A procedure for scenarizing by changing direct input coefficients observing a supply and use tables framework

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Abstract

The utilization of the supply and use tables in substitution of the Leontief inverse is explored in this paper. A linear model of the interrelations of the tables is proposed and utilized in some practical examples based on the Brazilian economy of 2002 and 2004. It is demonstrated that the model substitutes the Leontief inverse with a high level of accuracy, and its gains are advocated particularly in what concerns the possibilities of simulation by changing the input coefficients of the intermediate consumption rectangular matrix.

Introduction

This paper is a partial result of a research program undertaken at IPT, Instituto de Pesquisas Tecnológicas de São Paulo, a public research institution of the Government of São Paulo, with the support of CPFL, – Companhia Paulista de Força e Luz, a major Brazilian electric utility.

Its purpose is to contribute to the practice of utilizing rectangular instead of symmetric input-output matrices for assessing the impact of final demand and value added changes on total production. A causal structure, based on linear relations and following the supply and use (SU) tables framework outlined by the United Nations 1993 System of National Accounts, will be proposed to be utilized as a model to scenarize the impact of changes in value added, intermediate and final demand in total production.

It will be demonstrated that, with the help of Excel VBA, it is possible to use this framework in substitution of the Leontief inverse. As a gain, the impact on the other variables of the SU tables, i.e., imports, sectors production, and taxes by type of product, can also be assessed.

Practical demonstrations will be provided utilizing observed Brazilian input-output data worked out from the new system of national accounts just made available by the national statistics authority (IBGE – Instituto Brasileiro de Geografia e Estatística). The matrix notation and major matrices relations utilized are in a note at the very end of the text.

Construction of the model

The structure of the model is the same as the one observed in the supply and use tables, as shown in Figure 1. The figures presented correspond to the Brazilian supply and used tables of 2004, with prices deflated to 2002 in order to be utilized latter in comparative examples used in the paper. Its construction follows the ordinal numbers and arrows indicated in the figure according to the steps described below.

1. Definition of GDP, external current account balance (X-M), value added by industry, final demand and intermediate demand as exogenous variables. In the case of intermediate demand, it was opted to make the columns proportional to observed data having as basis the total value added per industry. This, however, can be changed at will, as we will see.

2. Calculation of total product taxes, equals to the difference between GDP and total industries value added. Calculation of total product taxes by product keeping the same proportion in relation to the total. Calculation of total industries output by product (line totals) as the sum of total intermediate and final demand by product (condition of equilibrium for the Leontief model). The individual industries output by product kept the same proportion in relation to their totals per product, which means to keep the industrial output market share constant. This data, however, can also be changed at will, provided the totals per line observe the addition of intermediate and final demand. Calculation of remuneration and social contributions keeping the proportion to total value added per industry.
3. Calculation of net taxes on production, taxes on products, and level of occupation proportionally to the total production by industry (X' vector). Calculation of margins observing the same proportion in relation to total product output. Gross mixed income and operating surplus calculated as adjustment variable, by difference with the other components of value added per industry. Imports per industry also calculated as adjustment variable by difference with the other components of total production.
4. Calculation of total taxes on final demand products as the difference between the total taxes calculated in 2 and the total taxes on value added calculated in 3.
5. Calculation of taxes on final demand items keeping the proportion with the total taxes on final demand calculated in 4.
6. Calculation of total exports at purchaser's prices by adding the correspondent product taxes with the total at basic prices given exogenously in 1.

7. Calculation of total imports by difference between the total exports and the external current account balance as given in 1. Calculation of total imports by product observing the same proportions in relation to the total. Calculation of total imports for final demand by difference between the total imports and the total imports for production (adjustment variable calculated in 3). Calculation of total imports by item of final demand observing the same proportion in relation to the total imports for final demand.
8. Calculation of total final demand at purchaser's prices.
9. Calculation of both total production and total demand at purchaser's prices by addition.

[Figure 1 Example of the structure of the model]

Example of application

The objective of this example is to give a view of how the model operates as well as of its capability to substitute the Leontief inverse. We begin with the construction of a general economic scenario according to the supply and use tables framework as shown above, which is considered, just for the sake of example, as the observed, or present (p) situation. The corresponding major tables involved in the calculation of the Ledontief inverse under the commodity by industry account method, and the industry-based-technology hypothesis, are shown in Fig. 2

[Fig. 2 - Calculation of the Leontief inverse with the original values (Brazil 2004, prices of 2002)]

Le us now simulate the impact of an uniform increase of 15% of GDP, industry value added and X-M, obtaining a future situation f. The corresponding tables involved in the calculation of the Leontief inverse are shown in Fig. 3. We can see that Df (market share) remains equal to Dp, but Bf changes. In result, we have a different Af (DfBf) square input coefficients matrix, which will produce total production results (Xf) that respond to the strict linearity conditions dictated by the model.

[Fig.3 Calculation of the Leontief inverse, first future hypothesis (f)]

In case we had stopped at this point, we could not claim that the procedure was producing, as part of its results, the same simulation obtained by the Leontief inverse, for the simple reason that the A matrix is changed (Af is different than Ap). In other words, the model cannot tell the impact of the new final demand as given by the Ap matrix. However, with the help of a quite simple Excel VBA code, it is possible to obtain a new projection with the model, and on the basis of the Ap matrix, by making the Bf matrix to converge to the Bp matrix, keeping all the other exogenous hypotheses the same. As D remains the same, we will obtain the Ap matrix again. The new results are shown in Figure 4.

[Fig 4 Calculation of the Leontief inverse, second future hypothesis (f2)]

The situation now is as follows: Df2=Df=Dp; Bf2=Bp; Thus, Af2 = Df2Bf2=DpBp = Ap, which means that the model is obtaining the same result as if we were projecting Xf2 multiplying the Leontief inverse of the observed Ap matrix by Yf2, as the last line of the V'f2 table (which corresponds to Xf2') produced by the model shows (Fig 5).

[Fig 5 Supply of products given by the model, second future hypothesis (f2)]

It is important to stress that the model produces a V' table with the total production detailed by industry and type of product. Thus, besides substituting the traditional application of the Leontief inverse, it also brings the advantage of much wider possibilities of impact analysis, such as to check the structure of production by sector, or how taxes will change, as shown in Figure 5. It must be noted that it is possible to simulate changes in the D matrix, allowing the simulation of alternative structures of production to be compared with observed ones, but that will be the matter for future work. For now, let us go a bit deeper on the possibilities offered by the returns given by the model, as shown by the next figure.

[Figure 6 – Projections of the model assuming the same A matrix (%)]

The mapping of scenario projections observing the consistency fo the SU tables, as shown in Figure 6, promotes the evaluation important outcomes for public policy planning in the same fashion of the Leontief inverse, such as the changes in the level of occupation. On the other hand, also allows the easy identification of inconsistencies.

The negative variation of imports (-1.09%), for instance, indicates a too ambitious projection of external current account balance.

Special attention should be paid to the intermediate demand table. The constant results per column shall remind us that the hypothesis of fixed input proportions is just a proposition for the first rounds of the model. In the first projection f, that would be equated to the gross value added variation (15%) by construction. After making B to converge to its initial values, we have the results equated to the variations of the total production per sector (X'vector – last line of the output of industries table), now being in line with the concept of input coefficients having total production as a denominator. However, in practice these figures can change considerably with time, and the intermediate demand table certainly is a space of priority for scenario simulations of technologyical change. For doing so, the study of past behavior can be of much help, and that is the matter of the next section.

Validation

In order to perform this exercise, data of the new Brazilian system of national accounts, released in March of this year by IBGE – Instituto Brasileiro de Geografia e Estatísica – was utilizaed.[1]. The original data is presented as 110 x 55 production x sector tables, which in our case were converted in 110 x 47 tables due to the limitations of Excel to invert high rank square matrices. The aggregation consists of the Other Services and Public Services sectors, remaining the total of the industries disaggregated as in the original source. The intermediate consumption table at basic prices, needed to

[1] http://www.ibge.gov.br/home/estatistica/economia/contasnacionais/referencia2000/2005/default.shtm

calculate the Leontief inverse, was estimated with basis on the methodology proposed by GUILHOTO, J.J.M., U.A. SESSO FILHO (2005).

Let us also clarify that by validation is meant to show that the substitution of the Leontief inverse can be accomplished by the model for observed and more disaggregated national accounts within acceptable margins of error, that is, acceptable differences between the X vectors obtained by the model and by the Leontief inverse when independently applied to a common observed SU. For doing so, let us take the 2002 SU table as a basis of reference and separately apply the Leontief inverse and the model in order to obtain the total production of 2004 at prices of 2002. In the case of the model, its application was done as illustrated above, with basis on the SU tables of 2002, applying the final demand and value added of 2004, and converging the B matrix so as to reproduce the A matrix of 2002. In the case of the Leontief inverse, the total production of 2004 was obtained by applying the final demand of 2004 to the inverse of the A matrix of 2002. The difference between the total production vectors (X vectors) obtained by the two approaches is shown in Table 1.

[Table 1 –Total production obtained by the model and by the Leontief inverse for the Brazilian economy in 2004 with basis on data of 2002]

We can see that practically the same results were obtained either by the model (which appears in the last row of V') and through the Leontief inverse (LInv). The margins of error (in this case less than 0.0001%).can be calibrated by the model.

Another comparison worth to be made refers to the difference between the projections shown above and the actual data verified in 2004. This is shown in Table 2, where we can see that the total difference between the X projected (either by the model or by the Leontief inverse) and the X observed in 2004 was of 1.01%, much in line with other similar exercises.[2] The table also shows, however, a dispersion ranging from – 16.65% to + 22.73% for the results achieved for the individual industries. A closer examination of these figures certainly will bring important insights on the structural changes of the Brazilian economy in this period, and the model, as already seen above, can be of much help to simulate alternative futures with basis on the observed behavior.

[Table 2 – Comparison between the total production projected and observed for 2004]

Future developments

The future developments envisaged at the moment address two sorts of application. The first is aimed at the development of public policies related to new forms of energy conversion, particularly in what concerns to the impact of distributed generation and the technologies involved. As it has been pointed out, the procedure here presented is perfectly adequate for simulating changes of production processes as represented by the intermediate consumption matrix. It also can be utilized for the analysis of the impact of new technologies with basis on their cash flows (PAIXÃO,

[2] Anne Carter, for instance, reached 0.8% between 1958 and 1961, MILLER R.E.; BLAIR P.D. (1985), p.269.

P.,2005). A second field of analysis will be more concerned with projections of electricity consumption. For this practice, it is fundamental to scenarize different alternatives of the structure of growth, so as to distinguish different possibilities of demand in function of the electricity consumption intensity of the different sectors of production and final consumption. Again, thanks to the possibility of mapping the growth of production and final demand by sector and commodity, the model can be of significant utility.

Conclusions

The possibility of assessing the impact of final demand on total economic production substituting the square Leontief inverse by the rectangular matrices of the supply and use tables framework was demonstrated as a practical case applied to the Brazilian economy. The linear model utilized is capable of simulating not only the impact of exogenous final demand, but also of intermediate demand, thus having considerable potential for the analysis of alternative outcomes of structural and technological change.

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Notation and basic relations

The notation of matrices utilized in the work is the same as the one employed in MILLER R.E.; BLAIR P.D. (1985), chapter 5. Thus, making reference to Figure 1, the output of industries is V'(the ' stands for transpose, being V' the transpose of V), the total production of industries (totals' line of V') is X', the final demand of commodities is E, and the intermediate consumption of commodities is U. Making reference to Figure 2, B is the rectangular matrix of input coefficients = UX_d^{-1}, being X_d the diagonal of X. Q is the total column vector of total output of commodities, and D is the market share of commodities output per industry, $D = VQ_d^{-1}$. A is the square input coefficients matrix, and on the technology-by-industry hypothesis, A = DB. Being I the identity matrix, the Leontief inverse is equal to $(I-A)^{-1}$, and being Y = DE,

$$X = (I-A)^{-1}Y.$$

Figure 1 Example of the structure of the model

	1=>	1,582	GDP										
	1=>	32	X-M				**2**						
	SUPPLY OF PRODUCTS - 2004				Output of industries (basic prices)								
	R$ billions 2002	Total supply at purchaser's prices	Margins	Taxes on products	Primary	Secondary	Terciary	Total	Imports				
	Agriculture, hunting, forestry and fishing	169	16	7	141	0	0	141	4				
	Mining, quarrying, textiles, paper products	525	71	41	10	366	3	379	34				
	Eletromechanic, Utilities and Construction	1,173	128	114	0	795	3	798	133				
	Services	1,258	-215	56	0	2	1,378	1,380	37				
9=>	Total	3,124	0	219	152	1,162	1,384	2,698	208	**<=7**			
	USE OF PRODUCTS 2004		**3**	**2**	Intermediate demand (basic pr.)				Final demand				
	R$ billions 2002				Primary	Secondary	Terciary	Total	Exports	Other Final Demand	Total	Total Demand at basic prices	
	Agriculture, hunting, forestry and fishing				13	77	2	92	15	33	49	141	
	Mining, quarrying, textiles, paper products				10	114	44	167	76	136	212	379	
	Eletromechanic, Utilities and Construction			**1=>**	19	301	91	411	103	284	387	798	
	Services				8	131	281	419	30	930	961	1,380	
	Total				49	623	418	1,090	224	1,383	1,607	2,698	
	VALUE ADDED 2004									**1**			
	R$ billions 2002				Primary	Secondary	Terciary	Total					
	Gross value added				91	378	893	1,362	**<=1**				
2=>	Remunerations and social contibutions				33	148	448	629					
adj=>	Gross mixed income and operating surplus				58	221	436	715					
3=>	Net taxes on production				1	9	9	18		**5**	**4**		
3=>	Taxes on products				4	59	45	108	15	96	111	219	**<=2**
adj=>	Imports				7	102	28	137		71	71	208	**<=7**
	Final demand at purchaser's prices								240	1,549	1,789		
	Total demand at purchaser's prices								**6**	**8**		3,124	**<=9**
3=>	Occupation (thousands of individuals)				18,874	17,060	52,311	88,245					

Fig. 2 - Calculation of the Leontief inverse with the original values (Brazil 2004, prices of 2002)

				Bp		
Dp				0.0862	0.0666	0.0014
0.9991	0.0267	0.0006	0.0000	0.0629	0.0977	0.0317
0.0000	0.9664	0.9960	0.0011	0.1228	0.2594	0.0659
0.0009	0.0069	0.0034	0.9989	0.0532	0.1124	0.2029

			Yp				Xp=(I-Ap)$^{-1}$Yp
Ap = DpBp			55	(I-Ap)$^{-1}$			152
0.0878	0.0694	0.0022	591	1.122	0.123	0.018	1,162
0.1832	0.3530	0.0965	962	0.336	1.616	0.197	1,384
0.0540	0.1139	0.2031	**1,607**	0.124	0.239	1.284	**2,698**

Fig.3 Calculation of the Leontief inverse, first future hypothesis (f)

				Bf		
Df				0.0874	0.0665	0.0014
0.9991	0.0267	0.0006	0.0000	0.0638	0.0974	0.0325
0.0000	0.9664	0.9960	0.0011	0.1245	0.2587	0.0675
0.0009	0.0069	0.0034	0.9989	0.0539	0.1121	0.2079

			Yf				$Xf=(I-Af)^{-1}Yf$
Af = DfBf			60	$(I-Af)^{-1}$			172
0.0891	0.0692	0.0023	683	1.124	0.123	0.019	1,340
0.1858	0.3520	0.0989	1,068	0.342	1.615	0.203	1,553
0.0548	0.1135	0.2081	**1,812**	0.127	0.240	1.293	**3,065**

Fig 4 Calculation of the Leontief inverse, second future hypothesis (f2)

				Bf2		
Df2				0.0862	0.0666	0.0014
0.9991	0.0267	0.0006	0.0000	0.0629	0.0977	0.0317
0.0000	0.9664	0.9960	0.0011	0.1228	0.2594	0.0659
0.0009	0.0069	0.0034	0.9989	0.0532	0.1124	0.2029

			Yf2				Xf2=(I-Af2)$^{-1}$Yf2
Af2 = Df2Bf2			60	(I-Af2)$^{-1}$			171
0.0878	0.0694	0.0022	683	1.122	0.123	0.018	1,334
0.1832	0.3530	0.0965	1,068	0.336	1.616	0.197	1,543
0.0540	0.1139	0.2031	**1,812**	0.124	0.239	1.284	**3,048**

Fig 5 Supply of products given by the model, second future hypothesis (f2)

SUPPLY OF PRODUCTS - f2 R$ billions 2002	Total supply at purchaser's prices	Margins	Taxes on products	Output of industries (basic prices)				Imports
				Primary	Secondary	Terciary	Total	
Agriculture, hunting, forestry and fishing	190	18	8	159	0	0	159	4
Mining, quarrying, textiles, paper products	596	81	47	12	419	3	433	34
Eletromechanic, Utilities and Construction	1,327	147	132	1	914	3	917	131
Services	1,393	-246	65	0	2	1,537	1,538	36
Total	3,506	0	252	171	1,334	1,543	3,048	205

Figure 6 – Projections of the model assuming the same A matrix (%)

SUPPLY OF PRODUCTS				Output of industries (basic prices)							
R$ billions 2002	Total supply at purchaser's prices	Margins	Taxes on products	Primary	Secondary	Terciary	Total	Imports			
Agriculture, hunting, forestry and fishing	12.68%		15.00%	12.94%	0.00%	12.94%	12.94%	-1.09%			
Mining, quarrying, textiles, paper products	13.52%		15.00%	14.49%	14.49%	14.49%	14.49%	-1.09%			
Eletromechanic, Utilities and Construction	13.15%		15.00%	14.97%	14.97%	14.97%	14.97%	-1.09%			
Services	10.72%		15.00%	0.00%	11.47%	11.47%	11.47%	-1.09%			
Total	12.21%		15.00%	13.05%	14.81%	11.48%	13.00%	-1.09%			

USE OF PRODUCTS				Intermediate demand (basic pr.)				Final demand			
R$ billions 2002				Primary	Secondary	Terciary	Total	Exports	Other Final Demand	Total	Total Demand at basic prices
Agriculture, hunting, forestry and fishing				13.05%	14.81%	11.48%	14.49%	12.00%	16.00%	10.00%	12.94%
Mining, quarrying, textiles, paper products				13.05%	14.81%	11.48%	13.83%	7.00%	12.00%	15.00%	14.49%
Eletromechanic, Utilities and Construction				13.05%	14.81%	11.48%	13.99%	13.00%	15.00%	16.00%	14.97%
Services				13.05%	14.81%	11.48%	12.55%	17.00%	15.00%	11.00%	11.47%
Total				13.05%	14.81%	11.48%	13.46%	0.00%	0.00%	0.00%	13.00%

VALUE ADDED											
R$ billions 2002				Primary	Secondary	Terciary	Total				
Gross value added				15.00%	15.00%	15.00%	15.00%				
Remunerations and social contibutions				15.00%	15.00%	15.00%	15.00%				
Gross mixed income and operating surplus				15.02%	15.01%	15.07%	15.05%				
Net taxes on production				13.05%	14.81%	11.48%	13.16%				
Taxes on products				13.05%	14.81%	11.48%	13.36%	16.60%	16.60%	16.60%	15.00%
Imports				-13.53%	14.10%	-99.17%	0.00%	0.00%	-3.20%	-3.20%	-1.09%
Final demand at purchaser's prices								1.07%	0.88%	0.90%	
Total demand at purchaser's prices											12.21%
Occupation (thousands of individuals)				13.05%	14.81%	11.48%	12.46%				

Table 1 –Total production obtained by the model and by the Leontief inverse for the Brazilian economy in 2004 with basis on data of 2002

Industry	X obtained by the model	X obtained by the Leontief inverse	Mod/LInv
Agriculture, hunting and forestry	98,629	98,629	0.000010%
Farming of animals and fishing	50,882	50,882	0.000007%
Extraction of oil and natural gas	35,305	35,305	0.000066%
Extraction of iron ore	13,448	13,448	0.000012%
Other mining activities	9,304	9,304	0.000036%
Manufacture of food products and beverages	172,158	172,158	0.000004%
Manufacture of tobacco products	7,114	7,114	0.000000%
Manufacture of textiles	28,241	28,241	0.000011%
Manufacture of wearing apparel	19,411	19,411	0.000002%
Manufacture of leather products anf footwear	18,468	18,468	0.000001%
Manufacture of wood products except furniture	14,337	14,337	0.000008%
Manufacture of pulp and paper products	28,008	28,008	0.000017%
Manufacture of papers, magazines and records	22,972	22,972	0.000016%
Oil and coke refining	62,731	62,731	0.000036%
Manufacture of ethanol	9,271	9,271	0.000028%
Manufacture of chemical products	34,857	34,857	0.000043%
Manufacture of plastics in primary forms and of synthetic rubber	12,909	12,909	0.000033%
Manufacture of pharmaceuticals	17,684	17,684	0.000003%
Manufacture of pesticides and other agrochemical products	6,263	6,263	0.000020%
Manufacture cleaning products and perfumes	12,715	12,715	0.000007%
Manufacture of paints, varnishes and similar coatings	5,977	5,977	0.000013%
Manufacture of other chemical products	8,303	8,303	0.000029%
Manufacture of rubber and plastics products	27,256	27,256	0.000019%
Manufacture of cement	4,767	4,767	0.000013%
Manufacture of other non-metallic mineral products	17,272	17,272	0.000010%
Manufacture of steel and steel products	39,737	39,737	0.000021%
Manufacture of non-ferrous metals	20,265	20,265	0.000020%
Manufacture of metal products except machinery and equipment	33,390	33,390	0.000023%
Machinery and equipment, including maintenance and repair	43,877	43,877	0.000011%
Manufacture of domestic appliances	5,488	5,488	0.000001%
Manufacture of office and computing machinery	10,287	10,287	0.000003%
Manufacture of electrical machinery and apparatus	20,167	20,167	0.000021%
Manufacture of electronic material and communication equipment	24,955	24,955	0.000006%
Manufacture of medical appliances/instruments and optical instrun	8,545	8,545	0.000003%
Manufacture of automobiles and vans	41,124	41,124	0.000000%
Manufacture of trucks and buses	10,465	10,465	0.000001%
Manufacture of parts and accessories for motor vehicles	27,909	27,909	0.000011%
Manufacture of other transport equipment	17,926	17,926	0.000004%
Furniture and other industry	24,219	24,219	0.000004%
Electricity, gas and water supply/collection/treatment	96,770	96,770	0.000030%
Construction	134,625	134,625	0.000002%
Wholesale and retail trade	243,174	243,174	0.000008%
Transport, storage and post services	107,861	107,861	0.000022%
Information services	94,241	94,241	0.000016%
Financial intermediation and insurance	159,745	159,745	0.000011%
Other services	499,411	499,411	0.000007%
Public services	322,377	322,377	0.000001%
Total	**2,724,842**	**2,724,842**	**0.000011%**

Table 2 – Comparison between the total production projected and observed for 2004.

Industry	X_{2004}/A_{2002}	X_{2004} Obs	Mod/Obs
Agriculture, hunting and forestry	98,629	100,257	-1.62%
Farming of animals and fishing	50,882	51,430	-1.07%
Extraction of oil and natural gas	35,305	35,186	0.34%
Extraction of iron ore	13,448	13,050	3.05%
Other mining activities	9,304	8,855	5.07%
Manufacture of food products and beverages	172,158	171,664	0.29%
Manufacture of tobacco products	7,114	7,168	-0.76%
Manufacture of textiles	28,241	27,899	1.22%
Manufacture of wearing apparel	19,411	19,313	0.50%
Manufacture of leather products anf footwear	18,468	18,215	1.39%
Manufacture of wood products except furniture	14,337	14,842	-3.40%
Manufacture of pulp and paper products	28,008	28,334	-1.15%
Manufacture of papers, magazines and records	22,972	22,304	3.00%
Oil and coke refining	62,731	66,109	-5.11%
Manufacture of ethanol	9,271	9,028	2.69%
Manufacture of chemical products	34,857	38,095	-8.50%
Manufacture of plastics in primary forms and of synthetic rubber	12,909	15,199	-15.06%
Manufacture of pharmaceuticals	17,684	17,764	-0.45%
Manufacture of pesticides and other agrochemical products	6,263	7,180	-12.76%
Manufacture cleaning products and perfumes	12,715	12,910	-1.51%
Manufacture of paints, varnishes and similar coatings	5,977	5,980	-0.05%
Manufacture of other chemical products	8,303	9,370	-11.39%
Manufacture of rubber and plastics products	27,256	28,461	-4.23%
Manufacture of cement	4,767	5,144	-7.33%
Manufacture of other non-metallic mineral products	17,272	17,802	-2.98%
Manufacture of steel and steel products	39,737	39,043	1.78%
Manufacture of non-ferrous metals	20,265	17,742	14.22%
Manufacture of metal products except machinery and equipment	33,390	32,488	2.78%
Machinery and equipment, including maintenance and repair	43,877	44,704	-1.85%
Manufacture of domestic appliances	5,488	5,630	-2.53%
Manufacture of office and computing machinery	10,287	11,003	-6.50%
Manufacture of electrical machinery and apparatus	20,167	20,769	-2.90%
Manufacture of electronic material and communication equipment	24,955	25,310	-1.40%
Manufacture of medical appliances/instruments and optical instrun	8,545	8,394	1.79%
Manufacture of automobiles and vans	41,124	39,980	2.86%
Manufacture of trucks and buses	10,465	12,555	-16.65%
Manufacture of parts and accessories for motor vehicles	27,909	30,692	-9.07%
Manufacture of other transport equipment	17,926	17,808	0.66%
Furniture and other industry	24,219	23,876	1.44%
Electricity, gas and water supply/collection/treatment	96,770	98,069	-1.32%
Construction	134,625	134,155	0.35%
Wholesale and retail trade	243,174	198,145	22.73%
Transport, storage and post services	107,861	121,329	-11.10%
Information services	94,241	97,802	-3.64%
Financial intermediation and insurance	159,745	150,859	5.89%
Other services	499,411	493,895	1.12%
Public services	322,377	321,842	0.17%
Total	**2,724,842**	**2,697,648**	**1.01%**