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12 Constructing Regional Supply and Use Tables: Recent Dutch Experiences¹

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12.1 Introduction

Input-output analysis is a very important tool for the analysis of economic structure and structural change. Traditionally attention was mainly directed to the interindustry relations. Miyazawa (1960, Miyazawa and Masegi, 1963) was one of the first to draw attention to the importance of the structure of consumption expenditures, especially in the context of interregional modelling (see also Miyazawa, 1976). This is especially noteworthy, as it took quite some time before the (regional) input-output community understood that the impacts of consumption expenditures by households, especially for small regions, tend to be more important than the impacts of intermediate demand by industries (see e.g. Oosterhaven, 1981, ch. 6). Modelling consumption expenditure, however, ideally requires the use of commodity information, which is an other aspect that is rather neglected by the (regional) input-output community up till very recently.

In the Netherlands, regional input-output analysis also has a long tradition in using only the industry dimension in modelling the regional economy, and neglecting its commodity dimension. Many other countries share the related Dutch tradition of constructing regional tables from national industry by industry tables (cf. Lahr, 1993). However, with the final shift towards the rectangular supply and use framework in national accounting (see e.g. UN, 1993 and Eurostat, 1996a), the (Dutch) regional construction procedures face a serious risk of becoming obsolete.

Hence, it seems legitimate to question the sustainability of the current (Dutch) methodology for the construction of (bi)regional input-output tables and to see whether regional input-output construction can, and indeed should, become more harmonized with current national accounting practices. Questioning current

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methodology implies a search for a new methodology and new concepts (see also Siddiqi and Salem, 1995).

In 1996, Statistics Netherlands in collaboration with the University of Groningen faced this task by starting a project (RIOT) to create 14 bi-regional input-output tables, based on a supply and use accounting framework. Based on this experience, this chapter will propose and discuss a step by step approach to structure the estimation/construction of regional supply and use tables.

First, as background information, an overview of earlier Dutch regional input-output experiences will be given, and the multi-regional rectangular accounting framework chosen used will be discussed. Then the core of the paper will discuss the step-wise approach chosen to fill the accounting framework with actual numbers. Both conceptual problems and the actual solutions chosen will be discussed. The conclusion of this chapter, then, contains some thoughts on the future of Dutch regional input-output analysis.

12.2 Earlier Dutch Regional Input-Output Experiences

Even a well-informed expert such as Jensen (1990, p. 11), starts the "classical era with 'genuine' regional tables" with Hirsch (1959), obviously unaware of comparable early starts elsewhere. In the Netherlands for example, such tables had already been constructed for the year 1948 for the Municipality of Amsterdam (Venekamp, 1954) and for 1953 for the Province of Groningen (Rijken van Olst, 1958). Oosterhaven (1980, p. 12) summarizes the development of Dutch regional input-output analysis up to the 1970's as running "from regional tables with only limited information used for primarily descriptive purposes towards ideal interregional tables used for analytical purposes, such as estimates of economic impacts, experiments with programming models and building full forecasting models". At present, about 70 regional technology tables and 50 regional and interregional full-information input-output tables are available in the Netherlands. Most of the latter have a hybrid, semi-survey character or are updates of such tables. In this section, we shall restrict ourselves to a brief discussion of the development since 1980.

The 1980's started with a flurry of construction activities by several regional research institutes (for a detailed account, we refer to Oosterhaven and Drewes, 1985, Ch. 3-5 and 8). Most tables were based on the publication of the new, and up to now unfortunately the last, series of regional domestic use tables for 1975 by Statistics Netherlands (CBS, 1983). These CBS-tables contain a complete breakdown of the national input-output table along its columns (including the foreign exports column) for the 11 Dutch provinces and the regions of Amsterdam, Rotterdam and The Hague. As opposed to the Dutch tables constructed in the 1970's and also unlike most tables constructed both in the US (see Brucker, Hastings and Latham III, 1990) and in Australia (see West, 1990), the Dutch (bi)regional tables of the 1980's are mainly based on surveys of export

coefficients instead of the usual approach via survey or non-survey import coefficients. As a consequence of this different trade survey strategy, the need for more detailed information on the structure of sectoral intermediate and final output became apparent. In most cases this led to an explicit estimate of a 'domestic sales table'.

This change of approach was the outcome of earlier experiences, that showed that, as a rule, companies know more about the spatial destination of their sales than about the spatial origin of their inputs. This is especially the case if there are a lot of different inputs and/or if inputs are purchased through wholesale or retail channels. Companies are only well informed about the real origin of their inputs if they deal with one or a few dominant inputs purchased directly from the producer of that input. On the sales side, however, companies may lack the necessary information on the spatial destination of their sales only if they primarily sell through wholesale firms. Even then, they appear to be better informed about their sales than about their purchases through wholesalers. This new approach became more or less standard, even when only single-region tables were constructed.

Besides the better coverage and the higher quality of export coefficients over import coefficients, there is another advantage of this approach to the construction of (bi)regional input-output tables. Through the construction of a regional (domestic) sales table, the consistency checks that result from the double-entry character of the input-output table can be used at the level of the individual cells of the table. In more traditional cases, they operate only at the level of entire rows since they use only domestic use (i.e. purchase) tables and import coefficients. When both approaches are combined (i.e. when import and export coefficients are used along with regional use and regional sales tables), a so-called reconciled dogleg table results in the case of a single region, whereas a reconciled interregional table results in the case of two regions (see Oosterhaven, 1984, for other members of the family of square single-region and multi-regional tables). Such fully reconciled tables have not yet been constructed in the Netherlands, due to the cost of collection and the potential unreliability of import data.

The second feature that distinguishes Dutch regional input-output table construction from practice in most of the English speaking world is the almost total absence of the use of any kind of coefficient method, such as LO, CIQ or SDP (*cf.* Miller and Blair, 1985, for a further discussion). All these methods implicitly maximize intra-regional transactions in one way or another. Consequently, all regional multipliers derived from such tables have a systematic upward bias, even when there are claims of relatively little cross-hauling (e.g. West, 1990, p. 108, for Australia). In densely populated and highly urbanized countries, however, cross-hauling is the rule, and even more so when commuting across regional boundaries is important and when attention is directed to type II multipliers. (*cf.* Oosterhaven, 1981, Ch. 6).

Finally, the 1980s revealed a whole series of updates of the older 1975-tables to 1980 (see Oosterhaven and Drewes, 1985, Ch. 11-13, for a methodological discussion of the alternative methods used and proposed). The experience with updating the Dutch semi-survey bi-regional tables may be of wider importance too. The somewhat higher initial costs of constructing bi-regional tables instead of

single-region tables proves to pay off in the form of lower updating costs and a greater reliability of the updated bi-regional tables. The costs appear to be lower because interregional trade is estimated as part of the updating procedure rather than needing to be estimated a priori, while the reliability is expected to be greater because national technological change may easily be incorporated in the updated table (see Oosterhaven et al. 1986, for details).

This history of the construction of regional input-output tables in the Netherlands culminated in the DEBRIOT-method, whose construction sequence includes the separate construction of a regional technology table, a regional domestic purchases or use (i.e. national origins) table and a regional domestic sales (i.e. national destinations) table. The latter is estimated row-wise using a weighted average of the regional demand structure and the national sales structure. In the trade survey, DEBRIOT concentrates on estimating intra-regional sales coefficients (RSC's) and regional export coefficients instead of estimating RPC's and import coefficients. Information on RPC's is collected only selectively for local industrial complexes to improve the accuracy for inverse-important intermediate transactions. Separate attention is paid to the estimation of the (inverse-important) household consumption columns. After the selective collection of some additional data, a reconciliation of these data leads to the final bi-regional table (see Boomsma and Oosterhaven, 1992, for details). The outcome is a typically hybrid input-output table in the sense that survey information is supplemented with guestimates and assumptions on lacking data.

With the establishment of the DEBRIOT method as the more or less standardized methodology for the construction of Dutch regional input-output tables, development of new methodology has, in recent years, been restricted to modifications of the DEBRIOT methodology (see e.g. Eding, et al., 1995). Given the advantages of the supply and use tables as an accounting framework and their world-wide implementation at a national level, the imminent question arose whether such a system could, and indeed should, also be realized at the regional level to replace 'traditional' input-output construction procedures in the Netherlands. Research has proven the feasibility of such an approach (see Eding and Oosterhaven, 1996) and, with work still in progress, a new era in Dutch regional input-output construction has begun.

12.3 Rectangular National and Regional Accounting

With the publication of new international guidelines for national accounting (UN, 1993 and Eurostat, 1996a), the construction of supply and use tables is put forward as the preferred national accounting framework. The advantages of such a rectangular accounting framework, *i.e.*, working more directly with real company data, have already led to a world-wide acceptance of this new method for national accounting. And an increasing number of countries, including the Netherlands, is now producing supply and use tables on a regular basis.

The main components of the rectangular accounting framework are the supply and use tables (see figure 12.1). The supply table, $(v_{ic} \in V)$, describes the supply of commodities c by industry i of origin. In the supply table, all production is recorded: both goods and services from primary activities as well as goods and services from ancillary activities of industries. Besides production from national industries, the supply table also contains a row representing the import of commodities from abroad (m). The upper part of the use table contains the use of commodities c by industries i , $(u_{ci} \in U)$, and the use of commodities c by final demand of type f , $(e_{cf} \in E)$, including a column with foreign exports (x). The use of goods and services is grouped into commodities just as in the supply table. The lower part of the use table describes the use of primary inputs v by industry i , i.e. the generation of value added, $(Y_{vi} \in Y)$. Value added entails elements like the compensation for production factors (e.g. wages and salaries, social security paid by employers, depreciation, etc.), indirect taxes and subsidies, and the operating surplus.

There are two direct observable connections between the supply and use tables. The first is the industry output equation, which states that the total output of an industry i , read row-wise from the supply table, (g) , must be equal to the total use of commodities plus the value added of industry i , which can be derived column-wise from the use table.

$$g = Vi = [i'U + i'Y]' \quad (12.1)$$

where i is a unit-vector of the appropriate dimension.

The second identity linking the supply and use table is the commodity balance equation, which states that total supply of commodity c , derived column-wise from the supply matrix, (q') , must be equal to total demand of commodity c , derived row-wise from the use matrix.

$$q' = i'V + m' = [Ui + Ei + x]' \quad (12.2)$$

The supply and use tables hardly rely on assumptions about economic behavior, as few modifications have been made from the original data. The latter belong more to the model construction phase of research and not to the measurement phase. The supply and use tables provide balanced data on production, commodity flows and value added at a very detailed level. The number of industries and commodities distinguished mainly depends on the availability of data. Besides, aspects like human resources to carry out data processing and balancing processes could also limit the number of industries and commodities (see also next section). Finally, while other frameworks are almost always constructed from the supply and use matrices, the rectangular framework provides us with the most detailed, integrated, and reliable picture of an economy possible, at a national level as well as at the regional level.

Figure 12.1 illustrates the general structure of a (multi-)regional accounting framework which could be derived from the above national framework. As with the national framework, in a regional accounting system each region has its own supply and use table. The supply table now describes the *regional* supply of

commodities, for instance for region r , (q^r). This regional supply consists of production by regional industries, (V^r), imports from all other regions k , ($t^r = \sum_k t^{rk}$), and imports from abroad, (m^r). The use table now displays the *regional* use of commodities (including primary inputs) by the different regional actors. These include regional industries, regional consumers, exports to other regions k ($t^r = \sum_k t^{rk}$), exports abroad, (x^r), etc. The main difference with the national accounting framework is the addition of an extra column in the use matrices, (t^{r*}) and an extra row in the supply matrices, (t^{*r}), which represent the interregional trade flows per commodity.

Figure 12.1 A Rectangular (Multi-)Regional Accounting Framework

		Commodities	Industries	Final Demand	Σ		
Commodities	Commodities		U^r	E^r	t^{r*} x^r	q^r	
	Industries	V^r				g^r	Final Demand E^s t^{s*} x^s
Prim. Inp.	Industries	t^{r*} m^r					q^s
	Commodities		Y^r				g^s
Σ	Commodities	q^{r*}	g^{r*}	Region r			
Prim. Inp.	Industries					Y^s	
	Commodities						Region s
Σ	Commodities					q^{s*}	g^{s*}

This framework presents a complete (multi-)regional rectangular accounting framework where all information, including the trade in commodities between regions is displayed. The construction of such a framework can, however, as with the square tables, be carried out in several ways (see Oosterhaven, 1984, for the whole family of rectangular tables). In the next sections we shall discuss a step by step approach for constructing such regional rectangular, accounting frameworks.

In this process two main regionalisation steps can be distinguished.

The first step is the straightforward disaggregation of the national supply and use matrices with regard to the regions at hand. This results in a set of so-called half-regionalised tables, in which regional industry output equals regional industry

input, including primary inputs, but in which regional commodity demand does not yet equals regional commodity supply. Thus, as opposed to the tables in Figure 12.1, these half-regionalised tables do not yet contain any information on interregional trade, i.e. they exclude the row with interregional imports in the supply table, (t^{rs}) as well as the column with interregional exports in the use table, (t^{rs}) .² Hence, these half-regionalised tables only satisfy the following condition (cf. equation 12.1):

$$g^r = V^r i = [i' U^r + i' Y^r]' \quad (12.3)$$

In the second regionalization step data on interregional trade will also be incorporated and the regional supply and use of commodities will be balanced too (cf. equation 12.2):

$$d i' = i' V^r + d i' + t^{rs} i' = [U^r i + E^r i + x^r + t^{r*}] \quad (12.4)$$

Together, equations (12.3) and (12.4) present all information on region r shown in figure 12.1.

Naturally, the disaggregation of the national supply and use tables should be such that the sum of the regions equals the nation. For the industry balance equations this is easily shown, by summing (12.3) over r :

$$\sum_r g_r = \sum_r V_r i = \sum_r [i' U^r + i' Y^r] = [i' U + i' Y]' = g \quad (12.5)$$

For the commodity balance equations this is more complicated, since the sum of the supply of the regional markets does not equal the supply at the national market, because the latter excludes interregional trade. The equality of regional commodity supply and demand can be shown by first summing over r in the first part of (12.4):

$$q^r = i' V^r + m^r + t^{rs} = i' V + m' + t^{rs} = q' + t^{rs} \quad (12.6)$$

And, second, by also summing over r in the last part of (12.4):

$$q^r = [U^r i + E^r i + x^r + t^{r*}] = [q + t^{r*}] \quad (12.7)$$

Both (12.6) and (12.7) show that the sum of the regional commodity supply and the sum of regional commodity use are indeed equal to each other, and together equal the corresponding national total plus the overall total of interregional trade:

$$t^{**} = \sum_r \sum_s t^{rs} \quad (12.8)$$

² Actually, the first regionalisation of the national supply and use matrices results in a set of two regional supply and use matrices in which the commodity balance does not hold. The balance can be restored by defining a so called balancing column in the use matrix. This column specifies the difference between the regional use and the regional production per commodity. It thus represents the net interregional flow of trade commodities at hand, i.e. $t^r - t^r$.

12.4 A Step by Step Regionalisation of National Supply and Use

In the last section the choice of the type of rectangular accounting framework was made and the relations between the national and the regional frameworks were clarified. In this section a step by step approach, to construct such regional input-output accounts will be formulated. Basically, five steps are defined:

1. classification of industries and commodities,
2. estimation of regional industrial supply and use of commodities,
3. estimation of regional final use of commodities,
4. estimation of foreign trade,
5. estimation of interregional trade.

The first three steps are part of the first main regionalisation step as mentioned in the previous section and the last two steps cover the second main regionalisation phase. The following subsections address these steps, with emphasis on concepts and practical estimation aspects.

12.4.1 Classification of industries and commodities

The first and relatively important step in the construction of the regional supply and use tables is the classification of commodities and industries. The basis for estimating the regional supply and use table is the Dutch National Accounts, which, at their most detailed level distinguish approximately 850 commodities and 250 industries³. Another important statistical source used in the Dutch construction procedure are the Regional accounts, which show a breakdown of national production, exports and other variables into their regional counterparts for about 190 industries (see CBS, 1996). Nevertheless, from a practical perspective such classifications cannot be applied realistically in the construction of regional input-output accounts. The present Dutch RIOT Project, for example, entails the construction of accounts for 14 different regions. Hence, with 850 commodities and 190 industries, the number of cells to be estimated (about 2.3 million) becomes too large to be estimated accurately from a practical point of view and/or considering the small staff working on the project.

But from a theoretical perspective, too, such classifications might be considered an overkill for constructing regional input-output accounts, due to limitations in data supply and quality. The trade-off between time needed and the level of detail at which the construction is planned, furthermore, depends on the possibilities of automation and surveyability. When automation is possible, cost may remain low

³ This classification is available internal purposes only. Published tables are aggregated according to confidentiality rules of Statistics Netherlands. The same holds for the regional supply and use tables. Here the aggregation to publication tables will be even more rigorous, due to the relative small (economic) size of certain regions.

while accuracy may improve. When analysts' decisions are involved, e.g. to solve inconsistencies or to fill in lacking data, a higher level of aggregation is needed. Finally it has to be kept in mind that the weakest data determine the quality of the end product. When, especially, the time cost of the trade survey is large and its level of aggregation is high, it does not improve the end quality of the tables when other construction phases work at a very detailed level (see also the plea of Jensen, 1990, for holistic accuracy as opposed to partial accuracy).

12.4.1.1 Existing Classifications

As they are based on the National Accounts, constructing regional input-output tables does not require a complete new classification for commodities and industries. Hence, one can limit oneself by critically reviewing the existing classification of commodities (850) and industries (250) as used for the National Accounts and the list of industries (190) used for the Regional accounts. Basically, the classifications used in a regional input-output project comprise a reclassification and, especially, aggregation of national classifications.

Before discussing this reclassification in the Dutch case, let us look at existing classifications in international practice. If we limit ourselves to the United Nations Statistics and Eurostat the four general classifications are:

Central Product Classification (CPC, United Nations, 1991)

Classification of Products by Activity (CPA, Eurostat, 1993)

International Standard Industrial Classification of All Economic Activities (ISIC, rev.3, United Nations, 1990)

Nomenclature générale des Activités économiques dans les Communautés Européennes (NACE, rev.1, Eurostat, 1996d)

The key word for all classifications is homogeneity, i.e. the categories within each level must be as homogeneous as possible. The evaluation criteria for this aspect have to be clear, although their application is not always straightforward (see e.g. Eurostat, 1996b). In addition to conceptual arguments, another aspect is of importance: the size of the categories distinguished. A homogeneous group must have a certain minimum size to be separated as a category. The conceptual criteria for industrial classifications are:

- homogeneity of output (produced goods and services),
- homogeneity of production process, and
- homogeneity of input (consumed goods and services).

Of these criteria, the kind of goods and services produced (output) is used as the main criterion. In their turn, the most important criteria for classifying goods and services are: (1) industrial origin, (2) the purpose or user category, (3) whether or not they can be stored, and (4) input structure (price structure).

The 850 commodities of the Dutch National Accounts are based on the Classification of Products by Activity (CPA). The main principle for classifying products in the CPA is the industrial origin criterion. Thus, each product is classified according to the activity which characteristically produces that product. These activities are defined according to the NACE-classification. The 250 industries of the Dutch National Accounts (and the 190 of the Regional Accounts)

are based on a Dutch industrial classification (Standaard Bedrijfs-Indeling 1974) which was inspired by the ISIC-classification. Both classifications, for industries and commodities, are modified for the purpose of the National Accounts. The aggregation for the regional supply and use tables is treated in the next two subsections.

12.4.1.2. Classification of Commodities

The major goal of reclassification is to reduce the number of commodities. Before treating the criteria with respect to content, it is important to think about which number of commodities suffices for the ultimate use of the supply and use tables, and not to think too much within the scope of surveyability and capacity. It is clear that the number of commodities to define in a regional supply and use framework must always be seen as a compromise. For the Dutch project, the number of commodities to be aimed at has been predetermined at about 225 categories. The final classification may possibly deviate considerably from this number, but for practical purposes, it is useful to work with a provisional target.

During the balancing process of the Dutch national supply and use tables the 850 commodities are already aggregated into 160 so-called statistical groups. These commodity groups are composed of commodities with more or less comparable users (industrial as well as final consumers). Hence, we choose to start with these 160 groups and will consider the question which groups should be desaggregated, using the 850 commodity classification. To this aim a checklist of criteria was used, which can be split up into two parts. There are some robust criteria to separate certain commodities and other criteria which only separate one or more commodities if the resulting category is substantial enough. The national boundary was set at 500 million Dutch guilders. With 14 regions this is about 50 million Dutch guilders for the largest and about 10 million for the smallest regions.

The strongest criterion to separate a commodity from a statistical group is the presence of taxes (excises and VAT) or subsidies on products. Taxes and subsidies on domestic products form the link between the production value in basic prices and in purchasers' prices. In a regional classification scheme these commodities must therefore be kept separate. All the other criteria are applied in combination and keeping in mind the importance in amounts. The other criteria are:

Margins. Supply tables are valued in basic prices and the amounts in the use table are valued in purchasers' prices. Margins form one of the differences between these values. Commodities with relatively high trade or transport margins should be kept apart.

Imports, import taxes and exports. Especially in an open economy like the Dutch one, a considerable part of the supply comes from imports and, similarly, a considerable part of the use has exports as destination. Big differences in foreign import and/or export ratio's are important criteria to divide statistical groups.

Differences between commodities in the share of final expenditures like household consumption and fixed capital formation may also be a reason to separate commodities.

If there is no reason to divide statistical groups on the basis of the criteria so far, there may be one from a regional point of view. In that case specific information on the regional production or use of a commodity must be available. Differences in production technology are probably the most important criterion. If two commodities belonging to the same statistical group show significant differences in production technology, these commodities should be separated in a regional classification scheme. This criterion also implies that commodities with the same production technology or products produced in one production process (by-products) could be combined into one category.

Almost all the above mentioned criteria are developed with the Dutch regional situation in mind. However, due to the nature of the criteria, most of them should be applied in an international context too. After several provisional lists and discussions, a final list of 206 commodities is composed to be used in the Dutch regional input-output accounts.

12.4.1.3. Classification of Industries

Following the reclassification of the commodities, the aggregation of industries is the next step in the classification phase. Because the number of commodities has been seriously reduced, the number of industries in the supply and use tables could (and should) be reduced too. Before that, the national supply table has been aggregated for the chosen 206 commodities and the 190 industries groups from the Regional Accounts. On further examination, several of these industry groups still turned out to produce the same commodities (according to the list of 206). Since, it is not useful and/or practical to separate such industry groups, they are combined. Besides content, there is the aspect of size. Except in special cases, industries with little production (in million Dfl.) have been taken together with other industries.

The final list of industries used for this project counts 139 industries.

12.4.2 Regional Industrial Supply and Use of Commodities

This section will address the next step in the construction of the regional supply and use tables: the actual estimation of the supply and use by regional industries. Two major topics will be discussed: the availability of data, and its related methodological concepts for constructing the supply and use table. These methodological issues entail aspects like the treatment of causality in estimation procedures, top-down versus bottom-up estimation and multi-regional companies. In addition, an empirical example from the estimation of the regional supply of commodities from the Dutch project will be given.

12.4.2.1 Top-Down versus Bottom-Up

The main feature of supply and use matrices is their double dimension in data supply: the commodity and the industry perspective. Hence, regionalising national

supply and use matrices can be done along one or both dimensions (see Oosterhaven, 1984 for an overview). An important decision in the regionalisation procedure is thus along which dimension(s) one should regionalise supply and use tables: commodities, industries or both. Another decision concerns the choice between bottom-up, top-down and hybrid estimation methods. Here we will discuss how these methods can be applied to the supply and use framework and which dimension(s) should accordingly be used.

The first approach is to use source (production) statistics in an (independent) construction of the regional supply and use matrices for each region, using data at establishment level: the so-called *bottom-up approach*. In this approach the regional supply and use matrices compiled may not instantly be consistent with national statistics. In fact, inconsistencies are almost inevitable. Besides inconsistencies with national statistics, the bottom-up method could also bring about inconsistencies between the regional supply and use matrix. At the national level these matrices are made consistent using all kinds of reconciliation methods. The result is a supply and a use matrix in which the industry output equation (12.1) as well as the commodity balance equation (12.2) holds. If regional supply and use matrices are compiled by bottom-up methodology, both types of inconsistencies have to be reconciled with the national statistics. However, this second type of inconsistencies might not become visible until interregional trade is incorporated in the regional supply and use accounting framework (see section 12.4.5.).

From a theoretical point of view, the bottom-up approach is to be preferred because it accounts for regional and industrial differences in production and sales structures. If a bottom-up methodology is chosen, both dimensions are explicitly used in the construction of regional supply and use matrices. From a theoretical point of view it also seems to be the most logical step to use both dimensions, because an industry in region r may produce quite different commodities than the same industry in region s . From a practical point of view this might not be the most optimal way to proceed, because the bottom-up methodology requires a considerable amount of data and time. With both being scarce, the choice for only one dimension in the regionalisation process could be a feasible alternative. Regionalising with only one dimension, however, implies use of a partial top-down methodology.

Basically, a complete *top-down approach* can be described as a (mechanical) decomposition of both the national supply and the national use matrices. In this approach, the rows of the national supply matrix and the columns of the national use matrix are divided into separate rows and columns representing the regions. This can be accomplished by using (source) statistics for the compilation of ratios. In the supply and use framework two kinds of ratios could be used: those relating to commodities and those relating to industries. The choice of ratios mainly depends on the availability of data at the regional level. For most countries, such as the Netherlands, regional production data relates to industries and not to commodities. This is a strong argument in favour of the use of the industry dimension in the top-down approach.

But even if commodity data are available at the regional level, from an economic perspective, it is still more plausible to use the industry dimension in the following way:

$$\tilde{V}_{ic}^r = (V_{ic} / g_i) g_i^r \quad (12.9a)$$

and

$$\tilde{U}_{ci}^r = (U_{ci} / g_i) g_i^r \quad (12.9b)$$

Using the commodity ratios implies that production and use of commodities is proportionally assigned to industries as follows:

$$\tilde{V}_{ic}^r = (V_{ic} / q_c) q_c^r \quad (12.10a)$$

and

$$\tilde{U}_{ci}^r = (U_{ci} / q_c) q_c^r \quad (12.10b)$$

In the latter case, the size of the regional production of industries (g_i) is made entirely dependent on the commodity ratios. In this way, the rationale behind the supply and use accounting framework is completely reversed, which is why we reject (12.10).

However, using industry ratios according to (12.9) is not straightforward either. For some industries, information about the regional diversity in the commodity mix of production, (V_{ic}^r / g_i^r) , might be available, while information on the use of commodities by industries, (U_{ci}^r / g_i^r) , is absent. In such cases this extra information can (and should), of course, be used in the regionalisation process of the supply table. However, such a commodity diversity in regional production may also imply a regional diversity in the use of commodities. Because, even if regional differences in commodity production processes are ignored, regional differences in the commodity mix of industries still have to be accounted for when constructing the regional use matrix. Hence, in the most optimal case, input structures for the production of specific commodities, (U_{gic}^r / g_{ic}^r) , have to be estimated to approximate the regional differences in the input structure of the industry at hand as follows (see also Konijn, 1994):

$$\tilde{U}_{ci}^r = \sum_g (U_{gic} / g_{ic}) V_{ic}^r \quad (12.11)$$

The amount of time needed for an occasional estimation of these structures could be considerably less than the time needed to fully implement a bottom-up methodology. Accounting for differences in the commodity mix of regional industries, where possible, enhances the accuracy of the estimated regional use (and supply) matrix. However, a major drawback of the top-down approach remains the rigid use of national structures to construct the regional use matrices.

For most regional industries the use of national input structures as in (12.9b), will not pose any major problems. Nevertheless, for some industries, for example the chemical industry and the agricultural sector, it would be a better option to construct the regional output (and input) structures with basic (production) statistics (according to the bottom-up approach). On the other hand, many industries exist where national structures could be applied without any major

theoretical and practical problems, and lastly, industries exist where the lack of information coerces into implementing a pure top-down methodology. For a majority of the industries, this option can also be justified, theoretically, as most commodities are produced in a similar fashion in different regions, as relative input prices within most nations only differ to a small extent between regions. In the construction of the Dutch regional supply and use tables, a mixture of top-down and bottom-up approaches is chosen, depending upon the information available at Statistics Netherlands.

12.4.2.2 Data Availability is a Key Determinant

For the construction of regional supply and use tables, data availability is thus one of the key determinants, both for actual construction methodology and for the reliability of statistical estimates. Preceding the actual construction of the regional industrial supply and use of commodities in the Netherlands, extensive research has been carried out to stocklist available data sources at Statistics Netherlands and other institutions, such as large employers, and entrepreneurial and professional associations.

For the agricultural sector most of the data needed to construct the regional supply tables are already available in the Regional Accounts, i.e. both information on the region of production and on the commodities produced there is available. In this sector only minor (proportional) adjustments had to be made to ensure a consistent estimate within the national accounting framework. For other industries, however, such detailed information is not readily available. There, data availability ranges from fairly detailed micro data for industrial activities to almost no information for some services sectors. Nevertheless, for all industries an estimate of total production for all regions is given in the regional accounts. If no other data becomes available, these data could serve as a key to regionalise commodity production by industries as in (9a).

Another problem stemming from the stocklisting of available data is an almost complete absence of regional data on the use of commodities by industries. Hence, estimating regional industrial use of commodities relies heavily on the use of the top-down formula (9b). Only for a few, region-specific industries an exception could be made.

To conclude: the construction of the regional industrial supply of commodities for the 14 Dutch regions is, to a large extent, based on empirical data, but for some industries a lack of data forces the use of more mechanical procedures. Besides, with most data being available about regional supply of commodities and with data on regional industrial use of commodities being scarce and/or unreliable, the estimates of regional industrial use of commodities rely heavily on the information from the national use table.

12.4.2.3 Multi-Regional and Heterogeneous Units

Even when abundant data on industrial activity would be available, the presence of multi-regional and heterogeneous units might cause further problems. In the

Dutch Regional Accounts, the kind of activity unit (KAU) is used as the main statistical observation unit (see e.g. CBS, 1996 and Eurostat, 1995). A KAU is classified according to its main activity. A company may very well have more than one activity. For producers with only one site, or producers with two or more sites within a single region, this observation unit does not pose regionalization problems. But for producers with production sites in more than one region complications arise. The Eurostat guidelines on regional accounting methods (Eurostat, 1995) depict several scenarios for solving practical and conceptual differences. The most appropriate method for an industry is mainly determined by data availability. Applied to the RIOT-project, the best method would be to use commodity information for each production site separately, since a multi-regional company may produce quite different commodities at their various production sites. If, however, no such information is available, one has to resort to more mechanical procedures. Where no explicit distinction in commodity diversity can be made, one has to regionalise industrial output using keys based on other statistics, e.g. employment figures, annual reports, etc.

In the Netherlands, the number of interregional and/or heterogeneous units is relatively small, but they do represent a substantial part of the Dutch economy. Moreover, almost all Dutch multi-regional companies have a wide product diversity between their regional production locations. A correct representation of these companies in the regional supply (and use) table thus requires extensive data. In some cases such information is directly available, but in other cases additional research, e.g. a direct survey with the companies at hand, is used to regionalise production (of commodities). In other cases, more mechanical procedures had to be used.

12.4.2.4 Some Empirical Results

As an example of the information gathered in the 14 Dutch regional supply and use tables, the regional supply of commodities by the agricultural industry is presented in Table 12.1. This table shows the regional differences in commodity production within one single industry. The same agricultural industry produces quite different commodities in, for instance, Groningen in the northern part of the Netherlands, than in the region Overig Zuid-Holland in the western part of the Netherlands. The example shows the importance of implementing a supply and use accounting framework in the construction of input-output accounts. In a traditional set-up, i.e. an institutional symmetric accounting framework, the output diversity shown in table 12.1 cannot be accounted for.

Another aspect relates to the regional differences in the use of commodities, e.g. in the agricultural industry. Different goods, services and primary inputs are needed to produce grain, potatoes and sugar beet as compared to greenhouse crops or to farm livestock. Hence regional input coefficients derived in a supply and use framework more accurately describe the regional production reality.

Table 12.1 Supply of commodities by agricultural in the 14 Dutch regions.

Regions /products	Grain, potatoes, Sugar beet %	Other agricult. prod.	Live stock	Animal products	Services	Other product	Total
Groningen	25	7	21	25	17	5	100
Friesland	5	4	26	56	6	3	100
Drenthe	17	11	26	29	12	4	100
Overijssel	2	2	50	39	5	2	100
Flevoland	26	22	6	11	20	15	100
Gelderland	1	12	53	25	5	4	100
Utrecht	0	17	39	38	4	2	100
Noordzeekanaalgebied	5	68	5	13	7	2	100
Overig Noord-Holland	7	52	7	15	8	10	100
Groot-Rijnmond	9	58	4	7	10	12	100
Overig Zuid-Holland	1	76	5	8	4	5	100
Zeeland	29	20	9	7	24	11	100
Noord-Brabant	2	12	54	19	5	7	100
Limburg	4	19	41	17	5	14	100
Total supply Netherlands	6	26	33	22	7	6	100

12.4.3 Regional Final Use of Commodities

Following the estimation of production and consumption of commodities by industries, the estimation of regional final demand in the use table presents the next step in our approach. The level of detail in final demand is an important decision, which should closely relate to perceived use, e.g. in model-building, of the regional input-output data. Besides, the level of detail also depends on the availability of data. From a modelling perspective it could be useful to have a large detail in consumer demand, e.g. for different social groups (see e.g. Miyazawa, 1968, Oosterhaven and Folmer, 1985). But without a minimum amount of data, the estimation procedures will not be reliable. In this section these issues will be addressed for different types of domestic final demand.

12.4.3.1 Estimating Regional Consumer Demand

Of all final demand categories, consumer demand is one of the most important. In the Netherlands, for example, about 40 percent of total final demand relates to consumer expenditure. The estimation of consumption expenditure therefore needs to be given a considerable amount of attention, not only to make the best

possible estimates, but also in the design of regional consumption expenditure columns. In the (Dutch) national use table only one column exists for consumption expenditures, its structure resembling the consumption pattern of an average Dutch inhabitant. However, the term average inhabitant might be too restrictive for a country (such as the Netherlands), with large regional differences in population composition. Different types of households have different consumption patterns (see Miyazawa, 1976, for the analytical importance of these differences). A single person household, for example, spends relatively more of its disposable income on rent, while a multi-person household with children will have quite different spending patterns compared to a household without children. When large regional disparities in population composition exist, the detail of consumer demand in the regional input-output accounts should be carefully considered, taking the future use of the regional input-output accounts into account.

Regional consumer demand can be estimated by various methods, ranging from the pure mechanical top-down to the theoretically preferred bottom-up methods. According to Eurostat guidelines, consumer demand should be regionalised using family budget surveys, combined with socio-demographic data and data on the turnover of enterprises in a region (see Eurostat, 1996c, par 5.4.2.3.d). The most appropriate method for a single country is, however, largely determined by data availability. The proposed methodology for the estimation of the Dutch regional consumer expenditures has recently been described in a Eurostat report on the construction of regional household accounts (see Van Kesteren et al., 1997). This approach uses an indirect estimation procedure, where national consumption information and information on (regional) disposable income serve as main data sources. Available regional data on consumption are, nonetheless, also integrated in the estimation procedure. Consequently, a synthetic estimate is used in the Dutch regionalisation of consumer demand, basically consisting of two major steps:

estimating regional disposable income per type of household (Y_h^r), and

estimating regional consumption expenditures per type of household (U_{hc}^r),

resulting in the estimation of regional consumption expenditures by regional residents (see also Van Kesteren et al., 1997).

12.4.3.2. Estimating Regional Fixed Capital Formation

Statistics Netherlands compiles data about gross fixed capital formation (GFCF) at the level of the Dutch provinces for an aggregated level of activities and type of goods (de Vet, 1997). The activities are: agriculture and fishery, industry (extraction and mining, manufacturing, electricity, gas, steam and hot water supply, collection, purification and distribution of water and construction), transport, real estate services, other industries and general government. The types of goods are: dwellings, non-residential buildings, civil engineering works, external transport equipment, increase in livestock and machinery and other equipment. For the compilation of these data more detailed figures are available, that still have to be delineated to 75 type of investment goods.

GFCF is regionalised according to the user's point of view, while what we need is GFCF according to the owner's point of view. This point is especially relevant for the allocation of GFCF to the regions. The transfer from the user's point of view to the owner's point of view amounts to about 4% of total GFCF. It concerns buildings to let for rent by, for instance, pension funds and the operational lease of transport equipment by lessors. In the case of buildings however, the difference in owner's or user's point of view does not influence the regional allocation of GFCF. In the case of operational lease there might be big differences in the regional allocation of mobile equipment. For instance a lessor in Gouda (the province of Zuid-Holland) lets its mobile equipment in all provinces of the Netherlands. In the regional use tables the investment in this kind of mobile equipment has to be allocated to the province of Zuid-Holland, while in the user's point of view it has to be allocated to all Dutch regions. Financial lease of GFCF is by definition according to the owner's point of view. In the latter case the user's point of view coincides with the owner's point of view. We may summarise this by saying that data have to be adapted to the level of detail in the column GFCF in the provincial use tables. And further, corrections have to be made for the application of the owner's point of view.

12.4.3.3. Estimating Government Consumption

General government consumption deviates in several aspects from household consumption. First government consumption is to a large extent collective in nature. This implies that the regions where these services have been produced need not to be the regions where they will be consumed.⁴ The second aspect is that by a lack of market prices, government consumption by definition equals the sum of intermediate consumption of government, compensation of government employees, consumption of fixed capital and taxes on products paid by government minus goods sold by government. This implies that for instance consumption of fixed capital is part of government consumption.

The consumption of general government can be divided in individualisable and collective consumption. To distinguish individualisable government consumption, one needs to know the purpose of the production of the government services, like education, medical care, culture, sport and recreation and so on.⁵ Based on this functional approach, the individual consumption can be allocated to regions according to suitable regional indicators, like the number of students, pupils etc.

For the regional allocation of the collective part of government consumption we should distinguish between the sub-sectors of general government: central government, local government and social security funds. The allocation of the

⁴ See for a detailed discussion the working document "Regional Accounts Methods: Tables of General Government", 1997, presented in a meeting of the Eurostat working party Economic accounts and statistical indicators at regional level".

⁵ For the goods and services provided by government units, the borderline between individual and collective goods and services is drawn on the basis of the Classification of the Functions of Government (COFOG); see European System of National and Regional Accounts 1995 (Eurostat, 1996a), paragraph 3.85.

final consumption of local government poses no problems, as we may reasonably suppose that the municipalities supply their services exclusively to their geographical areas of competence. In the case of central government and social security funds this is not true. Allocation of final collective consumption of these agents is highly arbitrary. The simplest assumption will be that all citizens of a country will share equally in the collective services provided by central government and social security funds. Eurostat (1996c) puts it the following way: "The per-capita algorithm gives fairly trivial information, and it can be seen as a contradiction to use capita as a key for an item which by definition and nature just cannot be allocated to persons. The global method can only be justified with the purpose of providing complete figures." As a consequence of the per capita allocation of final collective consumption of central government and social security funds, we have to assume that regions can export and import government services to and from other regions within the country. Given these 'disadvantages' one might also consider not to regionalise the government consumption, but instead treat it as a national demand for commodities in the use tables.

12.4.4 Estimation of Regional Foreign Trade

The fourth step in the construction procedure encompasses the estimation of regional relations with foreign economic actors, i.e. the import and export of commodities from/to foreign countries. The options available range from using extensive empirical data to mechanical procedures. Besides these estimation alternatives, a much more fundamental issue relates to the question whether the regional foreign relations will be estimated as part of the estimation of the use table, i.e. independent from interregional trade, or will be integrated with the estimation of interregional trade.

12.4.4.1 Independent versus Integrated Estimation of Foreign Trade

The choice for one of these methods mainly depends on data availability and data quality, and the perceived final results of the project. If one, for example, sets the estimation of the so-called half-regionalised supply and use tables as the ultimate goal of the project, estimating foreign trade could be neglected altogether or could be the last step in the estimation procedure. When, on the other hand, estimating fully reconciled bi-regional tables in the final aim, the consequent inclusion of the fifth and final step implies making a choice between an independent estimation or an integrated estimation of foreign trade. However, even if the fifth step is included, it could still be more sensible to address estimating foreign trade as an independent step in the construction procedure. Certainly when data availability for interregional trade causes major difficulties whereas data on regional foreign trade are more easily available.

The main advantage of treating foreign trade as an integrated part of total regional trade is the extra degree of freedom created. When foreign trade is estimated independently, the estimation of interregional trade may cause some

severe inconsistencies between regional supply and use of commodities (see also the next section). In our modular approach the results of the first four steps are assumed to be the best possible estimates and only when very severe inconsistencies arise, re-estimation of one of these earlier steps may be in order. With the estimated regional foreign relationships being fixed, inconsistencies can only be solved by the interregional trade estimation procedure. On the other hand, if step 4 is to be integrated with step 5, two possibilities for reconciliation will exist: adapting the foreign trade of commodities or adapting the interregional trade of commodities.

Which method will be used mainly depends on data availability and quality of foreign trade figures. In the Dutch project, extra information on foreign commodity trade will be collected in a survey which also collects the information on interregional trade (see also section 4.5.2). Hence, in the Dutch construction the integrated approach has been chosen.

12.4.4.2 Methods for Estimating Regional Foreign Relationships

In the Netherlands the statistics of the international goods transport provide data on imports and exports for 54 so-called Dutch traffic regions. These regions can be aggregated into the 14 regions of this project. The number of commodity categories for which data are available is 52. So this poses a problem of des-aggregation to 206 commodity groups. An additional problem is the absence of data on regional imports and exports of services in this source. However the biggest difficulty with these data is the inland transit. In this source, the regions of provenance and destination are the regions where goods are loaded or unloaded. These need not be the regions where the goods are produced or used (final or intermediate). For this reason it was decided to collect additional data on this subject.

In the next section the collection of data on interregional trade is examined. For this purpose an existing survey of the Dutch Chambers of Commerce was extended with a question on this subject. Regional foreign trade data will be part of this survey. This is only partly a solution because in the survey only the destination of the total sales is asked, without specifying the commodities at hand. Without sufficiently good data on regional foreign trade, the estimation of foreign trade is comparable with estimating of interregional trade, with the essential difference being the absence of 'mirror data'. An exported product from a region has no counterpart in an imported product in another region.

Anyway, the estimation of regional foreign trade cannot be done straightforwardly. Combining data from the statistics on international goods traffic, additional surveys and probably data from individual companies, together with the provisional regional supply and use tables, has to assure a consistent estimate.

12.4.5 Interregional Trade: Collection and Integration

The first four steps result in so-called half-regionalised supply and use tables. Such accounts are not suitable for most modelling applications because they force a user to estimate the region's trade relations with other regions within the country at hand before modelling a regional economy. Hence, complete and therefore useful regional supply and use tables should also contain the estimates of interregional commodity trade. In this section, an estimation procedure of interregional trade will be discussed, where topics such as data collection and the integration into the half-regionalised accounting framework will be addressed.

12.4.5.1 Integrating Interregional Trade Data

Sections 12.4.1 to 12.4.3. described the first regionalisation of the national supply and use matrix. The result of this first regionalisation is, however, not a complete supply and use accounting framework as presented in section 12.3. Although total output of regional industries equals the total intermediate use plus the primary inputs, the commodity balances do not yet hold true, because the column $t^{r\bullet}$, and the row $t^{r\bullet}$, of figure 12.1. are not yet specified. Without the addition of trade data any regional accounting framework that only satisfies (12.3), can only be used for descriptive analysis and not for modelling.⁶ Hence, incorporating trade information can be considered to be the most important step in the process of constructing useful (bi)regional input-output tables. In this fifth stage regional demand and supply of commodities are balanced according to (12.4).

Since the present project entails the construction of 14 bi-regional tables, for each individual bi-regional table there are only two regions: r and s . Consequently in all 14 cases, for any individual commodity (12.4) can be summarised as follows:

$$\sum_i V_{ic}^r + t_c^{sr} + m_c^r = \sum_i U_{ci}^r + \sum_q e_{cq}^r + t_c^{rs} + x_c^r \quad (12.12)$$

and, analogously, for region s :

$$V_{\bullet c}^s + t_c^{rs} + m_c^s = U_{\bullet c}^s + e_{\bullet c}^s + t_c^{sr} + x_c^s \quad (12.13)$$

Summing (12.12) and (12.13), while putting all interregional trade terms at the right-hand side and using the regional to national aggregation on the left-hand side, illustrates that the net interregional trade of region r equals the net interregional trade of its partner region s , but with an opposite sign:

$$(V_{\bullet c} + m_c) - (U_{\bullet c} + e_{\bullet c} + x_c) = (t^{rs} - t^{sr}) + (t^{sr} - t^{rs}) \quad (12.14)$$

The right-hand side, of course equals zero because it states the zero net interregional commodity balance at a national level. In other words the total interregional exports of commodity c by all regions equals total interregional imports of that commodity. The left-hand side also equals zero, because it is the (rewritten) commodity balance (12.5) at the national level. Thus the zero net trade assertion makes the regional supply and use framework consistent with the national framework.

⁶ This is the case, because without trade information economic models can not determine the regional impacts of changes in exogenous variables.

Incorporating trade information in the regional supply and use framework can, from a theoretical approach best be established by using the full information approach (see Oosterhaven, 1984 and Eding and Oosterhaven, 1996). But with the such data being almost impossible to acquire, this approach should be rejected from a practical view. Hence, two options remain: an industry approach or a commodity approach. With the industry approach having some major drawbacks in the balancing process, the commodity approach can be considered to be the best alternative in the process of incorporating trade data in the regional supply and use accounting framework, i.e. using information on interregional commodity trade.

After balancing we have a detailed picture of the interregional trade flows in commodities. Figure 12.2 displays the basic structure of these so-called commodity balances. Each of these balances shows the destination of use by a region of the commodities produced by a region in the rows, and the regional origin of use by a region of that commodity the columns. With these commodity balances, t^{*r} and t^{*s} in figure 12.1 can be constructed, thus balancing the regional supply and use accounting framework completely: both in industries and in commodities as in (12.3) and (12.4).

In the following section the estimation of interregional trade will be discussed. However, as the previous section noted, estimating interregional trade can also be combined with the estimation of international trade. In such cases, the m and x have also to be estimated, giving more degrees of freedom in the estimation procedure as illustrated in figure 12.2, where ROW stands for the rest of the world.

Figure 12.2 Interregional commodity flows

To				
From	Region r	Region s	ROW	Total
Region r				
Region s				
ROW				
Total				

12.4.5.2. The Nature and Collection of Trade Data

In the literature there has been much debate about the kind of trade data to be used in the (commodity) balancing process (see e.g. Isard and Langford, 1971). Some prefer data on exports, others data on imports. Of course collecting data on both is better, but also implies higher data collection costs. In view of the discussion of section 12.2 we propose to focus on the use of data on exports to the other region(s) because we hold this approach to be superior to the collection of data on imports. In spite of the drawbacks of the latter method we do, however, advocate the use of import data as a verification/enhancement of the export data. But to keep things as simple as possible, we abstain from the use of these data in our present discussion. Since we are considering only destination (i.e. export) data, the second regionalisation has to start with the supply matrix, and consistency has to be checked with the use matrix (Boomsma and Oosterhaven, 1992). Regionalising the supply matrix can be done at three levels: per cell, per row total (=industry) and per column total (=commodity).

Collecting interregional trade information can be done in several ways, of which the use of a survey is the most important. Such a survey could have two appearances: a direct survey of businesses concerning the destination of their outputs or a survey among the wholesale and retail sector, where the required information is obtained through an indirect approach. In the Netherlands, the first approach has been chosen, but in other countries such as Canada (see e.g. Siddiqi and Salem, 1995) the second approach has been successfully pursued.

In the Dutch survey, emphasis is on regional destination of outputs, with a differentiation between outputs sold in the own region, output sold in the rest of the country and outputs exported abroad. Explicitly including the exports abroad clearly indicates the preference for integrated estimation of foreign trade relationships, as mentioned in subsection 12.4.5.1. The Dutch survey is carried out as a part of the yearly ERBO-survey of the Dutch Chambers of Commerce (see KvK, 1996) and entails a sample survey of regional industries. Besides direct survey information, other sources can also be used in the estimation of interregional trade. Such sources could, for example, be the transport statistics, but direct information from companies (including wholesale and retail trade) might also prove useful in the estimation procedure. In the Netherlands the practical implementation of the fifth step is still being researched. We do, however, opt for the use of as many sources as possible, to ensure an accurate and consistent estimate of interregional trade in the Netherlands.

A disadvantage of the export approach is that one of the trade flows becomes residual⁷, which can cause severe consistency problems. For example, if we know that industry 1 in region r produces 100 of commodity 1, and that region r only uses 20 of commodity 1, it follows that at least 80 percent of this production should be exported to the other region(s). If a survey results in the same (or a higher) percentage no consistency problems become visible. But if we find, for example, an export rate of 70 percent, we immediately see an inconsistency. With a 70 percent export to the other region(s) 30 of commodity 1 has to be absorbed by

⁷ Using survey information on input percentages faces a similar problem. In such a set-up the export of commodities becomes a residual estimate.

local users, while we know that they only use 20. Hence we face an inconsistency, which results in a negative import from the other region(s). To solve these inconsistency problems extra information on trade may be required. This could either be a new export percentage or the addition of an import percentage to the construction process. We then enter the world of double entry methods for the construction of input-output tables (see e.g. Boomsma and Oosterhaven, 1992). In these methods both information on imports as well as on exports are collected, with one of them being used for the verification of the other. This can be done for all trade flows or just for the most important of them (see also section 12.2).

12.5 Conclusions

In this chapter, we presented a structured approach to construct rectangular as opposed to square regional input-output accounts, distinguishing five steps: the classification of commodities and industries, estimating the regional industrial supply and use of commodities, estimating regional final demand, estimating foreign trade and estimating interregional trade. With work still in progress at Statistics Netherlands, the step by step approach ensures a structured and consistent estimation of the regional supply and use tables.

A new era in Dutch regional input-output construction will start with the completion of the 14 regional supply and use tables, not only with respect to construction, but also in the field of applications. The new tables might well give an impulse to research in new (or renewed) applications, such as modelling the impacts of tourist and other consumption expenditures (cf. also Miyazawa, 1976), modelling the relation between economy and ecology (cf. Keuning and De Haan, 1996), ex-ante evaluation of regional economic aid schemes, regional labour market analysis and forecasting, the construction of regional social accounting matrices, etc.

However, the tables might also serve another, more statistical purpose, in that they will undoubtedly contribute to an improvement in the quality of the annual Regional Accounts in The Netherlands. For, with their detailed representation of the regional economy and their disaggregation of the national economy, they might well serve as a benchmark for the qualitative enhancement of regional and even of national statistical data.

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