NI rural and urban businesses information by weighting up and mapping NIABI samples, to achieve rural and urban industries' output, intermediate consumptions and its components, GVA and its components, and other industrial information. The estimation procedure of utilization NIABI to achieve rural and urban industrial characteristics is illustrated in Figure 3.1, and will be further discussed in the next section.

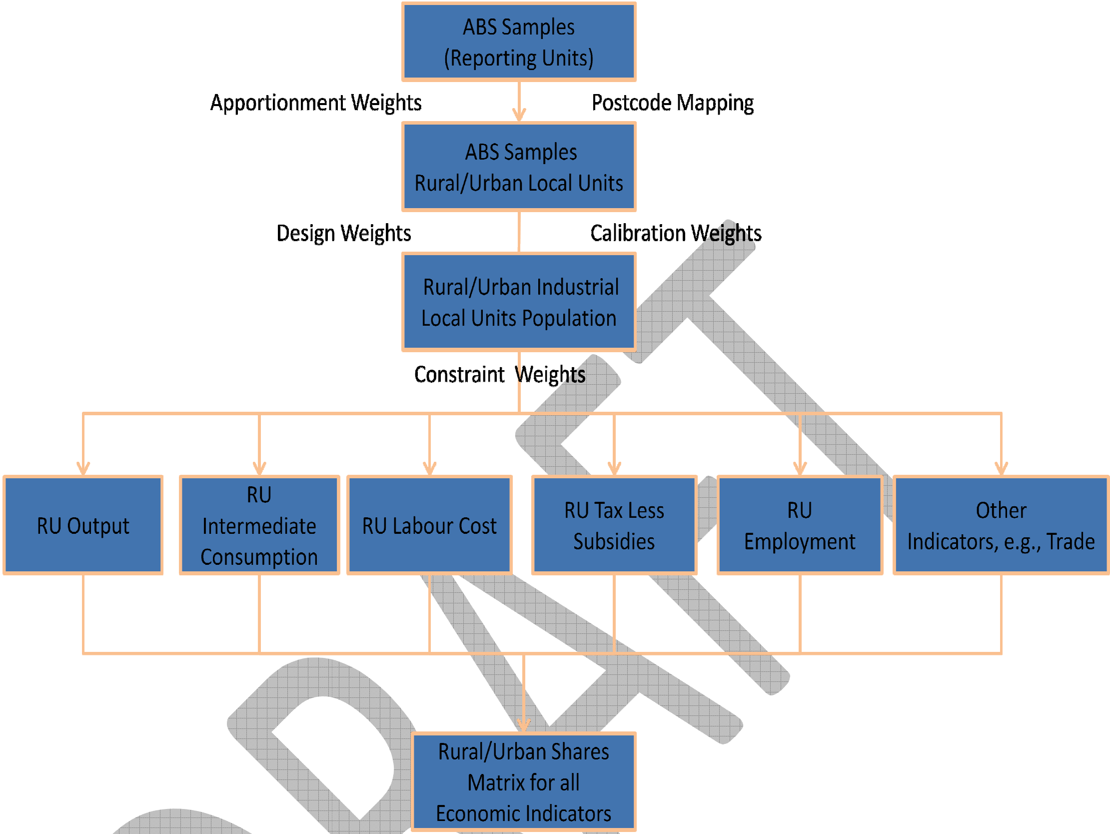

Figure 3.1 Procedure of Using NIABI to Make Spatial Division

Next, by applying the share matrix for all indicators back to the developed Agri-Food SAM, a Rural Urban SAM can be established. This method reflects the difference of inputs structure between NI rural and urban to the greatest extent possible.

3.3.2 Methodology of Spatial Businesses Estimation and Division

Due to reason that the current NIABI aims to estimate sectoral information in NI level, disregarding the differences between NI rural and urban sectors, there is a need to develop a new estimation method to apportionment business information from the report units to the actual production units (Local Units).

Table 3.1 illustrates the proportions of NI rural and urban businesses at reporting units and local units by industry sections. As shown, there are significant differences between rural and urban reporting and local units locations in most sectors, which means reporting units can not reflect the differences between NI rural and urban industrial structure or represent the regional characteristics as the actual production units (local units). Thus, NIABI estimation results are produced based on local units, which are apportioned from the reporting units' data, before grossing the information for the whole industry and regions.

Section [SIC]	Reporting Units		Local Units	
	Rural%	Urban%	Rural%	Urban%
Agriculture, Forest and Fishing [1-3]	76.2%	23.8%	76.6%	23.4%
Production [5-39]	57.5%	42.5%	56.7%	43.3%
Construction [41-43]	66.7%	33.3%	57.9%	42.1%
Distribution, Transport, Hotels and Restaurants [45-56]	55.4%	44.6%	48.5%	51.5%
Information and communication [58-63]	32.4%	67.6%	28.7%	71.3%
Finance, Insurance and Real Estate [64-68]	14.5%	85.5%	11.2%	88.8%
Professional and support activities [69-82]	27.4%	72.6%	25.3%	74.7%
Government, health & education [84-88]	43.5%	56.5%	34.3%	65.7%
Other services [90-97]	39.4%	60.6%	32.7%	67.3%
Total	24.7%	75.3%	24.0%	76.0%

Table 3.1 Proportion of rural and urban businesses by industry sections

Besides the sectoral and regional differences in businesses characteristics, the size of a business also has impacts on its characteristics, as small businesses generally make less use of more advanced information, capital and technologies than larger companies. A previous evidence in Ireland (CSO, 2008) already reveals that small and large enterprises have differences on technology, labor costs, and turnover, and the difference varies by sectors. E.g., the Irish study concludes that, medium and large enterprises contribute large percentage of turnover and employment in manufacturing industries, while small businesses have a greater share in services sectors' employment, turnover and gross value added.

Therefore, in order to fully capture the industrial differences and linkages between NI rural and urban economy, this research develops a methodology to make a spatial division of NI production activities with respect to the business size differences. Being consistent with the current NIABI published result, a small business here is defined as an enterprise that employs less than 50 people, while a large business has 50 or more employees.

Taking account of sectoral, regional and size factors, this estimation method assumes that, for the same industry, businesses locating in the same region with the same sizeband have the same characteristics and produce homogenous products with the same factors inputs. Based on this assumption, the spatial division methodology can be summarized as the following steps:

- Step 1: Stratification of reporting unit samples by industries (SIC2), regions (rural/urban) and employment sizebands (employment less than 50 or 50+)
- Step 2: Outlier detection of returned reporting units by its turnover, GVA and GVA per head
- Step 3: Validation of returned data by manual intervention
- Step 4: Imputation of non response units by median per head values of its stratum, taking account of the changes from the last year responses
- Step 5: Construction an apportionment weight matrix based on reporting units returned information for each variable with dimensions of industries, regions and sizes
- Step 6: Disaggregation reporting units information to local units by the apportionment weight matrix
- Step 7: Construction design weights for local units strata from Stratum Population/Stratum Samples to estimate the population information
- Step 8: Construction calibration weights for local units strata to ensure the estimation of population is no skewed based on employment data
- Step 9: Estimation strata population information by applying two weights on local units apportionment results
- Step 10: Estimation outliers information by assigning own strata and weights
- Step 11: Grossing weighted population and outliers information
- Step 12: Constraining aggregated industrial and regional result by Regional Account components
- Step 13: Calculation rural and urban ratio for all industrial economic indicators.

Step 1 compiles strata. In order to represent the characteristics of different businesses' profiles and to reflect the differences between regions, stratified reporting units samples in NI are grouped with a regional dimension: rural/urban, this allocation is achieved by mapping postcodes of reporting units with CPD settlement database, i.e. reporting units are grouped by SIC2, employment sizeband and regions, it can be denoted as

$$X \in S_P$$

Where

X= Sample reporting unit X

S_P= Stratified group $P$of reporting unit X according its industry, employment and location

Step 2- Step 4 utilize the current processed NIABI dataset, which already conducted detection of outliers, validation of returned information and imputation of non response units. As several measurements have already been carried out in the current dataset to maximise the accuracy of the returned information from reporting units (DETINI, 2013), this research assumes that the processed information precision has been optimized.

Step 5 constructs an apportionment weight matrix. Due to the same business characteristics in the same stratified group (regions, size and industry), businesses samples are allocated regarding to their regions, size and industry, an apportionment weight matrix for all variables in each stratum can then be produced. For each variable$i$ and each stratum P, the apportionment weight is calculated,

$$W_{Pi} = \frac{\overline{S_{Pi}}}{\overline{SIC_i}}$$

Where

W_{Pi} = Apportionment weight for variable i in stratifiedgroup P,P with respect to SIC2, employment sizeband and region (rural or urban)

$\overline{S_{Pi}}$= Mean per head value for variable i in stratified group P

$\overline{SIC_i}$= Mean per head value for variable i in SIC2group.

This process results in an apportionment weight matrix with a weight for each variable in each stratified groups. This step adopts mean per head value of variables for two reasons, firstly, mean value represents the features of variables in strata, secondly, mean per head value minimizes the discrepancy within the same sizeband group.

Step 6 disaggregates reporting units' information to local units. Similar to reporting units, local units are grouped in to strata by the SIC2, employment sizeband and region. A local unit and its reporting unit are grouped only in the same stratum when they have the same SIC2 code, within the same employment sizeband, and both locate in rural/urban areas. By the apportionment weight matrix achieved in last step, for a local unit Y in stratum group Q, its variables are derived from its reporting unit, following the equation,

$$Y_i = \frac{X_i}{\sum E_y W_{Qi}} \left(E_y W_{Qi}\right)$$

Subject to $\sum E_y = E_x$

Where

X_i= Variable i of sample reporting unit$X$

Y_i=Apportioned variable$i$of local unit$Y$in sample reporting unit X

E_y= Returned employment of local unit$Y$

W_{Qi}= Specific weight for Variable i in stratum group Q

$Q \neq P$, unless local unit Y is in the same stratum as reporting unit X

E_x= Employment of sample reporting unit$X$

This method ensures that, within in the same reporting unit, local units' results are estimated based on their own characteristics and are constrained by the reporting unit information. That is to say, for one reporting unit, its local units in different regions and different industry with different sizes correspond to their own weights and the grossing of local units' results is controlled by reporting units' returned result. Here, the variable employment is adopted as the auxiliary variables rather than other variables, because of its availability, accuracy and consistency in local units, reporting units and more aggregated geographic level. The employment data can also be used to calibrate the grossing result to be consistent with NI level.

Step 7 calculates design weights for each stratum. The design weights are calculated to estimate all local businesses in NI based on the apportioned estimation result of local units in stratified samples. A design weight for each local unit Y in stratum Q is calculated by dividing the total population in the stratum by the number of samples, denoted by

$$\alpha_y = \frac{N_Q}{n_Q}$$

$$\text{for } Y \in S_Q$$

WhereN_Q is the population number of local units in the stratum Q, $n_Q$is the number of local units samples in the stratum Q.

Step 8 calculates strata calibration weights. This calibration weight acts as a control on design weight to ensure the final weight is not skewed based on over or under sampling businesses by the employment of that stratum. As the calibration weights aims to correct for any imbalances in the samples, the calibration method can be simplified as the ratio between the total of the auxiliary variable (employment) estimated from the local units samples to the actual population total for that auxiliary variable. Therefore, a simplest form is,

$$G_y = \frac{E_Q}{\sum E_y \times \frac{N_Q}{n_Q}} = \frac{E_Q\, n_Q}{\sum E_y \times N_Q}$$

Where

G_y = Calibration weight for local unit Y
E_Q = Employment of population in stratum Q
E_y= Returned employment of local unit$Y$
N_Q= Population number of local units in the stratum Q
n_Q= Sample number of local units in the stratum Q

The calibration weights for strata can assure the spatial division does not damage the integrity of NI economic indicators.

Step 9 estimates strata population information. It is clear from the formula in step 7 that design weights are traditional survey weights, while calibration weights in step 8 aim to make a correction for any potential bias in the selected sample. An stratum population information can then be estimated by the corresponding variables values in local units level derived from step 6 times to their design weights (step 7) and times by their calibration weight (step 8). This progress can be denoted as,

$$Q_i = \sum_{Y \in S_Q} Y_i\, \alpha_y\, G_y$$

Where

Q_i = Variable i of population in stratum Q
Y_i= Variable i of local unit Y in stratum Q samples
α_y = Design weight for local unit Y, all local units within the stratum Q have a same design weight, α_y =α_Q
G_y = Calibration weight for local unit Y

Step 10 estimates outliers information. As mentioned in step 2, based on the processed NIABI dataset, by assigning outliers' own strata and weights, it is straightforward to gross up outliers information by regions and industries.

Step 11 sums up all strata population. As NIABI has partial fully enumerated results, partial stratified sample results with separate strata for outliers, for all variables in corresponding regions and industries, the population in the aggregate regional level is the summation of fully enumerated result in the region, strata population estimated result, and the corresponding outliers' value. The NI level information is then obtained by summing up rural result and urban result.

Step 12 constraint the primary estimated result by the most robust regional economic indicator Regional Account (NISRA, 2014)

Step 13 deduces rural to urban ratios for all activities' economic indicators. As the NIABI estimation provides a number of high level indicators of economic activity such as the total value of sales and work completed by businesses (Turnover), the value of the purchase of goods, materials and services and total employment costs, corresponding economic indicators can be derived based on the equations in Table 3.2. Further rural to urban ratio (rural and urban shares) are then acquired.

Economic Indicators	**NIABI Variables and Equations**
Intermediate Consumption of Goods	Total purchase of Goods, excluding purchases for re-sales without further processing, excluding stock changes.
Intermediate Consumption of Energy	Total purchases of energy and water
Intermediate Consumption of Services	Total purchases of services
Intermediate Consumption	Total Purchases of goods, material and services
Compensation of Employees	Total employment costs
Tax on Production	Amounts paid in business rates (national non-domestic rates) + Vehicle excise duty
Subsidies on Production	Total amounts received in subsidies from government sources and the EC
GFCF	Cost of acquisitions, minus proceeds from disposals

Stock Changes	Total value of all stocks at the end of the period - Total value of all stocks at the beginning of the period - Total value of stocks held at end of period of which stocks purchased for resale without reprocessing + Total value of stocks held at beginning of period of which stocks purchased for resale without reprocessing + (Total value of work in progress at end of period - Total value of all stocks at the beginning of the period)
Output at Basic Price	Total turnover – VAT included in total turnover + Gross written premiums + Fees and Commissions earned +Total Revenue from insurance + Value of insurance claims received + Stock changes + Value of work of a capital natured carried out by own staff included in acquisitions – Other amounts paid for taxes, duties and levies + Total amounts received in subsides from government sources and the EC + Total amount of excise drawback and allowances receivable from Customs and Excise
GVA at Basic Price	Output at Basic Price– Intermediate Consumption
Export of Goods and Services	Total value of exports of goods and services sold directly to businesses outside the UK
Exports of Goods	Exports of goods to the Republic of Ireland /Rest of EU/Rest of World
Exports of Services	Exports of services to the Republic of Ireland /Rest of EU/Rest of World
Imports of Goods and Services	Total value of imports of goods and services purchased directly from businesses outside the UK
Import of Goods	Import of goods from the Republic of Ireland /Rest of EU/Rest of World
Import of Services	Import of services from the Republic of Ireland /Rest of EU/Rest of World
Purchases of Goods from rest of UK	Total purchase of goods – purchases attributed to NI

Table 3.2 Derivation from NIABI information to economic indicator

Carrying out the above steps, this research develops a methodology to make a relative accurate division of rural and urban activities. The contribution of different industries to the regional and overall economy can be assessed, and because estimates of employment are collected at the same time, it is also possible to get a measure of value added and costs per head to allow better comparison between different sized industrial sectors. As this spatial division methodology is the fundamental of NI-RU-SAM, it is necessary to conduct an accuracy assessment.

4. Accuracy Assessment of Spatial Davison Methodology

This section is to review the accuracy of the NIABI results with spatial division. Different from most other spatial works, this approach develops apportionment weights to achieve business information at actual production units, which is local units, the apportionment weights take account of industries, sizes, and regions' dimensions. Therefore, the accuracy of the estimation is expected to be improved and similar to other data resources.

To test the reliability of this method, the outcome of this spatial division has been compared to the rural/urban employment data (workplace based) taken from the Census 2011. The comparison is carried out by three aspects,

Firstly, the comparison of NI whole industry structure (Figure 4.1)

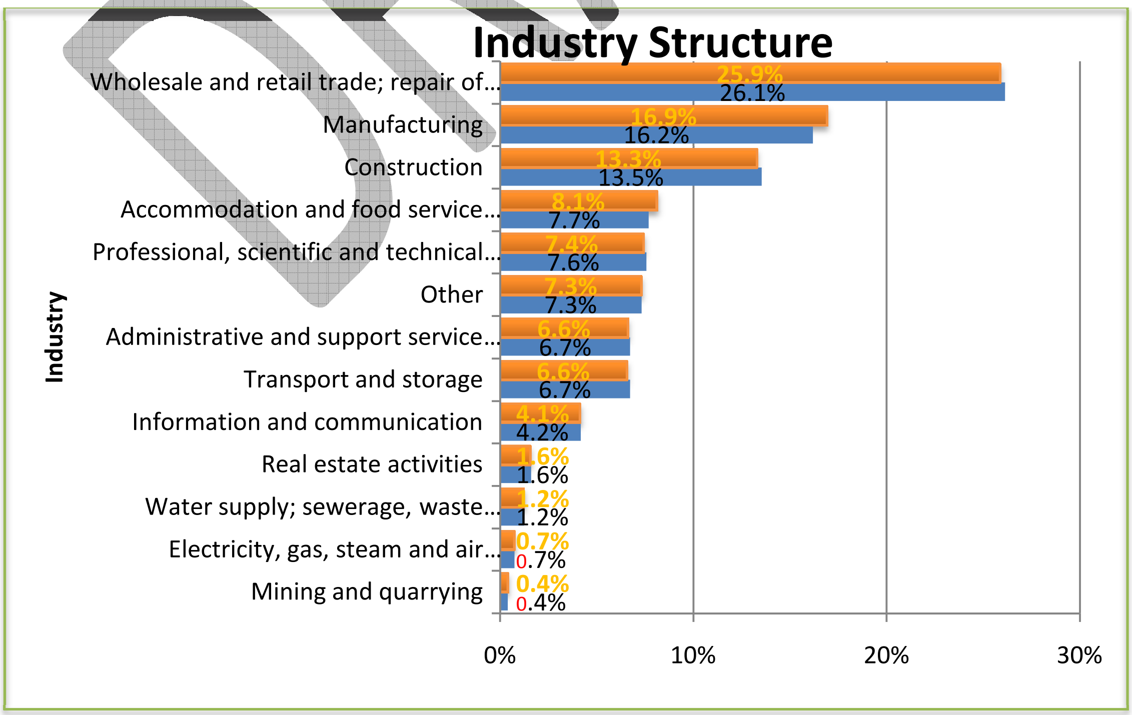

Figure 4.1 NI Employment Structure Comparison between RUSAM and Census

As blue shows the result from the developed method and orange shows Census, obviously, the developed spatial division has a very similar NI industrial employment structure with Census (all differences are less than 0.5%), which demonstrates that the spatial division method has a good ability to describe NI industrial structure

The second aspect is from the regional (Rural in Figure 4.2) industrial employment structure.

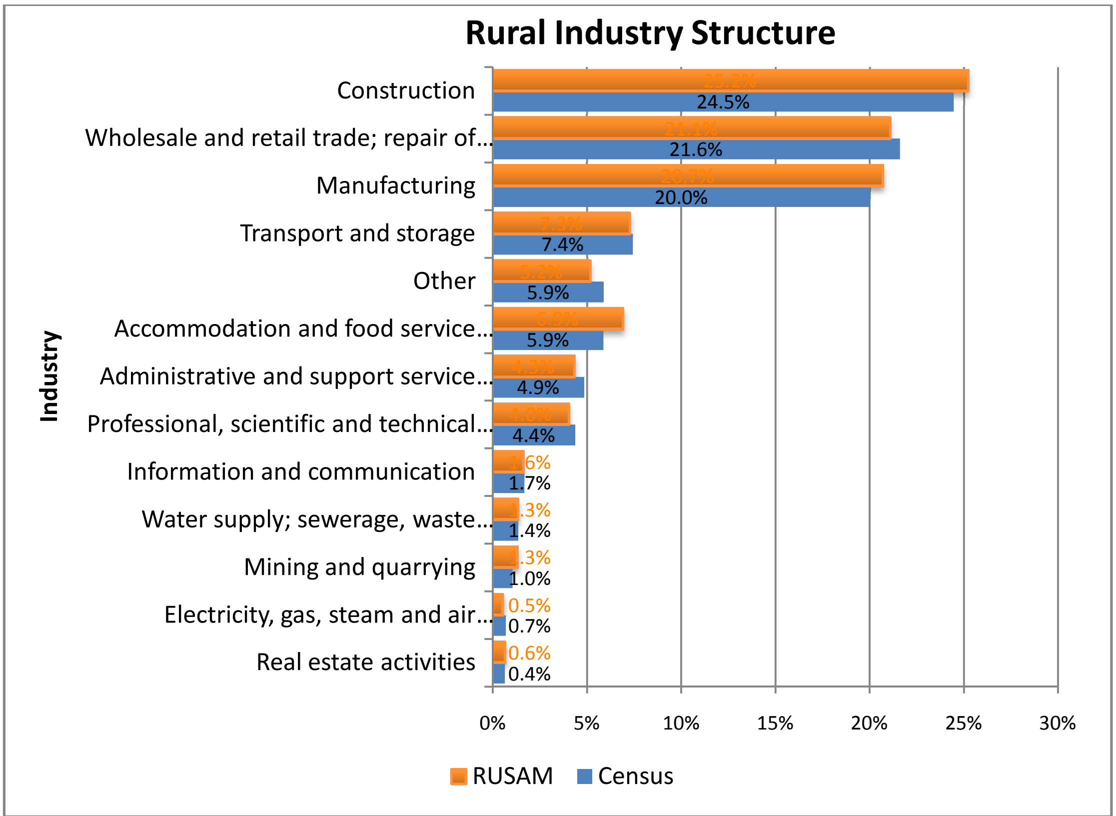

Figure 4.2 NI Rural Employment Structure Comparison between RUSAM and Census

For rural industrial employment structure, there are only very little differences of regional industrial employment structure between RUSAM and Census, the range of % differences is all below 1%. It also supports the spatial methodology reliability; rural industrial structures can be captured by this method.

The last test is to compare rural contribution to each industry (Figure 4.3).

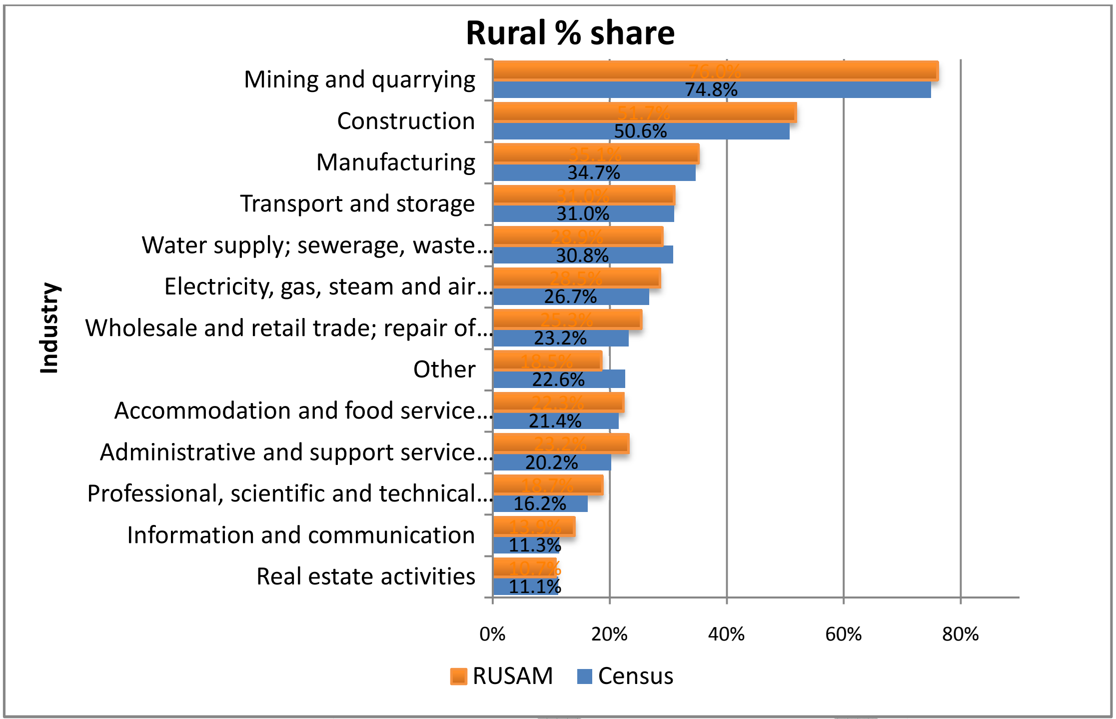

Figure 4.3 Rural Employment Contribution to Each Industry between RUSAM and Census

The final comparison shows rural contribution to each industry has slightly differences with Census, and the differences are majorly less than 2%. This proves that the developed spatial method is able to capture the rural contribution to the whole economy.

5. RUSAM Multipliers Result

As the spatial division method has been tested as a validated method, it is applied back to the Agri-Food SAM, the first NI rural urban SAM are then compiled, and some preliminary results can be derived and shown in Table 5.1 and Table 5.2.

	GDP	Output	Number of Employment	Labour Cost
Rural	26.31%	29.91%	25.76%	27.04%
Urban	73.69%	70.09%	74.24%	72.96%

Table 5.1 Selected Macroeconomic Indicators for NI rural and urban

	Output	Number of Employment	Labour Cost
Rural Agriculture	93.30%	86.62%	89.29%
Urban Agriculture	6.70%	13.38%	10.71%
Rural Food Processing	38.86%	42.73%	38.01%
Urban Food Processing	61.14%	57.27%	61.99%

Table 5.2 Selected Macroeconomic Indicators for NI rural and urban Agri-Food industries

As shown, the rural contribution to NI GDP is around 26%. Employment in NI rural industries takes around a quarter of NI employment. Also as expected, rural Agriculture contribute the most to the industry, and rural Food processing takes up to 38.86% of the whole Food processing industries, which examines the important roles of Agri-food sectors in NI.

A further multipliers analysis is also conducted, rural and urban food processing sectors multipliers value are shown in Table 5.3 as an interpretation example.

Food Processing Sectors		Output Multiplier	Rural	Urban
Rural Food Processing	Beef & Sheep meat	2.16	1.71	0.45
	Pigmeat	2.09	1.54	0.55
	Poultry meat	2.2	1.72	0.48
	Fish and fish products	1.72	1.28	0.44
	Fruit and vegetables	1.73	1.28	0.45
	Dairy products	2.12	1.67	0.45
	Bakeries and grain milling	1.67	1.23	0.44
	Other food products	1.87	1.32	0.54
	Prepared animal feeds	1.74	1.35	0.4
	Alcoholic beverages	1.57	1.19	0.37
	Soft drinks	1.8	1.59	0.21
Urban Food Processing	Beef & Sheep meat	2.15	0.73	1.42
	Pigmeat	2.08	0.58	1.5
	Poultry meat	2.18	0.69	1.49
	Fish and fish products	1.77	0.29	1.48
	Fruit and vegetables	1.79	0.31	1.48
	Dairy products	2.1	0.66	1.45
	Bakeries and grain milling	1.7	0.23	1.47
	Other food products	1.79	0.33	1.46
	Prepared animal feeds	1.74	0.35	1.38
	Alcoholic beverages	1.63	0.21	1.43
	Soft drinks	1.79	0.57	1.22

Table 5.3 Multipliers Result for NI rural and urban Agri-Food industries

The results suggests that all three meat processing sectors and dairy sector has a strong potential for stimulating local economic activity for the reason that a higher multiplier value of a particular industry shows the high amount of linkages it has to other local economic accounts. The rural and urban linkages can also be examined, for example multiplier value 2.16 for the rural beef processing suggests that one million pound increase in demand for the rural beef sector would result, 1 million increase in the rural beef sector as the direct response, in addition 0.71 million increase from the output of all rural sectors, (as the expansion of the rural beef processing increases demand for inputs and services), also, the shock will increase Urban industries by 0.45 million. For food processing sectors, economic Leakages from urban areas to the rural areas are higher than the other way, it implies that urban food processing industries are more dependent on production factors and final demands from rural areas than the reverse way. The important reason for this is that the major urban meat processing sectors use rural production factors.

6. Conclusion

Based on the developed method, the construction of a rural urban regional SAM for NI is a three stage process, (i) sectoral disaggregation (ii) spatial disaggregation (iii) monetary flows information retrieval. The main difficulties in developing a SAM in such a style are on separating activity accounts into rural / urban components and estimating factor and commodity flows between rural and urban. A contribution of this research is that it develops a generic spatial division method to distinguish rural accounts from urban, thus to trace the independencies of economic accounts in spatial dimensions and to measure the rural contribution to NI economy.

This first NISAM are therefore can examine rural contribution to the whole NI economy, and the preliminary results from Rural Urban SAM multiplier shows that urban Agri-Food industries are more dependent on rural production factors than the other way.

In the next stage, specific policy scenarios will be carried out, e.g. treatment of Pillar 1 and Pillar 2 to apply the policy shocks, and to allow prices and behaviors vary, this rural urban SAM will be extended to a CGE based model.

References

Balamou, E., and D. Psaltopoulos. 2007. "Agricultural Policy Changes and Regional Econmies: A Standard CGE Analysis for Greece." *SPERA International Seminar*.

CSO. 2008. *Small Business in Ireland.* Dublin: Central Statisitcs Office.

DARD. 2012. *Farm Incomes in Northern Ireland 2010/2011.* DARD: Policy and Economics Division.

DARD. 2012. *Northern Ireland Rural Development Programme 2007-2013.* Belfast: Department of Agriculture and Rural Development.

DARD. 2013. *Size and Performance of the Northern Ireland Food and Drinks Processing Sector, Subsector Statistics* Department of Agriculture and Rural Development, Rep. 978-1-84807-390-6.

DARD. 2012. *Statistical Review of Northern Ireland Agriculture 2011.* DARD: DARD.

DETINI. 2013. *Northern Ireland Annual Business Inquiry (NIABI) Quality Report.* Belfast: Department of Enterprise Trade and Investment.

Dixon, J., and A. Matthews. 2006. "The 2003 Mid Term Review of the Common Agricultural Policy: A Computable General Equilibrium Analysis for Ireland."

Hyytiä, N., and J. Kola. 2013. "Tourism Policy as a Tool for Rural Development." *Applied Economic Perspectives and Policy* 35(4):708-730.

Löfgren, H., R.L. Harris, and S. Robinson. 2002. *A Standard Computable General Equilibrium (CGE) Model in GAMS*: International Food Policy Research Inst.

Mules, T.J. 1983. "Input-Output Analysis in Australia: an Agricultural Perspective." *Review of Marketing and Agricultural Economics* 51(1):9-30.

Müller, M., I.P. Domínguez, and S.H. Gay. "Construction of Social Accounting Matrices for EU27 with a Disaggregated Agricultural Sector (AgroSAM). ." Institute for Prospective Technological Studies.

NISRA (2014) Central Postcode Directory, ed. NISRA.

NISRA. 2013. *Local Unit Results from the Northern Ireland Annual Business Inquiry 2011.*

NISRA. 2005. *Report of the Inter-Departmental Urban-Rural Definition Group.* Department of Fiannace and Personnel: NISRA.

NISRA. 2014. *Spreadsheet documentation, data sources and estimates used in the compilation of the NI Economic Accounts.* Belfast: Economic and Labour Market Statisitics Branch.

ONS. 2009. *UK Standard Industrial Classification of Economic Activities 2007 (SIC 2007).*

Patterson, H., and D. Anderson. 2003. "What is Really Different about Rural and Urban Firms? Some Evidence from Northern Ireland." *Journal of Rural Studies* (19):477-490.

Plevin, R.J., H.K. Gibbs, J. Duffy, S. Yui, and S. Yeh. "Agro-ecological Zone Emission Factor (AEZ-EF) Model (v47)."

Psaltopoulos, D., E. Balamou, D. Skuras, T. Ratinger, and S. Sieber. 2011. "Modelling the Impacts of CAP Pillar 1 and 2 Measures on Local Economies in Europe: Testing a Case Study-Based CGE-Model Approach." *Journal of policy modeling* 33(1):53-69.

Psaltopoulos, D., E. Balamou, and K.J. Thomson. 2006. "Rural-Urban impacts of CAP Measures in Greece: An Inter-regional SAM Approach." *Journal of Agricultural Economics* 57(3):441-458.

Psaltopoulos, D., E. Phimister, T. Ratinger, D. Roberts, D. Skuras, Z. Bednarikova, M.E. Goded, S.G.y. Paloma, S. Mary, F. Nohel, and F. Santini. 2012. *Ex-ante Spatial Policy Impact Analysis of the Rural Development policy in European Rural Areas (RURAL ECMOD).* Rep. EUR 25238 EN.

Pyatt, G., and J.I. Round. "Social Accounting Matrix: A Basis for Planning." World Bank.

Riddington, G., H. Gibson, and J. Anderson. 2006. "Comparison of Gravity Model, Survey and Location Quotient-based Local Area Tables and Multipliers." *Regional Studies* 40(9):1069-1081.

Roberts, D. 1998. "Rural-urban interdependencies: analysis using an inter-regional SAM model." *European Review of Agricultural Economics* 25(4):506-527.

Törmä, H., K. Zawalinska, M. Blanco-Fonseca, E. Ferrari, and T. Jansson (2010) Regional CGE Model Layout with a Focus on Integration with the Partial Equilibrium Models and Modelling of RD Measures, CAPRI-RD Deliverable 3.2. 1.