Projection of Malaysia Input-Output Table 2015 and Key Sectors Identification

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Presentation Outline

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Introduction

- The construction of the I-O tables based on detailed census is a complex procedure that requires substantial financial expenditures, large human capital and time.
- But, for policy makers, the long time lag affects the usefulness of I-O data for planning and formulating policies.
- Therefore, availability of timely and updated I-O tables is critical for the effective assessment of activities and industries in the economy and to assess structural change in the Malaysia economy.

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Objectives

- The aim of this study is to project the Malaysia Input-Output table for the year 2015 using EURO method.
- Analyse the inter-industrial linkages and identify key-sectors.

Literature Review

- The comparison study on projection method between RAS and EURO reported that EURO method performed better than RAS method (Norhayati, *et al.*, 2015).
- The MIOT 2005 and MIOT 2010 were projected and evaluated based on statistical measures and input-output analysis.
- The three statistical measures used were Mean Absolute Deviation (MAD), Root Mean Squared Error (RMSE) and Dissimilarity Index (DI).
- The results show that the EURO method has smaller value of MAD, RMSE and DI.

Literature Review

- Jose M.Rueda-Cantuche, et al. (2016) have compared the results of the SUT-EURO method against SUT-RAS Method.
- The projection was applied for the period 2000-2005 of Austria, Belgium, Italy and Spain.
- The outcomes have been tested using different goodness of fit statistics.
- Their results show that:
  - If output by industries is not available, then SUT-EURO prevails over SUT-RAS.
  - If output by industry is exogenous, then SUT-RAS prevails over SUT-EURO.

Methodology

- The Euro method is an approach of projecting all quadrants of an input-output table in a simultaneous way, which was developed by Joerg Beutel (Beutel, 2002; Eurostat, 2008).
- The fundamental idea drawn up is to develop a series of reliable and consistent input-output tables, which is dependent on official macroeconomic, that is, the Gross Domestic Product.
- This studywill only focuses on domestic input-output tables.

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As shown in Simplified I-O Table, the required data for EURO method is shaded in green colour.

Use Matrix of Domestic Production at Basic Prices (Industry by Industry)		Intermediate Demand					Total Intermediate Demand (d)	Final Demand (f)					Total Output (X)
		Industry	Agriculture	Mining	…	Services	$d_i = \sum_{j=1}^{m} x_{ij}$	Private Consumption	Government Consumption	Gross Fixed Capital Formation	Changes Inventory	Exports	$X_i = d_i + \sum_{k=1}^{5} f_k$
	Industry		*j=1*	*j=2*	…	*j=m*		*k=1*	*k=2*	*k=3*	*k=4*	*k=5*	
Intermediate Input	Agriculture	*i=1*	x_{11}	x_{12}	…	x_{1m}	d_1	f_{11}	f_{12}	f_{13}	f_{14}	f_{15}	X_1
	Mining	*i=2*	x_{21}	x_{22}	…	x_{2m}	d_2	f_{21}	f_{22}	f_{23}	f_{24}	f_{25}	X_2
	…	…	…	…	…	…	…	…	…	…	…	…	…
	Services	*i=n*	x_{n1}	x_{n2}	…	x_{nm}	d_n	f_{n1}	f_{n2}	f_{n3}	f_{n4}	f_{n5}	X_n
Total Intermediate Input (u)	$u_j = \sum_{i=1}^{n} x_{ij}$		u_1	u_2	…	u_m	ud	f_1	f_2	f_3	f_4	f_5	uX
Imported Commodities (m)			m_1	m_2	…	m_m	md	mf_1	mf_2	mf_3	mf_4	mf_5	mX
Taxes (t)			t_1	t_2	…	t_m	td	tf_1	tf_2	tf_3	tf_4	tf_5	tX
Value Added (v)			v_1	v_2	…	v_m	vd	vf_1	vf_2	vf_3	vf_4	vf_5	vX
Total Input (X) $X_j = u_j + m_j + t_j + v_j$			X_1	X_2	…	X_m	Xd	Xf_1	Xf_2	Xf_3	Xf_4	Xf_5	XX

Methodology – EURO Method

T1 is the base year of the input-output table (MIOT 2010)

		Agri 1	Mining 2	Other 3	Gov n	Private 13	Gov 14	GFCF 15	CI 16	Export 17	Output 18
	T1	IOT BASE YEAR									
1	Agriculture	8259	5	74661	533	20025	0	3462	432	13136	120513
2	Mining	48	953	60546	11	158	0	14	-401	43277	104605
3	Other	14553	5427	184990	4953	84745	0	20845	7692	477873	801078
12	Government	1	0	20	1098	16695	92610	4242	0	299	114965
13	Imported	11448	6379	280454	11710	56083	5161	78064	3973	35658	488929
14	taxes	-79	-185	2056	85	6109	6	4923	0	11038	23953
15	Value added	77038	89211	184881	70041	0	0	0	0	0	421172
16	Input	111267	101790	787609	88432	183814	97777	111550	11696	581281	2075216
		IOT PROJECTION									
1	Agriculture										
2	Mining										
3	Other										
12	Government										
13	Imported										779184
14	taxes										38517
15	Value added	100605	108281	266181	97208						1098927
16	Input					607713	150443	301893	7491	874061	

In the first iteration, the given growth rates for value added by industry, final demand by category and total value for 2010 are the starting points (values) for the input and output sectors.

1 Compilation of the macroeconomic variables and the corresponding growth rates.

Table 2: Growth rates for value added and final demand

	Value Added Agri 1	Value Added Mining 2	Value Added Other 3	Value Added Gov 12	Private 13	Gov 14	GFCF 15	CI 16	Export 17	Import 19	taxes 20	Total Value Added 18
IOT base year	77038	89211	184881	70041	183814	97777	111550	11696	581281	488929	23953	421172
IOT projection	100605	108281	266181	97208	607713	150443	301893	7491	874061	779184	38517	1098927
growth rates	30.59	21.38	43.97	38.79	230.61	53.86	170.63	-35.95	50.37	59.37	60.80	160.92
growth factor	1.31	1.21	1.44	1.39	3.31	1.54	2.71	0.64	1.50	1.59	1.61	2.61

The growth rates is defined as, $p = \frac{v(1)_j}{v(0)_j}$

where, $v(0)_j$ is actual value j for base year, $j=1,\ldots,m$

$v(1)_j$ is macroeconomic statistics j for projected year t, $j=1,\ldots,m$

The growth rates for input are **W0** and for output is **W1.**

The growth rates for the activity levels of the corresponding input and output sector for each element in the input-output table is weighted in an iterative procedure.

Row multipliers for inputs, W0

W0		Agri	Mining	Other	Gov	Imported	taxes	Value added
		1	2	3	12	13	14	15
1	Agriculture	1.31	0.00	0.00	0.00	0.00	0.00	0.00
2	Mining	0.00	1.21	0.00	0.00	0.00	0.00	0.00
3	Other	0.00	0.00	1.44	0.00	0.00	0.00	0.00
12	Government	0.00	0.00	0.00	1.39	0.00	0.00	0.00
13	Imported Com.	0.00	0.00	0.00	0.00	1.59	0.00	0.00
14	taxes	0.00	0.00	0.00	0.00	0.00	1.61	0.00
15	Value added	0.00	0.00	0.00	0.00	0.00	0.00	2.61

Column multipliers for outputs, W1

W1		Agri 1	Mining 2	Other 3	Gov 12	Private 13	Gov 14	GFCF 15	CI 16	Export 17
1	Agriculture	1.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Mining	0.00	1.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Other	0.00	0.00	1.44	0.00	0.00	0.00	0.00	0.00	0.00
12	Government	0.00	0.00	0.00	1.39	0.00	0.00	0.00	0.00	0.00
13	Private	0.00	0.00	0.00	0.00	3.31	0.00	0.00	0.00	0.00
14	Gov	0.00	0.00	0.00	0.00	0.00	1.54	0.00	0.00	0.00
15	GFCF	0.00	0.00	0.00	0.00	0.00	0.00	2.71	0.00	0.00
16	CI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.64	0.00
17	Export	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50

T2=W0*T1

Input-output table weighted with row multipliers, T2=W0*T1

T2		Agri 1	Mining 2	Other 3	Gov 12	Private 13	Gov 14	GFCF 15	CI 16	Export 17
1	Agriculture	10785	6	97501	696	26151	0	4521	564	17155
2	Mining	58	1157	73488	13	192	0	17	-487	52527
3	Other	20952	7813	266338	7131	122011	0	30012	11074	688013
12	Government	2	0	28	1524	23170	128530	5887	0	415
13	Imported Com.	18244	10166	446946	18662	89376	8224	124407	6332	56827
14	taxes	-128	-297	3306	137	9823	10	7916	0	17749
15	Value added	201009	232771	482394	182753	0	0	0	0	0

T3, (T3=T1*W1)

T3 is the input-output table weighted with column multipliers.

Input-output table weighted with column multipliers, T3=T1*W1

	T3	Agri 1	Mining 2	Other 3	Gov 12	Private 13	Gov 14	GFCF 15	CI 16	Export 17
1	Agriculture	10785	6	107493	740	66205	0	9369	277	19753
2	Mining	62	1157	87170	15	523	0	38	-257	65074
3	Other	19005	6587	266338	6874	280179	0	56415	4926	718568
12	Government	2	0	29	1524	55195	142493	11479	0	449
13	Imported Com.	14950	7742	403781	16252	185416	7940	211268	2545	53619
14	taxes	-104	-225	2960	118	20196	10	13323	0	16598
15	Value added	100605	108281	266181	97208	0	0	0	0	0

T4=(T2+T3)/2

By calculating the average input-output matrix weighted with row multipliers (T2), and column multipliers (T3), we obtain **inconsistent** input-output table (T4).

4 Compilation of the arithmetic mean of T2 and T3

	T4	Arithmetic mean, T4=(T2 + T3)/2								
1	Agriculture	10785	6	102497	718	46178	0	6945	420	18454
2	Mining	60	1157	80329	14	357	0	27	-372	58801
3		19978	7200	266338	7003	201095	0	43214	8000	703291
12	Government	2	0	29	1524	39182	135512	8683	0	432
13	Imported Com.	16597	8954	425363	17457	137396	8082	167837	4438	55223
14	taxes	-116	-261	3133	128	15010	10	10620	0	17174
15	Value added	150807	170526	374288	139980	0	0	0	0	0

5 Compilation of the inconsistent input-output table for T4

Table 3: Inconsistent input-output table

	Euro	Agri 1	Mining 2	Other 3	Gov 12	Private 13	Gov 14	GFCF 15	CI 16	Export 17	Output 18
1	Agriculture	10785	6	102497	718	46178	0	6945	420	18454	186003
2	Mining	60	1157	80329	14	357	0	27	-372	58801	140374
3	Other	19978	7200	266338	7003	201095	0	43214	8000	703291	1256118
12	Government	2	0	29	1524	39182	135512	8683	0	432	185364
13	Imported Com.	16597	8954	425363	17457	137396	8082	167837	4438	55223	841349
14	taxes	-116	-261	3133	128	15010	10	10620	0	17174	45697
15	Value added	100605	108281	266181	97208	0	0	0	0	0	572275
16	Input	147912	125337	1143870	124052	439218	143604	237327	12487	853373	3227180

6 Compilation of the input coefficients for Table 3

Table 4: Input coefficients

Based on T4 ,the input coefficient $a_{ij} = x_{ij} / X_j$ and Leontief inverse $(I - A)^{-1}$ were calculated.

		Agri 1	Mining 2	Other 3	Gov 12	Private 13	Gov 14	GFCF 15	CI 16	Export 17
1	Agriculture	0.07	0.00	0.09	0.01	0.11	0.00	0.03	0.03	0.02
2	Mining	0.00	0.01	0.07	0.00	0.00	0.00	0.00	-0.03	0.07
3	Other	0.14	0.06	0.23	0.06	0.46	0.00	0.18	0.64	0.82
12	Government	0.00	0.00	0.00	0.01	0.09	0.94	0.04	0.00	0.00
13	Imported Com.	0.11	0.07	0.37	0.14	0.31	0.06	0.71	0.36	0.06
14	taxes	0.00	0.00	0.00	0.00	0.03	0.00	0.04	0.00	0.02
15	Value added	0.68	0.86	0.23	0.78	0.00	0.00	0.00	0.00	0.00
16	Input	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

The Leontief inverse was then multiplied with vector of final demand to derive total output, $Y = (I - A)^{-1} f$

where, Y is total output of goods and services

f is column vector of final demand.

7 Compilation of the Leontief matrix and inverse matrix

Table 5: Leontief matrix and inverse

		Agri 1	Mining 2	Other 3	Gov 12
		Leontief matrix (I-A)			
1	Agriculture	0.93	0.00	-0.09	-0.01
2	Mining	0.00	0.99	-0.07	0.00
3	Other	-0.14	-0.06	0.77	-0.06
12	Government	0.00	0.00	0.00	0.99
		(I-A) Inverse			
1	Agriculture	1.10	0.01	0.13	0.01
2	Mining	0.01	1.01	0.09	0.01
3	Other	0.19	0.08	1.33	0.08
12	Government	0.00	0.00	0.00	1.01

Identity matrix	1	2	3	12
1	1.00	0.00	0.00	0.00
2	0.00	1.00	0.00	0.00
3	0.00	0.00	1.00	0.00
12	0.00	0.00	0.00	1.00

8 Compilation of the product output with the Leontief model

Table 6: Input-output model

		Agri 1	Mining 2	Other 3	Gov 12	Total Final 13	Output 14
		$(I-A)^{-1}$				f	Y
1	Agriculture	1.10	0.01	0.13	0.01	71997	205139
2	Mining	0.01	1.01	0.09	0.01	58813	152095
3	Other	0.19	0.08	1.33	0.08	955599	1306834
12	Government	0.00	0.00	0.00	1.01	183809	186131

The consistent input-output table is established through several adjustments of row multiplier and column multiplier in n iterations.

9 Compilation of the consistent input-output table after the first iteration

Table 7: Consistent input-output table

		Agri 1	Mining 2	Other 3	Gov 12	Private 13	Gov 14	GFCF 15	CI 16	Export 17	Output 18
1	Agriculture	14958	7	117099	1077	46178	0	6945	420	18454	205139
2	Mining	83	1404	91773	21	357	0	27	-372	58801	152095
3	Other	27708	8737	304283	10507	201095	0	43214	8000	703291	1306834
12	Government	2	0	33	2286	39182	135512	8683	0	432	186131
13	Imported Com.	23018	10866	485964	26193	137396	8082	167837	4438	55223	919018
14	taxes	-160	-317	3580	192	15010	10	10620	0	17174	46107
15	Value added	139529	131397	304103	145854	0	0	0	0	0	720884
16	Input	205139	152095	1306834	186131	439218	143604	237327	12487	853373	3536208

The projection is completed if tthe difference between the actual and the projected rates is minimal (less than 1%).

11 Compilation of the deviation of actual versus projected growth rates of macroeconomic variables

Table 8: Actual versus projected growth rates of macroeconomic variables

			1.81	1.47	1.64	2.08	2.39	1.47	2.13	1.07	1.47	1.88	1.92	1.71
			Value Added Agri	Value Added Mining	Value Added Other	Value Added Gov	Private	Gov	GFCF	CI	Export	Import	taxes	Total Value Added
			1	2	3	12	13	14	15	16	17	19	20	18
1	Actual		1.31	1.21	1.44	1.39	3.31	1.54	2.71	0.64	1.50	1.59	1.61	2.61
2	Project		1.81	1.47	1.64	2.08	2.39	1.47	2.13	1.07	1.47	1.88	1.92	1.71
3	Deviation		0.72	0.82	0.88	0.67	1.38	1.05	1.27	0.60	1.02	0.85	0.84	1.52
			0.90	1.01	1.09	0.77	1.11	1.11	0.96	0.55	1.03	0.64	0.83	1.87
	difference		-0.181	-0.189	-0.220	-0.105	0.269	-0.067	0.315	0.046	-0.008	0.210	0.010	-0.346

SECOND ITERATION

12 Compilation of row multipliers, W0

	W0'	Row multipliers for inputs WO'						
1	Agriculture	1.31	0.00	0.00	0.00	0.00	0.00	0.00
2	Mining	0.00	1.21	0.00	0.00	0.00	0.00	0.00
3	Other	0.00	0.00	1.44	0.00	0.00	0.00	0.00
12	Government	0.00	0.00	0.00	1.39	0.00	0.00	0.00
13	Imported Com.	0.00	0.00	0.00	0.00	3.31	0.00	0.00
14	taxes	0.00	0.00	0.00	0.00	0.00	1.54	0.00
15	Value added	0.00	0.00	0.00	0.00	0.00	0.00	2.71

Start

The iteration was done using Excel Visual Basic Programming.

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The observed deviations are then used to correct the rates of W0 and W1 during the iteration process.

Hence, a convex adjustment function is recommended to adjust the rates.

If the model underestimates or overestimates the projected macroeconomic variables, the corresponding rates, W0 and W1 respectively are increased or decreased according to the convex adjustment function.

$$af = 1 - \frac{[(1-d)100]c}{100} \quad \text{if } d < 0$$

$$af = 1 + \frac{[(d-1)100]c}{100} \quad \text{if } d > 0$$

where, af is adjustment function
d is deviation
c is adjustment elasticity (for this study, c=0.9 is used based on simulation results)

13 Compilation of the correction factors, MULT

Correction factors for inputs MULT

	MULT	0.72	0.82	0.88	0.67	0.85	0.84	1.52
1	Agriculture	0.80	0.00	0.00	0.00	0.00	0.00	0.00
2	Mining	0.00	0.87	0.00	0.00	0.00	0.00	0.00
3	Other	0.00	0.00	0.90	0.00	0.00	0.00	0.00
12	Government	0.00	0.00	0.00	0.77	0.00	0.00	0.00
13	Imported Com.	0.00	0.00	0.00	0.00	0.88	0.00	0.00
14	taxes	0.00	0.00	0.00	0.00	0.00	0.88	0.00
15	Value added	0.00	0.00	0.00	0.00	0.00	0.00	1.35

Correction factor mult =1+((deviation-1)*100)^0.9/100 for deviation > 1.0
Correction factor mult =1-((1-deviation)*100)^0.9/100 for deviation < 1.0

The best selection of coefficient is used for the adjustment. In order to identify the best adjustment elasticity, a simulation study was done for 2010 using nine values, which increased progressively by 0.1, starting from 0.1 till 0.9.

Data Requirement to Project MIOT 2015

REQUIRED DATA TO PROJECT USE MATRIX OF DOMESTIC PRODUCTION AT BASIC PRICES **USING EURO METHOD** 12 INDUSTRY x 12 INDUSTRY 2015 (RM Million)	Industry	Agriculture, Fishery & Forestry	Mining & Quarrying	Manufacturing	Electricity, Gas & Water	Construction	Wholesale & Retail Trade	Hotel & Restaurants	Transport & Communication	Finance & Insurance	Real Estate & Ownership of Dwellings	Business & Private Services	Government Services	**TOTAL INTERMEDIATE DEMAND**	Private Consumption	Government Consumption	Gross Fixed Capital Formation	Change in Inventories	Exports	**TOTAL FINAL DEMAND**	**TOTAL OUTPUT**
Industry		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Agriculture, Fishery & Forestry	1																				
Mining & Quarrying	2																				
Manufacturing	3																				
Electricity, Gas & Water	4																				
Construction	5																				
Wholesale & Retail Trade	6																				
Hotel & Restaurants	7																				
Transport & Communication	8																				
Finance & Insurance	9																				
Real Estate & Ownership of Dwellings	10																				
Business & Private Services	11																				
Government Services	12																				
TOTAL INTERMEDIATE INPUT	13																				
Imported Products	14																				731,895
Taxes	15																				34,319
Value Added	16	97,805	103,693	263,717	31,236	54,138	182,072	34,666	101,930	76,149	36,579	61,992	97,310								1,142,451
TOTAL INPUT															626,239	151,989	302,948	(12,601)	820,459		

Projected MIOT 2015

PROJECTED USE MATRIX OF DOMESTIC PRODUCTION AT BASIC PRICES **USING EURO METHOD** 12 INDUSTRY x 12 INDUSTRY 2015 (RM Million)	Industry	Agriculture, Fishery & Forestry	Mining & Quarrying	Manufacturing	Electricity, Gas & Water	Construction	Wholesale & Retail Trade	Hotel & Restaurants	Transport & Communication	Finance & Insurance	Real Estate & Ownership of Dwellings	Business & Private Services	Government Services	**TOTAL INTERMEDIATE DEMAND**	Private Consumption	Government Consumption	Gross Fixed Capital Formation	Change in Inventories	Exports	**TOTAL FINAL DEMAND**	**TOTAL OUTPUT**
Industry		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Agriculture, Fishery & Forestry	1	10,536	6	96,240	10	90	4,116	3,861	148	89	273	84	712	116,165	27,648	0	5,103	316	15,598	48,664	164,829
Mining & Quarrying	2	58	1,121	74,788	763	3,559	16	4	19	1	2	4	14	80,348	209	-	20	(271)	48,922	48,880	129,228
Manufacturing	3	20,051	7,259	256,124	5,563	48,610	45,938	15,311	27,552	4,282	688	12,251	7,120	450,750	125,569	-	32,830	6,409	615,703	780,511	1,231,261
Electricity, Gas & Water	4	1,387	195	19,314	9,670	730	1,434	4,106	2,059	4,179	329	1,703	4,311	49,415	16,469	-	522	13	1,111	18,115	67,530
Construction	5	1,369	1,303	6,458	36	12,591	89	493	2,845	781	1,766	861	7,401	35,994	11,981	-	105,719	5	8,355	126,060	162,054
Wholesale & Retail Trade	6	6,311	2,041	83,866	1,570	9,802	11,304	3,314	6,293	1,162	240	1,273	1,247	128,422	82,423	-	13,501	1,990	74,859	172,772	301,194
Hotel & Restaurants	7	362	15	674	19	196	2,963	5,262	1,635	5,890	128	496	2,292	19,932	58,389	0	24	(0)	65	58,477	78,409
Transport & Communication	8	3,202	2,100	28,155	987	1,821	8,316	3,089	69,556	12,007	1,231	7,119	9,740	147,322	72,952	-	1,629	151	43,837	118,569	265,891
Finance & Insurance	9	6,685	1,507	18,112	1,634	1,667	8,293	757	14,510	48,285	5,833	3,237	3,601	114,122	45,016	-	814	(0)	10,845	56,676	170,797
Real Estate & Ownership of Dwellings	10	144	-	2,504	-	1,656	3,119	219	2,803	2,152	6,988	998	7,613	28,196	28,560	-	-	-	-	28,560	56,756
Business & Private Services	11	1,257	757	9,079	2,662	1,108	4,900	1,170	4,606	3,984	1,088	12,057	3,696	46,362	42,372	12,181	4,227	(115)	11,677	70,344	116,706
Government Services	12	2	0	27	0	9	20	2	16	12	39	101	1,533	1,760	24,047	130,808	6,505	0	373	161,733	163,492
TOTAL INTERMEDIATE INPUT	13	51,365	16,304	595,340	22,915	81,839	90,508	37,590	132,043	82,822	18,604	40,182	49,277	1,218,788	535,637	142,989	170,893	8,497	831,344	1,689,361	2,908,149
Imported Products	14	15,288	8,259	377,174	13,659	26,261	34,232	6,905	35,883	5,475	1,246	13,462	16,337	554,182	80,746	7,286	119,668	3,144	44,447	255,291	809,472
Taxes less Subsidies on Products	15	(106)	(240)	2,774	(261)	(0)	1,641	(64)	(255)	822	59	604	119	5,092	8,824	9	7,570	-	13,811	30,213	35,306
Gross Value Added	16	98,282	104,906	255,973	31,217	53,954	174,813	33,979	98,221	81,679	36,847	62,458	97,759	1,130,087	-	-	-	-	-	-	1,130,087
TOTAL INPUT	17	164,829	129,228	1,231,261	67,530	162,054	301,194	78,409	265,891	170,797	56,756	116,706	163,492	2,908,149	625,206	150,284	298,132	11,641	889,601	1,974,864	4,883,013

Industrial Linkages – Rasmussen Method

- The backward linkage is known as the Power of Dispersion Index. It influences the effect of the greater purchase of inputs on the entire industries.

$$U_j = \frac{\frac{1}{n} B_{\bullet j}}{\frac{1}{n^2} \sum_{j=1}^{n} B_{\bullet j}}$$

where, U_j is Power of Dispersion Index

$B_{\bullet j}$ is the sum of column elements in sector j and

n is the number of sectors

Industrial Linkages – Rasmussen Method

- The forward index is known as the Sensitivity of Dispersion Index. It influences the effect of greater output productions on the entire industries.

$$U_i = \frac{\frac{1}{n} B_{i\bullet}}{\frac{1}{n^2} \sum_{i=1}^{n} B_{i\bullet}}$$

where, U_i is Sensitivity of Dispersion Index

$B_{i\bullet}$ is the sum of row elements in sector i and

n is the number of sectors

Key Sector

- The values of the indices for all sectors in which both U_j and U_i are greater than one (1), are then identified as key sectors

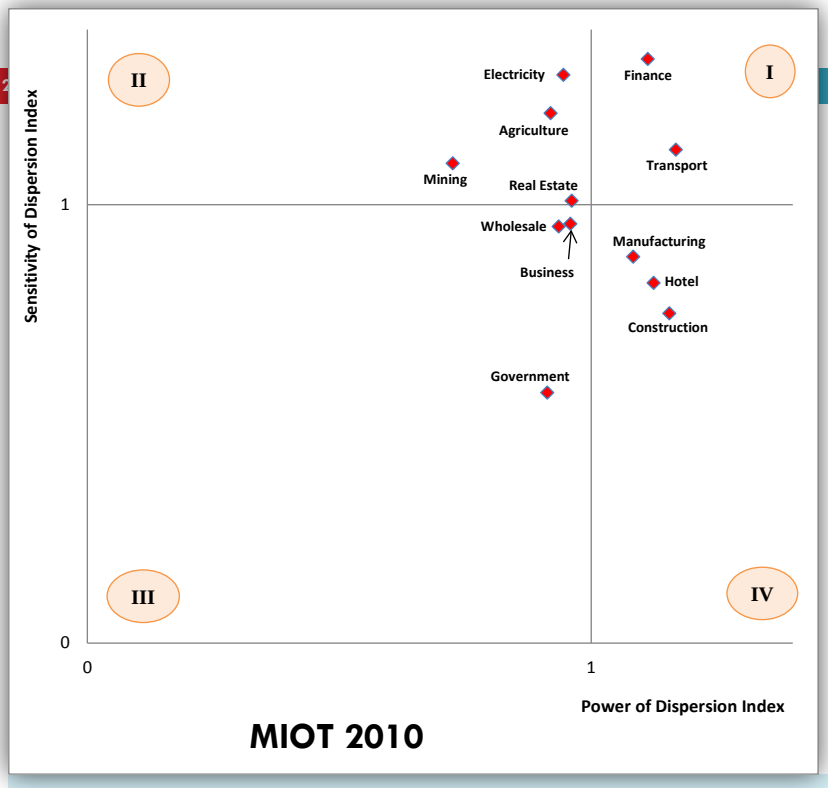
Results : Comparison Projected MIOT 2015 and MIOT 2010

Sector		Power of Dispersion Index	
		MIOT 2010	PROJECTED MIOT 2015
1	Agriculture, Fishery & Forestry	0.919	0.928
2	Mining & Quarrying	0.725	0.736
3	Manufacturing	1.083	1.085
4	Electricity, Gas & Water	0.945	0.950
5	Construction	1.155	1.143
6	Wholesale & Retail Trade	0.936	0.925
7	Hotel & Restaurants	1.124	1.108
8	Transport & Communication	1.168	1.172
9	Finance & Insurance	1.112	1.136
10	Real Estate & Ownership of Dwellings	0.961	0.948
11	Business & Private Services	0.959	0.951
12	Government Services	0.913	0.919

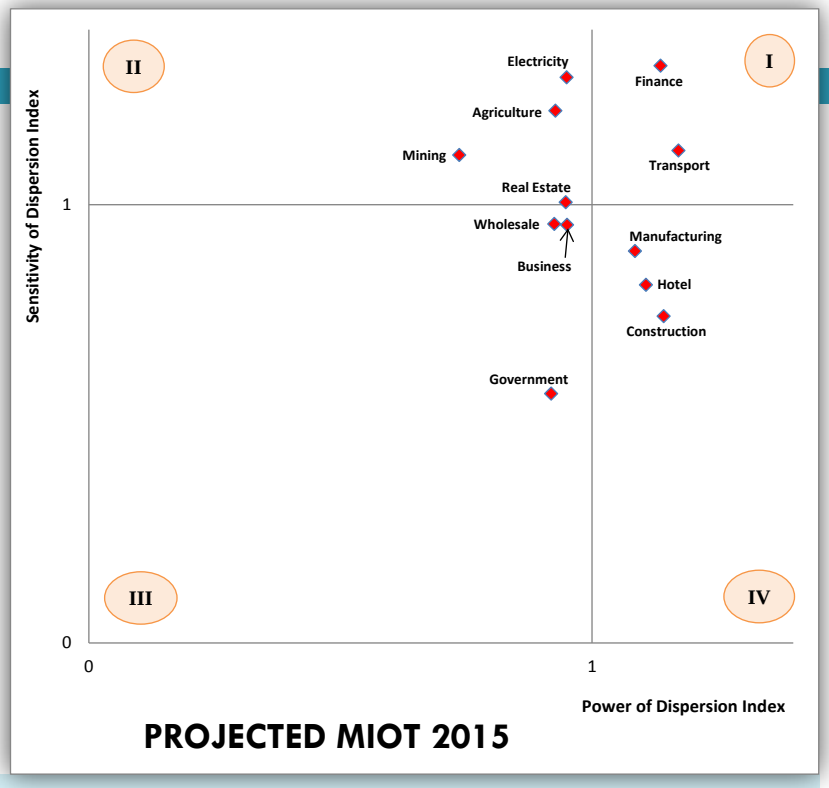
Sector		Sensitivity of Dispersion Index	
		MIOT 2010	PROJECTED MIOT 2015
1	Agriculture, Fishery & Forestry	1.209	1.214
2	Mining & Quarrying	1.094	1.113
3	Manufacturing	0.881	0.894
4	Electricity, Gas & Water	1.296	1.291
5	Construction	0.752	0.746
6	Wholesale & Retail Trade	0.950	0.956
7	Hotel & Restaurants	0.822	0.817
8	Transport & Communication	1.126	1.123
9	Finance & Insurance	1.333	1.317
10	Real Estate & Ownership of Dwellings	1.009	1.006
11	Business & Private Services	0.956	0.954
12	Government Services	0.571	0.569

(i) Transport & Communication and (ii) Finance & Insurance were identified as Key Sectors

Results : Identified Key Sectors



MIOT 2010



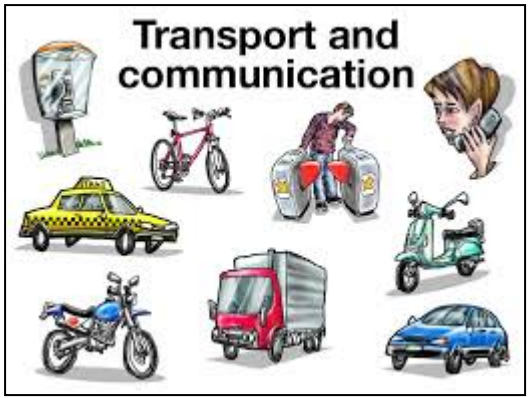
PROJECTED MIOT 2015

Sectors in Quadrant 1are Key Sectors.

(i) Transport & Communication and (ii) Finance & Insurance

Conclusion

- The application of Euro method shows that the projected MIOT for 2015 could be produced with minimal data based on macroeconomic official statistics, which is Gross Domestic Product.
- The identified Key Sectors in Malaysia economy are the same for 2010 and 2015 which are:



The End