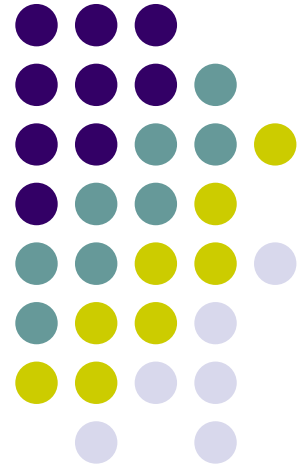


Fuzzy Set Approach to Poverty Reduction Compared with Growth Modelling

Wendy Olsen¹, Hisako Nomura²

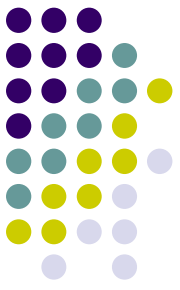
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With thanks to D. Byrne and Ray Kent



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Outline of the Talk

- 1 Growth and Poverty Reduction - A Realist Approach to Causality Using QCA
- 2 Variates and Measurement of Indications of Causal Mechanisms Over Time
 - 1992 the base year
 - 1992-2002 the change period for outcome Delta
- Example of Bivariate Necessity for a Single Configuration – Coverage of the Result
- 3 Growth's Insufficiency for Poverty Reduction – The Findings
- 4 Conclusions

Growth and Poverty Reduction



- Many causal mechanisms in the macro socio-economy do not simply work alone – e.g.
 - ‘The trickle-down theory that growth in average incomes will gradually reduce poverty of the poor’
- Instead, we argue, it is realist to suggest that each factor may work in conjunction with others.
- Using Qualitative Comparative Analysis, we make it an empirical question which factors work together.

Basic Presuppositions



- **Growth** is affected by exogenous factors, history, savings, investment, X , and inequality.
- **Inequality** (Gini Coefficient of income) is affected by other exogenous factors, history, and average income level.
- And
- Poverty reduction 'delta' is affected by exogenous factors, history, **growth and inequality**.

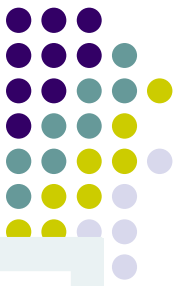


Our Outcome Variate

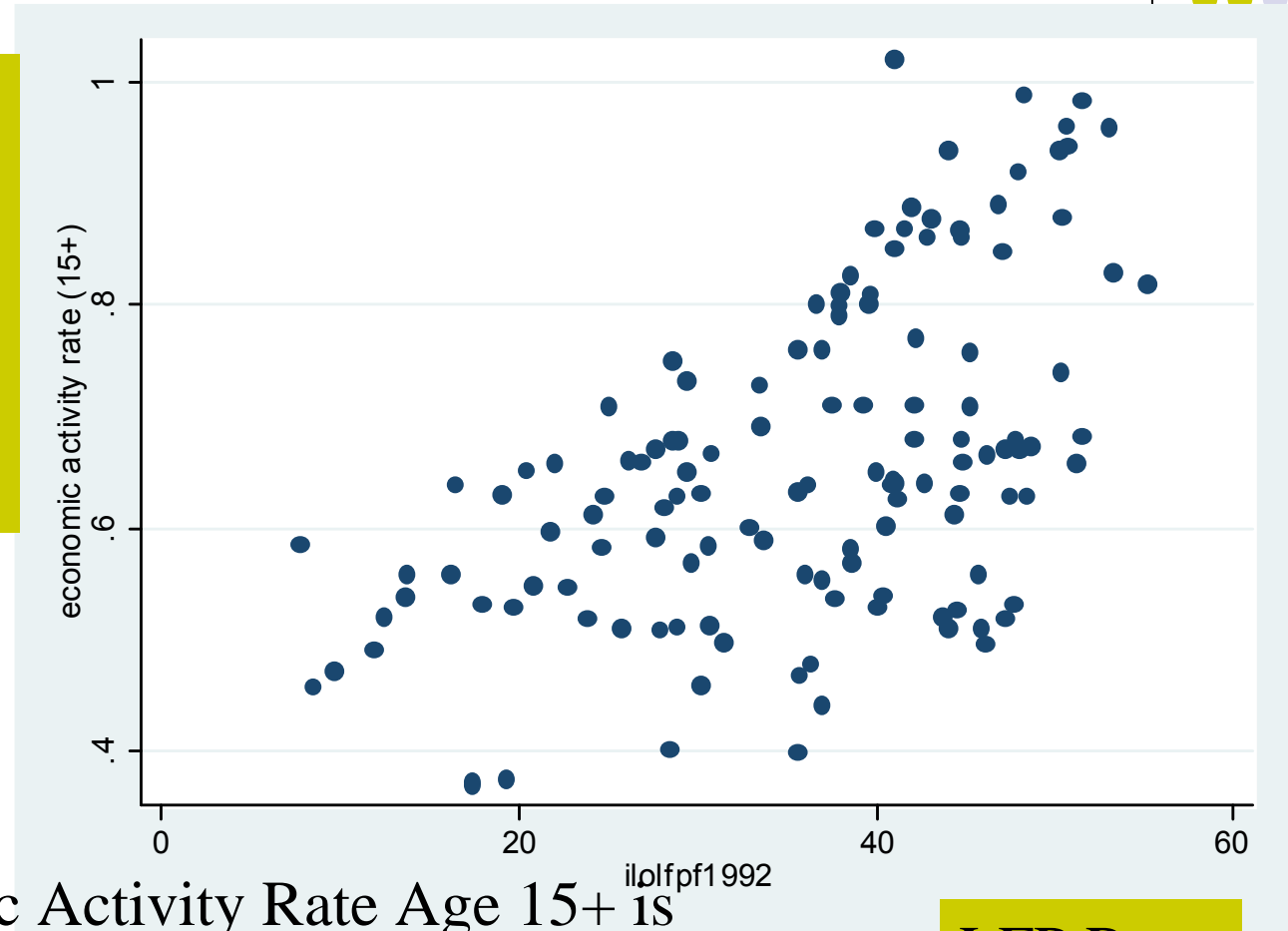
- Delta = The change of the income share of the poorest 20 % quintile in gross domestic product per capita using 1995 US dollars, over 1992 to 2002.
- Delta >1 implies lowest quintile gained income.
- Delta <1 implies lowest quintile lost income.

- Peter Edward has adapted the expenditure data to make it harmonised with the income data, so that all the Gini coefficients are comparable, and he divided the bottom quintile percent of national income by 1/5th of the population. Using this method, N=76
- Henderson, Hulme et al, N=32.
- Other articles, typically N= 28, 35, 38.

Background Findings



Economic
Activity
Rate =
L.F./Pop.



LFP Rate

The Economic Activity Rate Age 15+ is
constrained by the Women's Labour
Force Participation Rate (LFP Rate) age
15+ (both data for 1992)



Estimation Method	Fixed Effects
Column no.	(1)
Investment	.006(.003) **
Attainment	.078(.039) **
Fertility (Log)	.026(.154)
FDI	-.002(.001)
Economic Activity Rate	.064(.271)
Women in Labour Force	.021(.006) ***
Democracy	-.176(.081) **
Democracy Squared	.024(.010) **
Significance of Whole Estimate	<1% ***
Wald Chi-Squared	407177
R-Squared Overall	.45
N	83

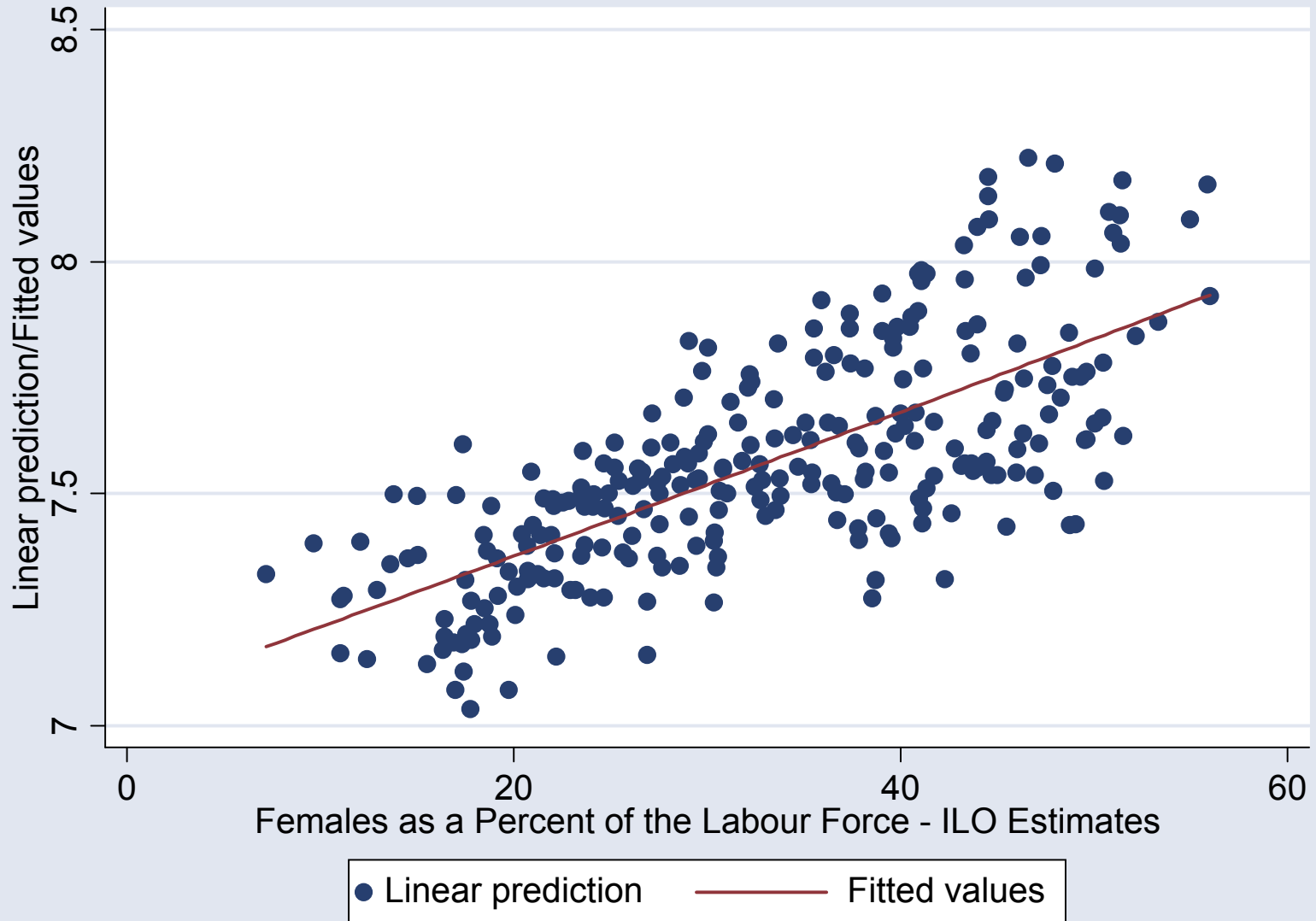
Table 1: Growth Outcomes Are Affected by Education Attainment and by a Gender-Sensitive LFP Variable (*statistical results, time-series model, panel data, fixed effects, instrumental variables*)

The dependent variable is the log of GDP per capita in constant US\$. Thus growth is affected by a *change in X*. Std. Errors in parentheses.

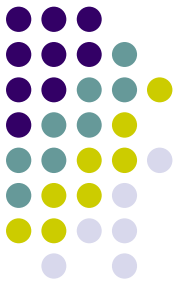
Women's Labour Force Participation Matters to the Growth Rate



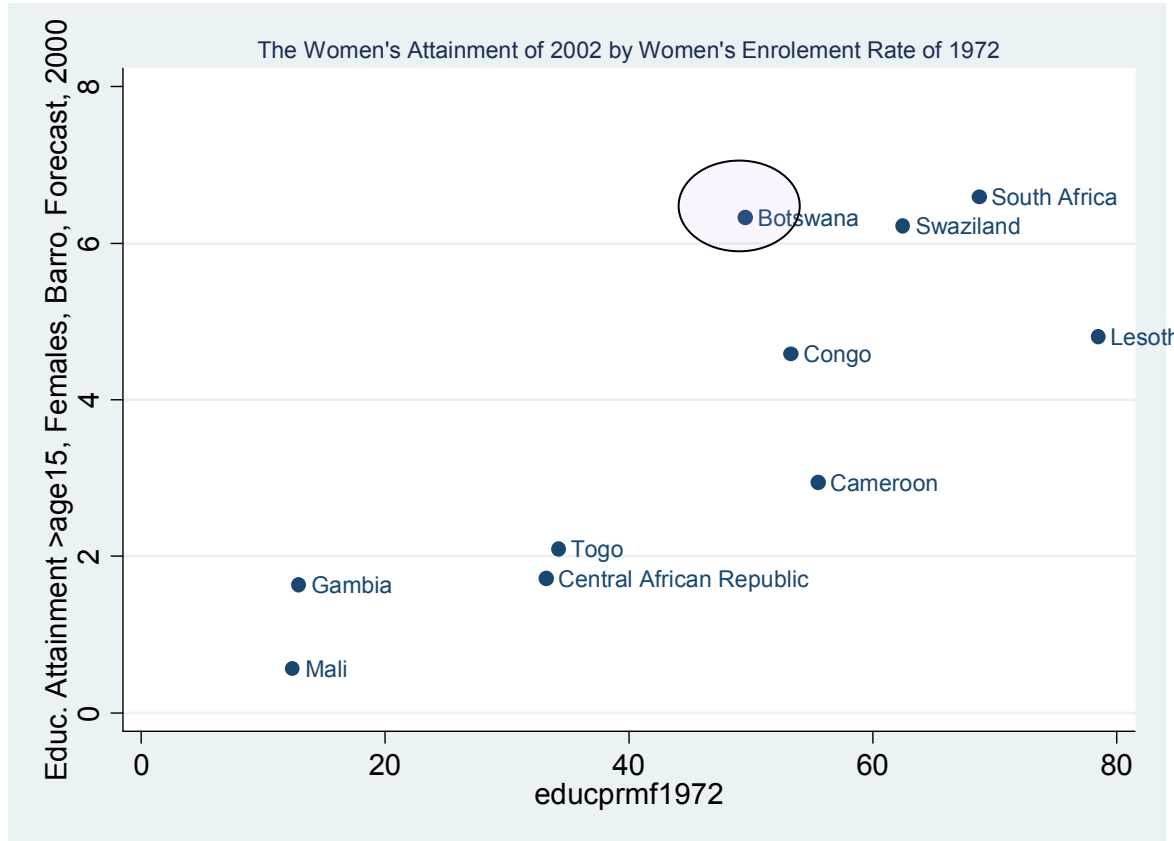
Statistical results, time-series model, panel data, fixed effects, instrumental variables, 1982-2002



Botswana is a High Performer on Attainments



Vertical Axis: Formal School Attainment, Females, 15+, 2002

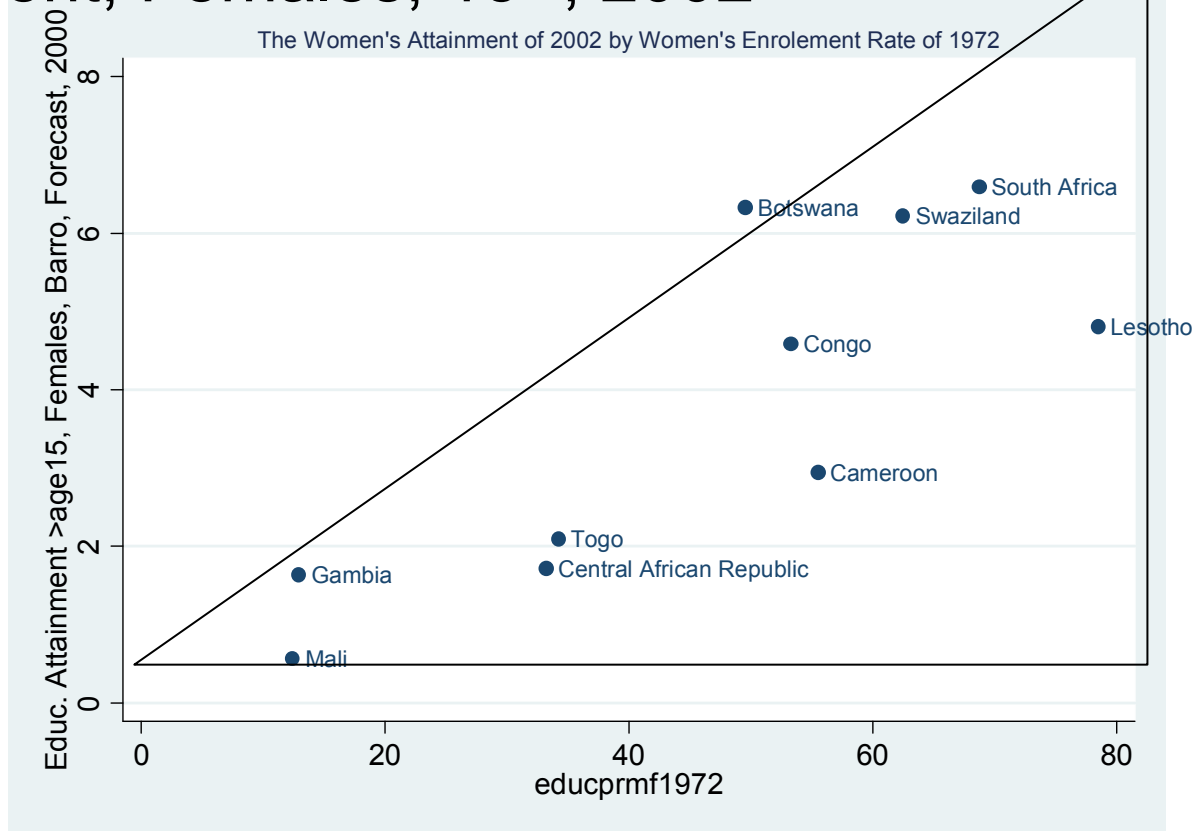


Horizontal Axis – Primary Enrolments, Females, 1972.

Both These Sets of Countries Illustrate Necessary Causality

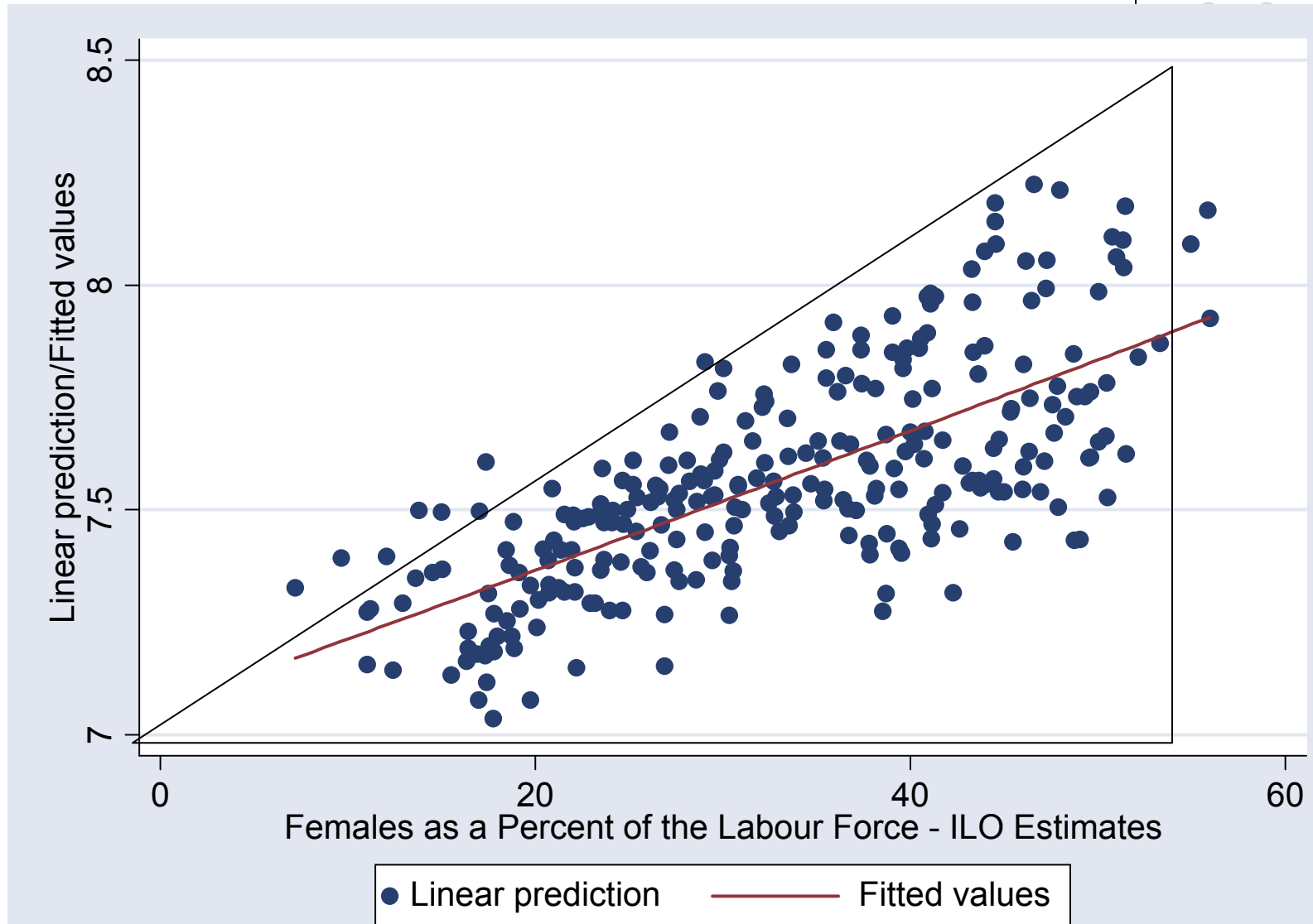


Attainment, Females, 15+, 2002



Horizontal Axis – Enrolments, Females, 1972.

Both These Sets of Countries Illustrate Necessary Causality

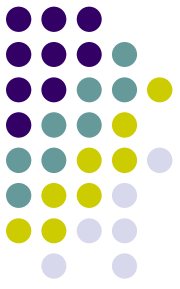


3 The Method of Fuzzy-Set QCA



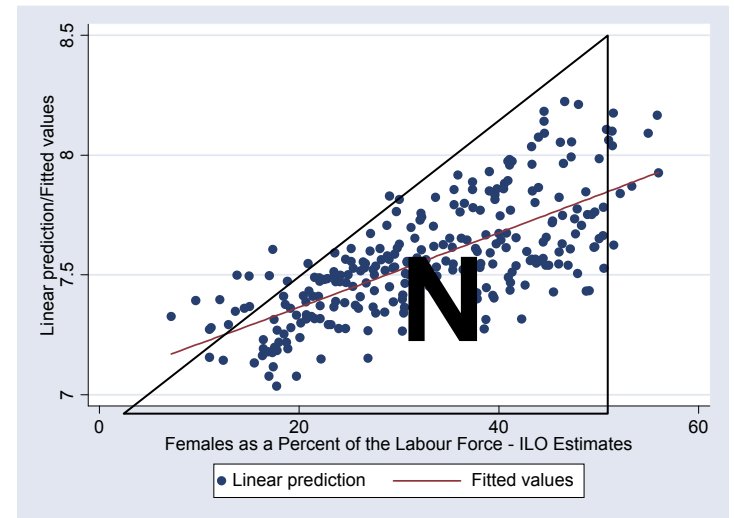
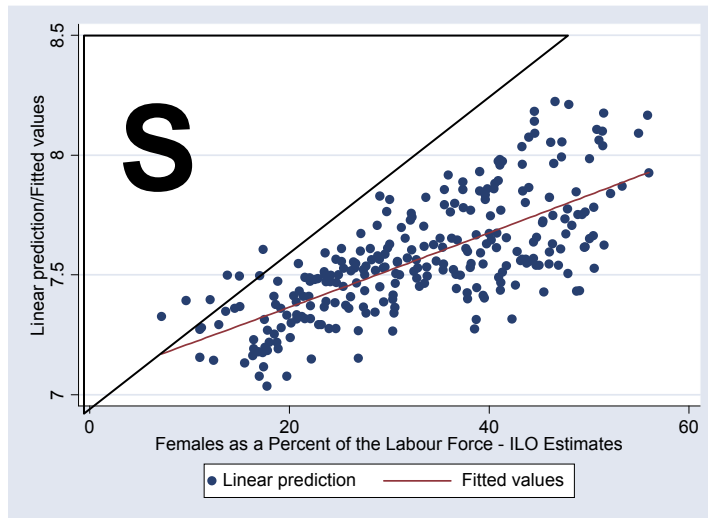
- 4a)
 - General Method: QCA studies multiple conjunctural causation with a Boolean Truth Table. QCA examines cases with respect to their different causally relevant conditions *and their contexts* by comparing cases within configurations.
- 4b)
 - The Fuzzy Variant in fsQCA and STATA software enables us to explore sufficient and necessary conditions of configurations using Fuzzy Algebra.
- 4c)
 - Constructing the interim truth table, fsQCA lays out all logically possible combinations of conditions which are considered, even those without empirical instances. Then it resolves to an 'intermediate solution' those causal *combinations* which are sufficient for Y to occur.
 - *We allow all remainders i.e. empty configurations, to lie either with Delta high or Delta low. We are agnostic ('don't care').*

3 – More on the Method of Fuzzy-Set QCA



● 4d)

- Sufficiency is quite a demanding test.
- We can also study Necessity.

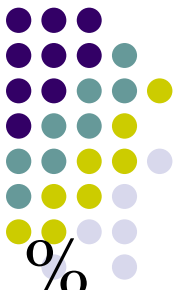


- We study them in k-dimensional space of X .
- Consistency of Sufficiency = $\Sigma(\min(X_i, Y_i)) / \Sigma(X_i)$.



4 Our Findings From Fuzzy-Set QCA

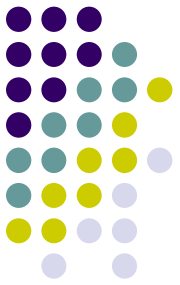
- The bivariate test of whether growth is sufficient for high poverty reduction is a failure. Consistency is only 0.64 when we require at least 0.80 for a reasonable level of consistency [for sufficiency].
- In that test, $N=76$.
- Only government expenditure is a strongly sufficient condition *in itself* across all these cases; consistency = 0.81 over 55 cases.
- When five variates are in the X vector, N falls a little due to missing values for a few cases.



Causal Variates

- The GDP per capita growth rate is annual % growth, adjusted for population size, 1992.
- Equality is 1- Gini Coefficient.
 - Source for these: WORLD BANK WDI.
- ILOlfpF is the ILO estimate of the proportion of the workforce that is female.
(female labour force participation rate) -dated on a 3-year period centred on 1990.
 - Source for this: ILO ILOSTAT database online.

Final Variates



- Government expenditure as percentage of GDP, 1992
- The estimated percentage of adults (aged 15-49) living with HIV/AIDS.



Table 2: The Interim Truth Table of Poverty Reduction Mode

Growth Rate 1992	Govt Exp in 1992	Equality in 1992	LFP of Females	Hiv	Number	<i>Delta fuzzy</i>	Consistency
0	0	1	1	0	1	1	0.97
1	0	1	1	0	4	1	0.95
1	1	1	0	0	3	1	0.95
1	0	0	1	1	2	1	0.92
1	0	1	1	1	1	1	0.91
1	1	1	1	0	7	1	0.90
1	1	1	1	1	1	1	0.90
1	0	0	0	1	4	0	0.82

NOTE: ‘Number’ appears to sum up 21, but many more cases had a Delta estimate. The software oddly miscounts Number.

Discussion



- The Results are as shown below:
- $GROWTHRATE * LF PF +$
- $EQUALITY * LF PF * hiv +$ [i.e. not-HIV]
- $GROWTHRATE * GOVTEXP * EQUALITY * hiv$
 - The generalisation of results *externally to wider populations* is likely to be fraught due to unique events.
- We seek to use retrodution to explore *why* and *how* things have happened.
- We give a discussion of gender, culture, and context in the paper.
- Consistency is 0.75 for this intermediate solution, quite good, with coverage 0.90 which is excellent. Much better than in bivariate tests.

Interpretation



- $GROWTHRATE * LFPF +$
 - This part shows that for a few countries, growth is part of a configuration that is sufficient for poverty reduction.
 - Quite a small number of countries are of this type.
- $EQUALITY * LFPF * hiv +$ [i.e. not-HIV]
 - This part shows that growth is *not* a part of another large explanatory configuration.
 - High equation, high Female LFP, and low HIV are a sufficient combination to have caused poverty reduction (delta in the higher 3/7 of its rank order).



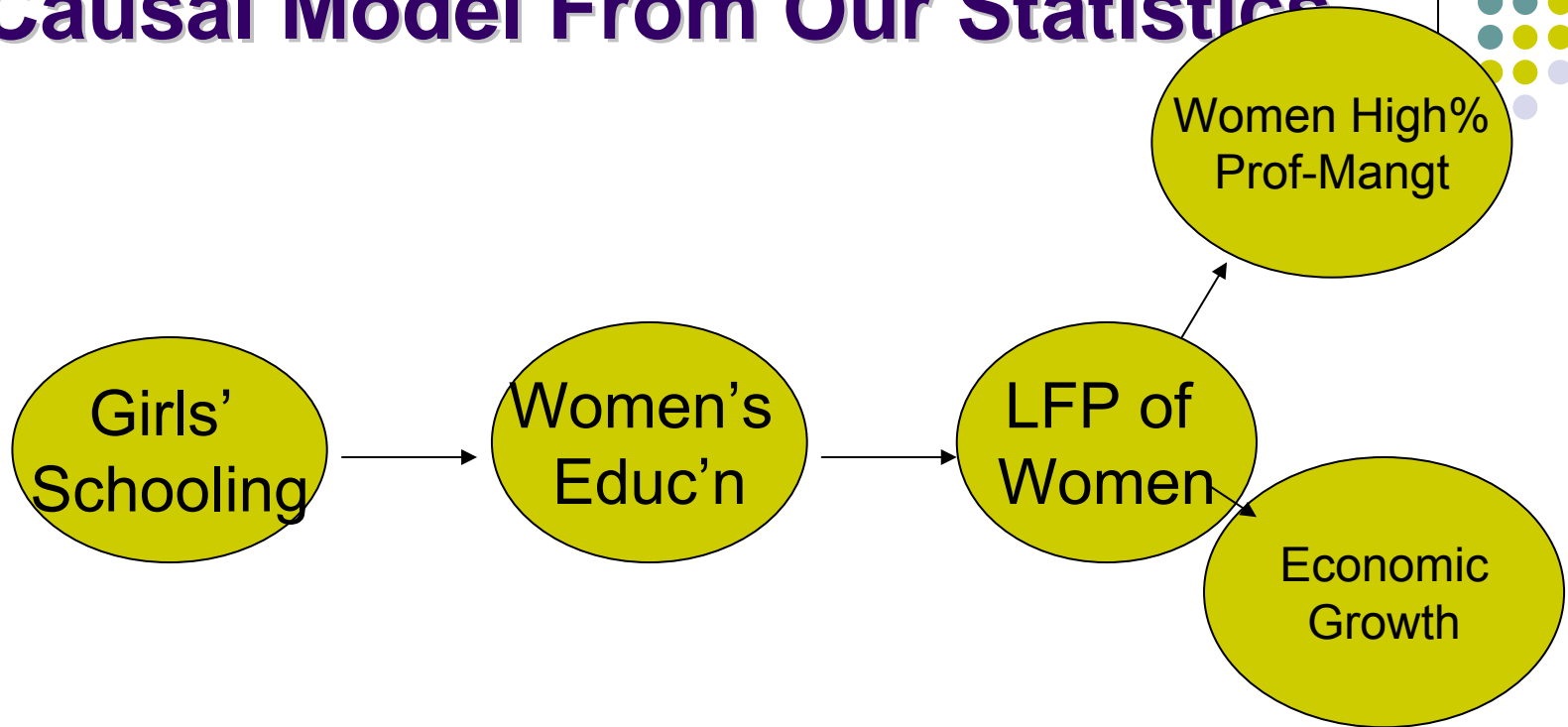
- In addition,
 - The third term means that, again, growth is part of another configuration that did work.
 - This one has low HIV again; and it has high government expenditure.
 - We have tested Attainments and they were not sufficient – but there is a problem over the date at which schooling was received; it is surprising to find that human capital (in schooling) is not effective in poverty reduction, apparently.
 - Thus some hypothesis testing has occurred.
 - But most knowledge is about concrete cases.

Exemplars:



- Group 1 – China, Korea, Poland had poverty reduction associated with growth + other factors.
- Group 2 – 5 additional cases but also has many overlapping cases with 1st configuration.
 - Burundi, Jamaica, Gambia, Uruguay, Belarus
- Group 3 has 3 additional cases not already covered: Egypt, Ireland, and Tunisia.
 - These have low Women's LFP for religious/historical reasons.

A Causal Model From Our Statistics

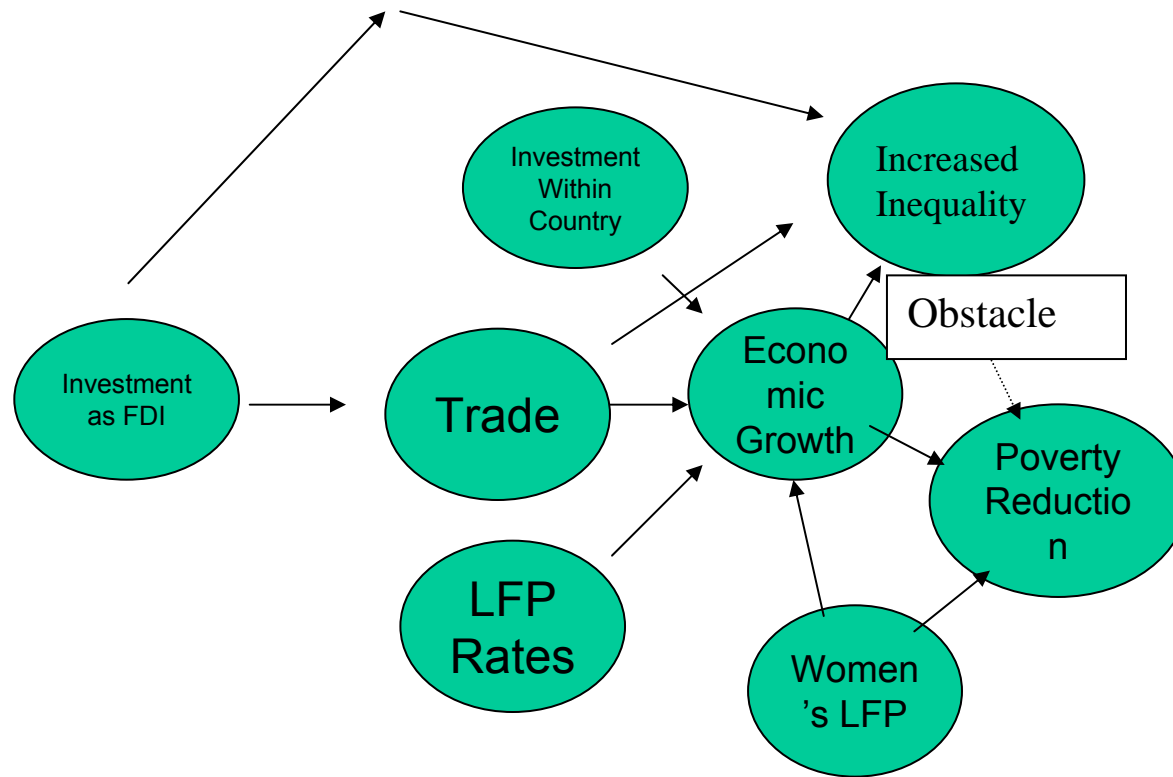


The benefits of women's labour force participation (LFP) are many. The LFP of Females also upwardly influences the economic growth rates.

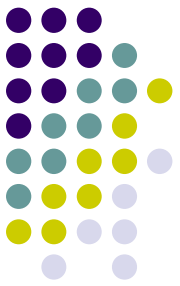
A Revised Model – With a Caveat*



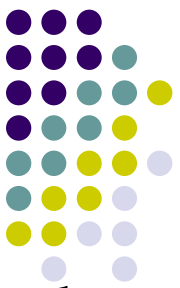
- *One model for the whole world would not be sensible. Culture and history are country-specific.



Conclusions



- The argument has been that a realist approach to methodology is consistent with QCA.
- The findings are 1) that there are three possible pathways to reduce poverty.
- 2) In these pathways, growth is not a necessary nor sufficient condition in itself.
- 3) Once we look for configurational causes, we find government expenditure and equality itself playing a role.
- HIV infection rates are also relevant. Some feedback causality may be present in the measurement of HIV rates due to their late timing around 2000.



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