AN ANALYSIS OF LINKAGE
BETWEEN 2004 JICA-DOTC COMMODITY-PASSENGER FLOW SURVEY AND INTERREGIONAL FLOWS IN MULTI-REGION SAM IN THE PHILIPPINES [*]

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1. Introduction

One of the basic problems in creating a database for a spatial computable general equilibrium model in the Philippines is estimating interregional commodity and income flows. The current database for such analysis is based on an interregional input-output table in 1994 prices extracted from JSPS-Manila database. (Secretario: 2002) This is a non-survey based table which was extracted from the last official national input-output table in 1994 prices. This paper aims to link two databases by looking at similarities between interregional I-O data embedded in multiregional social accounting matrix (MRSAM) and JICA-DOTC Commodity-Passenger Flow Survey data and then reconciling differences between the two databases.

2. Methodology for Passenger Flows and Freight Flows

(1) Methodology of JICA-DOTC Commodity-Passenger Flow Survey

The aim of JICA-DOST Survey on Passenger & Freight Flow Survey was to 1) provide a common socio-economic and transport information database for future planning in each of the transport sub-sector and 2) to assess transport sector and sub-sector performance on the basis of previous studies, existing databases and current plans and programs. The OD data were collected from both primary sources (passengers and freight drivers & operators) and secondary sources. The main value-added of the JICA-DOTC study was the primary data collected from freight transported by road in 2004. All the other commodity flow data via air, water and rail were derived from secondary data of the National Statistics Office. All commodity flows experienced a decline except for water mode, which increased from 2002 to 2003. The JICA-DOTC study also surveyed passenger flows for transport mode via air, road and rail for 2004.

Origin-destination tables were estimated for passenger and commodity flow per transport mode. Originally, interspatial flows across the Philippines were traced among 24 zones. These 24 zones were then compressed into 5 regions which are compatible with spatial disaggregation of SAM. These are Northern Luzon, Southern Luzon, NCR, Visayas and Mindanao. Passenger and freight flow OD tables were estimated for the following type of transport modes - road, rail, water and air. For freight flow data via air, water and rail; 2002 trade statistics from the National Statistics Office (NSO) were utilized. Survey data from roadside interviews were used for freight flow via road. On the other hand, passenger flow data were taken from primary sources which include roadside OD survey, airport interview survey and rail interview survey. The only secondary source of data was water passenger flow statistics from the National Statistics Office (NSO).

For freight flow data, the JICA-DOST study aimed to establish the volume of commodity flows in terms of number of trips and weight of each commodity type transported by all modes on an annual basis. Annual totals in terms of commodity flows via air, water and rail can be deduced from O-D pairs of data from National Statistics Office. For freight flow via road, the number of daily freight trips was expanded to a typical week OD .This was later expanded to an integrated annual OD data set. Commodity flow was expressed in terms of average weight per commodity type and vehicle type.

For passenger flow data, DOTC-JICA study aimed to establish the volume of annual person-trips for all modes of transport. From NSO passenger data, the number of passengers who traveled from port-to-port can be established. The study utilized "lookup tables" to convert port-to-port data to O-D data based on 24-zone system. For OD tables of passenger flow via rail, air and road; an intricate system of expansion was utilized. Individual 10-hour OD tables for one weekday and one weekend were constructed for each site. Then, expansion factors were applied to these tables to expand sampling data to universal data using actual sampling rates and average occupancy. Another set of factors were applied to expand the 10-hour population trip data to 24-hour data. These data for weekday and weekend were combined to form a weekly OD table. This weekly table was expanded using a factor of 52 to get annual values. The final step was to integrate annual OD tables for all survey sites to form a holistic table, which contained all passenger trips nationwide.

Alternatively, interspatial flow of people and goods was traced across 11 islands in the Philippines; each of which corresponds to the initial 24 zones. The 11 major islands used for a more detailed OD delineation are Luzon, Palawan, Mindoro, Masbate, Panay, Negros, Cebu, Bohol, Samar, Leyte and Mindanao.

(2) Methodology for Deriving Interregional Flows in 5-Region Social Accounting Matrix (SAM)

The main purpose of constructing the multiregional SAM is to provide the database to be used as benchmark in deriving equilibrium values of spatial computable general equilibrium model. The conceptual and accounting framework is designed

based on the closed type of inter-regional SAM model wherein the household sector is treated as endogenous within the production system. Furthermore, the model attempts to decompose the household sector into manageable income groupings, essentially aimed at providing an adequate database for meaningful, in-depth analyses of socio-economic differentials, both intra-regionally and inter-regionally alike.

The 15 administrative regions of the country in 1994 (now, 17) are regrouped into 5 greater regions following the geographic delineation followed in compiling the 1994 5-region Philippine Inter-Regional I-O PIRIO) table. These 5 regions are National Capital Region, Northern Luzon, Southern Luzon, Visayas and Mindanao. In this closed MRSAM model, seven major industry divisions and three income groups of households comprise the production sector, namely: Sector 1: Agriculture and forestry; Sector 2: Industry sector (covering manufacturing, mining, electricity & water, & construction); Sector 3: Water transport service; Sector 4: Air transport service; Sector 5: Land transport, storage & other transport-related services; Sector 6: Other private services; Sector 7: Government services; Sector 8: Households, Low-income group; Sector 9: Households, Middle-income group; and Sector 10: Households, High-income group. To complete the MRSAM accounts, the following institutional sectors are integrated: government, capital accumulation or investment and the rest of the world.

Given the accounting framework of the closed MRSAM model, three (3) identified major activities were carried out in their sequential order, as follows: (i) Expanding the Scope & Coverage of the 1994 Open-Type PIRIO (Phil Interregional IO) model, (ii) Closing the Expanded PIRIO Table with Respect to Household Sector, (iii) Compiling the MRSAM (multiregional SAM) accounts. The construction of 5-region SAM involved expanding the scope and coverage of the 1994 5-region Philippine Inter-Regional I-O model, in order to be able to support the data needs of the accounting framework of the MRSAM model. In this initial attempt, a minimum of three (3) sectors requiring further refinements have been specifically identified, as follows: Private Consumption Expenditure Sector of Final Demand [C] ; Operating Surplus [OS] and Rest of the World [ROW].

The household sectors in the 5-region IRIO table are further decomposed into 3 sub-sectors representing the 3 groups of households, as follows: low-income households; middle-income households and high-income households. The decomposition of the household sector into sub-groups is based solely on household income, based on the 1994 FIES data and regional poverty thresholds. The low-income group identification procedure is done by mapping poverty lines vis-à-vis income class ranges set in the FIES, where the number of families is recorded in each income class range. Estimation of final consumption expenditures for each of these 3 household groups, as sub-sectors of final demand, then follows using FIES data on expenditure patterns by income class with the recorded figures in the PIRIO table serving as the control totals.

The next part of expanding the 5-region PIRIO is to decompose the operating surplus component of GVA into – net land rent, net interest payments, domestic/foreign dividends /transfers; direct taxes and the residual which is the net operating surplus (composed of savings and other value-added) In the case of net land rent for the agricultural sector; land rent estimates were derived from regional cost and returns survey data from the Bureau of Agricultural Statistics (BAS), Dept. of Agriculture. For the non-agricultural sector; and private services, land rent data were derived from the 1994 Census on Establishments. The second component of operating surplus is net interest payment and is computed by subtracting interest income from interest expense. The data on transfers and direct taxes are taken from 1994 Family Income & Expenditure Survey. Then imports from rest-of-the world are broken down into (1) C.I. F. values and (2) estimated tariff and import taxes.

The second part is closing the PIRIO with the household sector as an endogenous sector. In accord with the MRSAM's framework, household income and expenditures need to be estimated by region as well as by source of income/expenditure based on the predetermined sector classification. For numerical consistency, the estimates need to be crosschecked with relevant entries in the IRIO table. The household sector is divided into 3 groups: low-income group; middle-income group and high-income group. Regional poverty thresholds, sourced from NSCB, provide the basic indicators in determining the low-income group. The middle- and high-income groups were identified based on judgmental assessment of the FIES income ranges. The high-income group includes households with annual income of P250, 000 and over, while the middle-income group includes families with income between the poverty threshold income range and high-income range.

(3) Procedure for Integrating Primary Data in OD Tables and Secondary Data in SAM

There are similarities in O-D tables of commodities and interregional input-output tables, which trace the flow of goods from place of origin to place of destination. Both trace the movement of freight and corresponding factors of production across space. However, there are certain improvements which maybe undertaken to link the two tools. The first area is that I-O tables trace commodity flows from producer to consumer (place of production to place of consumption) whereas O-D tables trace freight flow from point of embarkation (which maybe a port, an airport, a bus, truck or train terminal) to point of disembarkation. Consequently, freight flows in input-output tables include intermediate costs or transaction costs incurred in bringing goods from place of production to place of disembarkation. These include mark-up margins.

But certain methodologies maybe devised which can integrate the two tools. First, classification of freight in O-D table will be realigned with classification of commodities in input-output tables. Philippine input-output tables use Philippines Standard Industrial Classification (PSIC) classification. Secondly, O-D flows which are expressed in terms of volume-distance can be converted into monetary terms, using regional producer price indices for the year when the flows were surveyed. Currently, commodity flows from O-D tables are expressed in producer prices. This is the same monetary unit as commodity flows in SAM. Thirdly, the zonal classification of origin-destination areas will be converted into administrative disaggregation of regions as filed in Philippines statistical sources. Fourthly, all commodities transported by different transport mode from different O-D pairs should be added up together to get total commodities transported from one point to the other. Fifthly, since the current I-O data are in 1994 prices, the monetary conversion of volume-distance in CFS from 1994 to 2004 prices has to be undertaken. Alternatively, monetized volume data of commodity flow in O-D tables can be converted from 2004 to 1994 prices, depending on availability of conversion data.

With regards to interregional passenger flows, these can be effective indicators of interregional income flows. First, passenger-respondents in the survey need to be classified as short-term or long-term. The long-term travelers' movement may be an indication of interregional flow of labor income, remittances, transfers, dividends and taxes. Stylized movements of factors of production may be delineated from these. While our Philippine census data does not delineate between night-time and day-time population as in Japan migration data, current O-D data may give broad indicators of potential flows of income across regions.

3. Empirical Results of JICA-DOST Study & Multiregional SAM-IRIO Construction

The DOTC-JICA study came out with significant findings regarding trend in cargo movements. Commodity flow data from the National Statistics Office (used by DOST-JICA study) indicate that there was a downward trend in cargo movements from 1994 to 2002 in all modes of transport except water mode. There was a significant decline in the case of rail wherein rail cargo decreased from 15,000 tons a year in 1994 to 2,000 tons a year in 2002. For air cargo, the decline is not that abrupt from 65,000 tons in 1994 to 50,000 tons in 2002. Due to the institution of the roll-on roll-off scheme, water cargo increased from 24 million tons in 1994 to 28 million tons in 2002. This finding significantly impacts on using 2004 commodity flows in comparing 1994 commodity flows with 2004 commodity flows.

A very important finding of DOTC-JICA survey is that around 99.97% of annual commodity movement was via road. This finding may seem strange considering the fact that the Philippines are an archipelago and most of interspatial movement would be via water. One factor which may have lead to this result is that transport of cargo using inter-modal scheme such as the Ro-Ro (roll-on, roll-off) is classified as transport via road. It would be interesting to look at freight OD tables by all modes.

Table 1. Freight O-D Flows, All Modes of Transport, in 1994 prices in 000 pesos

Origin \ Destination	NCR	N.Luzon	S. Luzon	Visayas	Mindanao	TOTAL
NCR	0	361,568,241	92,063,364	48,581,268	29,237,677	531,450,550
NOL	172,309,121	203,991,169	22,654,161	7,478,358	4,595,067.754	411,027,877
SOL	272,726,933	56,662,323	218,939,394	16,211,102	6212525.819	570,752,277
VIS	25,285,870	23150.01687	9513596.719	36,101,253	10,963,769	81,887,638
MIND	32,065,817	1472559.62	1295699.766	23,709,715	119,791,444	178,335,235
TOTL	502,387,740	623,717,443	344,466,215	132,081,697	170,800,483	1,773,453,578

Note: Based on JICA_DOTC Study and Using NSO Water Cargo Mode 1994 Conversion rate

On the other hand, the interregional commodity flow of 5-region I-O which is part of the SAM showed the following results. NCR was the top region which received highest monetary value of goods as destination area. Also, Southern Luzon which includes the CALABARZON area was top region as place of origin of goods in 1994.

Table 2. Commodity Flow Data from Inter-regional Competitive IO Table, 1994

Origin \ Destination	NCR	N. Luzon	S. Luzon	Visayas	Mindanao	TOTAL
NCR	498,979,130	33,821,522	25,527,959	30,612,436	30,612,436	606,719,595
N. Luzon	22,887,240	256,315,385	3,592,537	5,738,896	5,738,896	292,491,134
S. Luzon	52,687,702	22,539,171	486,304,662	24,241,026	24,241,026	607,393,874
Visayas	23,967,225	7,138,252	5,327,474	195,345,327	195,345,327	236,874,402
Mindanao	49,374,951	3,280,117	10,099,464	9,318,617	260,152,023	332,225,172
TOTAL	647,896,248	323,094,447	530,852,096	265,256,302	265,256,302	2,075,704,177

Note: thousand pesos at 1994 producers' prices

A side-by- side comparison of freight flow data in monetary terms of JICA-DOTC study and SAM study is now undertaken. Adjustments are made so that metric ton units in JICA-DOTC study are converted into monetary units in 1994 prices using NSO per peso metric ton conversion rate.

The results indicate that monetary values of commodity flows in interregional input-output (IO) flows are higher than those in O-D tables in all regions except Northern Luzon. This can be attributed to the following reasons :(1) interregional I-O data includes transport costs from point of production to point of disembarkation while O-D includes only monetary value of commodities transported excluding transport margins, profit margins etc and other intermediation costs. (2) The interregional flows from I-O data include monetary value of intangibles like services which are excluded from actual interregional flow of goods in O-D tables. Therefore flows tend to be overstated ; 3) the O-D tables exclude intraregional flow of goods within NCR and have assigned a zero value to NCR-NCR transactions and (4) the concept of "quantity "in expressed differently in freight flows in O-D tables (metric tons) as compared to quantity in interregional I-O tables; (5) I-O interregional flows are also higher than OD flows because the non-survey method used (simple location quotient) does not adjust national technical coefficients (used as proxy for regional technical coefficients) if the region is export-oriented . Domestic imports are assumed to be zero A comparative view of the monetary values from O-D tables (JICA-DOTC study) and I-O tables (5region SAM) is shown in the table below.

The table above indicates the monetized value of passenger trips made in 2004 and expressed in 1994 prices. Total value of passenger flows based on JICA-DOTC Survey which is 1.3 billion pesos is only around 0.10% of nominal gross domestic product in the Philippines. This is quite a small figure and seems unrealistic.

Table 3. Comparison of Commodity Outflow & Inflow Data from I-O and O-D Tables

Region	Origin			Destination		
	I-O Outflows	O-D Outflows	% Differential	I-O Inflows	O-D Inflows	% Differential
NCR	606,719,595.0	531,450,550	14.2	647,896,248	502,387,740	29.0
Northern Luzon	292,491,134.0	411,027,877	-28.8	323,094,447	623,717,443	-48.2
Southern Luzon	607,393,874.0	570,752,277	6.4	530,852,096	344,466,215	54.1
Visayas	236,874,402.0	81,887,638	189.3	265,256,302	132,081,697	100.8
Mindanao	332,225,172.0	178,335,235	86.3	308,605,084	170,800,483	80.7
Total Differential	2,075,704,177	1,773,453,578	17.0	2,075,704,177	1,773,453,578	17.0

Note: thousand pesos at 1994 producers' prices

Table 4 : Passenger O-D Flows , All Modes of Transport, in 1994 prices in thousand pesos

Origin \ Destination	NCR	N.Luzon	S. Luzon	Visayas	Mindanao	TOTAL
NCR	0	225,608	102,916	109,244	5,792	443,560
Northern Luzon	344,932	202,504	29,812	2,472	8,908	588,628
Southern Luzon	83,424	3,736	456	780	460	88,856
Visayas	80,368	1,068	88	26,352	3,212	111,088
Mindanao	7,812	1,472	60	1,776	90,796	101,916
TOTAL	516,536	434,388	133,332	140,624	109,168	1,334,048

Note: Based on JICA_DOTC Study and Using NSO Average Transport Fare Rate for All Modes

Table 5 : Passenger Flow Data from Multiregional Social Accounting Matrix (MRSAM), 1994

Origin \ Destination	NCR	N. Luzon	S. Luzon	Visayas	Mindanao	TOTAL
NCR	13,971,736	3,119,887	4,085,301	2,686,725	2,773,805	32,195,779
N. Luzon	122,816	7,546,758	898,879	258,561	588,226	9,415,240
S. Luzon	34,922	65,853	4,938,751	88,802	191,241	5,319,569
Visayas	234,671	749,790	1,095,273	10,522,991	1,025,798	13,628,522
Mindanao	124,494	27,666	152,677	43,036	7,525,255	7,873,128
TOTAL	14,488,639	11,509,955	11,170,881	13,600,115	12,104,324	68,432,238

Note: thousand pesos at 1994 producers' prices

In a parallel manner, the passenger flow survey of JICA-DOST study indicated that almost 97% of passenger trips were via road. Based on the table 5, the total value of passenger trips made in 1994 is 68.4 million pesos which is 3.9% of nominal GDP. The official nominal GDP figure in 1994 was 1.742 trillion pesos. A comparative analysis of aggregate monetary value of passenger trips indicate that the passenger flow data estimated in multi-region SAM more closely approximates values reflected in national income accounts data. The big differential between passenger-flow data of JICA-DOST Survey and MRSAM data maybe due to underestimation of passenger flows in primary data collected by JICA-DOST Survey. This is because a big bulk of passenger-trips measured in JICA-DOTC Survey is for short-term purpose, mainly business trips. Only a small percentage accounts for long-term trips due to migration. Total monetary value of secondary data (I-O data) is 834 times bigger than primary data (O-D data)

4. Conclusion

The above results indicate that there is a way of linking freight flows from origin-destination tables of surveys and interregional commodity flows of I-O table contained in SAM. This is also true for passenger-flow data. A methodology was devised utilizing database from both I-O and O-D tables, so that interregional flows of goods and people can be reliably estimated. Initial empirical results indicate that the O-D tables used in engineering and I-O tables used in economics can be reconciled so that a comprehensive and reliable database for spatial computable general equilibrium modeling can be established.

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