

Social Accounting Matrix and its Application

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Basic Structure

- Balanced matrix representation of flow of funds in the economy (row sum=column sum)
- It follows National Accounting Convention (value added =Income = final expenditure)

	Factors	Households	Activities	Exogenous
Factors	0	0	Factor Incomes	...
Households	Distribution	Redistribution	0	...
Activities	0	Demand	Input-Output	...
Exogenous (Government, Trade, Capital)	...	...	...	...

How to build one

- South African SAM

National accounts function as total control (row sum).

Labor force survey and Income Expenditure survey are used to calculate coefficients.

Gender Dimension

- Factors
 - By skill and gender
- Household
 - By geography, type of residence, race, and income
 - By gender of household head
- Unpaid work
 - Time use data to measure gendered contribution to unpaid work. (recognized value since the inception of NIPA by Kuznets, but not incorporated in the system due to difficulties of measurement and valuation issues)
 - Intra-household resource allocation, tax incidence analysis, paid-unpaid work substitution.
 - Issues of valuation, integration to paid-work economy.

Incorporating non-market transactions : unpaid work

- Valuation: output vs. input approach:
- Output approach
 - To observe quantity of output (e.g. number of meals, clothing, etc.) and amount of input used including time, and to value them at equivalent market prices. (Acharya 1995)
 - It corrects for productivity differences across households.
 - Small sample, high-cost method, not immune to non-market valuation.
- Input approach
 - To measure quantity of inputs, mainly time, and value them at equivalent market prices (opportunity cost, specialist, generalist wages)
 - Manageable data requirement. Its bottom-up approach is reconcilable with national accounting system for service industry and government.
 - Various prices for time, but lack of theoretical and empirical evidence.

Marketed
Output

Non-marketed
Output

Final consumption and
material purchase is Not
separated

Ex.1 Unpaid work within hh accounts

	Expenditures:								
Receipts:	1. Activities	2. Commodities	3. Factors	4. Institutions	5. Rest of the World	6. Capital Account	Total		
				Households	Enterprises	Government			
1.Activities		Domestic Sales		Caring		Export subsidies	Exports f.o.b.		Production
2.Commodities	Intermediate inputs			Final HH Consump.		Final Gov. Consump.	Investment		Domestic Demand
3.Factors	Value-Added								Value-Added (f.c.)
Households			VA Labor	Interhousehold Transfers	Transfers	Government Transfers	Remittances from Abroad		Household Income
Enterprises			VA Capital						Enterprise Income
Government	Indirect Taxes	Import Tariffs		Income Taxes	Corporate Taxes				Government Receipts
5.ROW		Imports c.i.f.							Imports
6.Capital Account				HH Savings	Enterprise Savings	Gov. Savings	Net Capital Inflow		Total Savings
Total	Gross Output	Domestic Supply	Factor Outlay	HH Expenditure	Enterprise Expenditure	Government Expenditure	Foreign Ex Earnings	Total Investment	

4.

Source: Marzia Fontana 2006 GEM presentation

Intra-household
transfers

Ex.2. Unpaid work in the factor account

	SNA Production or Market Activities									Non-SNA Production or Non-Market Work			Non Work		
	Commodities	SNA Male labour	SNA Female Labour	SNA Capital	Households	Other Institutions	Taxes	ROW	Capital	Non SNA Male Labour	Non SNA Female Labour	Household activities	Male personal activity	Female personal activity	Total
Commodities															
SNA Male labour															
SNA Female Labour															
SNA Capital															
Households															
Other Institutions															
Taxes															
ROW															
Capital															
Non SNA Male Labour															
Non SNA Female Labour															
Household activities															
Male personal activity															
Female personal activity															
Total															

Source: Marzia Fontana 2006 GEM presentation

Incorporating non-market transactions : unpaid work (2)

- Expanded SAM for Spain 1995
 - It includes all three inputs, labor, capital, and intermediate, for unpaid work. → more intersection with paid work economy.
 - Transactions between paid and unpaid economy are fully recorded, through which policy impact are delivered to unpaid work.
 - Alas, cumbersome data requirement may hinder application to many other countries.

What do we need

- Luck (by order of magnitude): Free SAM online; somebody else does it for you; purchase at a reasonable price; or do it yourself.....
- Data
 - Input-output data : make and use tables
Current Survey of Business, Government, etc.
 - Household income and expenditure
 - Household IE survey, Labor force survey, etc.
 - Other data from national accounting (NIPA)

Balancing to make two ends meet

- To disaggregate data, one need to use multiple data sources (hh survey, conversion of gov't administrative data to economic data, etc) .
 - Often, the sources and national account data do not match. (e.g. sum of all household's income reported in hh survey may not equal to personal income in the account.)
 - Time inconsistency
 - Multiple phases to expand the dimension.
- A huge undertaking for an individual researcher.
- Instead, one can update SAM with reasonable workload.
(See Poverty and Economic Policy Research Network—
SAM balancing code in GAMS and manual
(www.pep-net.org)).

Practical use of SAM (1)

- Multiplier analysis
 - Short term impact analysis on aggregate demand shocks.
 - It keeps track of quantity changes based on accounting identity.
 - Pros: a quick, simple, and intuitive tool; an easy concept to communicate with others; flexibility to (dis)aggregate unit of analysis (e.g. gender, household types to assess distributional impact, detailed inter-industry linkages, etc); to identify key paths to maximize an intended policy impact (Structural path analysis).
 - Cons: fixed price assumption; lack of micro behavioral responses; lack of time dimension.

Practical use of SAM (2)

- Benchmark data for Computable General Equilibrium models.
 - SAM provides a consistent (receipts= expenditure) base-year data.
 - It is used for parameter calibration (technology parameters, shares of household consumption).

Multiplier Analysis- concept

- $Y = n + x \rightarrow Y = A * Y + x \rightarrow (I - A) * Y = x$

$$\text{where, } A = \begin{pmatrix} \frac{n}{Y} \\ \frac{x}{Y} \end{pmatrix}$$

$$Y = \underbrace{(I - A_n)^{-1}}_{\text{Multiplier matrix (M)}} * X$$

Multiplier matrix (M)

Assumptions

- There exists excess productive capacity, which allows prices to remain constant
- Fixed propensities (no substitution in either production or consumption)
- Production technology and resource endowment are given

Extension – to add flexibility to rigid SAM structure for *ex ante* analysis

- Public employment programs, infrastructure development programs using more labor than usual, for instance.
- Different technology requirements (e.g. higher labor intensity)
- Job targeting to counter existing inequality.
 - To create a new sector that does not exist in the SAM.

Q: How to incorporate the new sector into SAM?

Difficulties:

- No prior information to use for balancing.

Hypothetical Integration: concept

	Factors	EPWP Factors	Households	Activities	EPWP sector	Exogenous
Factors	0	0	0	Factor Incomes	0	...
EPWP Factors	0	0	0	0	Factor Incomes	
Households	Distribution	Distribution	Redistribution	0	0	...
Activities	0	0	Demand	Input-Output	Hypothetical Input-Output	...
EPWP sector	0	0	Hypothetical demand	Hypothetical Use	0	...
Exogenous	...	...	...	...	0	...

Source: Author's calculations

Hypothetical Integration

- Assumptions
 1. No leakages to exogenous accounts.
 2. EPWP specific unskilled from targeting.
 3. EPWP income spent on EPWP service.
 3. EPWP input output symmetry.

Modifying EPWP column sum

				FACTORS			HOUSEHOLDS			ACTIVITIES			X		
				1	2	3	4	5	6	7	8	9	10		
				1	2	3	1	2	3	1	2	3	1		
				FGOS	UL	SL	EPWP	HIGH	POOR	ENT	PRIM	MANUF	SERV	EPWP	
F	1	1	FGOS	0	0	0	0	0	0	0	11076	10315	16071	0	0
A	2	2	UL	0	0	0	0	0	0	0	3826	4365	6209	0	0
C	3	3	SL	0	0	0	0	0	0	0	4030	5421	17723	12	0
			EPWP	0	0	0	0	0	0	0	0	0	0	192	0
H	4	1	HIGH	88266	84396	194213	0	2724	1	109031	0	0	0	0	0
O	5	2	POOR	6431	14420	1766	192	2523	8	3235	0	0	0	0	0
U	6	3	ENT	143486	0	0	0	0	0	139857	0	0	0	0	0
A	7	1	PRIM	0	0	0	0	59179	2238	0	24665	22159	6945	60	0
C	8	2	MANUF	0	0	0	0	19037	213	0	2984	26289	6187	180	0
T	9	3	SERV	0	0	0	0	64707	593	0	20294	20280	20792	156	0
			EPWP	0	0	0	0	0	192	0	60	180	156	0	0
				154409	952	1899	0	25712	70	82953	12207	29348	5872	0	0
TOTAL				392593	99768	197878	192	173882	3123	335075	79082	118176	79799	600	1

FACTORS				HOUSEHOLDS					ACTIVITIES					X			
				1	2	3				4	5	6	7	8	9	10	
				1	2	3				1	2	3	1	2	3	1	
				FGOS	UL	SL	EPWP	HIGH	POOR	ENT	PRIM	MANUF	SERV	EPWP			
F	1	1	FGOS	0	0	0	0.032	0	0	0	11076	10315	16071	0		0	
A	2	2	UL	0	0	0		0	0	0	3826	4365	6209	0		0	
C	3	3	SL	0	0	0		0	0	0	4030	5421	17723	0.002		0	
			EPWP	0	0	0		0	0	0	0	0	0	0	0.032		0
H	4	1	HIGH	88266	84396	194213		0	2724	1	109031	0	0	0	0		0
O	5	2	POOR	6431	14420	1766		0.032	2523	8	3235	0	0	0	0		0
U	6	3	ENT	143486	0	0		0	0	0	139857	0	0	0	0		0
A	7	1	PRIM	0	0	0		0	59179	2238	0	24665	22159	6945	0.010		0
C	8	2	MANUF	0	0	0		0	19037	213	0	2984	26289	6187	0.030		0
T	9	3	SERV	0	0	0		0	64707	593	0	20294	20280	20792	0.026		0
			EPWP	0	0	0	0	0	0.032	0	0.010	0.030	0.026	0		0	
				154409	952	1899	0	25712	70	82953	12207	29348	5872	0		0	
TOTAL				392593	99768	197878	0.032	173882	2931.032	335075	79082.01	118176.03	79799.026	0.10		1	

Maintaining average expenditure propensity tor EPWP

FACTORS					HOUSEHOLDS				ACTIVITIES				X			
					1	2	3	4	5	6	7	8	9	10		
					1	2	3	1	2	3	1	2	3	1		
					FGOS	UL	SL	EPWP	HIGH	POOR	ENT	PRIM	MANUF	SERV	EPWP	
F	1	1	FGOS		0	0	0	0	0	0	0	0.14	0.09	0.20	0	0.02
A	2	2	UL		0	0	0	0	0	0	0	0.05	0.04	0.08	0	0.00
C	3	3	SL		0	0	0	0	0	0	0	0.05	0.05	0.22	0.02	0.00
			EPWP		0	0	0	0	0	0	0	0	0	0	0.32	0
H	4	1	HIGH		0.22	0.85	0.98	0	0.02	0.00	0.33	0	0	0	0	0.02
O	5	2	POOR		0.02	0.14	0.01	1.00	0.01	0.00	0.01	0	0	0	0	0.02
U	6	3	ENT		0.37	0	0	0	0	0	0.42	0	0	0	0	0.07
A	7	1	PRIM		0	0	0	0	0.34	0.72	0	0.31	0.19	0.09	0.10	0.27
C	8	2	MANUF		0	0	0	0	0.11	0.07	0	0.04	0.22	0.08	0.30	0.25
T	9	3	SERV		0	0	0	0	0.37	0.19	0	0.26	0.17	0.26	0.26	0.30
			EPWP		0	0	0	0	0	0.06	0	0.0008	0.0015	0.0020	0	0
					0.39	0.01	0.01	0	0.15	0.02	0.25	0.15	0.25	0.07	0	0.05
TOTAL					1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Very close to zero linkages

				FACTORS				HOUSEHOLDS			ACTIVITIES			
				FGOS	UL	SL	EPWP	HIGH	POOR	ENT	PRIM	MANUF	SERV	EPWP
F	1	1	FGOS	1.2397	0.5326	0.5232	0.5968	0.5276	0.5968	0.3046	0.6065	0.4904	0.6734	0.5843
A	2	2	UL	0.0899	1.1995	0.1963	0.2216	0.1979	0.2216	0.1142	0.2228	0.1889	0.2556	0.2202
C	3	3	SL	0.1915	0.4222	1.4192	0.4456	0.4230	0.4456	0.2436	0.4211	0.3617	0.6100	0.4802
			EPWP	0.0017	0.0056	0.0030	1.0217	0.0029	0.0217	0.0020	0.0027	0.0027	0.0034	0.3290
H	4	1	HIGH	0.8084	1.6840	1.8117	0.8951	1.8378	0.8951	1.0412	0.8757	0.7367	1.1213	0.9228
O	5	2	POOR	0.0561	0.2196	0.0823	1.0868	0.0739	1.0868	0.0593	0.0652	0.0550	0.0774	0.3926
U	6	3	ENT	0.7777	0.3341	0.3282	0.3744	0.3310	0.3744	1.9075	0.3805	0.3076	0.4224	0.3665
A	7	1	PRIM	0.6004	1.3682	1.2960	1.8356	1.3038	1.8356	0.7586	2.2173	0.9786	1.0613	1.4045
C	8	2	MANUF	0.2173	0.4765	0.4768	0.4787	0.4815	0.4787	0.2768	0.3701	1.5524	0.4597	0.7850
T	9	3	SERV	0.6804	1.4906	1.4938	1.4836	1.5085	1.4836	0.8671	1.3133	1.0853	2.4120	1.5887
			EPWP	0.0054	0.0174	0.0094	0.0680	0.0089	0.067958	0.0061	0.008582	0.008408	0.010691	1.0281

				FACTORS				HOUSEHOLDS			ACTIVITIES			
				FGOS	UL	SL	EPWP	HIGH	POOR	ENT	PRIM	MANUF	SERV	EPWP
F	1	1	FGOS	1.2420	0.5414	0.5266	0.6398	0.5307	0.6398	0.3070	0.6093	0.4925	0.6767	0.5999
A	2	2	UL	0.0907	1.2027	0.1975	0.2373	0.1991	0.2373	0.1151	0.2238	0.1896	0.2568	0.2259
C	3	3	SL	0.1930	0.4283	1.4215	0.4747	0.4252	0.4747	0.2453	0.4230	0.3631	0.6125	0.4908
			EPWP	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3200
H	4	1	HIGH	0.8117	1.6966	1.8166	0.9563	1.8422	0.9563	1.0447	0.8796	0.7396	1.1263	0.9450
O	5	2	POOR	0.0546	0.2150	0.0796	1.0697	0.0714	1.0697	0.0576	0.0627	0.0526	0.0743	0.3853
U	6	3	ENT	0.7791	0.3396	0.3303	0.4013	0.3329	0.4013	1.9090	0.3822	0.3090	0.4245	0.3763
A	7	1	PRIM	0.6079	1.3986	1.3063	1.9927	1.3129	1.9927	0.7663	2.2252	0.9845	1.0702	1.4599
C	8	2	MANUF	0.2172	0.4773	0.4762	0.4890	0.4807	0.4890	0.2766	0.3691	1.5515	0.4585	0.7876
T	9	3	SERV	0.6848	1.5088	1.4999	1.5789	1.5138	1.5789	0.8716	1.3177	1.0883	2.4173	1.6220
			EPWP	0.0000	0.0000	0.0000	0.0000	0.0000	0.000013	0.0000	0.0000015	0.0000014	0.0000019	1.0000

Social Accounting Matrix of South Africa 2000

- PROVIDE, Dep. of Agriculture
- 20 household types by location, type of residence, race, income (ex. Urban formal African Poor)
- 26 +1 activities.
- 5 + 2 factors (1 capital, 4+2 labor factors by skill and gender)
- Gender decomposition in factor accounts highlights inequalities of employment.

	Education	Health	EPWP
Capital	9.8	9.3	0.0
Male Skilled	20.8	8.7	1.9
Female Skilled	32.0	16.6	3.2
Male Unskilled	2.1	1.9	0.0
Female Unskilled	2.0	5.4	0.0
EPWP Male Unskilled	0.0	0.0	13.4
EPWP Female Unskilled	0.0	0.0	18.6
Agriculture	0.1	0.2	10.5
Mining	0.1	0.1	0.1
Food	0.1	0.3	31.3
Textile	0.5	1.6	0.4
Paper	0.6	1.3	0.5
Petroleum	0.5	1.4	0.4
Nonmetal	2.7	10.4	2.3
Metal	0.2	0.0	0.2
Machinery	1.0	0.3	0.7
Communication Equipment	1.4	4.8	1.1
Transportation Equipment	4.6	0.6	2.5
Other Manufacturing	0.5	3.0	0.5
Electricity	0.2	0.6	0.1
Water	0.1	0.3	0.1
Building	0.3	0.5	0.5
Construction	0.3	0.1	0.3
Trade, Hotels, and Catering	0.4	2.1	0.4
Transportation and Communication	2.1	4.7	3.0
Financial Service	0.7	1.1	0.5
Business Service	3.8	12.9	2.9
Education	9.7	0.8	0.2
Other Government Service	0.0	3.3	3.8
Health	1.1	0.1	0.1
Social Service	0.5	0.0	0.3
Other Service	0.3	0.5	0.1
Exogenous Accounts	1.5	7.1	0.0
Total	100.0	100.0	100.0

Input Composition

EPWP Job Targeting

Household Type	Shares of EPWP Jobs
Urban Formal African Poor	3.5%
Urban Formal African Ultrapoor	16.3%
Urban Formal Colored Poor	0.5%
Urban Formal Colored Ultrapoor	1.8%
Urban Informal African Poor	2.5%
Urban Informal African Ultrapoor	6.8%
Rural Commercial African Poor	2.6%
Rural Commercial African Ultrapoor	13.8%
Rural Commercial Colored Poor	0.1%
Rural Commercial Colored Ultrapoor	0.3%
Ex-homeland African Poor	8.5%
Ex-homeland African Ultrapoor	43.3%

Simulation

- R 9.3 billion (1% of GDP)
- Social Sector consists of ECD/Education and HCBC/Health
- High female intensity (60 and 69% respectively)
→ addresses female unemployment in the short run
- *Data source:* Friedman, Irwin, Bhengu, L., Mothibe, N., Reynolds, N., and Mafuleka, A., (2007) *Scaling up the EPWP*, Health Systems Trust, November, Volume 1-4. Study commissioned by Development Bank of South Africa and EPWP.

Over a half million jobs

EPWP Intervention - Direct job creation (# of annual jobs)

Types of Intervention (9.29 bn)	Male Unskilled	Male Skilled	Female Unskilled	Female Skilled	Total Jobs
Social sector	228,184	9,928	317,007	16,386	571,505
Infrastructure (labor intensive)	366,497	13,061	8,628	86	388,273
Infrastructure (machine intensive)	69,025	25,351	1,625	96	96,098

EPWP Intervention - Indirect job creation (# of annual jobs)

Types of Intervention (9.29 bn)	Male Unskilled	Male Skilled	Female Unskilled	Female Skilled	Total Jobs
Social sector	71,789	33,207	66,149	22,638	193,783
Infrastructure (labor intensive)	57,266	26,949	50,138	17,418	151,772
Infrastructure (machine intensive)	53,253	25,199	45,399	16,013	139,864

Pro-poor growth out of highly unequal system.

	w/o EPWP with EPWP <i>(in million rand)</i>		w/o EPWP with EPWP <i>(% growth)</i>	
Nonpoor	10,862	8,496	1.70	1.30
Poor	850	983	2.20	2.60
Ultrapoor	309	2,620	1.90	16.40
GDP	14,897	15,167	1.78	1.81

Source: Author's calculations

1/3 of spending is covered by multiplier effects

Tax Revenue from Multiplier effects (Billion Rand)

Types of Intervention (9.29 bn)	Sales Tax	Indirect Tax	Direct Tax	Tax total
Social sector	1.48	0.28	1.55	3.31
Infrastructure (labor intensive)	1.67	0.23	1.51	3.41
Infrastructure (machine intensive)	1.67	0.22	1.43	3.32

Changes in Tax Revenue

Types of Intervention (9.29 bn)	Sales Tax	Indirect Tax	Direct Tax	Tax total
Social sector	1.8%	1.5%	1.3%	1.5%
Infrastructure (labor intensive)	2.0%	1.2%	1.2%	1.5%
Infrastructure (machine intensive)	2.0%	1.2%	1.2%	1.5%

Unpaid Work as production activities

- How to treat it in a model?
 1. Individual optimization or Structure (allocation of time)
: output max or cost min (time bind, second shift). | fixed share of time and resources spent
 2. Substitution or Complement (Interdependence of paid and unpaid work)
: availability and access to market substitutes or complement; .
 3. Joint production (work only or work+joy)
: high income households spend more time on childcare. (U-curve)