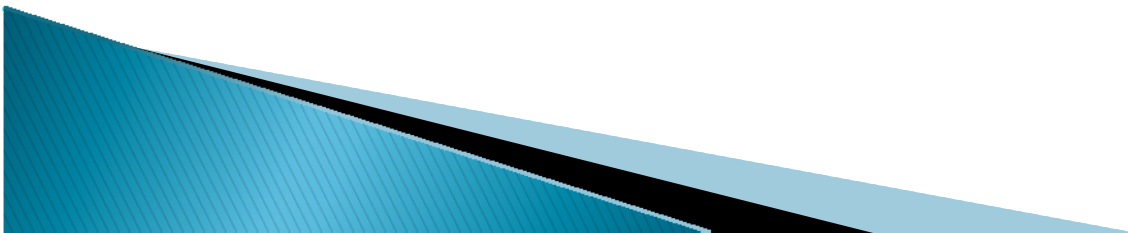


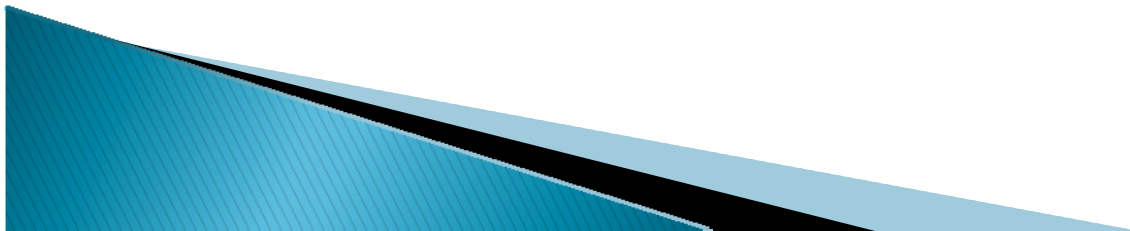
Macro Models: An Overview

By Were, M
GEM_IWG 2009



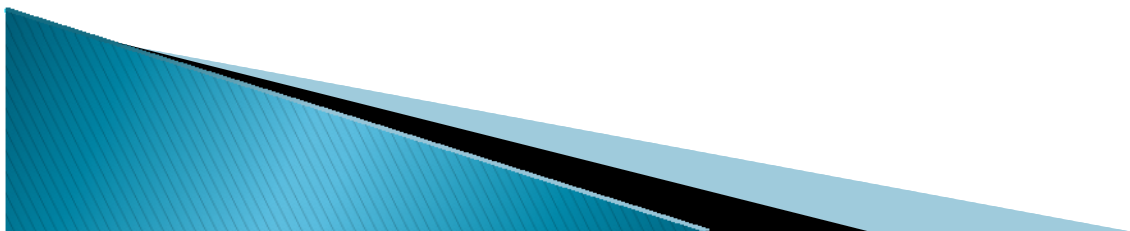
Introduction

- Macroeconomists—interested in how the whole economy works
- Hence, think in terms of models or key relationships
- A model is a (mathematical)logical representation of economic relationships—a set of equations that explain how the economy works and how agents interact in the economy



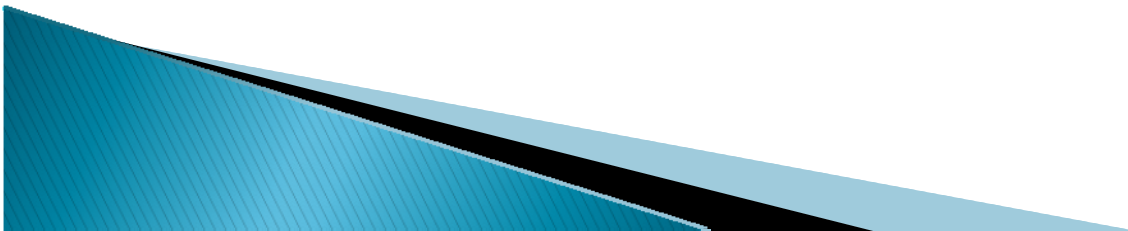
Why do we need macro models?

- ▶ The world/reality is too complex—simplify the reality/complexity
- ▶ Model—as a tool that provides a framework for logical reasoning, analysis of the economy in a consistent and coherent manner
- ▶ Models used to clarify interactions & magnitude, test, illustrate basic theoretical or economic principles
- ▶ Illustrate relationships among a group of variables/economic agents



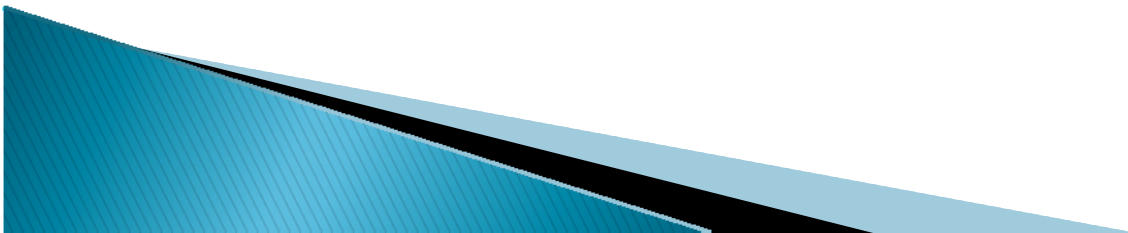
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- ▶ Used for policy simulations— “what if” scenarios to evaluate possible effects of changes in fiscal or other macroeconomic policies
- ▶ Economic projections build foundations for decision-making and planning
- ▶ How? Collect data (over time and/or cross-section)
- ▶ Formulate/adapt theories that explain the data



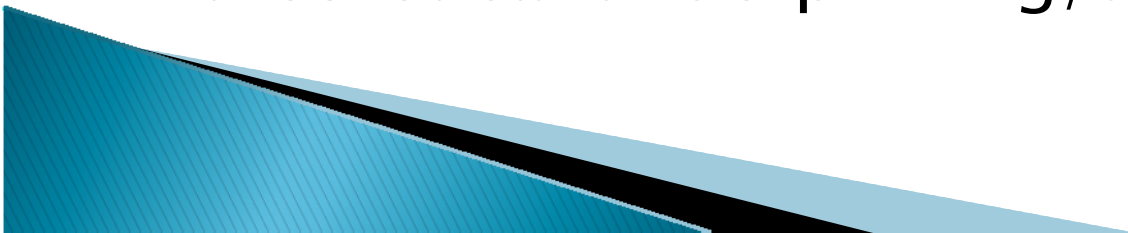
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- ▶ Built to explain different aspects of economy—hence different types of models
- ▶ Economic analysis heavily biased towards quantitative forms of analysis
- ▶ Models important tools of economic analysis, planning and evaluating policies



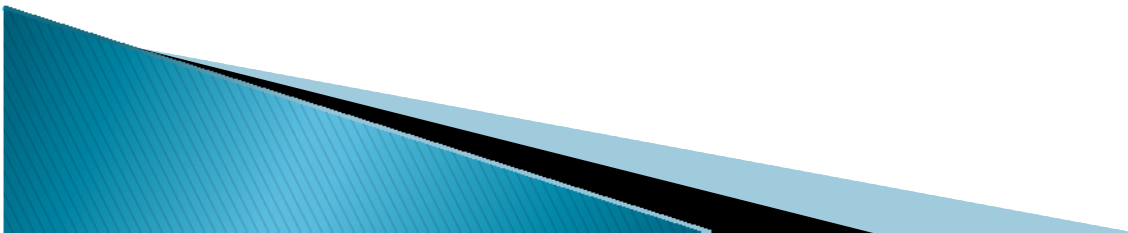
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- ▶ Underpins assessment of economic performance/ growth, poverty, formulation of policies, access to aid etc
- ▶ Gender implications?
- ▶ Are gender issues easily amenable to 'quantifiability'? Quantitative verification? Does the nature of data support this?
- ▶ Largely based on type/nature of data & theoretical underpinning/assumptions



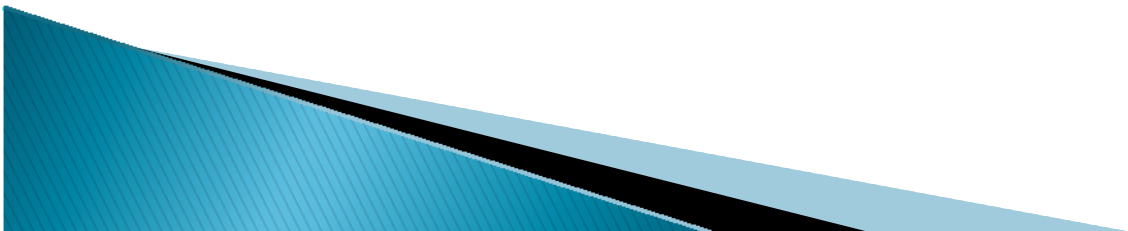
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- ▶ Also depends on level of detail and complexity
- ▶ No one model can adequately answer all the questions--complementarity
- ▶ If data base is gender-blind—so is the macro model
- ▶ If macroeconomic underpinning is gender-blind?



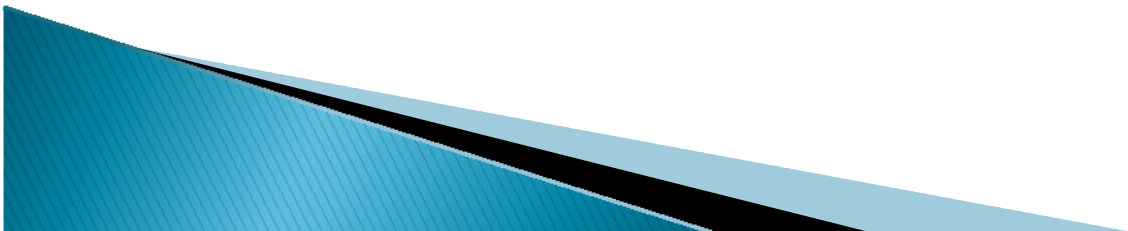
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- ▶ Types of macro models—have followed developments in field of macroeconomics over time (keynesian→neoclassical)
- ▶ Core features:
 - Non-general equilibrium Vs General Equilibrium
 - Econometric vs calibration
 - Time series/dynamic vs cross-section/static



Types of macro models

- ▶ (Empirical) macroeconometric models
- ▶ Applied general equilibrium models:
 - Dynamic stochastic general equilibrium (DSGE) models
 - Computable general equilibrium (CGE) models
- ▶ Agent-based Computational macroeconomics models
- ▶ Note: Also simple frameworks/simple models
(The Revised Minimum Standard Model (RMSM)
(World Bank); Financial Programming Model (IMF))
- ▶ Others
 - T21 (evaluate MDGs, long term vision), Futures, etc
 - Gravitation models—analyse external trade, Suitable for regional integration, migration analysis



Macroeconometric (forecasting) models

- Their history dates back to 1940s and 1950s, when economists set out to construct quantitative models to describe the dynamics observed in the (time series) data
- First comprehensive quantitative macro model developed by Dutch economist Jan Tinbergen for the Netherlands in 1936 (later applied to the US and UK)
- ▶ Tinbergen's model of the Dutch economy—constructed for the express purpose of policy simulation



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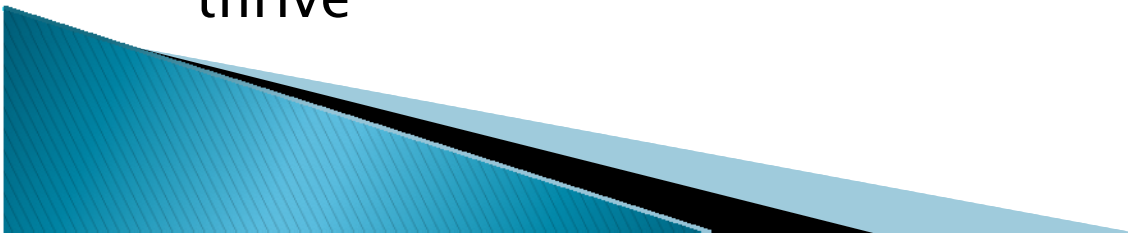
Other Empirical (Pioneer) Models

- ▶ Lawrence Klein's Model of the US Economy in the Great Depression– a small model over the period 1921 – 1941.
- ▶ Klein and Goldberger's Model of the US Economy in the Great Depression— relatively large model of the U.S. economy over the period 1929 –1941 (thirty equations)
- ▶ Trevor Swan's Model of the Australian Economy in the Great Depression Between 1943 and 1945



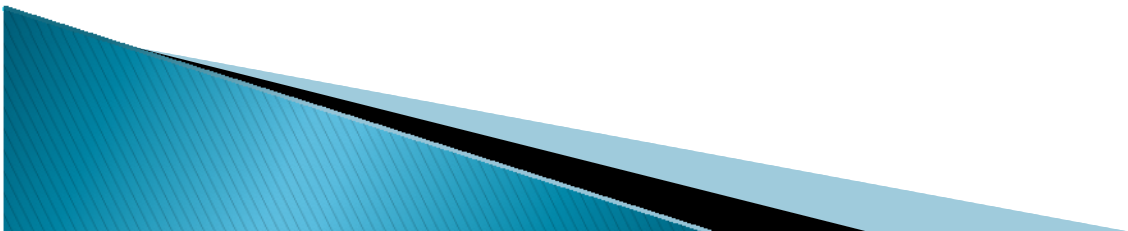
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- ▶ Developed along the conventional AD–AS Keynesian macroeconomic framework
- ▶ Empirical coherence (empirical estimations—parameters) based on macroeconomic theory
- ▶ Time series (SNA data)
- ▶ (Estimate) the dynamic relationships or correlations in different sectors of the economy
- ▶ Ran into strong criticism from academicians economists in the 1970s (i.e. the Lucas critique)
- ▶ However, macroeconometric models have continued to thrive



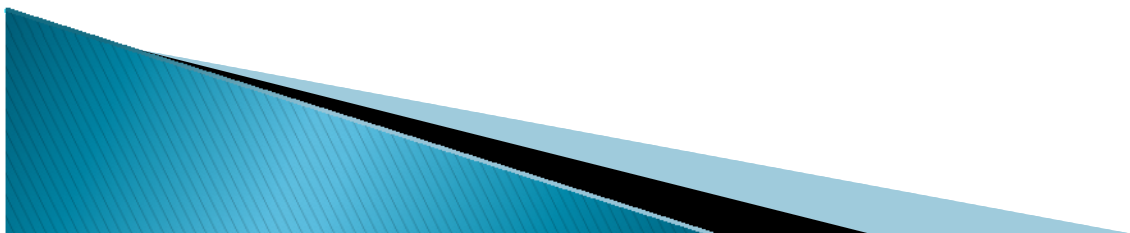
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- Commonly used Governments, central banks & research/policy institutions for forecasting and analysing policies (policy simulations)
- ▶ Suitable for macro analysis
- ▶ Largely based on national accounts data (SNA)—not supported gendered analysis
- ▶ Does not incorporate gender—gender neutral/blind



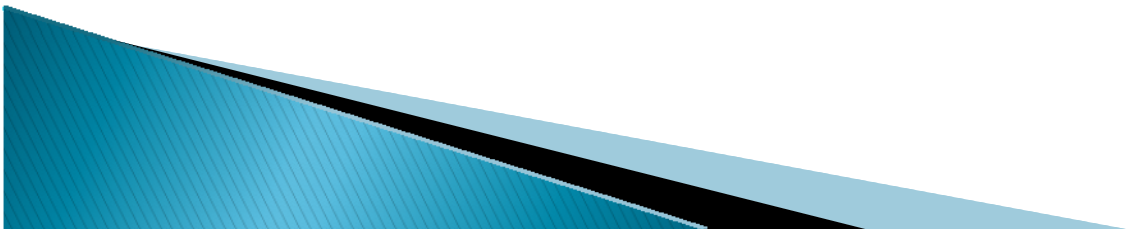
Dynamic Stochastic General Equilibrium (DSGE) Models

- ▶ Fairly recent development (1980s and 1990s)
- ▶ Partly a response to Lucas critique
- ▶ Is a branch of applied general equilibrium theory
- ▶ The DSGE methodology attempts to explain aggregate economic phenomena (e.g. economic growth, business cycles, effects of monetary & fiscal policy) on the basis of macro models derived from microeconomic principles/foundations



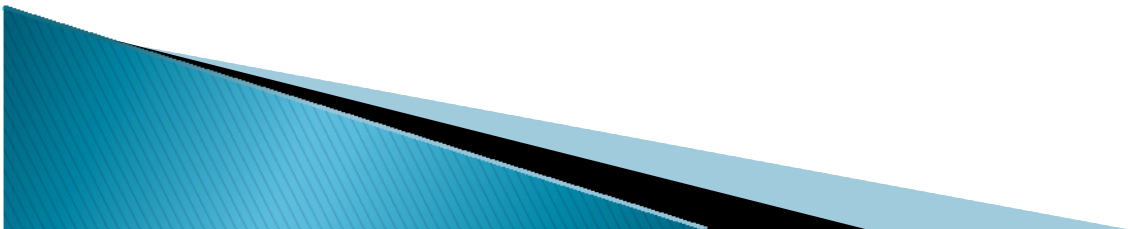
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- ▶ Place greater emphasis on **theoretical coherence**
- ▶ Begin by specifying a set of agents (households, firms, governments)—each is assumed to make optimal choice, taking into account prices and strategies of other agents in such a way that equate supply and demand in every market



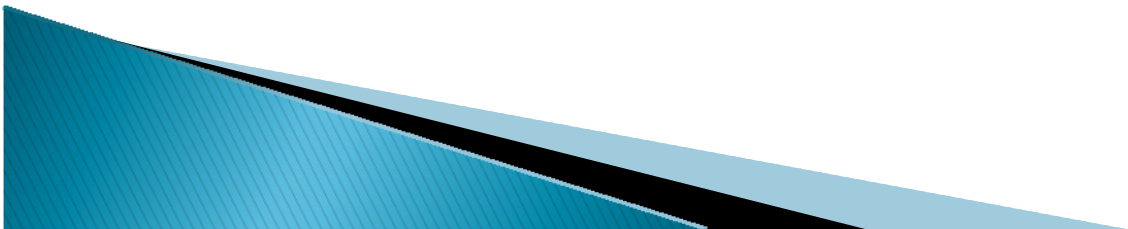
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- Parameters reflect the preferences (maximization) and constraints faced by economic agents, i.e. Technological (what the agents produce) and institutional (the way they interact)
- Abstract from sectoral details and include far fewer variables (mainly because they are difficult to solve)
- Constructed on the basis of assumptions about agents' preferences



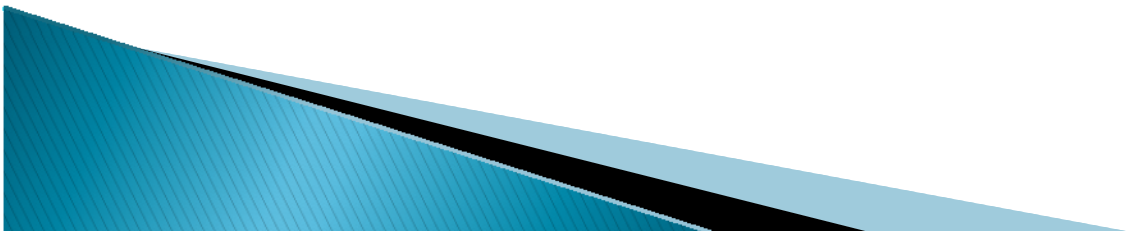
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- Suitable for studying business cycles and cyclical effects of monetary and fiscal policy (often at a quarterly frequency)
- Hence now common in central banks –studies of optimal monetary policy–how the central bank should adjust the nominal interest rate to changes in inflation and output



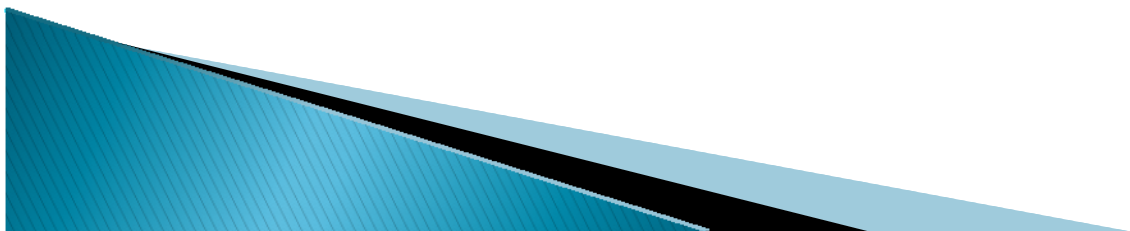
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- Difficult to study interactions between individual agents and not suited for economic forecasting
- Strong assumptions(e.g. complete markets)
- May exaggerate individual rationality and foresight, and understate the importance of heterogeneity



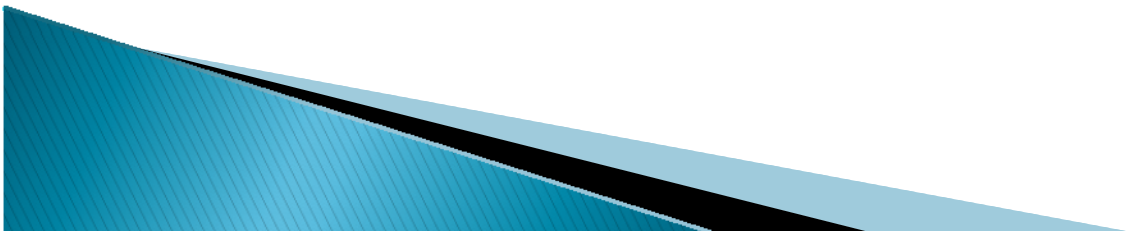
CGE models

- ▶ Pre-dates DSGE modeling
- ▶ Like DSGE models, CGE models are often microfounded on assumptions about preferences, technology and budget constraints.
- ▶ However, CGE models focus mostly on long run relationships—suited to the long run impact of permanent policies like tax system or trade policy



Contd....

- ▶ Multiple interacting agents
- ▶ Highly structural–behaviour derived from optimization (tend to be neo–classical in spirit)
- ▶ Mainly static–model reactions of the economy at one point in time—move towards dynamism
- ▶ Been widely used to analyse impact of trade policy, tax, income distribution etc



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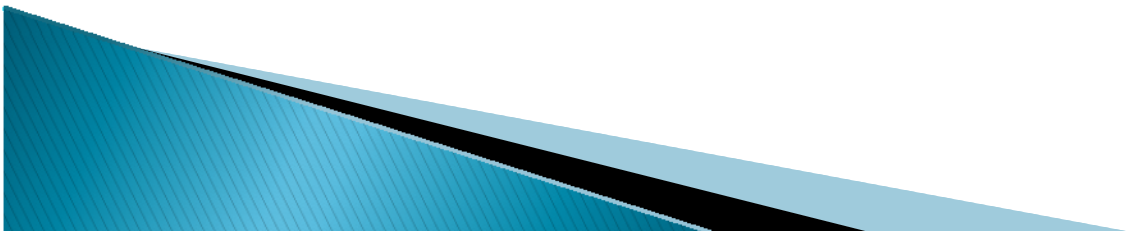
- ▶ Influential in the research and academic arena—less used by Governments in policy–decision making & planning
- ▶ However, supported gendered analysis—deliberate effort
- ▶ Fairly detailed database—Input–Output table (Leontief framework) / Social Accounting Matrix (SAM)
- ▶ The first two CGE models were published by Adelman and Robinson [1978] on Korea and Lysy and Taylor [1980]



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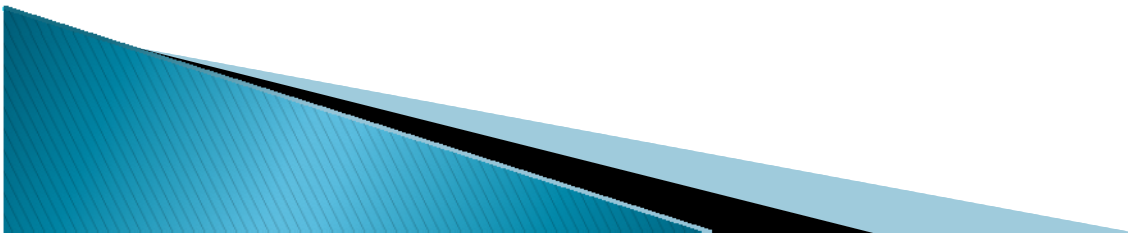
Neo Classical CGE

- Investment is given in nominal terms, price level adjusts to make real investment equal to available real savings.
- full capacity utilization,
- prices determined by marginal productivity rules
- full employment
- Therefore, adjustment to an external shock takes place through reallocation of labor between productive sectors (driven by relative prices)
- Only relative prices matter,



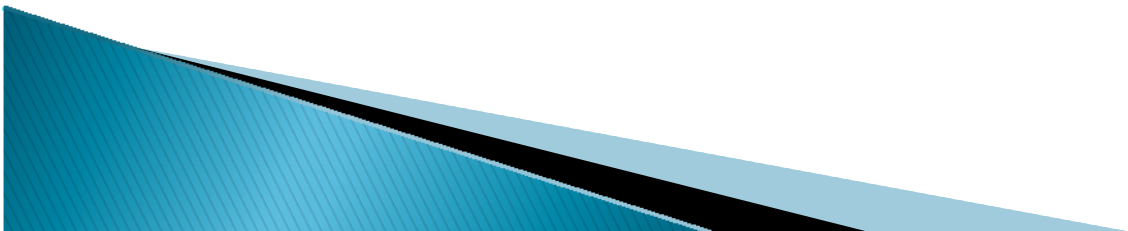
The case of Kenya

- ▶ Kenya—SAM 2003 (jointly between IFPRI and KIPPRA)
- ▶ A macroeconometric forecasting model developed in 2000 –called KIPPRA–Treasury Macro Model (KTMM)
- ▶ Been actively used by the Government/Treasury in macroeconomic framework in the national budgetary process



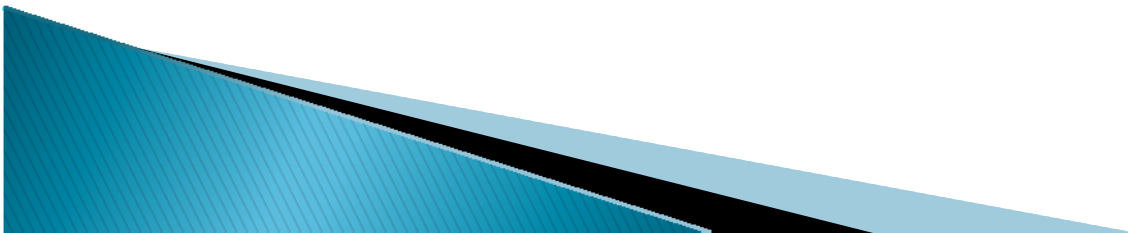
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- ▶ Designed along Aggregate Demand (AD)–Aggregate Supply (AS) framework
- ▶ Excess capacity so that any demand is actually met.
- ▶ Model is demand-driven in the short run, with multiplier effects through consumption and investment
- ▶ The model contains 12 behavioural variables, several semi-behavioural and secondary variables

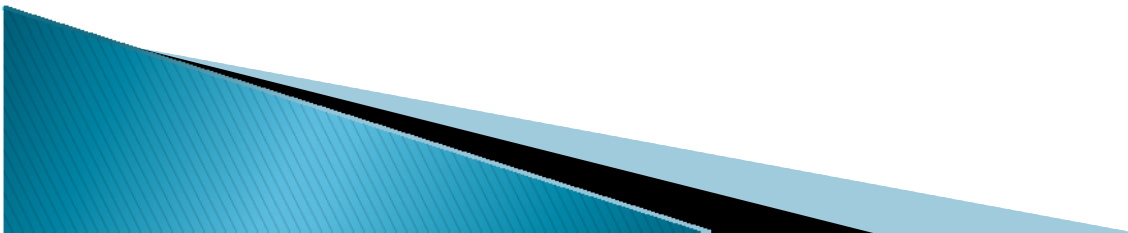


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- ▶ Designed along institutions/SNA93 framework—Monetary, Business/Private Sector, Households, labour etc
- ▶ Built in Excel and hence fairly simple to operate
- ▶ In the process of being revised
- ▶ Not gendered—doesn't support gender analysis/gender blind

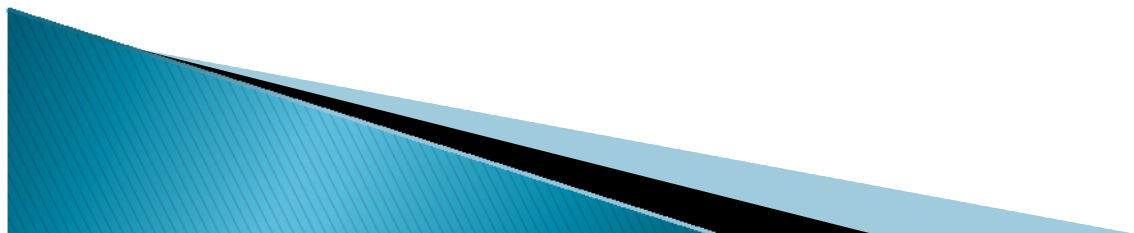


SAM & Gender: The Case of 2003 SAM for Kenya: GEM_IWG July 2009



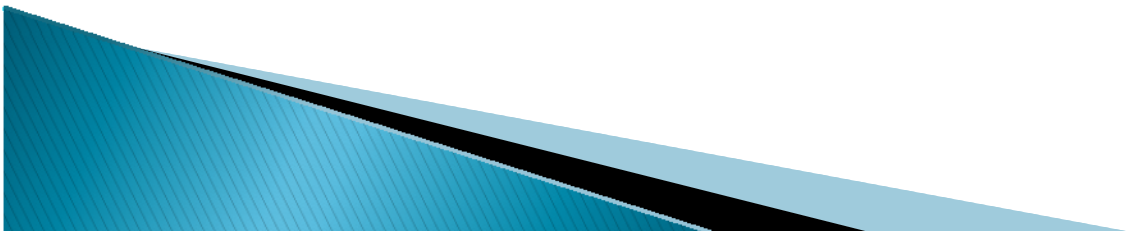
What is a SAM?

- ▶ A matrix of interaction b/n production, income, consumption and capital accumulation
- ▶ Snapshot of an economy (economic structure).
- ▶ Consistent framework of economic processes - details linkages; for analyzing income and expenditure flows in the economy.



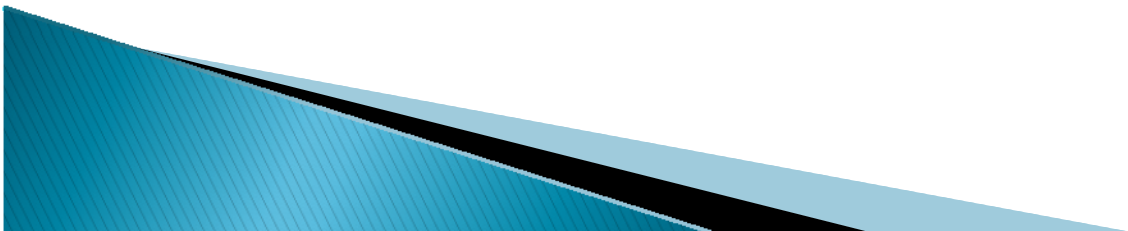
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- ▶ **Need for consistent multisectoral data for supporting policy analysis & economy wide modelling.**
- ▶ **Interactions within a SAM enable policy simulations – impact analysis, mainly growth, income distribution, employment and poverty.**
- ▶ **Principle of double entry – expenditures in columns and incomes in rows – incoming in one account must be outgoing in another!**



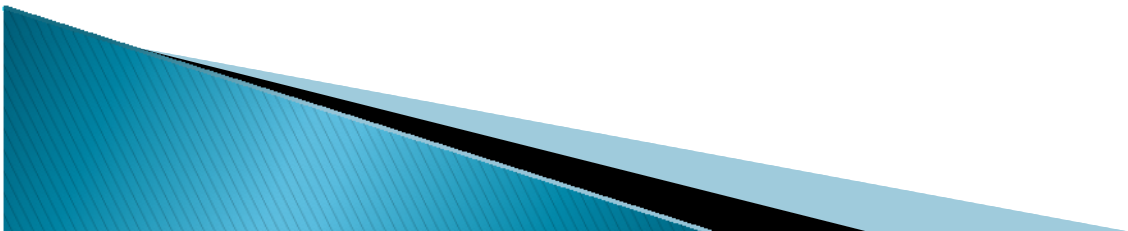
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- ▶ For each sector: Total income (row) = Total Expenditure (column)
- ▶ SAM embodies national accounts (macro)—disaggregation (meso)
- ▶ I-O is a sub-set of SAM – commodity & activity a/cs only => generated from a supply and use table.



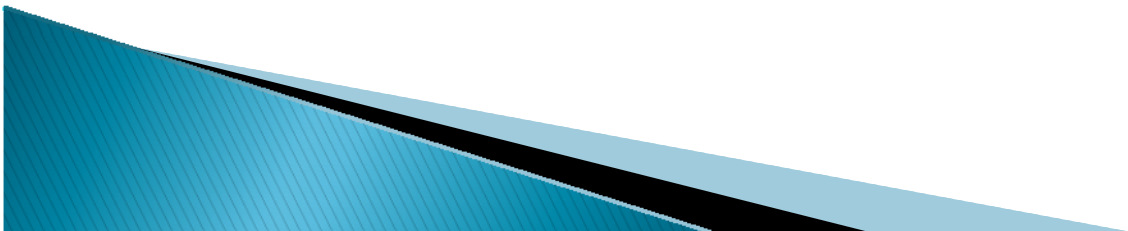
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- ▶ **Basic I-O equation: Output + imports (total supply) = Intermediate consumption + Exports + GFCF + Final consumption + change in inventories (total use)**
- ▶ **SAM as a basis for simple modelling thro' multiplier analysis (MA)**



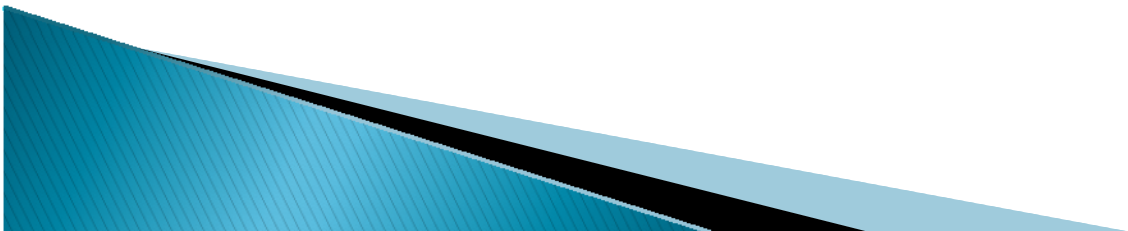
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- ▶ **I-O multipliers** => direct & indirect effects of a change in exogeneous demand—don't capture induced effects on factors of production & hh incomes & activity outputs due to income expenditure multipliers
- ▶ MA reflect the strength of linkages among different sectors of the economy—indirect as well as direct causal linkages



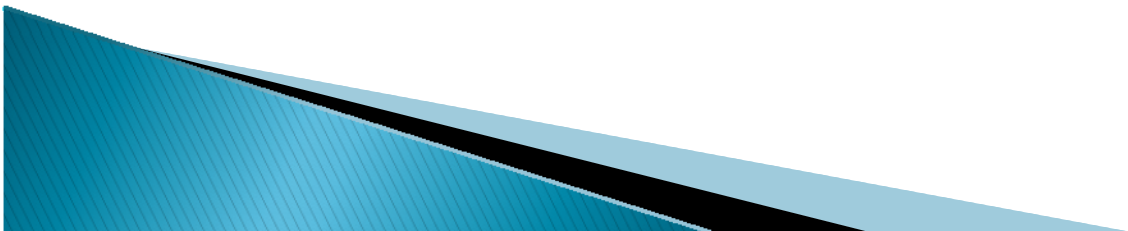
Assumptions

- ▶ Dd driven (excess capacity)
- ▶ Constant price relatives
- ▶ Constant returns to scale
- ▶ Constant market shares.
- ▶ Exogenously determined final dd
- ▶ Perfect complementarity betwn factors
- ▶ Homogenous products within sectors but heterogeneous factors
- ▶ Homogenous technology



Standard accounts

- ▶ Production a/c (activities & commodities)
- ▶ Factors of production (land, labour, capital)
- ▶ Institutions (households & enterprises)
- ▶ Government
- ▶ Capital account(saving–investment)
- ▶ ROW
- ▶ Production--VA--income
distr'(institutions)--household groups



Social Accounting Matrix structure

	Production and Product Markets	Income Distribution	Demand Patterns	Financial Sector	Rest of the World
Production and Product Markets			Consumption	Investment	Exports
Income Distribution	Value Added				
Demand Patterns		Disposable Incomes			
Financial Sector			Saving		
Rest of the World	Imports				

Table A.1: *A Sample Social Accounting Matrix*

A Basic SAM Structure

	Activities	Commodities	Factors	Households	Enterprises	Government	Investment	Rest of the World	Total
Activities		marketed outputs		home-consumed outputs					activity income
Commodities	intermediate inputs	transactions costs		private consumption		government consumption	investment,	exports	total demand
Factors	value-added								factor income
Households			factor income to households	Intra-household transfers	surplus to households	transfers to households		transfers to households from RoW	household income
Enterprises			factor income to enterprises			transfers to enterprises		transfers to enterprises from RoW	enterprise income
Government		sales taxes, import tariffs	factor income to government	direct household taxes	surplus to government, enterprise taxes			transfers to government from RoW	government income
Savings				household savings	enterprise savings	government savings	change in stocks	foreign savings	savings
Rest of the World (RoW)		imports			surplus to RoW	government transfers to RoW			Foreign exchange outflow
Total	activity expenditures	total supply	factor expenditures	household expenditures	enterprise expenditures	government expenditures	investment	foreign exchange inflow	

A 2003 SAM for Kenya

- ▶ Data sources: national accounts and other macroeconomic databases complemented with survey data.
- ▶ Has 6 standard accounts – activities/commodities, factors of production, institutions (enterprises & HH), government, capital account and rest of the world.
- ▶ Activities—entities that carry out production
- ▶ Commodities—rep mkts for goods & services and non-factor services.



▶ Distinction between home & marketed consumption

The 2003 Macro SAM

	Activities	Commodities	Factors	Enterprises	Households	Taxes	Govt	Investment	Rest of the World	Total
Activities		1,783,049			95,043					1,878,092
Commodities	867,692	117,117			772,972		202,913	196,723	281,387	2,438,804
Factors	1,010,400									1,010,400
Enterprises			544,860				41,297		4,909	591,066
Households			461,261	335,194			17,898		91,014	905,367
Taxes		131,756		37,053	33,603					202,412
Govt			4,279	7,332	6,298	202,412			5,677	225,998
Savings				204,248	-2,548		-36,286	17,498	31,310	231,719
Rest of the World		406,882		7,239			176			414,297
Total	1,878,092	2,438,804	1,010,400	591,066	905,367	202,412	225,998	231,719	414,297	

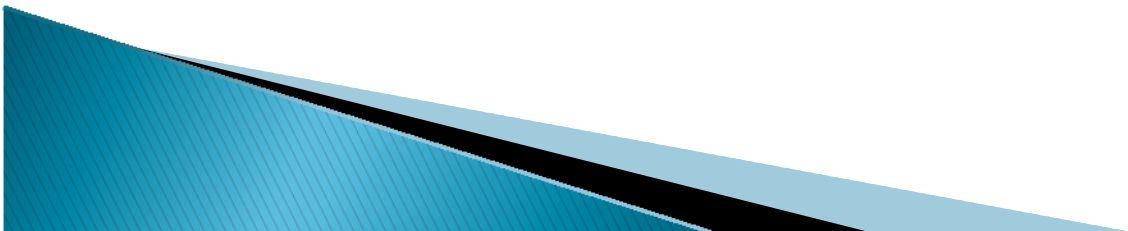
Disaggregation

- Used the SAM 2003 to analyse the gendered employment outcomes of various growth options in Kenya—but had to create an employment satellite account
- Disaggregation: production—27 sectors;
- Factors—COE 16 employee categories by gender, region(urban/rural),sector (formal/informal) & skill(skilled/unskilled)
- Institutions—no disaggregation for enterprises but hhs disaggregated according to region and expenditure deciles(lower/upper)



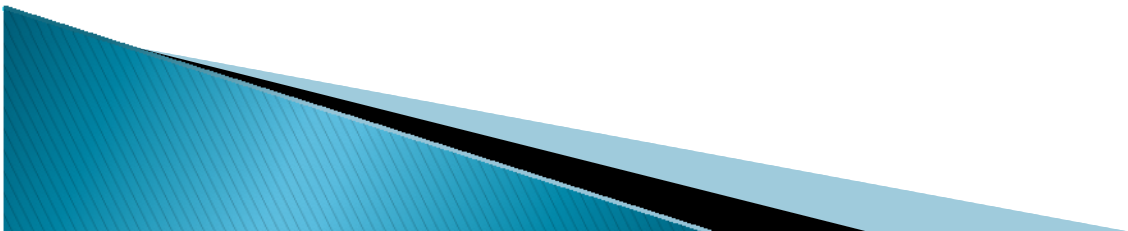
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- Govt—core govt account plus taxes disaggregated into commodity, direct and trade taxes
- No disaggregation for capital (savings–investment) and ROW
- To analyse the employment outcomes in a SAM framework, we constructed an employment satellite account hence interpret multipliers as employment ratios



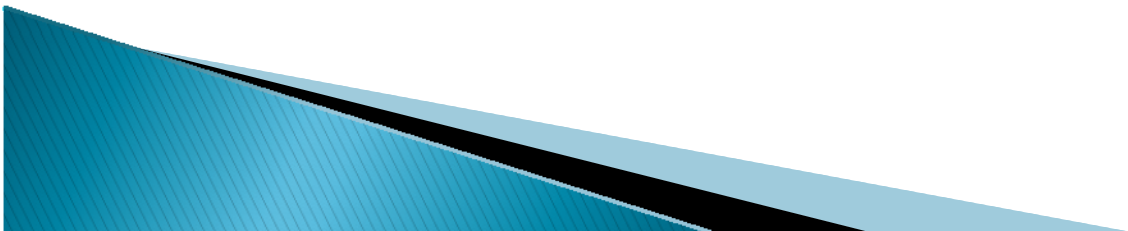
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- ▶ Used NA employment data for aggregates, disaggregated broadly into formal (public and private) and informal, and a further disaggregation of formal employment by sector and gender
- ▶ Used respective employment ratios derived from Integrated Household Labourforce Survey 1998/99 to further disaggregate formal employment into labour categories according to gender, region, sector & skill



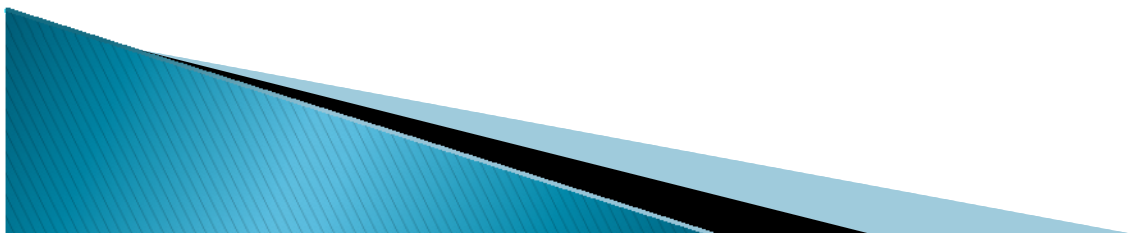
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- ▶ Consider only people earning an income (paid employees) but very small sample—majority of women in unpaid work and hence proportion of women in the sample reduced.
- ▶ WMS 1997 used to increase the sample—66% males & 34% females
- ▶ Consistency maintained



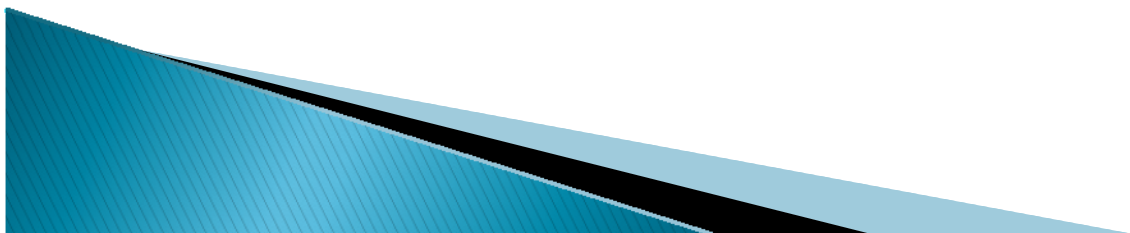
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- ▶ For MA distinguish b/n endogeneous (production, factors & hhs) & exogenous accounts (e.g. ROW, govt, capital)—Table 3
- ▶ MA usually examine nature of multiplier effects of an income injection in one part of system on functional and institutional distribution as well as on incomes of socio-economic groups of hhs
- ▶ In the paper, MA also used to analyse the effect on gendered employment outcomes



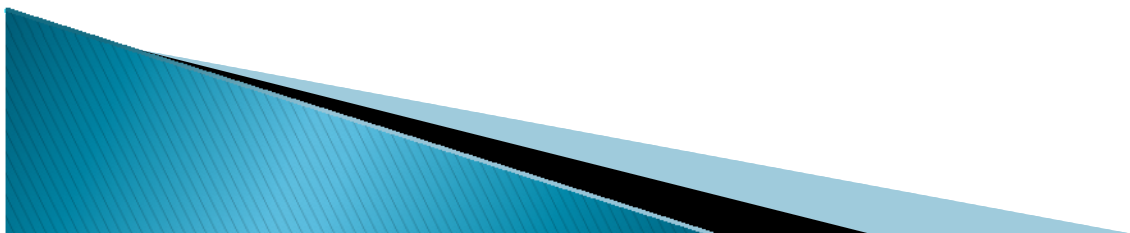
Simulation Results

- ▶ Priority sectors—agriculture, services and manufacturing
- ▶ Selected sectors with highest level of linkages in manufacturing and services
- ▶ 5 simulations targetting different combinations of sectors: 1) agriculture 2) manufacturing 3) private services 4) agr & manufacturing 5) all three



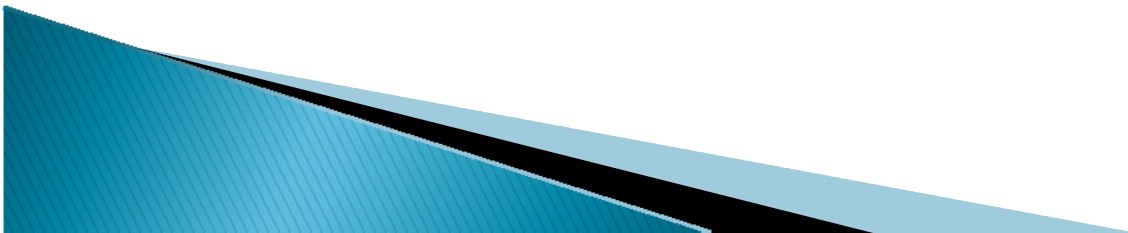
Results of injections on COE

- ▶ Investing in agriculture yields highest increase in incomes (cost of labour)—14.1%
- ▶ Intuitive given agriculture is more labour-intensive—services more capital-intensive
- ▶ Overall, highest increase registered in informal sector
- ▶ Formal sector—private services(61%), manufacturing(50%) & agr(42%)



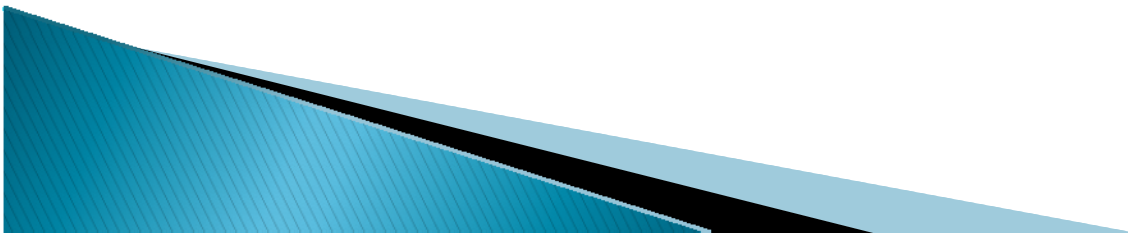
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- ▶ Gender—overall male accounted for over 80% of total increase in COE
 - propn for female higher in the informal sector
 - Results in line with the employment patterns and general socio-economic structure by gender
- ▶ Skill—skilled labour benefited most (over 70%)—relatively higher proportion of male are skilled
 - In agrc, unskilled labour accounts for only 14% of the increase



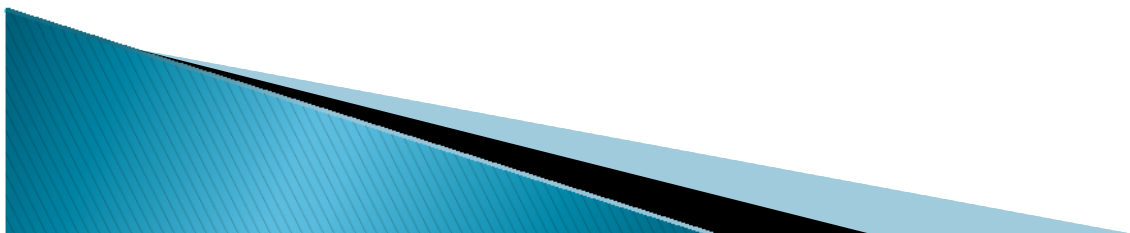
Distr' of wage incomes across households

- ▶ Agr yields highest increase in incomes for hhs—26% and services yield lowest (6.2%)
 - Increase benefits rural hhs more than urban (in kenya agriculture dominantly rural activity)
 - Benefits hhs in upper deciles
- ▶ Investing in services & manufacturing benefits urban folks
- ▶ Analysis by gender wasn't possible but inferences can be made



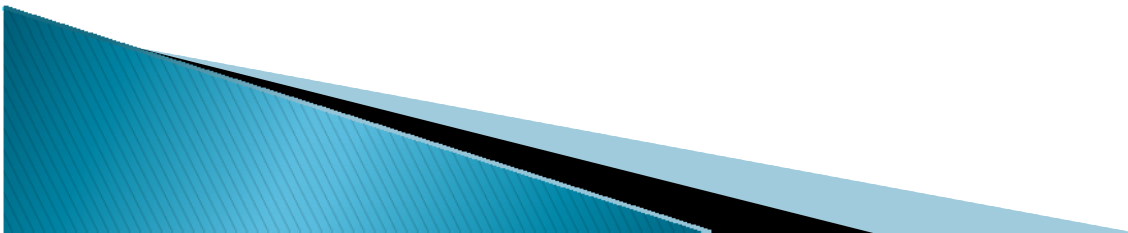
Impact on gendered employment creation

- ▶ Unlike COE, investing in manufacturing generates highest increase in employment (17% additional jobs vis 14% for agr and 12% services)
 - However, jobs created largely informal sector(86%) — precarious with low earnings
 - Gender—females account for higher propn of growth in informal sector
 - Manufacturing accounts for slightly higher propn of the increase in female employment (33% vis 32% for services
- ▶ Skill—highest propn of the increase is for unskilled labour with agriculture taking the lead (71%)
 - Women benefit slightly more from the increase (unskilled labour)



Conclusion

- ▶ Formal sector is male dominated
- ▶ MA shows investing in priority sectors is bound to benefit men disproportionately more than women both in terms of earnings/incomes and employment opportunities
- ▶ Results illustrate disparities in incomes between unskilled and skilled with later benefiting most majority of whom are male



Contd...

- ▶ Overall, Illustrates how the biased socio-economic structure inhibits equal access/benefit from economic growth potentials
- ▶ Need to improve skills for females
- ▶ Investing in agriculture has potential of raising rural incomes which benefit majority of women
- ▶ Tap the potential of increasing employment opportunities for women in the manufacturing sector



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Reference/details:

Wanjala, B and Were,M. 2009. “Gender Disparities and Economic Growth in Kenya: A Social Accounting Multiplier Approach” in *Feminist Economics* (special issue), pp.1–26—forthcoming

