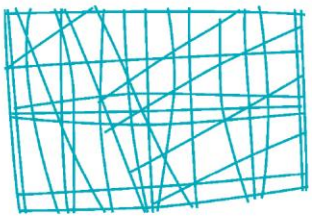

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TECHNICAL NOTE ON THE CONSTRUCTION OF THE INTERREGIONAL INPUT-OUTPUT SYSTEM FOR THE CONCESSION AREAS OF ANEEL

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Technical Note on the Construction of the Interregional Input-Output System for the Concession Areas of ANEEL[1]

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Abstract. The objective of this technical note is to document the methodology used to generate an interregional input-output system (IIOS) for the Concession Areas of ANEEL. The system consists of 58 regions closely associated with the territories of the concession areas under contract with the Federal Government. It also includes up to 110 products and 15 sectors in each region, identifying the spatial and sectoral linkages in the Brazilian interregional system. This is the first study ever that attempts to model the economies of all the concession areas of electric-power distribution services in an integrated framework for Brazil.

1. Introduction

The electric-power distribution companies in Brazil supply electricity to their consumers based on the obligations and rights established in a concession contract made with the Federal Government to render electric-power distribution services in their concession area.[2] In most states, mainly in the North and Northeast, contracts correspond to specific state geographical boundaries. However, distribution contracts may cover areas smaller than the state itself. There are, for instance, nine different concessionaires in Rio Grande do Sul, and fifteen in São Paulo. There are also cases where, in geographical terms, contracts cover more than one area of the distribution company's home state. Thus, in many instances, economic models based on standard regionalization of administrative units (e.g. states) may mask important differences in the performance of the concession areas.

Usual geomarketing strategies in the electricity sector in Brazil focus on the direct demand by different types of consumers located within the geographical limits of the concession areas. However, indirect demand affects, to different extents, local demand by the various consumption classes (i.e. residential, rural, commercial, public and industrial). Especially for the industrial consumption class, spatial and sectoral linkages

[1] This study is part of an initiative involving researchers from the Regional and Urban Economics Lab at the University of São Paulo (NEREUS) and from the Fundação Instituto de Pesquisas Econômicas (FIPE).

[2] www.aneel.gov.br

play an important role. As it has been noticed by Hewings (1999, p. 2)[3], it is well known that, in any given region, firms exchange goods and services with each other; this phenomenon is usually captured in **input-output tables**. With this formulation in place, it is possible to trace the consequences on other sectors of the economy of an expansion or contraction in any one sector or set of sectors. However, regional and metropolitan economies are, by their very nature, open and subject to the economic vicissitudes of demand and supply interactions in other parts of the country and other parts of the world. Hence, in parallel to the economic linkages between sectors within a region there is a parallel set of linkages between regions. The growth or decline of one region's economy will have potential impacts on the economies of other regions; the nature and extent of this impact will depend on the degree of exchange between the two regions – as well as exchange with other regions.

In this note, the methodology used to generate an interregional input-output system (IIOS) for the Concession Areas of ANEEL is provided. The description is organized around the TABLO Input file, used for data manipulation in GEMPACK.[4] As we intend to develop an interregional computable general equilibrium CGE model for the country based on the same regional setting, to be implemented using GEMPACK, the choice of the language for the code for generating the IIOS was straightforward. Attention is directed to the different steps undertaken and their underlying assumptions. We present the complete text of the TABLO Input file divided into a sequence of excerpts and supplemented by tables and explanatory text. The presentation draws on the document "ORANI-G: A Generic Single-Country Computable General Equilibrium Model", by **Mark Horridge**, March 2006.

2. Dimensions of the IIOS for the Concession Areas of ANEEL (IIOS-ANEEL)

Excerpt 1 of the TABLO Input file begins by defining logical names for input and output files. Initial data are stored in the BDATA input file. The RIODATA output file is used to store results for the manipulation of the initial information. Note that

[3] Hewings, G. J. D. (1999). "Economic Forecasting for Businees Strategic Decision-Making in Minas Gerais". Unpublished Technical Note, Belo Horizonte: AERI.

[4] The TABLO language is essentially conventional algebra, with names for variables and coefficients chosen to be suggestive of their economic interpretations. It is no more complex than alternative means of setting out a CGE model and undertaking calculations from an original set of data.

BDATA and RIODATA are logical names. The actual locations of these files (disk, folder, filename) are chosen by the user.

The rest of Excerpt 1 defines sets: lists of descriptors for the components of vector coefficients. Set names appear in upper-case characters. For example, the first **SET** statement is to be read as defining a set named "COM" which contains commodity descriptors. The elements of COM (a list of commodity names) are read from the input file REGSETS (this allows the model to use databases with different numbers of sectors). By contrast the two elements of the set SRC – dom and imp – are listed explicitly.

```
! Excerpt 1 of TABLO input file: !
! Files and sets !

FILE BDATA # Data File #;
FILE(NEW) RIODATA # Regional IO data #;
FILE REGSETS # Sets file #;

SET
COM # Commodities #
READ ELEMENTS FROM FILE REGSETS HEADER "COM";
MARGCOM # Margin Commodities #
READ ELEMENTS FROM FILE REGSETS HEADER "MAR";
SUBSET MARGCOM IS SUBSET OF COM;
SET
MARGCOM1 # Margin Commodity 1 #
READ ELEMENTS FROM FILE REGSETS HEADER "MAR1";
MARGCOM2 # Margin Commodity 2 #
READ ELEMENTS FROM FILE REGSETS HEADER "MAR2";
SUBSET MARGCOM1 IS SUBSET OF COM;
SUBSET MARGCOM2 IS SUBSET OF COM;
SUBSET MARGCOM1 IS SUBSET OF MARGCOM;
SUBSET MARGCOM2 IS SUBSET OF MARGCOM;
SET
NONMARGCOM # NonMargin Commodities #
READ ELEMENTS FROM FILE REGSETS HEADER "NMAR";
SUBSET NONMARGCOM IS SUBSET OF COM;
SET
```

```
SRC # Source of Commodities # (dom,imp);
IND # Industries #
READ ELEMENTS FROM FILE REGSETS HEADER "IND";
REGDEST # Regional destinations #
READ ELEMENTS FROM FILE REGSETS HEADER "REEN";
ALLSOURCE # Origin of goods #
READ ELEMENTS FROM FILE REGSETS HEADER "ASEN";
REGSOURCE # Domestic origin of goods #
READ ELEMENTS FROM FILE REGSETS HEADER "RSEN";
SUBSET REGSOURCE IS SUBSET OF ALLSOURCE;
SUBSET REGSOURCE IS SUBSET OF REGDEST;
SUBSET REGDEST IS SUBSET OF REGSOURCE;
```

The commodity and industry classifications of the IIOS-ANEEL described here are based on aggregates of the classifications used in the national input-output tables published by IBGE, which consider 56 industries and 110 commodities. We were constrained by availability of information in the *Balanço Energético Nacional* at the sectoral level, ending up with 15 sectors and 110 commodities. Multiproduction is explicitly considered in the 58 domestic regions of the system.

Table 1 lists the elements of the set COM which are read from file. GEMPACK uses the element names to label the rows and columns of results and data tables. The element names cannot be more than 12 letters long, nor contain spaces. The IND elements are presented in Table 2 and the REGDEST elements in Table 3.

Elements of the set MARGCOM are margins commodities, i.e., they are required to facilitate the flows of other commodities from producers (or importers) to users. Hence, the costs of margins services, together with indirect taxes, account for differences between basic prices (received by producers or importers) and purchasers' prices (paid by users). In the IIOS-ANEEL, we considered two commodity as margins, namely "C92" (*comércio*) and "C93" (*transporte de carga*).

TABLO does not prevent elements of two sets from sharing the same name; nor, in such a case, does it automatically infer any connection between the corresponding elements. The **SUBSET** statement which follows the definition of the set MARGCOM

is required for TABLO to realize that the two elements of MARGCOM, are the same as the 92nd and 93rd elements of the set COM.

The statement for NONMARGCOM defines that set as a complement. That is, NONMARGCOM consists of all those elements of COM which are not in MARGCOM. In this case TABLO is able to deduce that NONMARGCOM must be a subset of COM. Note that we have furthered defined the two elements of MARGCOM in two separate subsets, MARGCOM1 and MARGCOM2.

The regionalization adopted in IIOS-ANEEL followed as close as possible the territorial boundaries of the concession areas. As we have departed from a previous study developed by FIPE, which built trade matrices at the microrregional[5] level, we were constrained to define our working regions as combinations of those spatial units. The spatial compatibilization between the set of microrregions and the set of concession areas was based on the following criteria: (i) 465 out of 558 microrregions were direted allocated (one-to-one) to specific concession areas; (ii) for the remaining 93 microrregions, we have first allocated each one to the concessionaire for which the municipalities within its territorial limits were responsible for the largest share in the industrial value added; (iii) in a few instances, when small concessionaires would disappear as a working region, we have relaxed criterion (ii) and assigned the small concessionaire to the entire microrregion, as was the cases of CHESP, COCEL, CFLO, EEB, CAUIÁ, MUX ENERGIA, CPFL Leste Paulista, CPFL Mococa, RS Cooperativa and SC Cooperativa. The final regionalization is presented in Table 3 an in the annex.

[5] The FIPE study considered 558 "*microrregiões homogêneas*" from IBGE.

Table 1. Commodity Classification

Elements of Set COM	*Description (in Portuguese)*	*Elements of Set COM*	*Description (in Portuguese)*
C1	Arroz em casca	C56	Gasoálcool
C2	Milho em grão	C57	Óleo combustível
C3	Trigo em grão e outros cereais	C58	Óleo diesel
C4	Cana-de-açúcar	C59	Outros produtos do refino de petróleo e coque
C5	Soja em grão	C60	Álcool
C6	Outros produtos e serviços da lavoura	C61	Produtos químicos inorgânicos
C7	Mandioca	C62	Produtos químicos orgânicos
C8	Fumo em folha	C63	Fabricação de resina e elastômeros
C9	Algodão herbáceo	C64	Produtos farmacêuticos
C10	Frutas cítricas	C65	Defensivos agrícolas
C11	Café em grão	C66	Perfumaria, sabões e artigos de limpeza
C12	Produtos da exploração florestal e da silvicultura	C67	Tintas, vernizes, esmaltes e lacas
C13	Bovinos e outros animais vivos	C68	Produtos e preparados químicos diversos
C14	Leite de vaca e de outros animais	C69	Artigos de borracha
C15	Suínos vivos	C70	Artigos de plástico
C16	Aves vivas	C71	Cimento
C17	Ovos de galinha e de outras aves	C72	Outros produtos de minerais não-metálicos
C18	Pesca e aquicultura	C73	Gusa e ferro-ligas
C19	Petróleo e gás natural	C74	Semi-acabacados, laminados planos, longos e tubos de aço
C20	Minério de ferro	C75	Produtos da metalurgia de metais não-ferrosos
C21	Carvão mineral	C76	Fundidos de aço
C22	Minerais metálicos não-ferrosos	C77	Produtos de metal - exclusive máquinas e equipamento
C23	Minerais não-metálicos	C78	Máquinas e equipamentos, inclusive manutenção e reparos
C24	Abate e preparação de produtos de carne	C79	Eletrodomésticos
C25	Carne de suíno fresca, refrigerada ou congelada	C80	Máquinas para escritório e equipamentos de informática
C26	Carne de aves fresca, refrigerada ou congelada	C81	Máquinas, aparelhos e materiais elétricos
C27	Pescado industrializado	C82	Material eletrônico e equipamentos de comunicações
C28	Conservas de frutas, legumes e outros vegetais	C83	Aparelhos/instrumentos médico-hospitalar, medida e óptico
C29	Óleo de soja em bruto e tortas, bagaços e farelo de soja	C84	Automóveis, camionetas e utilitários
C30	Outros óleos e gordura vegetal e animal exclusive milho	C85	Caminhões e ônibus
C31	Óleo de soja refinado	C86	Peças e acessórios para veículos automotores
C32	Leite resfriado, esterilizado e pasteurizado	C87	Outros equipamentos de transporte
C33	Produtos do laticínio e sorvetes	C88	Móveis e produtos das indústrias diversas
C34	Arroz beneficiado e produtos derivados	C89	Sucatas recicladas
C35	Farinha de trigo e derivados	C90	Produção e distribuição de eletricidade, gás, água, esgoto e limpeza urbana
C36	Farinha de mandioca e outros	C91	Construção civil
C37	Óleos de milho, amidos e féculas vegetais e rações	C92	Comércio
C38	Produtos das usinas e do refino de açúcar	C93	Transporte de carga
C39	Café torrado e moído	C94	Transporte de passageiro
C40	Café solúvel	C95	Correio
C41	Outros produtos alimentares	C96	Serviços de informação
C42	Bebidas	C97	Intermediação financeira, seguros e previdência complementar e serviços relacionados
C43	Produtos do fumo	C98	Atividades imobiliárias e aluguéis
C44	Beneficiamento de algodão e de outros têxt e fiação	C99	Aluguel imputado
C45	Tecelagem	C100	Serviços de manutenção e reparação
C46	Fabricação outros produtos Têxteis	C101	Serviços de alojamento e alimentação
C47	Artigos do vestuário e acessórios	C102	Serviços prestados às empresas
C48	Preparação do couro e fabricação de artefatos - exclusive calçados	C103	Educação mercantil
C49	Fabricação de calçados	C104	Saúde mercantil
C50	Produtos de madeira - exclusive móveis	C105	Serviços prestados às famílias
C51	Celulose e outras pastas para fabricação de papel	C106	Serviços associativos
C52	Papel e papelão, embalagens e artefatos	C107	Serviços domésticos
C53	Jornais, revistas, discos e outros produtos gravados	C108	Educação pública
C54	Gás liquefeito de petróleo	C109	Saúde pública
C55	Gasolina automotiva	C110	Serviço público e seguridade social

Table 2. Industry Classification

	Elements of Set IND	*Description (in Portuguese)*
S1	Agropecuario	Agropecuária
S2	Energetico	Energia e Outros S.I.U.P.
S3	Mineracao	Mineração
S4	Alimentos	Alimentos e Bebidas
S5	Textil	Têxtil
S6	Outras_Ind	Outras Indústrias
S7	Papel	Papel
S8	Quimica	Química
S9	N_metalicos	Não Metálicos
S10	Ferro_e_Aco	Ferro e Aço
S11	N_Ferrosos	Minerais Não-Ferrosos
S12	Eletricidade	Eletricidade
S13	Servicos	Serviços
S14	Transportes	Transportes
S15	Publico	Público

Table 3. Regional Classification

Elements of Set REGDEST		*Description (in Portuguese)*
R1	ELETRODONIA	ELETROBRÁS DISTRIBUIÇÃO RONDÔNIA
R2	ELETROACRE	ELETROBRÁS DISTRIBUIÇÃO ACRE
R3	ELETROAM	ELETROBRÁS AMAZONAS ENERGIA
R4	ELETRORR	ELETROBRÁS DISTRIBUIÇÃO RORAIMA
R5	CERR	CERR
R6	CELPA	CELPA
R7	CEA	CEA
R8	CELTINS	CELTINS
R9	CEMAR	CEMAR
R10	ELETROI	ELETROBRÁS DISTRIBUIÇÃO PIAUÍ
R11	COELCE	COELCE
R12	COSERN	COSERN
R13	EPB	EPB
R14	EBO	EBO
R15	CELPE	CELPE
R16	ELETROALAGO	ELETROBRÁS DISTRIBUIÇÃO ALAGOAS
R17	ESE	ESE
R18	SULGIPE	SULGIPE
R19	COELBA	COELBA
R20	CEMIG	CEMIG-D
R21	CPFL_M	CPFL Mococa
R22	DMEPC	DMEPC
R23	EEB	EEB
R24	EMG	EMG
R25	ESCELSA	ESCELSA
R26	ELFSM	ELFSM
R27	AMPLA	AMPLA
R28	LIGHT	LIGHT
R29	ELEKTRO	ELEKTRO
R30	CPFL_Paul	CPFL Paulista (incorpora as distribuidoras SP Cooperativa e CPFL Jaguari)
R31	CNEE	CNEE
R32	CPFL_Sta_C	CPFL Santa Cruz
R33	CPFL_L_P	CPFL Leste Paulista
R34	CAIUA	CAIUÁ
R35	EDEVP	EDEVP
R36	CPFL_S_Paul	CPFL Sul Paulista
R37	CPFL_Pirat	CPFL Piratininga
R38	BANDEIRANTE	BANDEIRANTE
R39	ELETROPAULO	ELETROPAULO
R40	COPEL	COPEL-Dis
R41	CFLO	CFLO
R42	COCEL	COCEL
R43	CELESC	CELESC-Dis (incorpora as distribuidoras Cooperaliança e EFLUL)
R44	IENERGIA	IENERGIA
R45	SC_COOP	SC Cooperativa
R46	RGE	RGE (incorpora a distribuidora "RS INDEFINIDA")
R47	MUX	MUX-ENERGIA
R48	HIDROMEI	DEMEI/HIDROPAN (fusão da DEMEI e da HIDROPAN)
R49	ELETROCAR	ELETROCAR
R50	RS_COOP	RS COOPERATIVA
R51	AES_SUL	AES SUL
R52	UHENPAL	UHENPAL
R53	CEEE	CEEE-D
R54	ENERSUL	ENERSUL
R55	CEMAT	CEMAT
R56	CELG	CELG-D
R57	CHESP	CHESP
R58	CEB	CEB-DIS

3. Initial Data

The next excerpts of the TABLO file contain statements indicating data to be read from file. The data items defined in these statements appear as coefficients in the initial database. The statements define coefficient names (which all appear in upper-case characters), and the locations from which the data are to be read.

3.1. National input-output data

This excerpt groups the data according to the information contained in the national input-output system organized as illustrated in Figure 1.[6] Thus, Excerpt 2 begins by defining coefficients representing the basic commodity flows corresponding to the flows of Figure 1 for each user except exports and inventories, i.e., the basic flow matrices for intermediate consumption, investment demand, household consumption and government consumption, and the associated margins and indirect taxes flows. Preceding the coefficient names are their dimensions, indicated using the "all" qualifier, and the sets defined in Excerpt 1. For example, the first **COEFFICIENT** statement defines a data item LABAS(c,i) which is the basic value of a flow of intermediate inputs of commodity c to user industry i, aggregated by source (domestic and imported). The first **READ** statement indicates that this data item is stored on file BDATA with header 'ABAS'. (A GEMPACK data file consists of a number of data items such as arrays of real numbers. Each data item is identified by a unique key or "header").

[6] The procedure to estimate the 2007 national input-output tables followed Guilhoto and Sesso Filho (2005).

Figure 1. Structure of the National Flows Database

			Intermediate consumption	Investment demand	Household consumption	Exports	Government consumption	Inventories
		Dim.	1 2 … 15	1 2 … 15	1	1	1	1
Basic Flows	Dom/Imp	1 2 … 110	LABAS	LIBAS	LCBAS	LXBAS	LGBAS	LSBAS
Margins 1 (comércio)	Dom/Imp	1 2 … 110	LAMR1	LIMR1	LCMR1	LXMR1	LGMR1	0
Margins (transporte)	Dom/Imp	1 2 … 110	LAMR2	LIMR2	LCMR2	LXMR2	LGMR2	0
Indirect taxes (ICMS)	Dom/Imp	1 2 … 110	LATX1	LITX1	LCTX1	LXTX1	LGTX1	0
Indirect taxes (IPI)	Dom/Imp	1 2 … 110	LATX2	LITX2	LCTX2	LXTX2	LGTX2	0
Indirect taxes (Outras)	Dom/Imp	1 2 … 110	LATX3	LITX3	LCTX3	LXTX3	LGTX3	0
	Intermerdiate consumption		CITO	0	0	0	0	0
	Labor payments		LABR	0	0	0	0	0
	Capital payments		CPTL	0	0	0	0	0
	Other costs		OCTS	0	0	0	0	0
	Value added		VA	0	0	0	0	0
	TOTAL		MAKE_I	ITOT	CTOT	XTOT	GTOT	STOT

Dim.	1 2 … 110
1 2 … 15	MAKE

```
! Excerpt 2 of TABLO input file: !
! Initial data !

COEFFICIENT
(all,c,COM)(all,i,IND)
LABAS(c,i) # Technical level matrix - national #;
(all,c,COM)(all,i,IND)
LIBAS(c,i) # Investment level matrix - national #;
(all,c,COM)
LCBAS(c) # Consumption level matrix - national #;
(all,c,COM)
LGBAS(c) # Government level matrix - national #;
(all,c,COM)(all,i,IND)
LAMR1(c,i) # MAR1 1 level matrix - national #;
(all,c,COM)(all,i,IND)
LIMR1(c,i) # MAR2 1 level matrix - national #;
(all,c,COM)
LCMR1(c) # MAR3 1 level matrix - national #;
(all,c,COM)
LXMR1(c) # MAR4 1 level matrix - national #;
(all,c,COM)
LGMR1(c) # MAR5 1 level matrix - national #;
(all,c,COM)(all,i,IND)
LAMR2(c,i) # MAR1 2 level matrix - national #;
(all,c,COM)(all,i,IND)
LIMR2(c,i) # MAR2 2 level matrix - national #;
(all,c,COM)
LCMR2(c) # MAR3 2 level matrix - national #;
(all,c,COM)
LXMR2(c) # MAR4 2 level matrix - national #;
(all,c,COM)
LGMR2(c) # MAR5 2 level matrix - national #;
(all,c,COM)(all,i,IND)
LATX1(c,i) # TAX1 1 level matrix - national #;
(all,c,COM)(all,i,IND)
LITX1(c,i) # TAX2 1 level matrix - national #;
(all,c,COM)
LCTX1(c) # TAX3 1 level matrix - national #;
(all,c,COM)
LXTX1(c) # TAX4 1 level matrix - national #;
```

```
(all,c,COM)
LGTX1(c) # TAX5 1 level matrix - national #;
(all,c,COM)(all,i,IND)
LATX2(c,i) # TAX1 2 level matrix - national #;
(all,c,COM)(all,i,IND)
LITX2(c,i) # TAX2 2 level matrix - national #;
(all,c,COM)
LCTX2(c) # TAX3 2 level matrix - national #;
(all,c,COM)
LXTX2(c) # TAX4 2 level matrix - national #;
(all,c,COM)
LGTX2(c) # TAX5 2 level matrix - national #;
(all,c,COM)(all,i,IND)
LATX3(c,i) # TAX1 3 level matrix - national #;
(all,c,COM)(all,i,IND)
LITX3(c,i) # TAX2 3 level matrix - national #;
(all,c,COM)
LCTX3(c) # TAX3 3 level matrix - national #;
(all,c,COM)
LXTX3(c) # TAX4 3 level matrix - national #;
(all,c,COM)
LGTX3(c) # TAX5 3 level matrix - national #;
(all,c,COM)
XTX1(c) # Exports - tax 1 #;
(all,c,COM)
XTX2(c) # Exports - tax 2 #;
(all,c,COM)
XTX3(c) # Exports - tax 3 #;
(all,i,IND)
CITO(i) # Total intermediate consumption - national #;
CTOT # Total household consumption - national #;
ITOT # Total investment demand - national #;
GTOT # Total government demand - national #;

READ
LABAS from file BDATA header "ABAS";
LIBAS from file BDATA header "IBAS";
LCBAS from file BDATA header "CBAS";
LGBAS from file BDATA header "GBAS";
LAMR1 from file BDATA header "AMR1";
```

```
LIMR1 from file BDATA header "IMR1";
LCMR1 from file BDATA header "CMR1";
LXMR1 from file BDATA header "XMR1"
LGMR1 from file BDATA header "GMR1";
LAMR2 from file BDATA header "AMR2";
LIMR2 from file BDATA header "IMR2";
LCMR2 from file BDATA header "CMR2";
LXMR2 from file BDATA header "XMR2"
LGMR2 from file BDATA header "GMR2";
LATX1 from file BDATA header "ATX1";
LITX1 from file BDATA header "ITX1";
LCTX1 from file BDATA header "CTX1";
LXTX1 from file BDATA header "XTX1";
LGTX1 from file BDATA header "GTX1";
LATX2 from file BDATA header "ATX2";
LITX2 from file BDATA header "ITX2";
LCTX2 from file BDATA header "CTX2";
LXTX2 from file BDATA header "XTX2";
LGTX2 from file BDATA header "GTX2";
LATX3 from file BDATA header "ATX3";
LITX3 from file BDATA header "ITX3";
LCTX3 from file BDATA header "CTX3";
LXTX3 from file BDATA header "XTX3";
LGTX3 from file BDATA header "GTX3";
CITO from file BDATA header "CITO";
CTOT from file BDATA header "CTOT";
ITOT from file BDATA header "ITOT";
GTOT from file BDATA header "GTOT";
```

3.2. National input-output shares

The use of the national aggregates presented in Excerpt 2, disregarding domestic and foreign sources, will allow us to assume the same national technolology of production, and the same composition of investment demand and household expenditures in each region (similarly for government demand). However, the associated regional compositions will be region-specific, including the share of foreign imports. Excerpt 3 presents the coefficients that make explicit the national structures.

```
! Excerpt 3 of TABLO input file: !
! Initial data !

COEFFICIENT
(all,c,COM)(all,i,IND)
ABAS(c,i) # Technical coefficient matrix - national #;
(all,c,COM)(all,i,IND)
IBAS(c,i) # Investment coefficient matrix - national #;
(all,c,COM)
CBAS(c) # Consumption coefficient matrix - national #;
(all,c,COM)
GBAS(c) # Government coefficient matrix - national #;
(all,c,COM)(all,i,IND)
AMR1(c,i) # MAR1 1 coefficient matrix - national #;
(all,c,COM)(all,i,IND)
IMR1(c,i) # MAR2 1 coefficient matrix - national #;
(all,c,COM)
CMR1(c) # MAR3 1 coefficient matrix - national #;
(all,c,COM)
GMR1(c) # MAR5 1 coefficient matrix - national #;
(all,c,COM)(all,i,IND)
AMR2(c,i) # MAR1 2 coefficient matrix - national #;
(all,c,COM)(all,i,IND)
IMR2(c,i) # MAR2 2 coefficient matrix - national #;
(all,c,COM)
CMR2(c) # MAR3 2 coefficient matrix - national #;
(all,c,COM)
GMR2(c) # MAR5 2 coefficient matrix - national #;
(all,c,COM)(all,i,IND)
ATX1(c,i) # TAX1 1 coefficient matrix - national #;
(all,c,COM)(all,i,IND)
ITX1(c,i) # TAX2 1 coefficient matrix - national #;
(all,c,COM)
CTX1(c) # TAX3 1 coefficient matrix - national #;
(all,c,COM)
GTX1(c) # TAX5 1 coefficient matrix - national #;
(all,c,COM)(all,i,IND)
ATX2(c,i) # TAX1 2 coefficient matrix - national #;
(all,c,COM)(all,i,IND)
ITX2(c,i) # TAX2 2 coefficient matrix - national #;
```

```
(all,c,COM)
CTX2(c) # TAX3 2 coefficient matrix - national #;
(all,c,COM)
GTX2(c) # TAX5 2 coefficient matrix - national #;
(all,c,COM)(all,i,IND)
ATX3(c,i) # TAX1 3 coefficient matrix - national #;
(all,c,COM)(all,i,IND)
ITX3(c,i) # TAX2 3 coefficient matrix - national #;
(all,c,COM)
CTX3(c) # TAX3 3 coefficient matrix - national #;
(all,c,COM)
GTX3(c) # TAX5 3 coefficient matrix - national #;

FORMULA
(all,c,COM)(all,i,IND)
ABAS(c,i)=LABAS(c,i)/CITO(i);
(all,c,COM)(all,i,IND)
IBAS(c,i)=LIBAS(c,i)/ITOT;
(all,c,COM)
CBAS(c)=LCBAS(c)/CTOT;
(all,c,COM)
GBAS(c)=LGBAS(c)/GTOT;
(all,c,COM)(all,i,IND)
AMR1(c,i)=LAMR1(c,i)/CITO(i);
(all,c,COM)(all,i,IND)
IMR1(c,i)=LIMR1(c,i)/ITOT;
(all,c,COM)
CMR1(c)=LCMR1(c)/CTOT;
(all,c,COM)
GMR1(c)=LGMR1(c)/GTOT;
(all,c,COM)(all,i,IND)
AMR2(c,i)=LAMR2(c,i)/CITO(i);
(all,c,COM)(all,i,IND)
IMR2(c,i)=LIMR2(c,i)/ITOT;
(all,c,COM)
CMR2(c)=LCMR2(c)/CTOT;
(all,c,COM)
GMR2(c)=LGMR2(c)/GTOT;
(all,c,COM)(all,i,IND)
ATX1(c,i)=LATX1(c,i)/CITO(i);
```

```
(all,c,COM)(all,i,IND)
ITX1(c,i)=LITX1(c,i)/ITOT;
(all,c,COM)
CTX1(c)=LCTX1(c)/CTOT;
(all,c,COM)
GTX1(c)=LGTX1(c)/GTOT;
(all,c,COM)(all,i,IND)
ATX2(c,i)=LATX2(c,i)/CITO(i);
(all,c,COM)(all,i,IND)
ITX2(c,i)=LITX2(c,i)/ITOT;
(all,c,COM)
CTX2(c)=LCTX2(c)/CTOT;
(all,c,COM)
GTX2(c)=LGTX2(c)/GTOT;
(all,c,COM)(all,i,IND)
ATX3(c,i)=LATX3(c,i)/CITO(i);
(all,c,COM)(all,i,IND)
ITX3(c,i)=LITX3(c,i)/ITOT;
(all,c,COM)
CTX3(c)=LCTX3(c)/CTOT;
(all,c,COM)
GTX3(c)=LGTX3(c)/GTOT;
```

3.3. Commodity trade matrices

The coefficients of Excerpt 4 are associated with commodity trade matrices, i.e., the intra-regional and the interregional flows, for each commodity, from every possible origin-destination pair (including foreign origin). The basic sources for this information and the procedures adopted to generate the commodity trade matrices are described in detail in the document "Estimação das Elasticidades de Substituição do Comércio Regional do Brasil", by **Weslem Faria** and **Eduardo Haddad**, TD NEREUS 01-2011, available at www.usp.br/nereus.

```
! Excerpt 4 of TABLO input file: !
! Initial data !

COEFFICIENT
(all,s,ALLSOURCE)(all,q,REGDEST)
```

```
P1(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P2(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P3(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P4(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P5(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P6(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P7(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P8(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P9(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P10(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P11(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P12(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P13(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P14(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P15(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P16(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P17(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P18(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P19(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P20(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
```

```
P21(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P22(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P23(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P24(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P25(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P26(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P27(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P28(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P29(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P30(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P31(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P32(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P33(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P34(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P35(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P36(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P37(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P38(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P39(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P40(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
```

```
P41(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P42(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P43(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P44(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P45(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P46(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P47(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P48(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P49(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P50(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P51(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P52(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P53(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P54(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P55(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P56(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P57(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P58(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P59(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P60(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
```

```
P61(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P62(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P63(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P64(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P65(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P66(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P67(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P68(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P69(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P70(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P71(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P72(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P73(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P74(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P75(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P76(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P77(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P78(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P79(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P80(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
```

```
P81(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P82(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P83(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P84(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P85(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P86(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P87(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P88(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P89(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P90(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P91(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P92(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P93(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P94(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P95(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P96(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P97(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P98(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P99(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P100(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
```

```
P101(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P102(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P103(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P104(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P105(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P106(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P107(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P108(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P109(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P110(s,q) # Trade matrix - flows #;

READ
P1  from file BDATA header "P1";
P2  from file BDATA header "P2";
P3  from file BDATA header "P3";
P4  from file BDATA header "P4";
P5  from file BDATA header "P5";
P6  from file BDATA header "P6";
P7  from file BDATA header "P7";
P8  from file BDATA header "P8";
P9  from file BDATA header "P9";
P10   from file BDATA header "P10";
P11   from file BDATA header "P11";
P12   from file BDATA header "P12";
P13   from file BDATA header "P13";
P14   from file BDATA header "P14";
P15   from file BDATA header "P15";
P16   from file BDATA header "P16";
P17   from file BDATA header "P17";
P18   from file BDATA header "P18";
P19   from file BDATA header "P19";
```

```
P20   from file BDATA header "P20";
P21   from file BDATA header "P21";
P22   from file BDATA header "P22";
P23   from file BDATA header "P23";
P24   from file BDATA header "P24";
P25   from file BDATA header "P25";
P26   from file BDATA header "P26";
P27   from file BDATA header "P27";
P28   from file BDATA header "P28";
P29   from file BDATA header "P29";
P30   from file BDATA header "P30";
P31   from file BDATA header "P31";
P32   from file BDATA header "P32";
P33   from file BDATA header "P33";
P34   from file BDATA header "P34";
P35   from file BDATA header "P35";
P36   from file BDATA header "P36";
P37   from file BDATA header "P37";
P38   from file BDATA header "P38";
P39   from file BDATA header "P39";
P40   from file BDATA header "P40";
P41   from file BDATA header "P41";
P42   from file BDATA header "P42";
P43   from file BDATA header "P43";
P44   from file BDATA header "P44";
P45   from file BDATA header "P45";
P46   from file BDATA header "P46";
P47   from file BDATA header "P47";
P48   from file BDATA header "P48";
P49   from file BDATA header "P49";
P50   from file BDATA header "P50";
P51   from file BDATA header "P51";
P52   from file BDATA header "P52";
P53   from file BDATA header "P53";
P54   from file BDATA header "P54";
P55   from file BDATA header "P55";
P56   from file BDATA header "P56";
P57   from file BDATA header "P57";
P58   from file BDATA header "P58";
P59   from file BDATA header "P59";
```

```
P60   from file BDATA header "P60";
P61   from file BDATA header "P61";
P62   from file BDATA header "P62";
P63   from file BDATA header "P63";
P64   from file BDATA header "P64";
P65   from file BDATA header "P65";
P66   from file BDATA header "P66";
P67   from file BDATA header "P67";
P68   from file BDATA header "P68";
P69   from file BDATA header "P69";
P70   from file BDATA header "P70";
P71   from file BDATA header "P71";
P72   from file BDATA header "P72";
P73   from file BDATA header "P73";
P74   from file BDATA header "P74";
P75   from file BDATA header "P75";
P76   from file BDATA header "P76";
P77   from file BDATA header "P77";
P78   from file BDATA header "P78";
P79   from file BDATA header "P79";
P80   from file BDATA header "P80";
P81   from file BDATA header "P81";
P82   from file BDATA header "P82";
P83   from file BDATA header "P83";
P84   from file BDATA header "P84";
P85   from file BDATA header "P85";
P86   from file BDATA header "P86";
P87   from file BDATA header "P87";
P88   from file BDATA header "P88";
P89   from file BDATA header "P89";
P90   from file BDATA header "P90";
P91   from file BDATA header "P91";
P92   from file BDATA header "P92";
P93   from file BDATA header "P93";
P94   from file BDATA header "P94";
P95   from file BDATA header "P95";
P96   from file BDATA header "P96";
P97   from file BDATA header "P97";
P98   from file BDATA header "P98";
P99   from file BDATA header "P99";
```

```
P100  from file BDATA header "P100";
P101  from file BDATA header "P101";
P102  from file BDATA header "P102";
P103  from file BDATA header "P103";
P104  from file BDATA header "P104";
P105  from file BDATA header "P105";
P106  from file BDATA header "P106";
P107  from file BDATA header "P107";
P108  from file BDATA header "P108";
P109  from file BDATA header "P109";
P110  from file BDATA header "P110";
```

3.4. Mapping commodity trade matrices

The bi-dimensional coefficients from the initial database related to the original commodity trade matrices (Excerpt 4) are mapped into tri-dimensional coefficients. This is necessary only because of the way the initial data were prepared in order to make the calculations more efficient.

```
! Excerpt 5 of TABLO input file: !
! Initial data !

COEFFICIENT
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TRADE(c,s,q) # Trade matrices, by commodity, regional #;
(all,s,ALLSOURCE)(all,q,REGDEST)
TRADE_C(s,q) # Trade matrices, regional #;

FORMULA
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C1",s,q)=  P1 (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C2",s,q)=  P2 (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C3",s,q)=  P3 (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C4",s,q)=  P4 (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C5",s,q)=  P5 (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C6",s,q)=  P6 (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C7",s,q)=  P7 (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C8",s,q)=  P8 (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C9",s,q)=  P9 (s,q);
```

```
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C10",s,q)= P10  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C11",s,q)= P11  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C12",s,q)= P12  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C13",s,q)= P13  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C14",s,q)= P14  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C15",s,q)= P15  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C16",s,q)= P16  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C17",s,q)= P17  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C18",s,q)= P18  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C19",s,q)= P19  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C20",s,q)= P20  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C21",s,q)= P21  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C22",s,q)= P22  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C23",s,q)= P23  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C24",s,q)= P24  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C25",s,q)= P25  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C26",s,q)= P26  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C27",s,q)= P27  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C28",s,q)= P28  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C29",s,q)= P29  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C30",s,q)= P30  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C31",s,q)= P31  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C32",s,q)= P32  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C33",s,q)= P33  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C34",s,q)= P34  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C35",s,q)= P35  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C36",s,q)= P36  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C37",s,q)= P37  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C38",s,q)= P38  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C39",s,q)= P39  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C40",s,q)= P40  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C41",s,q)= P41  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C42",s,q)= P42  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C43",s,q)= P43  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C44",s,q)= P44  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C45",s,q)= P45  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C46",s,q)= P46  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C47",s,q)= P47  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C48",s,q)= P48  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C49",s,q)= P49  (s,q);
```

```
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C50",s,q)= P50  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C51",s,q)= P51  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C52",s,q)= P52  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C53",s,q)= P53  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C54",s,q)= P54  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C55",s,q)= P55  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C56",s,q)= P56  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C57",s,q)= P57  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C58",s,q)= P58  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C59",s,q)= P59  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C60",s,q)= P60  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C61",s,q)= P61  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C62",s,q)= P62  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C63",s,q)= P63  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C64",s,q)= P64  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C65",s,q)= P65  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C66",s,q)= P66  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C67",s,q)= P67  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C68",s,q)= P68  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C69",s,q)= P69  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C70",s,q)= P70  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C71",s,q)= P71  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C72",s,q)= P72  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C73",s,q)= P73  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C74",s,q)= P74  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C75",s,q)= P75  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C76",s,q)= P76  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C77",s,q)= P77  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C78",s,q)= P78  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C79",s,q)= P79  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C80",s,q)= P80  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C81",s,q)= P81  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C82",s,q)= P82  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C83",s,q)= P83  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C84",s,q)= P84  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C85",s,q)= P85  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C86",s,q)= P86  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C87",s,q)= P87  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C88",s,q)= P88  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C89",s,q)= P89  (s,q);
```

```
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C90",s,q)= P90  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C91",s,q)= P91  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C92",s,q)= P92  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C93",s,q)= P93  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C94",s,q)= P94  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C95",s,q)= P95  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C96",s,q)= P96  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C97",s,q)= P97  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C98",s,q)= P98  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C99",s,q)= P99  (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C100",s,q)=P100 (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C101",s,q)=P101 (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C102",s,q)=P102 (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C103",s,q)=P103 (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C104",s,q)=P104 (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C105",s,q)=P105 (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C106",s,q)=P106 (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C107",s,q)=P107 (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C108",s,q)=P108 (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C109",s,q)=P109 (s,q);
(all,s,ALLSOURCE)(all,q,REGDEST)  TRADE("C110",s,q)=P110 (s,q);
```

3.5. Regional information

The last piece of information from the initial database is related to regional aggregates. Regional information on sectoral intermediate consumption and value added, as well as on regional aggregates (total investment, total household consumption and total government consumption) is also part of the initial database. Finally, the regional distribution of exports by commodities was made available using information from ALICEWEB[7], the website for official foreign trade statistics in Brazil.

```
! Excerpt 6 of TABLO input file: !
! Initial data !

COEFFICIENT
(all,i,IND)(all,q,REGDEST)
CINT(i,q) # Total regional intermediate consumption, by sector #;
```

[7] aliceweb.desenvolvimento.gov.br/

```
(all,q,REGDEST)
INV(q) # Total investment demand - regional #;
(all,q,REGDEST)
CONS(q) # Total household demand - regional #;
(all,q,REGDEST)
GOV(q) # Total government demand - regional #;
(all,c,COM)(all,q,REGDEST)
BAS4_S(c,q) # Total export demand - regional #;
(all,s,ALLSOURCE)(all,q,REGDEST)
SHIND(s,q) # Diagonal trade share matrix #;
(all,i,IND)(all,q,REGDEST)
CPTL(i,q) # Total regional capital payments, by sector #;

READ
CINT from file BDATA header "CINT";
INV from file BDATA header "INV";
CONS from file BDATA header "CONS";
GOV from file BDATA header "GOV";
BAS4_S from file BDATA header "EXP";
SHIND from file BDATA header "SHND";
CPTL from file BDATA header "CPTL";
```

4. The Chenery-Moses Approach

4.1. Interregional coefficients

As the basic data are prepared, we can proceed with the application of the adaptation of the Chenery-Moses approach to generate the interregional input-output coefficients for Brazil.[8] The SHIN(c,s,q) coefficients correspond to the proportions of a commodity c in region q that come from within the region, and from each of the other regions (including the rest of the world – s is an element of the set ALLSOURCE). It is assumed that all users in each region share the same importing pattern for a given commodity.

The SHIN coefficients are applied to the national aggregate coefficients for the following users: intermediate consumption, investment demand, household

[8] This adapted approach is known as **I**nterregional **I**nput-**O**utput **A**djustment **S**ystem – IIOAS.

consumption and government consumption. The treatment adopted for exports and changes in inventories are explained later.

```
! Excerpt 7 of TABLO input file: !
! Regionalization of the national coefficients !

COEFFICIENT
(all,c,COM)(all,q,REGDEST)
TOTDEM(c,q) # Total regional demand, by commodity #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
SHIN(c,s,q) # Import trade share matrices, by commodity, regional #;
TINY # A very small number #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RABAS(c,s,i,q) # Technical coefficient, commodity usage, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RIBAS(c,s,i,q) # Investment coefficient, commodity usage, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RCBAS(c,s,q) # Consumption coefficient, commodity usage, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RGBAS(c,s,q) # Government coefficient, commodity usage, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RAMR1(c,s,i,q) # Technical coefficient, margin 1 usage, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RIMR1(c,s,i,q) # Investment coefficient, margin 1 usage, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RCMR1(c,s,q) # Consumption coefficient, margin 1 usage, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RGMR1(c,s,q) # Government coefficient, margin 1 usage, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RAMR2(c,s,i,q) # Technical coefficient, margin 2 usage, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RIMR2(c,s,i,q) # Investment coefficient, margin 2 usage, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RCMR2(c,s,q) # Consumption coefficient, margin 2 usage, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RGMR2(c,s,q) # Government coefficient, margin 2 usage, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RATX1(c,s,i,q) # Technical coefficient, tax 1, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
```

```
RITX1(c,s,i,q) # Investment coefficient, tax 1, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RCTX1(c,s,q) # Consumption coefficient, tax 1, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RGTX1(c,s,q) # Government coefficient, tax 1, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RATX2(c,s,i,q) # Technical coefficient, tax 2, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RITX2(c,s,i,q) # Investment coefficient, tax 2, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RCTX2(c,s,q) # Consumption coefficient, tax 2, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RGTX2(c,s,q) # Government coefficient, tax 2, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RATX3(c,s,i,q) # Technical coefficient, tax 3, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RITX3(c,s,i,q) # Investment coefficient, tax 3, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RCTX3(c,s,q) # Consumption coefficient, tax 3, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RGTX3(c,s,q) # Government coefficient, tax 3, regional #;

Formula
TINY = 0.00000000000000001;
(all,s,ALLSOURCE)(all,q,REGDEST)
TRADE_C(s,q)=sum(c,COM,TRADE(c,s,q));
(all,c,COM)(all,q,REGDEST)
TOTDEM(c,q)=sum(s,ALLSOURCE,TRADE(c,s,q));
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
SHIN(c,s,q)=TRADE(c,s,q)/(TINY+TOTDEM(c,q));
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RABAS(c,s,i,q)=SHIN(c,s,q)*ABAS(c,i);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RIBAS(c,s,i,q)=SHIN(c,s,q)*IBAS(c,i);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RCBAS(c,s,q)=SHIN(c,s,q)*CBAS(c);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RGBAS(c,s,q)=SHIN(c,s,q)*GBAS(c);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RAMR1(c,s,i,q)=SHIN(c,s,q)*AMR1(c,i);
```

```
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RIMR1(c,s,i,q)=SHIN(c,s,q)*IMR1(c,i);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RCMR1(c,s,q)=SHIN(c,s,q)*CMR1(c);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RGMR1(c,s,q)=SHIN(c,s,q)*GMR1(c);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RAMR2(c,s,i,q)=SHIN(c,s,q)*AMR2(c,i);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RIMR2(c,s,i,q)=SHIN(c,s,q)*IMR2(c,i);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RCMR2(c,s,q)=SHIN(c,s,q)*CMR2(c);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RGMR2(c,s,q)=SHIN(c,s,q)*GMR2(c);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RATX1(c,s,i,q)=SHIN(c,s,q)*ATX1(c,i);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RITX1(c,s,i,q)=SHIN(c,s,q)*ITX1(c,i);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RCTX1(c,s,q)=SHIN(c,s,q)*CTX1(c);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RGTX1(c,s,q)=SHIN(c,s,q)*GTX1(c);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RATX2(c,s,i,q)=SHIN(c,s,q)*ATX2(c,i);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RITX2(c,s,i,q)=SHIN(c,s,q)*ITX2(c,i);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RCTX2(c,s,q)=SHIN(c,s,q)*CTX2(c);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RGTX2(c,s,q)=SHIN(c,s,q)*GTX2(c);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RATX3(c,s,i,q)=SHIN(c,s,q)*ATX3(c,i);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RITX3(c,s,i,q)=SHIN(c,s,q)*ITX3(c,i);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RCTX3(c,s,q)=SHIN(c,s,q)*CTX3(c);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RGTX3(c,s,q)=SHIN(c,s,q)*GTX3(c);
```

4.2. Structural flows

4.2.1. Basic flows

In Excerpt 8, the basic flows are calculated for the various users in the system (except for inventories, discussed later). For producers, investors, households and government, the interregional coefficients described above are transformed into monetary values according to the relevant levels provided by the information on regional aggregates (Excerpt 6). Exports had been previously organized in a bi-dimensional matrix according to the COM and ALLSOURCE sets, in BAS4_S(c,q).

Note that the coefficient S_CPTL(i,q) is calculated based on information for total capital payments by sector (Excerpt 6). The coefficient is then used for disaggregating investors demand by region. As this information is not readily available for Brazil, the shares used are those for regional value added by sector, with the undelying assumption that the composition of investment demand for sectors in all regions are restricted to a standard unit of capital, implying not only similar capital structures but also an equilibrium in the capital market.

```
! Excerpt 8 of TABLO input file: !
! Basic flows !

COEFFICIENT
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
BAS1(c,s,i,q) # Intermediate consumption - basic values #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
BAS2(c,s,i,q) # Investment demand - basic values #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
BAS3(c,s,q) # Household demand - basic values #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
BAS4(c,s,q) # Export demand - basic values #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
BAS5(c,s,q) # Government demand - basic values #;
(all,i,IND)(all,q,REGDEST)
S_CPTL(i,q) # Sectoral share in regional capital payments #;
```

```
FORMULA
(all,i,IND)(all,q,REGDEST)
S_CPTL(i,q)=CPTL(i,q)/(sum(j,IND,CPTL(j,q)));
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
BAS1(c,s,i,q)=RABAS(c,s,i,q)*CINT(i,q);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
BAS2(c,s,i,q)=RIBAS(c,s,i,q)*INV(q)*S_CPTL(i,q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
BAS3(c,s,q)=RCBAS(c,s,q)*CONS(q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
BAS4(c,s,q)=SHIND(s,q)*BAS4_S(c,q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
BAS5(c,s,q)=RGBAS(c,s,q)*GOV(q);
```

4.2.2. Margin flows

Margin demands in monetary terms are calculated here. For each basic flow, there is a corresponding margin demand in the system. The distribution of margins is based on commodity-user-specific national margin rates, which are applied to the corresponding basic flows elsewhere.

```
! Excerpt 9 of TABLO input file: !
! Margin flows !

COEFFICIENT
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
MR11(c,s,i,q) # Intermediate consumption - margin 1 #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
MR12(c,s,i,q) # Investment demand - margin 1 #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
MR13(c,s,q) # Household demand - margin 1 #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
MR14(c,s,q) # Export - margin 1 #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
MR15(c,s,q) # Government demand - margin 1 #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
MR21(c,s,i,q) # Intermediate consumption - margin 2 #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
```

```
MR22(c,s,i,q) # Investment demand - margin 2 #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
MR23(c,s,q) # Household demand - margin 2 #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
MR24(c,s,q) # Export - margin 2 #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
MR25(c,s,q) # Government demand - margin 2 #;
(all,c,COM)
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
X_SH(c,s,q)=BAS4(c,s,q)/(TINY+sum(r,ALLSOURCE,sum(t,REGDEST,BAS4(c,r,t))));

FORMULA
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
X_SH(c,s,q)=BAS4(c,s,q)/(TINY+sum(r,ALLSOURCE,sum(t,REGDEST,BAS4(c,r,t))));
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
MR11(c,s,i,q)=RAMR1(c,s,i,q)*CINT(i,q);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
MR12(c,s,i,q)=RIMR1(c,s,i,q)*INV(q)*S_CPTL(i,q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
MR13(c,s,q)=RCMR1(c,s,q)*CONS(q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
MR14(c,s,q)=X_SH(c,s,q)*LXMR1(c);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
MR15(c,s,q)=RGMR1(c,s,q)*GOV(q);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
MR21(c,s,i,q)=RAMR2(c,s,i,q)*CINT(i,q);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
MR22(c,s,i,q)=RIMR2(c,s,i,q)*INV(q)*S_CPTL(i,q); ! check !
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
MR23(c,s,q)=RCMR2(c,s,q)*CONS(q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
MR24(c,s,q)=X_SH(c,s,q)*LXMR2(c);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
MR25(c,s,q)=RGMR2(c,s,q)*GOV(q);
```

4.2.3. Indirect tax flows

Tax values associated with the basic flows are calculated here. For each basic flow, the corresponding tax rate is applied. Three indirect taxes are considered: ICMS (tax 1), IPI (tax 2), and other indirect taxes (tax 3).

```
! Excerpt 10 of TABLO input file: !
! Tax flows !

COEFFICIENT
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
TX11(c,s,i,q) # Intermediate consumption - tax 1 #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
TX12(c,s,i,q) # Investment demand - tax 1 #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TX13(c,s,q) # Household demand - tax 1 #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TX14(c,s,q) # Export - tax 1 #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TX15(c,s,q) # Government demand - tax 1 #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
TX21(c,s,i,q) # Intermediate consumption - tax 2 #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
TX22(c,s,i,q) # Investment demand - tax 2 #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TX23(c,s,q) # Household demand - tax 2 #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TX24(c,s,q) # Export - tax 2 #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TX25(c,s,q) # Government demand - tax 2 #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
TX31(c,s,i,q) # Intermediate consumption - tax 3 #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
TX32(c,s,i,q) # Investment demand - tax 3 #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TX33(c,s,q) # Household demand - tax 3 #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TX34(c,s,q) # Export - tax 3 #;
```

```
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TX35(c,s,q) # Government demand - tax 3 #;

FORMULA
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
TX11(c,s,i,q)=RATX1(c,s,i,q)*CINT(i,q);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
TX12(c,s,i,q)=RITX1(c,s,i,q)*INV(q)*S_CPTL(i,q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TX13(c,s,q)=RCTX1(c,s,q)*CONS(q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TX14(c,s,q)=X_SH(c,s,q)*LXTX1(c);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TX15(c,s,q)=RGTX1(c,s,q)*GOV(q);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
TX21(c,s,i,q)=RATX2(c,s,i,q)*CINT(i,q);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
TX22(c,s,i,q)=RITX2(c,s,i,q)*INV(q)*S_CPTL(i,q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TX23(c,s,q)=RCTX2(c,s,q)*CONS(q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TX24(c,s,q)=X_SH(c,s,q)*LXTX2(c);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TX25(c,s,q)=RGTX2(c,s,q)*GOV(q);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
TX31(c,s,i,q)=RATX3(c,s,i,q)*CINT(i,q);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
TX32(c,s,i,q)=RITX3(c,s,i,q)*INV(q)*S_CPTL(i,q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TX33(c,s,q)=RCTX3(c,s,q)*CONS(q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TX34(c,s,q)=X_SH(c,s,q)*LXTX3(c);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TX35(c,s,q)=RGTX3(c,s,q)*GOV(q);
```

4.2.4. Disaggregation of sectoral value added

This excerpt shows the procedure for the disaggregation of the sectoral value added. Direct information was available from IBGE for the national sectoral aggregates; for

the regional aggregates, estimates were based on both direct estimated state-level sectoral shares, using the regional accounts from IBGE and assuming the same sectoral composition within each state (see Faria and Haddad, 2011).

```
! Excerpt 11 of TABLO input file: !
! Value added !

COEFFICIENT
(all,i,IND)(all,q,REGDEST)
LABR(i,q) # Total regional labor payments, by sector #;
(all,i,IND)(all,q,REGDEST)
OCTS(i,q) # Other costs, by sector #;
(all,i,IND)(all,q,REGDEST)
VA(i,q) # Total regional value added, by sector #;

READ
LABR from file BDATA header "LABR";
OCTS from file BDATA header "OCTS";

FORMULA
(all,i,IND)(all,q,REGDEST)
VA(i,q)=LABR(i,q)+CPTL(i,q)+OCTS(i,q);
```

4.2.5. Production aggregates

The coefficient MAKE(i,c,s) refers to the 58 regional make matrices, and was estimated from the structure of the national make matrix and the information on regional ouptut by commodity and sector. A balancing procedure (RAS) was carried out as needed.

This excerpt also shows specific aggregations of the make matrix to be used for balance checking purposes.

```
! Excerpt 12 of TABLO input file: !
! Gross output !
```

```
COEFFICIENT
(all,i,IND)(all,q,REGDEST)
MAKE_I(i,q) # Total regional output, by sector #;
(all,i,IND)(all,q,REGDEST)
MAKE_I2(i,q) # Total regional output, by sector, make version #;
(all,c,COM)(all,s,REGSOURCE)
MAKE_C(c,s) # Total regional output, by commodity #;
(all,i,IND)(all,c,COM)(all,s,REGSOURCE)
MAKE(i,c,s) # Make matrix, by region #;

READ
MAKE from file BDATA header "MAKE";

FORMULA
(all,i,IND)(all,q,REGDEST)
MAKE_I(i,q)=VA(i,q)+CINT(i,q);
(all,i,IND)(all,q,REGDEST)
MAKE_I2(i,q)=sum(c,COM,MAKE(i,c,q));
(all,c,COM)(all,s,REGSOURCE)
MAKE_C(c,s)=sum(i,IND,MAKE(i,c,s));
```

4.2.6. Balancing checks

The first check was undertaken to assure that the information provided in the make matrix was consistent with the information on the absorption (use) matrix, i.e. MAKE_I(i,q) = MAKE_I2(i,q), for every i and q.

The second check refers to the commodity balance check. Changes in inventories are defined as the discrepancy needed to be inserted in the system for commodity balancing purposes between the use and make tables.

```
! Excerpt 13 of TABLO input file: !

! Check 1 - Sector output balance check !

COEFFICIENT
(all,i,IND)(all,q,REGDEST)
CHECKA(i,q) # Check MAKE_I = MAKE_I2 #;
```

```
FORMULA
(all,i,IND)(all,q,REGDEST)
CHECKA(i,q)=MAKE_I(i,q)-MAKE_I2(i,q);

! Check 2 - Commodity balance check !

COEFFICIENT
(all,c,COM)(all,s,REGSOURCE)
DIRSALES(c,s) # Direct usage #;
(all,r,MARGCOM)(all,s,REGSOURCE)
MARSALES1(r,s) # Margin 1 usage #;
(all,c,COM)(all,s,REGSOURCE)
SALES(c,s) # All usage #;
(all,c,COM)(all,s,REGSOURCE)
LOSTGOODS(c,s) # Discrepancy #;
(all,c,COM)(all,s,REGSOURCE)
BAS7(c,s) # Change in stocks - for balancing purposes #;
(all,i,IND)(all,q,REGDEST)
V1TOT(i,q) # Total cost by sector #;
(all,i,IND)(all,q,REGDEST)
STOK(i,q) # Total cost adjustment by sector #;
(all,i,IND)(all,q,REGDEST)
CHECKB(i,q) # Check MAKE_I = MAKE_I2 #;

FORMULA
(all,c,COM)(all,s,REGSOURCE)
DIRSALES(c,s)=sum(i,IND,sum(q,REGDEST,BAS1(c,s,i,q)))
+sum(i,IND,sum(q,REGDEST,BAS2(c,s,i,q)))
+sum(q,REGDEST,BAS3(c,s,q))
+sum(q,REGDEST,BAS4(c,s,q))
+sum(q,REGDEST,BAS5(c,s,q));
(all,r,MARGCOM)(all,s,REGSOURCE)
MARSALES1(r,s)=sum(i,IND,sum(c,COM,sum(ss,ALLSOURCE,MR11(c,ss,i,s))))
+sum(i,IND,sum(c,COM,sum(ss,ALLSOURCE,MR12(c,ss,i,s))))
+sum(c,COM,sum(ss,ALLSOURCE,MR13(c,ss,s)))
+sum(c,COM,sum(ss,ALLSOURCE,MR14(c,ss,s)))
+sum(c,COM,sum(ss,ALLSOURCE,MR15(c,ss,s)));
(all,r,MARGCOM2)(all,s,REGSOURCE)
MARSALES2(r,s)=sum(i,IND,sum(c,COM,sum(ss,ALLSOURCE,MR21(c,ss,i,s))))
```

```
+sum(i,IND,sum(c,COM,sum(ss,ALLSOURCE,MR22(c,ss,i,s))))
+sum(c,COM,sum(ss,ALLSOURCE,MR23(c,ss,s)))
+sum(c,COM,sum(ss,ALLSOURCE,MR24(c,ss,s)))
+sum(c,COM,sum(ss,ALLSOURCE,MR25(c,ss,s)));
(all,c,NONMARGCOM)(all,s,REGSOURCE)
SALES(c,s)=DIRSALES(c,s);
(all,c,MARGCOM1)(all,s,REGSOURCE)
SALES(c,s)=DIRSALES(c,s)+MARSALES1(c,s);
(all,c,MARGCOM2)(all,s,REGSOURCE)
SALES(c,s)=DIRSALES(c,s)+MARSALES2(c,s);
(all,c,COM)(all,s,REGSOURCE)
LOSTGOODS(c,s)=SALES(c,s)-MAKE_C(c,s);
(all,c,COM)(all,s,REGSOURCE)
BAS7(c,s)=-LOSTGOODS(c,s);
(all,i,IND)(all,q,REGDEST)
STOK(i,q)=CHECKA(i,q);
(all,i,IND)(all,q,REGDEST)
V1TOT(i,q)=VA(i,q)+CINT(i,q)-STOK(i,q);
(all,i,IND)(all,q,REGDEST)
CHECKB(i,q)=V1TOT(i,q)-MAKE_I2(i,q);
```

4.2.7. Renaming arrays

This excerpt renames some of the arrays in order to be consistent with the notation adopted in the model code, as presented in Figure 2.

```
COEFFICIENT
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)(all,r,MARGCOM)
MAR1(c,s,i,q,r);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)(all,r,MARGCOM)
MAR2(c,s,i,q,r);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)(all,r,MARGCOM)
MAR3(c,s,q,r);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)(all,r,MARGCOM)
MAR4(c,s,q,r);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)(all,r,MARGCOM)
MAR5(c,s,q,r);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
TAX1(c,s,i,q);
```

```
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
TAX2(c,s,i,q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TAX3(c,s,q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TAX4(c,s,q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TAX5(c,s,q);

FORMULA
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)(all,r,MARGCOM1)
MAR1(c,s,i,q,r)=MR11(c,s,i,q);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)(all,r,MARGCOM1)
MAR2(c,s,i,q,r)=MR12(c,s,i,q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)(all,r,MARGCOM1)
MAR3(c,s,q,r)=MR13(c,s,q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)(all,r,MARGCOM1)
MAR4(c,s,q,r)=MR14(c,s,q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)(all,r,MARGCOM1)
MAR5(c,s,q,r)=MR15(c,s,q);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)(all,r,MARGCOM2)
MAR1(c,s,i,q,r)=MR21(c,s,i,q);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)(all,r,MARGCOM2)
MAR2(c,s,i,q,r)=MR22(c,s,i,q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)(all,r,MARGCOM2)
MAR3(c,s,q,r)=MR23(c,s,q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)(all,r,MARGCOM2)
MAR4(c,s,q,r)=MR24(c,s,q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)(all,r,MARGCOM2)
MAR5(c,s,q,r)=MR25(c,s,q);
all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
TAX1(c,s,i,q)=TX11(c,s,i,q)+TX21(c,s,i,q)+TX31(c,s,i,q);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
TAX2(c,s,i,q)=TX12(c,s,i,q)+TX22(c,s,i,q)+TX32(c,s,i,q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TAX3(c,s,q)=TX13(c,s,q)+TX23(c,s,q)+TX33(c,s,q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TAX4(c,s,q)=TX14(c,s,q)+TX24(c,s,q)+TX34(c,s,q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
```

```
TAX5(c,s,q)=TX15(c,s,q)+TX25(c,s,q)+TX35(c,s,q);
```

4.2.8. Writing the results to the output file

The final step is to write the relevant results for the output file RIODATA, which can then be used to prepare the consolidated IIOS-ANEEL in Excel format.

```
WRITE BAS1 TO FILE RIODATA HEADER "BAS1";
WRITE BAS2 TO FILE RIODATA HEADER "BAS2";
WRITE BAS3 TO FILE RIODATA HEADER "BAS3";
WRITE BAS4 TO FILE RIODATA HEADER "BAS4";
WRITE BAS5 TO FILE RIODATA HEADER "BAS5";
WRITE BAS7 TO FILE RIODATA HEADER "BAS7";
WRITE MAR1 TO FILE RIODATA HEADER "MAR1";
WRITE MAR2 TO FILE RIODATA HEADER "MAR2";
WRITE MAR3 TO FILE RIODATA HEADER "MAR3";
WRITE MAR4 TO FILE RIODATA HEADER "MAR4";
WRITE MAR5 TO FILE RIODATA HEADER "MAR5";
WRITE TAX1 TO FILE RIODATA HEADER "TAX1";
WRITE TAX2 TO FILE RIODATA HEADER "TAX2";
WRITE TAX3 TO FILE RIODATA HEADER "TAX3";
WRITE TAX4 TO FILE RIODATA HEADER "TAX4";
WRITE TAX5 TO FILE RIODATA HEADER "TAX5";
WRITE LABR TO FILE RIODATA HEADER "LABR";
WRITE CPTL TO FILE RIODATA HEADER "CPTL";
WRITE OCTS TO FILE RIODATA HEADER "OCTS";
WRITE MAKE TO FILE RIODATA HEADER "MAKE";
WRITE CHECKA TO FILE RIODATA HEADER "CHKA";
WRITE CHECKB TO FILE RIODATA HEADER "CHKB";
```

Figure 2. Structure of the Interregional Flows Database: The Absorption (Use) Matrix

			User 1			User 2			User 3			User 4	User 5			User 7
			Producers			Investors			Household			Exports	Government			Inventories
		Size	15	15	15	15	15	15	1	1	1	1	1	1	1	1
	Size	Source/ Destination	R1	…	R58	R1	…	R58	R1	…	R58		R1	…	R58	
Basic Flows	110	R1	BAS1			BAS2			BAS3			BAS4	BAS5			BAS7
	110	…														
	110	R58														
	110	ROW														
Margins (Trade)	110	R1	MAR1			MAR2			MAR3			MAR4	MAR5			0
	110	…														
	110	R58														
	110	ROW														
Taxes	110	R1	TAX1			TAX2			TAX3			TAX4	TAX5			0
	110	…														
	110	R58														
	110	ROW														
Value Added	1		LABR													
	1		CPTL													
	1		OCTS													

5. Structural Analysis: An Illustration of the IIOS-ANELL

In this section, some of the structural features of the economy of Brazil are revealed through the use of indicators derived from the IIOS-ANEEL. An analysis of output decomposition considering the interaction of intermediate demand and final demand is presented in order to illustrate some porperties of the system. Production linkages between sectors are considered through the analysis of the intermediate inputs portion of the interregional input-output database. Both the direct and indirect production linkage effects of the economy are captured based on the evaluation of the Leontief inverse matrix.

The conventional input-output model is given by the system of matrix equations:

$$x = Ax + f \tag{1}$$

$$x = (I - A)^{-1} f = Bf \tag{2}$$

where x and f are respectively the vectors of gross output and final demand; A consists of input coefficients a_{ij} defined as the amount of product i required per unit of product j (in monetary terms), for $i, j = 1,\ldots, n$; and B is known as the Leontief inverse.

Let us consider systems (1) and (2) in an interregional context, with R different regions, so that:

$$x = \begin{bmatrix} x^1 \\ \vdots \\ x^R \end{bmatrix}; A = \begin{bmatrix} A^{11} & \cdots & A^{1R} \\ \vdots & \ddots & \vdots \\ A^{R1} & \cdots & A^{RR} \end{bmatrix}; f = \begin{bmatrix} f^1 \\ \vdots \\ f^R \end{bmatrix}; \text{ and } B = \begin{bmatrix} B^{11} & \cdots & B^{1R} \\ \vdots & \ddots & \vdots \\ B^{R1} & \cdots & B^{RR} \end{bmatrix} \tag{3}$$

and

$$\begin{aligned} x^1 &= B^{11} f^1 + \cdots + B^{1R} f^R \\ &\vdots \\ x^R &= B^{R1} f^1 + \cdots + B^{RR} f^R \end{aligned} \tag{4}$$

Let us also consider different components of *f*, which include demands originating in the specific regions, v^{rs}, s = 1,…, R, and abroad, *e*. We obtain information of final demand from origin s in the IIOS-ANEEL, allowing us to treat *v* as a matrix which provides the monetary values of final demand expenditures from the domestic regions in Brazil and from the foreign region.

$$v = \begin{bmatrix} v^{11} & \cdots & v^{1R} \\ \vdots & \ddots & \vdots \\ v^{R1} & \cdots & v^{RR} \end{bmatrix};\ e = \begin{bmatrix} e^{1} \\ \vdots \\ e^{R} \end{bmatrix}$$

Thus, we can re-write (4) as:

$$\begin{aligned} x^1 &= B^{11}(v^{11} + \cdots + v^{R1} + e^1) + \cdots + B^{1R}(v^{1R} + \cdots + v^{RR} + e^R) \\ &\vdots \\ x^R &= B^{R1}(v^{11} + \cdots + v^{R1} + e^1) + \cdots + B^{RR}(v^{1R} + \cdots + v^{RR} + e^R) \end{aligned} \qquad (5)$$

With (5), we can then compute the contribution of final demand from different origins on regional output. It is clear from (5) that regional output depends, among others, on demand originating in the region, and, depending on the degree of interregional integration, also on demand from outside the region.

In what follows, interdependence among sectors in different regions is considered through the analysis of the complete intermediate input portion of the interregional input-output table. The Leontief inverse matrix, based on the system (4), will be considered, and some summary interpretations of the structure of the economy derived from it will be provided. Regional output is decomposed, by taking into account not only the multiplier structure, but also the structure of final demand in the 58 domestic and the foreign regions (Sonis et al., 1996).

According to equation (5), regional output (for each region) was decomposed, and the contributions of the components of final demand from different areas were calculated. The results are presented in Table 4.

The self-generated component of output in each region, i.e., the share of output generated by demand within the region, ranges from less than 12% (SULGIPE) to almost 75% (CEA). The demand for foreign exports is relevant for most of the concession areas whose economic bases are associated with the production of resource-based output destined to foreign markets. For instance, their contribution to regional output is above 15% for the concession areas of CELPA and CEMAT (around 7.2% for the country as a whole), heavily influenced by the exports of iron ore and agricultural products, respectively. Figure 4 highlights the external dependency for each concession area. These results confirm that market strategies for concessionaires should go beyond the analysis of local markets only.

Table 4. Components of Decomposition of Regional Output Based on the Sources of Final Demand: by Concession Area of ANEEL (in % of total output)

	Elements of Set REGDEST	*Intra-regional dependency*	*Interregional dependency*	*External dependency*
R1	ELETRODONIA	42.54	53.52	3.94
R2	ELETROACRE	67.73	30.77	1.51
R3	ELETROAM	25.46	71.10	3.45
R4	ELETRORR	71.86	26.92	1.22
R5	CERR	22.92	72.19	4.88
R6	CELPA	47.48	37.48	15.04
R7	CEA	74.44	23.23	2.34
R8	CELTINS	60.77	36.03	3.20
R9	CEMAR	61.05	32.05	6.90
R10	ELETROI	64.88	33.64	1.48
R11	COELCE	65.01	31.79	3.19
R12	COSERN	57.06	40.46	2.47
R13	EPB	60.31	37.94	1.75
R14	EBO	47.31	50.73	1.96
R15	CELPE	61.29	36.27	2.44
R16	ELETROALAGO	51.50	42.45	6.05
R17	ESE	47.27	48.62	4.11
R18	SULGIPE	11.79	78.16	10.05
R19	COELBA	56.51	36.02	7.46
R20	CEMIG	45.90	46.54	7.56
R21	CPFL_M	19.32	71.67	9.01
R22	DMEPC	17.67	67.25	15.08
R23	EEB	15.64	78.17	6.19
R24	EMG	28.47	64.47	7.06
R25	ESCELSA	38.81	49.99	11.20
R26	ELFSM	37.01	51.20	11.79
R27	AMPLA	15.93	70.84	13.22
R28	LIGHT	59.28	35.84	4.88
R29	ELEKTRO	28.12	64.51	7.37
R30	CPFL_Paul	32.59	59.28	8.14
R31	CNEE	22.65	62.38	14.96
R32	CPFL_Sta_C	23.17	66.71	10.12
R33	CPFL_L_P	24.69	65.80	9.51
R34	CAIUA	38.12	51.29	10.59
R35	EDEVP	27.84	58.46	13.71
R36	CPFL_S_Paul	22.13	69.39	8.47
R37	CPFL_Pirat	17.97	74.01	8.02
R38	BANDEIRANTE	20.02	71.29	8.69
R39	ELETROPAULO	59.28	35.69	5.03
R40	COPEL	37.80	49.95	12.25
R41	CFLO	41.43	45.50	13.07
R42	COCEL	42.45	51.31	6.24
R43	CELESC	43.29	50.04	6.67
R44	IENERGIA	28.79	63.03	8.18
R45	SC_COOP	20.80	70.57	8.63
R46	RGE	28.50	64.16	7.34
R47	MUX	17.35	71.16	11.50
R48	HIDROMEI	18.96	73.78	7.26
R49	ELETROCAR	36.50	55.42	8.08
R50	RS_COOP	17.87	68.84	13.28
R51	AES_SUL	52.03	40.45	7.53
R52	UHENPAL	20.98	69.36	9.66
R53	CEEE	26.39	59.32	14.29
R54	ENERSUL	47.62	42.64	9.74
R55	CEMAT	36.68	46.08	17.24
R56	CELG	53.30	40.51	6.19
R57	CHESP	25.68	68.08	6.23
R58	CEB	71.90	27.02	1.07

Figure 3. Components of Decomposition of Regional Output Based on the Sources of Final Demand, by Concession Area of ANEEL (in % of total output)

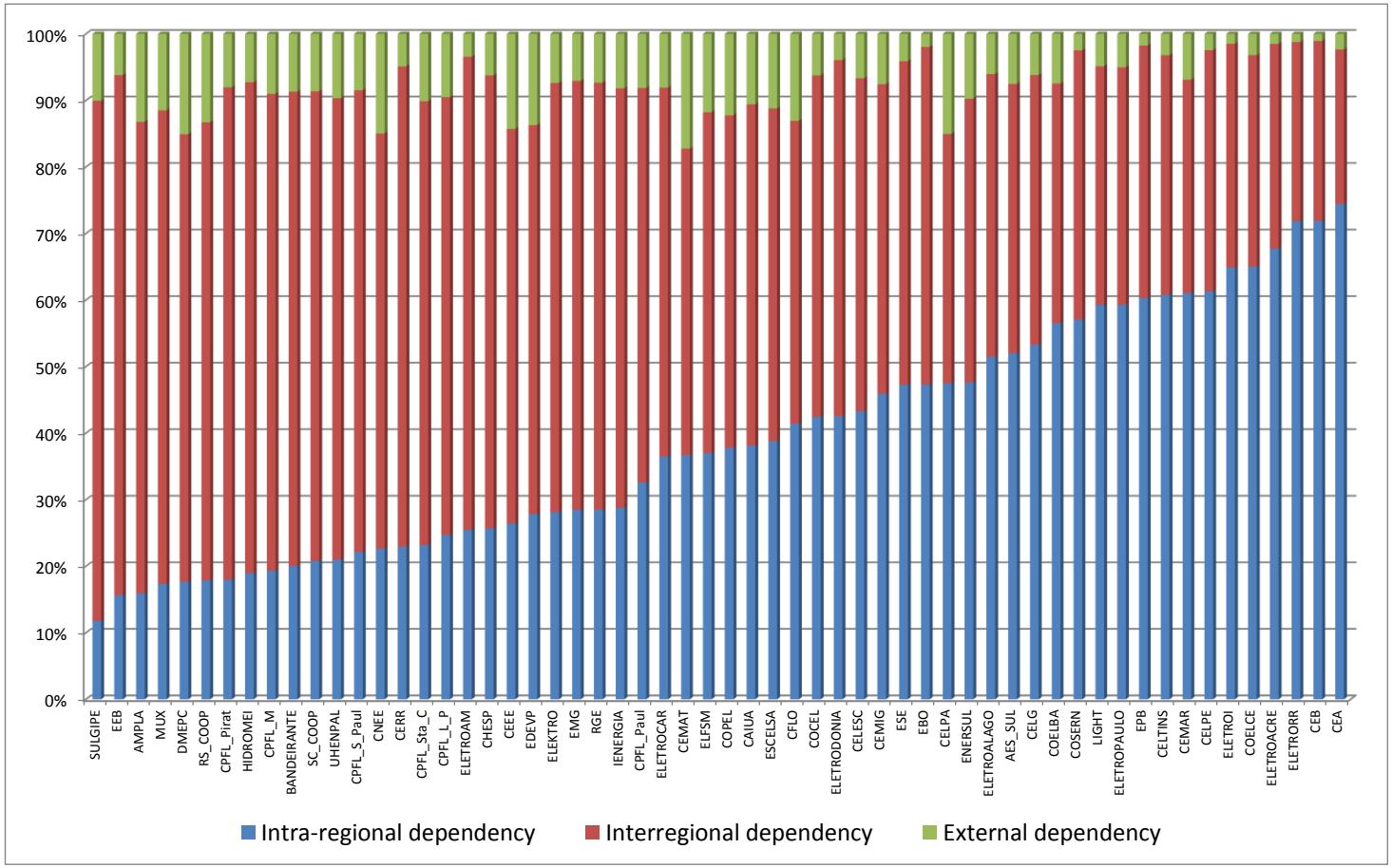
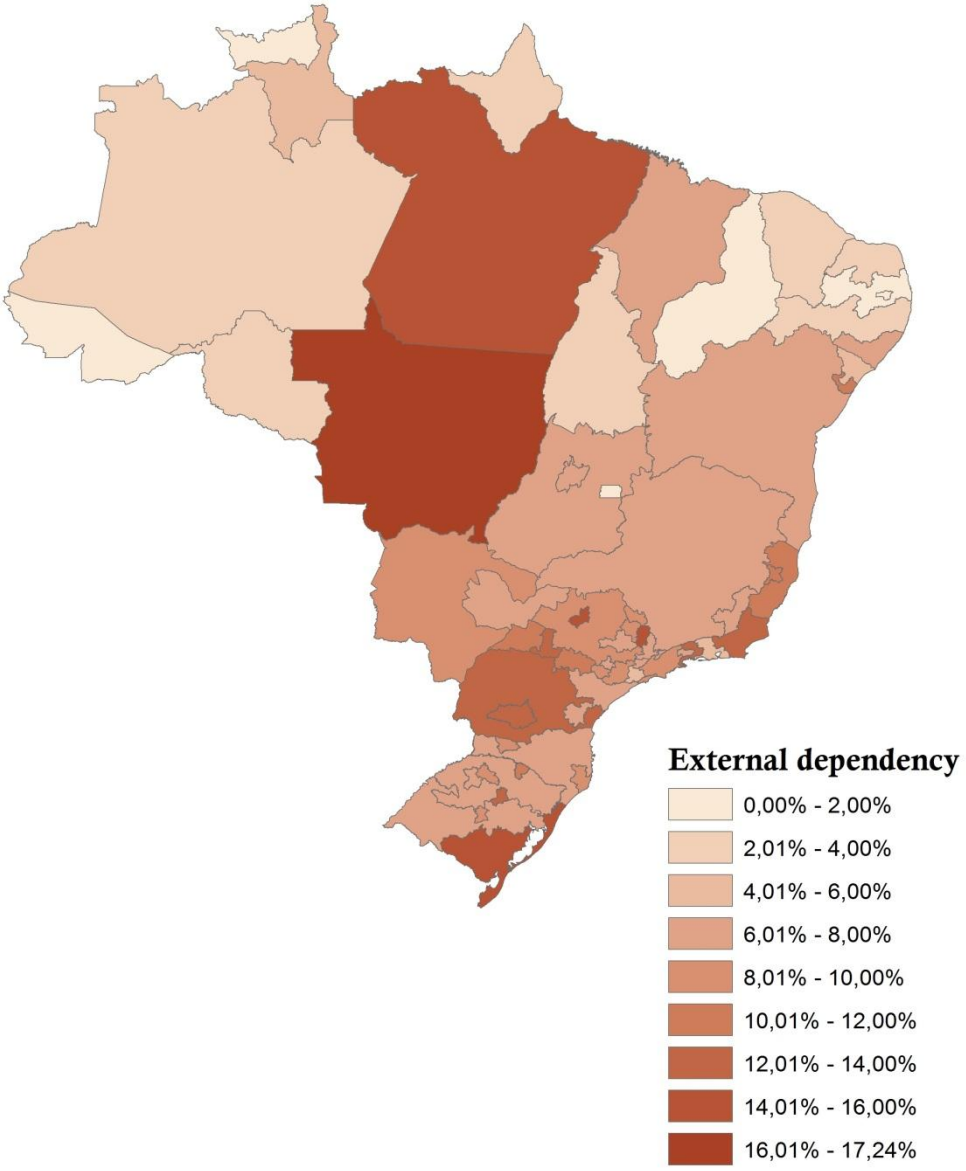


Figure 4. External Dependency of Regional Output, by Concession Area of ANEEL (in % of total output)



6. Next Steps

The main goal of this technical note was to present the recent developments in the construction of an interregional input-output system for Brazil, considering the concession areas of ANEEL for regionalization purposes. The understanding of the functioning of the Brazilian regional economies within an integrated system, which considers concession areas of electric-power distribution services, is one of the main goals of the ongoing research project involving NEREUS and FIPE.

The brief analysis of the structure of the database suggests that there are some important differences in the internal structure of the regional economies and the external interactions among their different agents.[9] As the IIOS-ANEEL will serve as the basis for the future calibration of a hybrid input-output system and an interregional CGE model, understanding of the relationships underlying it is fundamental for a better understanding of the model's results.

References

Chenery, H. B. (1956). Interregional and International Input-Output Analysis. In: T. Barna (ed.), *The Structure Interdependence of the Economy*, New York: Wiley, pp. 341-356.

Faria, W. and Haddad, E. A. (2011). Estimação das Elasticidades de Substituição do Comércio Regional do Brasil, *TD NEREUS 01-2011*, University of São Paulo.

Guilhoto, J.J.M., U.A. Sesso Filho (2005). Estimação da Matriz Insumo-Produto a Partir de Dados Preliminares das Contas Nacionais. *Economia Aplicada*. Vol. 9. N. 2. pp. 277-299. Abril-Junho.

Moses, L. N. (1955). The Stability of Interregional Trading Patterns and Input-Output Analysis, *American Economic Review*, vol. XLV, no. 5, pp. 803-832.

Sonis, M., Hewings, G. J. D., Guo, J. (1996). Sources of Structural Change in Input-Output Systems: a Field of Influence Approach. *Economics Systems Research*, 8 (1): 15-32.

[9] A thorough strucutral analysis of the IIOS-ANEEL will be developed in the context of the M.A. thesis of Maria Carolina C. Marques, under the supervision of Eduardo A. Haddad.

Annex

Código IBGE	*Nome da Microrregião*	*Distribuidora Alocada*	*Código IBGE*	*Nome da Microrregião*	*Distribuidora Alocada*
11006	Cacoal	ELETRODONIA	22006	Valenca do Piaui	ELETROI
11003	Ariquemes	ELETRODONIA	22013	Picos	ELETROI
11008	Colorado do Oeste	ELETRODONIA	22012	Chapadas do Extremo Sul Piauiense	ELETROI
11002	Guajara-Mirim	ELETRODONIA	22007	Alto Parnaiba Piauiense	ELETROI
11004	Ji-Parana	ELETRODONIA	22001	Baixo Parnaiba Piauiense	ELETROI
11005	Alvorada D'Oeste	ELETRODONIA	22002	Litoral Piauiense	ELETROI
11007	Vilhena	ELETRODONIA	22009	Floriano	ELETROI
11001	Porto Velho	ELETRODONIA	23033	Brejo Santo	COELCE
12004	Rio Branco	ELETROACRE	23013	Baturite	COELCE
12005	Brasileia	ELETROACRE	23001	Litoral de Camocim e Acarau	COELCE
12001	Cruzeiro do Sul	ELETROACRE	23021	Sertao de Senador Pompeu	COELCE
12002	Tarauaca	ELETROACRE	23020	Sertao de Inhamuns	COELCE
12003	Sena Madureira	ELETROACRE	23004	Meruoca	COELCE
13005	Tefe	ELETROAM	23030	Caririacu	COELCE
13003	Alto Solimoes	ELETROAM	23023	Baixo Jaguaribe	COELCE
13006	Coari	ELETROAM	23008	Itapipoca	COELCE
13013	Madeira	ELETROAM	23027	Varzea Alegre	COELCE
13007	Manaus	ELETROAM	23011	Medio Curu	COELCE
13001	Rio Negro_am	ELETROAM	23016	Fortaleza	COELCE
13010	Parintins	ELETROAM	23022	Litoral de Aracati	COELCE
13011	Boca do Acre	ELETROAM	23018	Sertao de Crateus	COELCE
13012	Purus	ELETROAM	23029	Chapada do Araripe	COELCE
13004	Jurua	ELETROAM	23031	Barro	COELCE
13009	Itacoatiara	ELETROAM	23028	Lavras da Mangabeira	COELCE
13002	Japura	ELETROAM	23019	Sertao de Quixeramobim	COELCE
13008	Rio Preto da Eva	ELETROAM	23032	Cariri	COELCE
14001	Boa Vista	ELETRORR	23014	Chorozinho	COELCE
14002	Nordeste de Roraima	CERR	23015	Cascavel_ce	COELCE
14003	Caracarai	CERR	23012	Caninde	COELCE
14004	Sudeste de Roraima	CERR	23005	Sobral	COELCE
15011	Cameta	CELPA	23002	Ibiapaba	COELCE
15017	Paragominas	CELPA	23007	Santa Quiteria	COELCE
15012	Tome-Acu	CELPA	23026	Iguatu	COELCE
15005	Furos de Breves	CELPA	23003	Coreau	COELCE
15019	Parauapebas	CELPA	23025	Serra do Pereiro	COELCE
15002	Santarem	CELPA	23017	Pacajus	COELCE
15003	Almeirim	CELPA	23006	Ipu	COELCE
15015	Altamira	CELPA	23010	Uruburetama	COELCE
15007	Belem	CELPA	23024	Medio Jaguaribe	COELCE
15010	Bragantina	CELPA	23009	Baixo Curu	COELCE
15013	Guama	CELPA	24012	Serido Oriental	COSERN
15014	Itaituba	CELPA	24004	Vale do Acu	COSERN
15004	Portel	CELPA	24009	Angicos	COSERN
15018	Sao Felix do Xingu	CELPA	24005	Serra de Sao Miguel	COSERN
15020	Maraba	CELPA	24006	Pau dos Ferros	COSERN
15016	Tucurui	CELPA	24007	Umarizal	COSERN
15008	Castanhal	CELPA	24002	Chapada do Apodi	COSERN
15006	Arari	CELPA	24001	Mossoro	COSERN
15009	Salgado	CELPA	24019	Litoral Sul_rn	COSERN
15022	Conceicao do Araguaia	CELPA	24003	Medio Oeste	COSERN
15001	obidos	CELPA	24014	Borborema Potiguar	COSERN
15021	Redencao	CELPA	24013	Baixa Verde	COSERN
16003	Macapa	CEA	24010	Serra de Santana	COSERN
16002	Amapa	CEA	24015	Agreste Potiguar	COSERN
16001	Oiapoque	CEA	24008	Macau	COSERN
16004	Mazagao	CEA	24011	Serido Ocidental	COSERN
17003	Miracema do Tocantins	CELTINS	24017	Macaiba	COSERN
17001	Bico do Papagaio	CELTINS	24018	Natal	COSERN
17005	Gurupi_to	CELTINS	24016	Litoral Nordeste	COSERN
17008	Dianopolis	CELTINS	25007	Serra do Teixeira	EPB
17006	Porto Nacional	CELTINS	25005	Pianco	EPB
17002	Araguaina	CELTINS	25015	Brejo Paraibano	EPB
17004	Rio Formoso	CELTINS	25016	Guarabira	EPB
17007	Jalapao	CELTINS	25011	Cariri Oriental	EPB
21009	Imperatriz	CEMAR	25012	Curimatau Ocidental	EPB
21016	Coelho Neto	CEMAR	25023	Litoral Sul_pb	EPB
21013	Baixo Parnaiba Maranhense	CEMAR	25002	Cajazeiras	EPB
21001	Litoral Ocidental Maranhense	CEMAR	25010	Cariri Ocidental	EPB
21008	Pindare	CEMAR	25003	Sousa	EPB
21015	Codo	CEMAR	25013	Curimatau Oriental	EPB
21020	Gerais de Balsas	CEMAR	25004	Patos	EPB
21007	Gurupi_mar	CEMAR	25014	Esperanca	EPB
21005	Baixada Maranhense	CEMAR	25019	Umbuzeiro	EPB
21014	Chapadinha	CEMAR	25020	Litoral Norte	EPB
21011	Alto Mearim e Grajau	CEMAR	25009	Serido Oriental Paraibano	EPB
21003	Rosario	CEMAR	25022	Joao Pessoa	EPB
21010	Medio Mearim	CEMAR	25001	Catole do Rocha	EPB
21018	Chapadas do Alto Itapecuru	CEMAR	25006	Itaporanga	EPB
21004	Lencois Maranhenses	CEMAR	25017	Campina Grande	EBO
21021	Chapadas das Mangabeiras	CEMAR	25018	Itabaiana	EPB
21017	Caxias	CEMAR	25021	Sape	EPB
21019	Porto Franco	CEMAR	25008	Serido Ocidental Paraibano	EPB
21006	Itapecuru Mirim	CEMAR	26017	Recife	CELPE
21012	Presidente Dutra	CEMAR	26003	Pajeu	CELPE
21002	Aglomeracao Urbana de Sao Luis	CEMAR	26005	Petrolina	CELPE
22015	Alto Medio Caninde	ELETROI	26012	Brejo Pernambucano	CELPE
22005	Medio Parnaiba Piauiense	ELETROI	26015	Mata Meridional Pernambucana	CELPE
22014	Pio IX	ELETROI	26007	Vale do Ipanema	CELPE
22004	Campo Maior	ELETROI	26008	Vale do Ipojuca	CELPE
22003	Teresina	ELETROI	26013	Mata Setentrional Pernambucana	CELPE
22010	Alto Medio Gurgueia	ELETROI	26011	Garanhuns	CELPE
22011	Sao Raimundo Nonato	ELETROI	26016	Itamaraca	CELPE
22008	Bertolinia	ELETROI	26001	Araripina	CELPE

Annex (cont.)

Código IBGE	*Nome da Microrregião*	*Distribuidora Alocada*	*Código IBGE*	*Nome da Microrregião*	*Distribuidora Alocada*
26004	Sertao do Moxoto	CELPE	31065	Juiz de Fora	CEMIG
26006	Itaparica	CELPE	31012	Aracuai	CEMIG
26010	Medio Capibaribe	CELPE	31018	Uberlandia	CEMIG
26018	Suape	CELPE	31020	Patos de Minas	CEMIG
26009	Alto Capibaribe	CELPE	31026	Bom Despacho	CEMIG
26002	Salgueiro	CELPE	31023	Araxa	CEMIG
26014	Vitoria de Santo Antao	CELPE	31048	Sao Sebastiao do Paraiso	CPFL_M
26019	Fernando de Noronha	N/D	31044	Formiga	CEMIG
27001	Serrana do Sertao Alagoano	ELETROALAGO	31001	Unai	CEMIG
27012	Sao Miguel dos Campos	ELETROALAGO	31064	Uba	EMG
27006	Arapiraca	ELETROALAGO	31015	Teofilo Otoni	CEMIG
27009	Mata Alagoana	ELETROALAGO	31025	Curvelo	CEMIG
27011	Maceio	ELETROALAGO	31042	Piui	CEMIG
27004	Batalha	ELETROALAGO	31030	Belo Horizonte	CEMIG
27005	Palmeira dos indios	ELETROALAGO	31032	Itaguara	CEMIG
27003	Santana do Ipanema	ELETROALAGO	31050	Varginha	CEMIG
27008	Serrana dos Quilombos	ELETROALAGO	31009	Bocaiuva	CEMIG
27002	Alagoana do Sertao do Sao Francisco	ELETROALAGO	31040	Caratinga	CEMIG
27013	Penedo	ELETROALAGO	31052	Pouso Alegre	EEB
27010	Litoral Norte Alagoano	ELETROALAGO	31046	Oliveira	CEMIG
27007	Traipu	ELETROALAGO	31003	Januaria	CEMIG
28007	Propria	ESE	31008	Grao Mogol	CEMIG
28003	Nossa Senhora das Dores	ESE	31002	Paracatu	CEMIG
28011	Aracaju	ESE	31007	Montes Claros	CEMIG
28012	Boquim	SULGIPE	31035	Guanhaes	CEMIG
28004	Agreste de Itabaiana	ESE	31056	Itajuba	CEMIG
28001	Sergipana do Sertao do Sao Francisco	ESE	31006	Pirapora	CEMIG
28008	Cotinguiba	ESE	31053	Santa Rita do Sapucai	CEMIG
28002	Carira	ESE	31017	Ituiutaba	CEMIG
28010	Baixo Cotinguiba	ESE	31021	Frutal	CEMIG
28013	Estancia	SULGIPE	31043	Divinopolis	CEMIG
28009	Japaratuba	ESE	31057	Lavras	CEMIG
28006	Agreste de Lagarto	ESE	31034	Conselheiro Lafaiete	CEMIG
28005	Tobias Barreto	SULGIPE	31058	Sao Joao Del Rei	CEMIG
29023	Seabra	COELBA	31004	Janauba	CEMIG
29005	Paulo Afonso	COELBA	31038	Mantena	CEMIG
29017	Alagoinhas	COELBA	31010	Diamantina	CEMIG
29015	Ribeira do Pombal	COELBA	31033	Ouro Preto	CEMIG
29012	Feira de Santana	COELBA	31029	Para de Minas	CEMIG
29025	Livramento do Brumado	COELBA	32007	Afonso Claudio	ESCELSA
29024	Jequie	COELBA	32002	Nova Venecia	ESCELSA
29032	Porto Seguro	COELBA	32001	Barra de Sao Francisco	ESCELSA
29031	Ilheus-Itabuna	COELBA	32011	Alegre	ESCELSA
29019	Catu	COELBA	32010	Guarapari	ESCELSA
29009	Irece	COELBA	32003	Colatina	ELFSM
29028	Vitoria da Conquista	COELBA	32012	Cachoeiro de Itapemirim	ESCELSA
29008	Senhor do Bonfim	COELBA	32006	Linhares	ESCELSA
29002	Cotegipe	COELBA	32009	Vitoria	ESCELSA
29027	Brumado	COELBA	32005	Sao Mateus	ESCELSA
29016	Serrinha	COELBA	32008	Santa Teresa	ESCELSA
29020	Santo Antonio de Jesus	COELBA	32013	Itapemirim	ESCELSA
29001	Barreiras	COELBA	32004	Montanha	ESCELSA
29011	Itaberaba	COELBA	33013	Baia da Ilha Grande	AMPLA
29006	Barra	COELBA	33002	Santo Antonio de Padua	AMPLA
29007	Bom Jesus da Lapa	COELBA	33010	Lagos	AMPLA
29022	Boquira	COELBA	33005	Tres Rios	AMPLA
29026	Guanambi	COELBA	33012	Barra do Pirai	LIGHT
29010	Jacobina	COELBA	33011	Vale do Paraiba Fluminense	AMPLA
29030	Valenca	COELBA	33018	Rio de Janeiro	LIGHT
29021	Salvador	COELBA	33007	Nova Friburgo	AMPLA
29004	Juazeiro	COELBA	33001	Itaperuna	AMPLA
29003	Santa Maria da Vitoria	COELBA	33016	Macacu-Caceribu	AMPLA
29014	Euclides da Cunha	COELBA	33004	Macae	AMPLA
29018	Entre Rios	COELBA	33003	Campos dos Goytacazes	AMPLA
29013	Jeremoabo	COELBA	33006	Cantagalo-Cordeiro	AMPLA
29029	Itapetinga	COELBA	33009	Bacia de Sao Joao	AMPLA
31019	Patrocinio	CEMIG	33014	Vassouras	LIGHT
31024	Tres Marias	CEMIG	33017	Itaguai	LIGHT
31061	Manhuacu	EMG	33015	Serrana	AMPLA
31060	Ponte Nova	CEMIG	33008	Santa Maria Madalena	AMPLA
31039	Ipatinga	CEMIG	35035	Adamantina	CAIUA
31036	Pecanha	CEMIG	35004	Sao Jose do Rio Preto	CPFL_Paul
31022	Uberaba	CEMIG	35029	Pirassununga	ELEKTRO
31045	Campo Belo	CEMIG	35030	Sao Joao da Boa Vista	CPFL_L_P
31016	Nanuque	CEMIG	35033	Amparo	CPFL_Paul
31005	Salinas	CEMIG	35022	Avare	CPFL_Sta_C
31041	Aimores	CEMIG	35028	Piracicaba	CPFL_Paul
31055	Andrelandia	CEMIG	35020	Bauru	CPFL_Paul
31054	Sao Lourenco	CEMIG	35042	Itapetininga	CPFL_S_Paul
31051	Pocos de Caldas	DMEPC	35036	Presidente Prudente	CAIUA
31066	Cataguases	EMG	35015	Batatais	CPFL_Paul
31049	Alfenas	CEMIG	35018	Birigui	CPFL_Paul
31059	Barbacena	CEMIG	35046	Sorocaba	CPFL_Pirat
31014	Almenara	CEMIG	35003	Votuporanga	ELEKTRO
31037	Governador Valadares	CEMIG	35038	Marilia	CPFL_Paul
31047	Passos	CEMIG	35032	Campinas	CPFL_Paul
31062	Vicosa	CEMIG	35024	Araraquara	CPFL_Paul
31031	Itabira	CEMIG	35025	Sao Carlos	CPFL_Paul
31028	Conceicao do Mato Dentro	CEMIG	35016	Andradina	ELEKTRO
31013	Pedra Azul	CEMIG	35023	Botucatu	CPFL_Paul
31011	Capelinha	CEMIG	35051	Guaratingueta	BANDEIRANTE
31063	Muriae	EMG	35001	Jales	ELEKTRO
31027	Sete Lagoas	CEMIG	35044	Capao Bonito	ELEKTRO

Annex (cont.)

Código IBGE	*Nome da Microrregião*	*Distribuidora Alocada*	*Código IBGE*	*Nome da Microrregião*	*Distribuidora Alocada*
35017	Aracatuba	CPFL_Paul	42020	Ararangua	CELESC
35011	Ituverava	CPFL_Paul	42018	Tubarao	SC_COOP
35052	Bananal	ELEKTRO	42013	Itajai	CELESC
35027	Limeira	ELEKTRO	42006	Canoinhas	CELESC
35037	Tupa	EDEVP	42007	Sao Bento do Sul	CELESC
35005	Catanduva	CNEE	42019	Criciuma	CELESC
35031	Moji-Mirim	ELEKTRO	43031	Campanha Meridional	CEEE
35059	Guarulhos	BANDEIRANTE	43010	Passo Fundo	RGE
35039	Assis	EDEVP	43019	Restinga Seca	UHENPAL
35048	Braganca Paulista	CPFL_Paul	43008	Ijui	HIPROPAN/DEMEI
35006	Auriflama	ELEKTRO	43001	Santa Rosa	RGE
35041	Itapeva	ELEKTRO	43029	Campanha Ocidental	AES_SUL
35021	Jau	CPFL_Paul	43009	Carazinho	ELETROCAR
35055	Registro	ELEKTRO	43003	Frederico Westphalen	RGE
35009	Barretos	CPFL_Paul	43011	Cruz Alta	RGE
35014	Ribeirao Preto	CPFL_Paul	43023	Montenegro	AES_SUL
35057	Osasco	ELETROPAULO	43026	Porto Alegre	AES_SUL
35013	Jaboticabal	CPFL_Paul	43032	Serras de Sudeste	CEEE
35040	Ourinhos	CPFL_Sta_C	43014	Guapore	RGE
35063	Santos	CPFL_Pirat	43016	Caxias do Sul	RGE
35062	Moji das Cruzes	BANDEIRANTE	43028	Camaqua	CEEE
35043	Tatui	ELEKTRO	43004	Erechim	RGE
35026	Rio Claro	ELEKTRO	43021	Lajeado-Estrela	AES_SUL
35050	Sao Jose dos Campos	BANDEIRANTE	43027	Osorio	CEEE
35019	Lins	CPFL_Paul	43033	Pelotas	CEEE
35058	Franco da Rocha	ELEKTRO	43025	Sao Jeronimo	AES_SUL
35047	Jundiai	CPFL_Pirat	43020	Santa Cruz do Sul	AES_SUL
35049	Campos do Jordao	ELEKTRO	43034	Jaguarao	CEEE
35054	Caraguatatuba	BANDEIRANTE	43005	Sananduva	MUX
35060	Itapecerica da Serra	ELETROPAULO	43002	Tres Passos	RGE
35012	Franca	CPFL_Paul	43013	Soledade	RS_COOP
35053	Paraibuna/Paraitinga	BANDEIRANTE	43015	Vacaria	RGE
35061	Sao Paulo	ELETROPAULO	43007	Santo angelo	RGE
35034	Dracena	ELEKTRO	43018	Santa Maria	AES_SUL
35002	Fernandopolis	ELEKTRO	43022	Cachoeira do Sul	AES_SUL
35010	Sao Joaquim da Barra	CPFL_Paul	43006	Cerro Largo	RGE
35045	Piedade	CPFL_Pirat	43024	Gramado-Canela	RGE
35008	Novo Horizonte	CNEE	43017	Santiago	RGE
35056	Itanhaem	ELEKTRO	43035	Litoral Lagunar	CEEE
35007	Nhandeara	CPFL_Paul	43012	Nao-Me-Toque	RGE
41015	Cornelio Procopio	COPEL	43030	Campanha Central	AES_SUL
41035	Cerro Azul	COPEL	50007	Tres Lagoas	ELEKTRO
41039	Rio Negro_pr	COPEL	50003	Alto Taquari	ENERSUL
41037	Curitiba	COCEL	50010	Dourados	ENERSUL
41004	Goioere	COPEL	50002	Aquidauana	ENERSUL
41002	Umuarama	COPEL	50008	Nova Andradina	ENERSUL
41001	Paranavai	COPEL	50011	Iguatemi	ENERSUL
41007	Porecatu	COPEL	50006	Paranaiba	ENERSUL
41025	Capanema	COPEL	50004	Campo Grande	ENERSUL
41023	Cascavel_pr	COPEL	50009	Bodoquena	ENERSUL
41006	Astorga	COPEL	50005	Cassilandia	ENERSUL
41038	Paranagua	COPEL	50001	Baixo Pantanal	ENERSUL
41034	Sao Mateus do Sul	COPEL	51016	Rosario Oeste	CEMAT
41010	Apucarana	COPEL	51010	Canarana	CEMAT
41020	Jaguariaiva	COPEL	51002	Alta Floresta	CEMAT
41013	Ivaipora	COPEL	51022	Alto Araguaia	CEMAT
41005	Campo Mourao	COPEL	51009	Norte Araguaia	CEMAT
41014	Assai	COPEL	51015	Alto Paraguai	CEMAT
41022	Toledo	COPEL	51011	Medio Araguaia	CEMAT
41026	Francisco Beltrao	COPEL	51020	Tesouro	CEMAT
41016	Jacarezinho	CPFL_Sta_C	51014	Jauru	CEMAT
41033	Uniao da Vitoria	COPEL	51001	Aripuana	CEMAT
41028	Pitanga	COPEL	51018	Alto Pantanal	CEMAT
41012	Faxinal	COPEL	51013	Tangara da Serra	CEMAT
41027	Pato Branco	COPEL	51004	Parecis	CEMAT
41011	Londrina	COPEL	51019	Primavera do Leste	CEMAT
41029	Guarapuava	CFLO	51017	Cuiaba	CEMAT
41021	Ponta Grossa	COPEL	51007	Sinop	CEMAT
41018	Wenceslau Braz	COPEL	51003	Colider	CEMAT
41024	Foz do Iguacu	COPEL	51012	Alto Guapore	CEMAT
41003	Cianorte	COPEL	51021	Rondonopolis	CEMAT
41030	Palmas	COPEL	51008	Paranatinga	CEMAT
41017	Ibaiti	COPEL	51006	Alto Teles Pires	CEMAT
41008	Florai	COPEL	51005	Arinos	CEMAT
41031	Prudentopolis	COPEL	52010	Goiania	CELG
41019	Telemaco Borba	COPEL	52012	Entorno de Brasilia	CELG
41032	Irati	COPEL	52014	Vale do Rio dos Bois	CELG
41036	Lapa	COPEL	52009	Anicuns	CELG
41009	Maringa	COPEL	52015	Meia Ponte	CELG
42009	Curitibanos	CELESC	52004	Porangatu	CELG
42003	Xanxere	IENERGIA	52005	Chapada dos Veadeiros	CELG
42014	Ituporanga	CELESC	52011	Vao do Parana	CELG
42011	Rio do Sul	CELESC	52008	Ipora	CELG
42004	Joacaba	CELESC	52007	Anapolis	CELG
42002	Chapeco	CELESC	52017	Catalao	CELG
42017	Tabuleiro	SC_COOP	52013	Sudoeste de Goias	CELG
42005	Concordia	CELESC	52003	Aragarcas	CELG
42001	Sao Miguel d'Oeste	CELESC	52002	Rio Vermelho	CELG
42015	Tijucas	CELESC	52006	Ceres	CHESP
42010	Campos de Lages	CELESC	52018	Quirinopolis	CELG
42016	Florianopolis	CELESC	52016	Pires do Rio	CELG
42012	Blumenau	CELESC	52001	Sao Miguel do Araguaia	CELG
42008	Joinville	CELESC	53001	Brasilia	CEB

Figure A1. Official Concession Areas of ANNEL

Figure A2. Regionalization of Concession Areas in the the IIOS-ANEEL