



Foundations of International Flow-of-Funds Accounts

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Abstract

The current version of the balance of payments statistics (BPM6) consists of the goods and services account, the primary income account, the secondary income account, the capital account, and the financial account. The accounts are to be compiled on a horizontal double-entry bookkeeping basis; it ensures the consistency of recording for each transaction category by counterparties. The nature of horizontal double entry allows the bilateral international transactions to be presented in a from-whom-to-whom matrix format; several international organizations publish such statistics. This paper is an attempt to tentatively make an international flow of funds accounts using the available data. The from-whom-to-whom matrix consists of 242 economic regions, and covers the goods and services account, the primary account, and FDI and portfolio investment portion of the financial account of the balance of payments statistics. The enhancement of balance of payments statistics in the from-whom-to-whom format and accompanying analytical tools will surely promote the better understanding of the flow of funds at the global perspective.

Keywords: Balance of Payments; From Whom To Whom; Structural Analysis; Matrix Triangulation; Dispersion Indices.

1. Introduction

The balance of payments is by far the most widely used statistics to depict the international transactions, however, there is a pervasive conceptual confusion about the meaning of ‘balance of payments’. It is widely acknowledged that Misselden (1623) was the first author who used the expression ‘balance of trade’. The impression very generally given in economic literature is that the Mercantilists’ ‘balance of trade’ was a balance of commodity trade (Fetter (1935)). This is far from the truth because Misselden took freight and other services provided by merchants into consideration when he wrote of ‘balance of trade’ (*Ibid.* p. 124). Petty (1690) wrote that the labor of seamen and freight of ships are of the nature of an exported or imported commodity (p. 19). The word ‘balance of debt’ was first introduced by Foster (1804), which was defined as the difference between the amount payable and amount receivable (p. 4). While ‘balance of trade’ covers only the current transactions, such as sales of goods and services, remuneration for labor, etc., ‘balance of debt’ also includes lending, borrowing, sale of negotiable instruments, etc. The term ‘balance of payments’ soon replaced ‘balance of debt’. For example, Bosanquet (1810) frequently used the former expression but with a slightly different connotation.

In the year of 1792, France declared war on Great Britain so that the British government’s military expenses rose very quickly. By 1797, the Bank of England’s gold reserves had been reduced to dangerously low levels as a result of heavy demands for gold redemptions from both domestic and foreign note holders; to save the Bank from bankruptcy, the British government passed the Bank Restriction Act to free the central bank from

converting bank notes and other financial claims into gold. However in 1809, the newly-officialized United Kingdom experienced a rapid depreciation of its currency and a mass exodus of gold bullion. A committee of House of Commons was appointed to 'inquire into the cause of the high price of bullion, and to take into consideration the state of the circulating medium, and of the exchanges between Great Britain and foreign parts'. Bosanquet and his contemporary authors used the expression 'balance of payments' as a synonymous to the 'international shipment of gold bullion'.

As Frisch (1947) remarked, as far as exchange transactions are concerned, the balance settled in anything with highest degree of liquidity is commonly referred to as 'balance of payments'; obviously it could be gold but it is not necessary to be gold. The Bretton Woods system was an international monetary system, which was developed at the United Nations Monetary and Financial Conference held in Bretton Woods, New Hampshire, on July 1-22, 1944. Although gold formally served as the base reserve, the U.S. dollar was mainly used as an international reserve currency, which was then convertible to gold. On the 15th of August 1971, after the prolonged negative balance of payments, the United States finally terminated convertibility of the U.S. dollar to gold. The currencies of the world are no longer pegged to gold either directly or indirectly. In the current IMF regime, the currency of the members that the IMF considers to be in a sufficiently strong external position that their currency can be used to settle international accounts is classified as 'usable currencies' (IMF (2014), p. 22); specifically the four currencies, the U.S. dollar, euro, Japanese yen, and pound sterling, whose basket the value of the SDR is based on, are widely regarded as 'international currency'.

2. Balance of Payments Statistics

The sixth edition of Balance of Payments and International Investment Position Manual, widely known as BPM6, defines that the balance of payments statistics as a statement that summarizes economic transactions between residents and nonresidents of an economic territory during a specific time period (BPM6 2.2). It consists of the goods and services account, the primary income account, the secondary income account, the capital account, and the financial account. The accounts for an economy are to be compiled on a vertical double-entry bookkeeping basis from the perspective of the residents of that economy. The main characteristic of vertical double-entry bookkeeping is that each transaction leads to at least two corresponding entries, traditionally referred to as a credit entry and a debit entry. Because each transaction is either an exchange or a transfer, it requires two entries. This principle ensures that the total of all credit entries and that of all debit entries for all transactions are equal (BPM6 3.27). The concept of horizontal double-entry bookkeeping is that if unit A provides something to unit B, the accounts of both A and B show the transaction for the same amount: as a payment in A's account and as a receipt in B's account. Horizontal double-entry bookkeeping ensures the consistency of recording for each transaction category by counterparties (BPM6 3.28).

The nature of horizontal double entry allows the bilateral international transactions to be presented in a from-whom-to-whom matrix format; several international organizations publish such statistics. The OECD STAN Bilateral Trade by Industry and End-use (BTDIxE) consists of values of imports and exports of goods, broken down by reporting and partner countries, and by both industrial activities and end-use categories. Estimates are expressed in nominal terms, in current US dollars and are presented in the form of time-series for more than a hundred reporters and partners, including all 34 OECD member countries, as well as a wide range of non-member economies. OECD Statistics on International Trade in Services aims to assemble and disseminate balance of payments data on trade in services shown in US dollars

at the most detailed partner-country and service-category level available. To the extent that countries report them, data are also broken down by type of service according to the Extended Balance of Payments Services Classification (EBOPS). These two datasets provide the from-whom-to-whom matrices that correspond to the goods and services account of the balance of payments statistics.

OECD Database on Foreign Direct Investment (FDI) Statistics include annual and quarterly aggregate FDI statistics for 34 OECD member countries and for seven non-OECD G20 countries (Argentina, Brazil, China, India, Indonesia, Saudi Arabia and South Africa). Datasets related to FDI financial flows and positions by partner country are presented on a directional basis. Under the directional presentation, the direct investment flows and positions are organized according to the direction of the investment for the reporting economy—either outward or inward; inward and outward FDI statistics by partner country are presented by immediate host and immediate destination country. IMF Coordinated Portfolio Investment Survey (CPIS) reflect end-June and end-December data on portfolio investment holdings (equity and debt securities) reported by participating economies. Global Tables comprise tables for cross-border holdings of securities and derived liabilities based on the creditor data; the geographic breakdown of the reported data is limited to the CPIS participating economies, while the geographic breakdown of the derived data covers all economies that issue securities that are held by CPIS participating economies. These two datasets provide the from-whom-to-whom matrices that correspond to the financial account of the balance of payments statistics; however, financial derivatives, employee stock options, and other investment are excluded.

3. Tools for Structural Analysis

In linear algebra, a triangular matrix is a special kind of square matrix. The principal diagonal of a square matrix \mathbf{X} is the collection of entries x_{ij} where $i = j$; a square matrix is called lower triangular if all the entries above the principal diagonal are zero. Triangulation is a technique to simultaneously rearrange the rows and columns of a square matrix to transform it into lower triangular; if the i 'th row of the original matrix is shifted to the j 'th row, then the i 'th column must be shifted to the j 'th column. If all the entries above the principal diagonal are zero as a result of the rearrangement, the matrix is referred to as strictly (lower) triangular matrix. Although several algorithms for triangulation were proposed by Simpson and Tsukui (1965) and Fukui (1986), there are more simple alternatives. Let R_i be the number of zero entries in the i 'th row; and C_i be the number of zero entries in the i 'th column. The triangulation that rearrange the rows and columns in the descending order of R_i is referred to as triangulation according to row. The triangulation that rearrange the rows and columns in the ascending order of C_i is referred to as triangulation according to column. The triangulation that rearrange the rows and columns in the descending order of $R_i + (n - C_i)$, where n is the number of rows and columns, is the hybrid method of triangulation. As Leontief (1963) pointed out, in the hierarchical order of a structure with a strictly triangular from-whom-to-whom matrix, the lower units affect the upper units but not vice versa.

There is no universal indicator of from-whom-to-whom matrix structure, however, Rasmussen (1956) proposed in relation to the input-output accounts to use Leontief inverse rather than the input coefficients to create indicators. Let \mathbf{X} be a square matrix, then $\mathbf{\Gamma} = (\mathbf{I} - \mathbf{X}\mathbf{T}^{-1})^{-1}$, where $\mathbf{T} = \text{diag}(\text{maxi}(\mathbf{X}\mathbf{i}, \mathbf{X}\mathbf{i}))$, is known as Leontief inverse; maxi is



an operator that gives a vector each of whose element is the max of the corresponding elements of the vectors shown in the parenthesis. Rasmussen referred to $\gamma_{PDI} = \Gamma \mathbf{i} (\mathbf{i}' \Gamma \mathbf{i})^{-1}$ as power of dispersion indices; and $\gamma_{SDI} = \Gamma \mathbf{i} (\mathbf{i}' \Gamma \mathbf{i})^{-1}$ as sensitivity of dispersion indices. If a square matrix \mathbf{X}^S represents from-whom-to-whom relationship, there is a corresponding matrix $\mathbf{X}^K = (\mathbf{X}^S)'$ that represents to-whom-from-whom relationship so that there are two pairs of dispersion indices $\gamma_{PDI}^S, \gamma_{SDI}^S, \gamma_{PDI}^K$ and γ_{SDI}^K ; the former pair is referred to as Stone formula while the latter pair is as Klein formula. While the triangulation depicts the direct linkage hierarchy between units, the dispersion indices measure the degree of indirect as well as direct interdependence among the units.

4. From-Whom-To-Whom Balance of Payments Structure of the World

As we have already mentioned, several international organizations publish balance of payments statistics in the from-whom-to-whom matrix format: BTDIXE, EBOPS, FDI Statistics and CPIS. While the first two statistics cover the goods and service accounts, the latter two do the FDI and portfolio investment part of the financial accounts. Since both FDI Statistics and CPIS publish from-whom-to-whom stock matrices, we compiled from-whom-to-whom investment income matrices by allocating each country's investment income according to the investee's share. In addition to that, we composed from-whom-to-whom compensation-of-employees matrix in the same manner using the stock of foreign population by nationality published as a part of the OECD International Migration Database. These three matrices cover almost entire part of the primary income account. Finally, we made a from-whom-to-whom balance-of-payments matrix by adding up all the above matrices. In this matrix, the balance of payments include not only deposits and reserves, which is considered to be the main components of the 'balance of payments' but also what should be dealt in the secondary income and capital accounts, however, in most economic regions the latter two accounts are negligible.

Our from-whom-to-whom balance-of-payments matrix for 2012 consists of 242 economic regions of the world, plus international organizations that include IMF and World Bank. The top five gross payers are United States, China, Germany, United Kingdom and France; top five gross recipients are United States, Germany, China, United Kingdom and Japan in that order. The top five net payers are United States, Hong Kong, Japan, Luxembourg and Singapore; top five net recipients are China, Russia, Saudi Arabia, Malaysia and Taiwan. We will confine the following discussion to the top 30 gross payers and recipients of the world.

As we have mentioned, the triangulation is an analytical technique that examines the direct linkage hierarchy between economic regions. Since international payments between economic regions are more or less balanced, it is rather difficult to directly triangulate the balance-of-payments matrix so that we modified the original matrix before triangulation. Let $\mathbf{Y}^* = \mathbf{Y} - \mathbf{Y}'$ where \mathbf{Y} is a from-whom-to-whom payment matrix; if $y_{ij}^* < 0$ then $x_{ij} = 0$ else $x_{ij} = y_{ij}^*$. The five countries at the top of the lower triangle are Taiwan, Thailand, Brazil, Russia and China. These countries export their products such as manufactured goods to all over the world so that receive payments from many regions; and invest the surplus funds by purchasing negotiable instruments from a limited number of economic regions, however, it

might be because of missing data in CPIS. The five countries at the bottom of the lower triangle are United States, Norway, Hong Kong, Belgium and Luxembourg. Indeed, these countries are great importers, however, the most prominent thing is that they are most active investors of the world in terms of FDI so that they invest in almost anywhere in the world.

The dispersion indices measure the degree of indirect as well as direct interdependence among the economic regions. Stone-formula PDI is an indicator of the region's presence in the world as either an exporter or investee. Austria, Poland, Belgium, Russia and Sweden have the largest Stone-formula PDI while Hong Kong, Singapore, United States, India and Luxembourg's PDI are the smallest among the big players. The economic regions with the largest Stone-formula SDI, such as United States, Germany, United Kingdom, China and France, are supposed to be a last resort as a fund supplier. In contrast to this, Saudi Arabia, Malaysia, United Arab Emirates, Thailand and Taiwan have the smallest SDI. Klein-formula PDI is an indicator of the region's presence in the world as either an importer or investor. Canada, Austria, Germany, Norway and United Kingdom have the largest Klein-formula PDI while Saudi Arabia, Malaysia, Taiwan, Russia and China's PDI are the smallest among the big players. The economic regions with the largest Klein-formula SDI, such as United States, China, Germany, United Kingdom and France, are supposed to be the final destination of the surplus funds. In contrast to this, United Arab Emirates, Thailand, Hong Kong, Turkey and Poland have the smallest SDI. Unlike PDI, the Stone-formula and Klein-formula SDI are highly correlated. The economic regions with highest SDI are considered to be the financial centers of the world.

5. Concluding Remarks

This paper is meant to be an attempt to tentatively make the international flow of funds accounts using the available data. The from-whom-to-whom matrix consists of 242 economic regions, and covers the goods and services account, the primary income account, and FDI and portfolio investment portion of the financial account of the balance of payments statistics. Therefore, the balance of payments include not only deposits and reserves, which is considered to be the main components of the 'balance of payments' but also what should be dealt in the secondary income and capital accounts. Although in most economic regions the latter two accounts are negligible, it will be desirable if the international organizations supply from-whom-to-whom matrices that covers the two remaining accounts. Another problem is that there are so many missing entries in the metadata of the investment statistics. The enhancement of balance of payments statistics in the from-whom-to-whom format and accompanying analytical tools will surely promote the better understanding of the flow of funds at the global perspective.

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Table: From-whom-to-whom balance-of-payments matrix for 2012 (million US dollars, top 30 payers and recipients)

	Australia	Austria	Belgium	Brazil	Canada	China	France	Germany	HK	India	Ireland	Italy	Japan	Korea	Lux.	Malaysia	Mexico	Neth.	Norway	Poland	Russia	S. Arabia	Singapore	Spain	Sweden	Switz.	Taiwan	Thailand	Turkey	UAE	UK	US	ROW
Australia	993	1089	2343	1172	11289	49788	8470	84396	6973	5913	4278	1289	26343	1903	3859	12241	7393	3989	3036	1448	499	21798	3829	4905	168	6344	11709	2078	3171	33964	76341	77697	
Austria	529	0	4715	768	484	8488	11510	74657	444	1053	1695	15418	-3187	1137	14914	692	864	0	915	8925	3148	762	705	1574	4217	14689	769	797	7659	645	4503	14635	6348
Belgium	3154	2893	-202	4144	3182	17966	78225	97896	2132	6233	17220	20173	11275	0	0	890	1900	88116	22252	7072	10943	1705	6941	2625	0	1318	2046	4939	3737	41952	78917	96183	63346
Brazil	1477	1971	7870	0	5951	34346	7274	17604	399	5044	1163	8204	9643	9554	1099	8205	5971	2801	646	2909	3193	864	4679	2452	3186	3166	2054	989	309	7134	98937	65097	
Canada	6826	1998	1825	4875	3055	88912	19719	30758	4465	5917	3031	8088	24143	9914	18889	8280	30222	5888	8304	4162	2946	3218	4816	4165	5749	7405	9909	2071	5835	242	32056	44319	93389
China (Mainland)	86483	5732	12442	52081	24686	142020	32737	108817	95206	19797	7088	18220	186779	187935	6913	98110	8248	11287	6968	2002	45666	48681	20068	7599	9365	24000	129189	39598	3039	10892	23697	170798	409883
France	8826	5302	104889	10547	10715	81788	6396	129234	6547	9385	38014	87402	23930	11175	77381	9132	4588	95008	16088	14725	29194	7885	6997	47417	17684	39111	2343	6025	9163	3430	91729	76118	299342
Germany	14889	1184	10940	9396	3313	56143	9685	18253	8443	0	5163	6121	14780	17562	343	16645	9499	3078	1708	932	5468	39227	3795	1928	2335	28994	4349	5493	1098	97799	10939	37152	171360
Hong Kong	14314	1010	8245	2382	10993	354157	11516	17692	0	11978	1187	7569	63133	34898	18735	16309	669	7703	1227	307	980	891	46821	5279	1719	21807	38971	15892	327	5175	52030	80006	88117
India	1644	17881	21419	6338	3448	38918	62337	65860	2147	7069	3728	0	6613	4736	49024	1200	1676	18775	3180	10214	27504	13205	841	33820	5208	24809	2773	678	9897	2978	16847	19884	189695
Ireland	9343	2917	12418	4050	4897	6263	38675	38222	2028	1189	0	10047	6636	4422	20719	1570	5988	28975	4985	3271	3344	222	0	6195	9642	3272	1527	1789	3289	1252	99029	68822	148636
Italy	1644	17881	21419	6338	3448	38918	62337	65860	2147	7069	3728	0	6613	4736	49024	1200	1676	18775	3180	10214	27504	13205	841	33820	5208	24809	2773	678	9897	2978	16847	19884	189695
Japan	78445	2413	17105	16580	24827	211604	145995	41305	15324	10580	13821	11610	0	60673	0	38732	8789	49913	0	4532	22772	55818	24831	1391	13889	20651	30322	28771	2832	45278	34311	261181	274921
Korea (RCP)	29729	1517	1842	8437	7383	102389	10789	23829	8023	7889	2081	5902	22361	52	3019	10449	3984	8822	5869	1091	12390	39978	10632	2099	2387	8712	14208	9848	138	10217	12940	83989	180424
Luxembourg	0	1833	28336	8736	18873	7203	40002	48340	14883	5148	17939	38380	6711	7748	0	8910	16635	46466	4399	3378	18002	69	10332	9658	31735	4113	3178	8109	10096	11752	150257	152098	191958
Malaysia	7716	527	951	1792	1403	28859	5282	9000	6098	3789	789	1918	24179	9746	140	57	280	2781	448	168	884	2431	30845	579	866	1700	8112	11839	654	4397	3160	20970	34905
Mexico	4238	974	1952	6905	11066	37009	4919	16438	340	2968	1161	6016	18027	1424	221	4737	0	10222	346	495	1227	697	1371	10014	1601	6890	6188	3807	427	190	1001	22937	28775
Netherlands	6820	11671	66140	11428	5378	48907	66107	41877	8098	8307	37591	24575	33683	5637	23980	9438	5104	0	20572	11460	32324	6825	15087	13517	17110	6232	4434	4884	8920	2002	71997	106189	184285
Norway	10782	1232	14293	4184	9225	12101	7038	29036	2192	2969	4198	2432	17300	8081	5424	2273	5198	10257	0	5498	5447	101	3074	346	27544	14006	3873	2595	4117	342	18790	52461	67825
Poland	11781	4762	5982	927	800	17521	9933	46602	270	1327	2118	11567	3098	4608	224	696	361	8555	3898	0	29433	274	897	4664	3717	2025	1020	859	2849	106	6531	7842	49179
Russia	1324	8253	9374	3449	3339	53920	21820	50001	438	3383	2907	17466	16466	12183	2077	1469	1235	9547	2480	9162	0	372	597	8667	6265	8568	2022	424	15191	2073	16268	25830	109122
Saudi Arabia	2158	1179	1380	3127	2236	19975	8548	12495	489	5134	1748	5444	10483	9422	241	2040	983	2658	493	633	1463	0	1059	2504	2250	3703	1708	2434	3528	6452	15497	21263	38378
Singapore	15018	1043	2978	2045	2043	46600	11224	14668	14932	29376	9274	5339	39647	34606	19440	51688	1727	10965	918	203	4618	13711	0	1424	2980	4530	27574	14654	690	15698	14654	88186	131203
Spain	899	2800	10479	6314	2531	24472	45307	40651	0	4607	12431	18682	3787	2813	13647	849	8511	19710	3989	4405	10809	8400	854	0	5418	1812	1187	1251	1452	694	17886	17701	212832
Sweden	1485	2810	18127	3405	4214	9078	12088	40543	3462	2584	6812	7188	5000	187	21659	845	188	16498	28487	4937	10939	195	723	4241	0	7952	1399	1726	2212	1919	27199	25896	89162
Switzerland	6285	14503	18964	4186	9696	13829	37682	78956	8992	3149	24901	39397	9011	2925	30787	2844	2850	17128	3516	5721	7102	218	1192	13009	10072	0	2130	1800	1777	0	63758	66124	798780
Taiwan	8976	71	1138	2241	1941	38777	2884	8984	15112	2828	908	1451	58442	14402	1028	7068	429	2983	333	190	3274	13407	14451	565	839	1849	0	2420	118	0	3014	28795	45005
Thailand	6418	426	1190	8924	112	38828	3182	7340	2978	3307	448	13719	1009	1868	512	212	4100	8240	1324	4248	6048	8189	704	1324	7969	6189	2283	247	18901	4348	14337	41730	
Turkey	0	2316	4318	1767	1128	23184	10336	23873	170	5888	1377	14379	3762	5689	541	1286	868	7073	1077	3180	29125	2177	231	6921	2379	4284	2069	1311	0	3628	7300	15110	91844
United Arab Emirates	2118	655	3078	2467	3710	28668	5333	14214	4930	39781	1979	747	6227	6888	0	4018	424	9491	607	481	1786	1081	4713	2785	1114	4268	0	2871	8267	0	10898	22459	28538
United Kingdom	13946	12825	51124	28188	38033	63974	10399	29240	25993	12817	72348	10774	38447	4341	20766	4878	8000	103822	53784	16391	26284	2972	8431	58830	30152	54134	3394	5026	24958	2028	4933	162105	386100
United States	8206	18264	69770	69289	549000	497890	181144	280004	49396	84866	120883	195420	286411	115894	84716	39120	384495	100019	34288	17115	51983	59847	58912	99503	38213	135703	63149	43066	39729	4122	409070	0	923931
ROW	96104	49056	71891	100813	62910																												