Measuring Differential Economic Impact of Education across Income Groups and Provinces in Pakistan: A Model Consistent Approach

Fahd Rehman

PhD Economics Student at UNSW Canberra, Australia

Russel J. Cooper

Visiting Professor UNSW Canberra, Australia

Outline

- Overview and Literature
- Research Gaps, Focus of Paper and Data
- Modified Almost Ideal Demand System (MAIDS)
- Key Basic Education Indicators
- Results
- Conclusion ,Policy Implications and Future Research

Overview and Literature

- Education and earnings (Schultz, 1988)
- Education and informed choices (Sen, 1999)
- Lack of attainment of education and income inequality (Bardhan, Udry, 1999)
- Lack of even coverage and access to educational opportunities across provinces in Pakistan (UNDP, 2011)
- Utilization of Engel Curve to do welfare comparison across different groups and determine the properties of demand system (Barnett and Serlitis, 2008)
- Development of Modified Almost Demand System to fit the Engel Curve well (Cooper, McLaren, 1992)

Research Gaps

- No attempt to combine consumer demand with Hedonic pricing, specifically where official differential prices are not available
- Education as ability to purchase things and its impact on the welfare
- Engel's Law has not been exploited in the Pakistani context to infer measures of household well-being from observation of food share

Focus of Paper

- Theoretically derived MAIDS, its application to close the gap between economic theory and practice
- Application of MAIDS for the aggregated data
- Adapting the Model to handle data and role of economic agents

Data

- Secondary Data Sources from Pakistan Bureau of Statistics
- Aggregated Data of HIES for 2008 and 2011
-

Modified Almost Ideal Demand System (MAIDS)

- MAIDS indirect utility function $\left(M / \prod_{i=1}^{N} p_i^{\beta_i}\right) \ln\left(M / \prod_{i=1}^{N} p_i^{\alpha_i}\right)$
- Budget share equations $$s_i = \frac{\alpha_i + \beta_i \ln\left(M / \prod_{i=1}^{N} p_i^{\alpha_i}\right)}{1 + \ln\left(M / \prod_{i=1}^{N} p_i^{\alpha_i}\right)}$$
- Price index approximation leads to simpler form for estimation $$s_i = \frac{\alpha_i + \beta_i \ln\left(M / P_S\right)}{1 + \ln\left(M / P_S\right)}$$
- Data-determined 'hedonic' price index --- allowing for education $$P_S = PPE^{0.5} PME^{0.5}$$

where PPE is derived from Net Primary Education ratio in region and PME comes from Net Matriculation Education ratio in region

Engel Curve for Food Nonlinear in M but Linear in Z

- MAIDS form of food share equation: $s_F = \frac{\alpha_F + \beta_F \ln(M/P_S)}{1+\ln(M/P_S)}$

Engel Curve is hyperbolic in M

- Linearization using transformed real expenditure variable:

$$Z = \frac{\ln(M/P_S)}{1+\ln(M/P_S)} \quad \text{leads to} \quad s_F = \alpha(1-Z) + \beta Z$$

and further simplifies to

$$s_F = \alpha_F + \delta_F Z \quad where \quad \delta_F = \beta_F - \alpha_F$$

Engel Curve is linear in Z

- This form allows easy addition of additive dummies for time and regions, shifting the Engel Curve

Figure 1a: Share of food as a linear function of Z

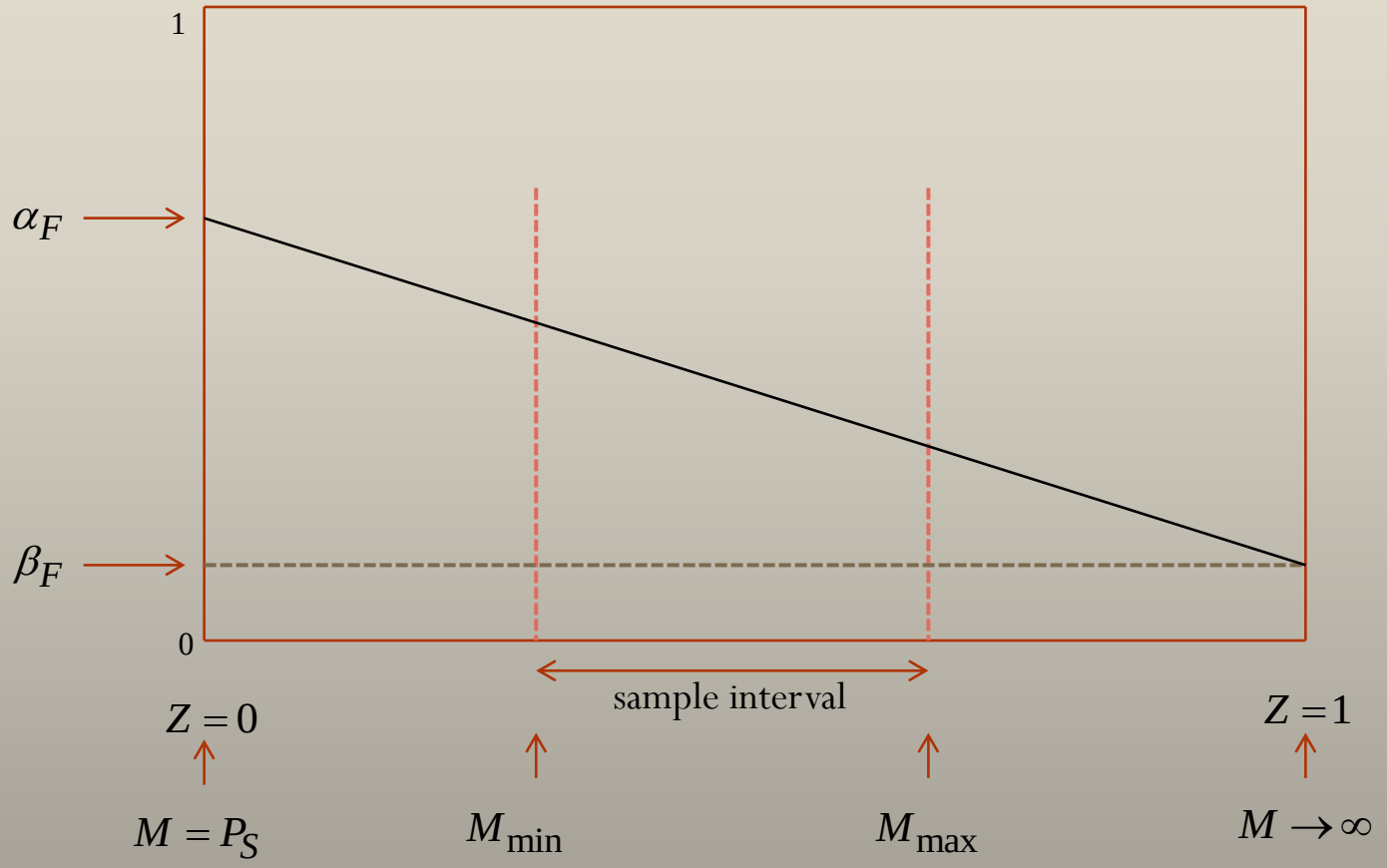
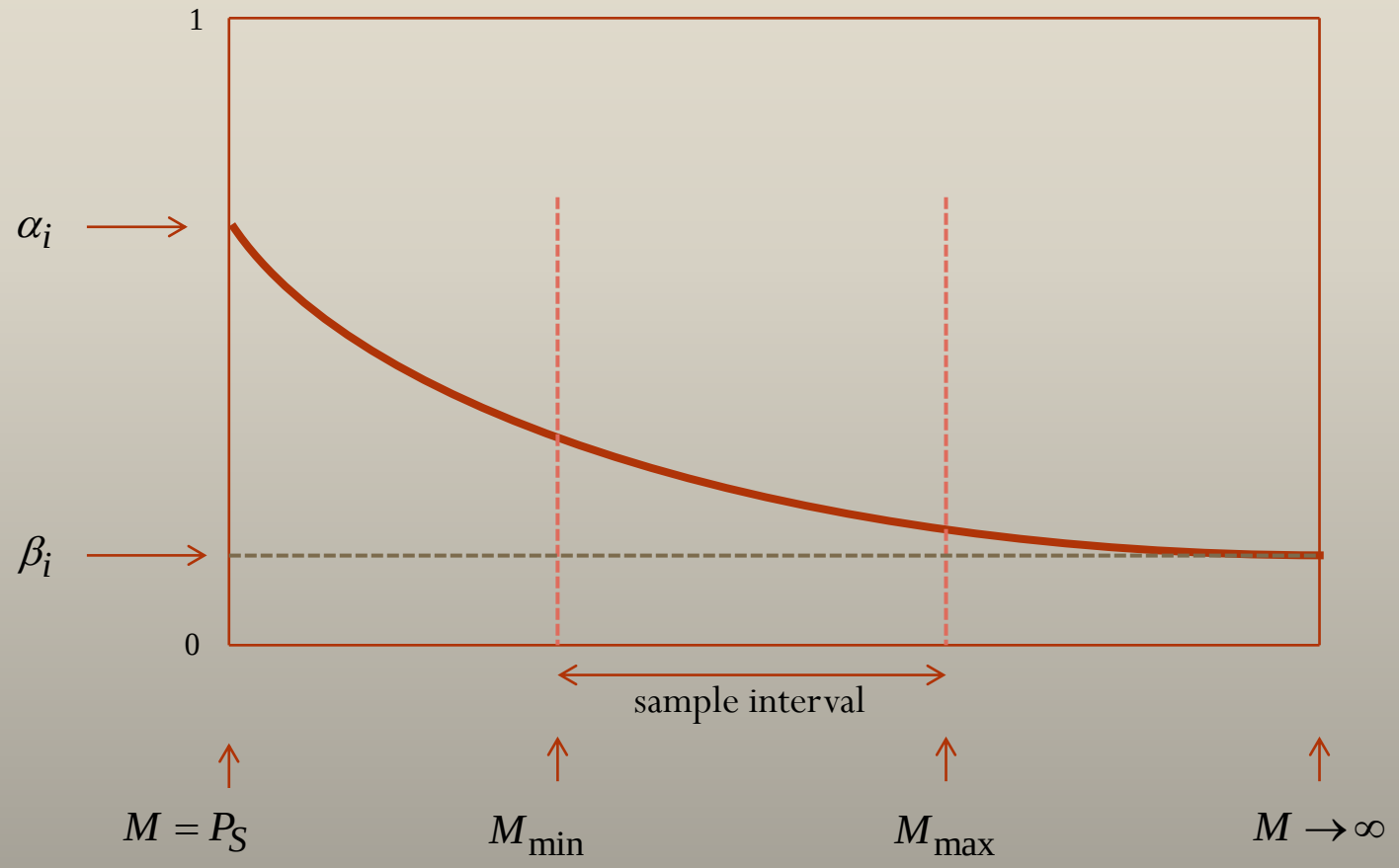


Figure 1b: Share of food as a non-linear function of *M*

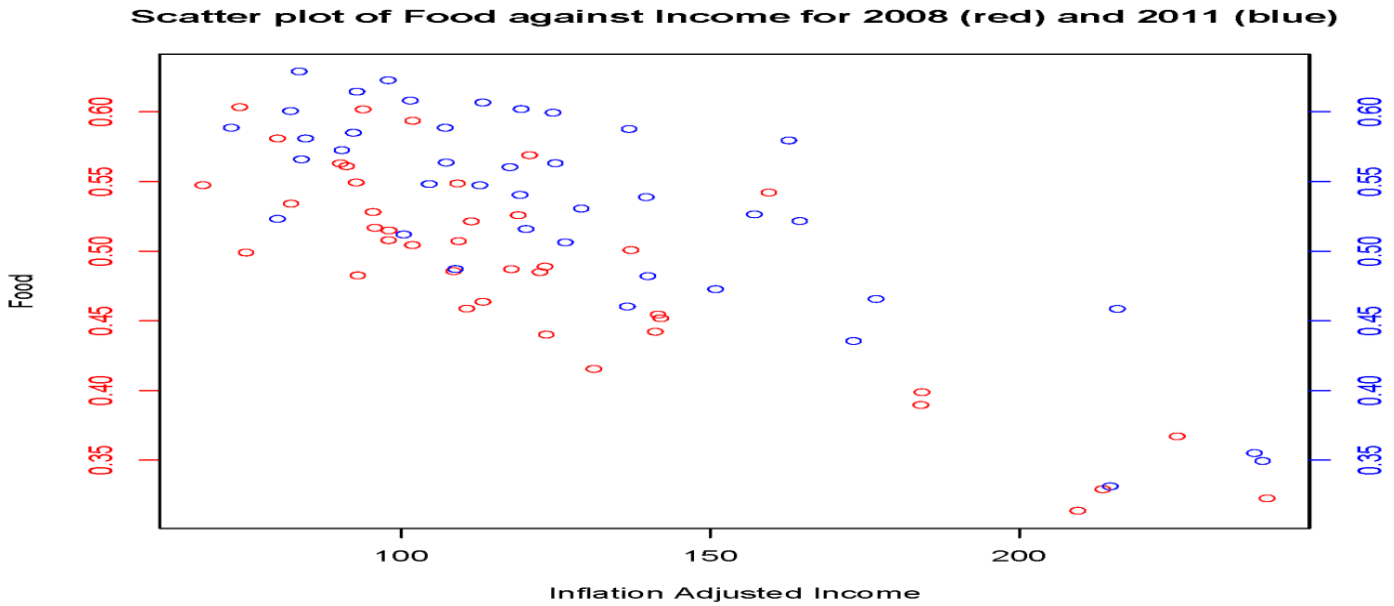


Summary of Key Basic Educational Statistics across Provinces (Percentages)

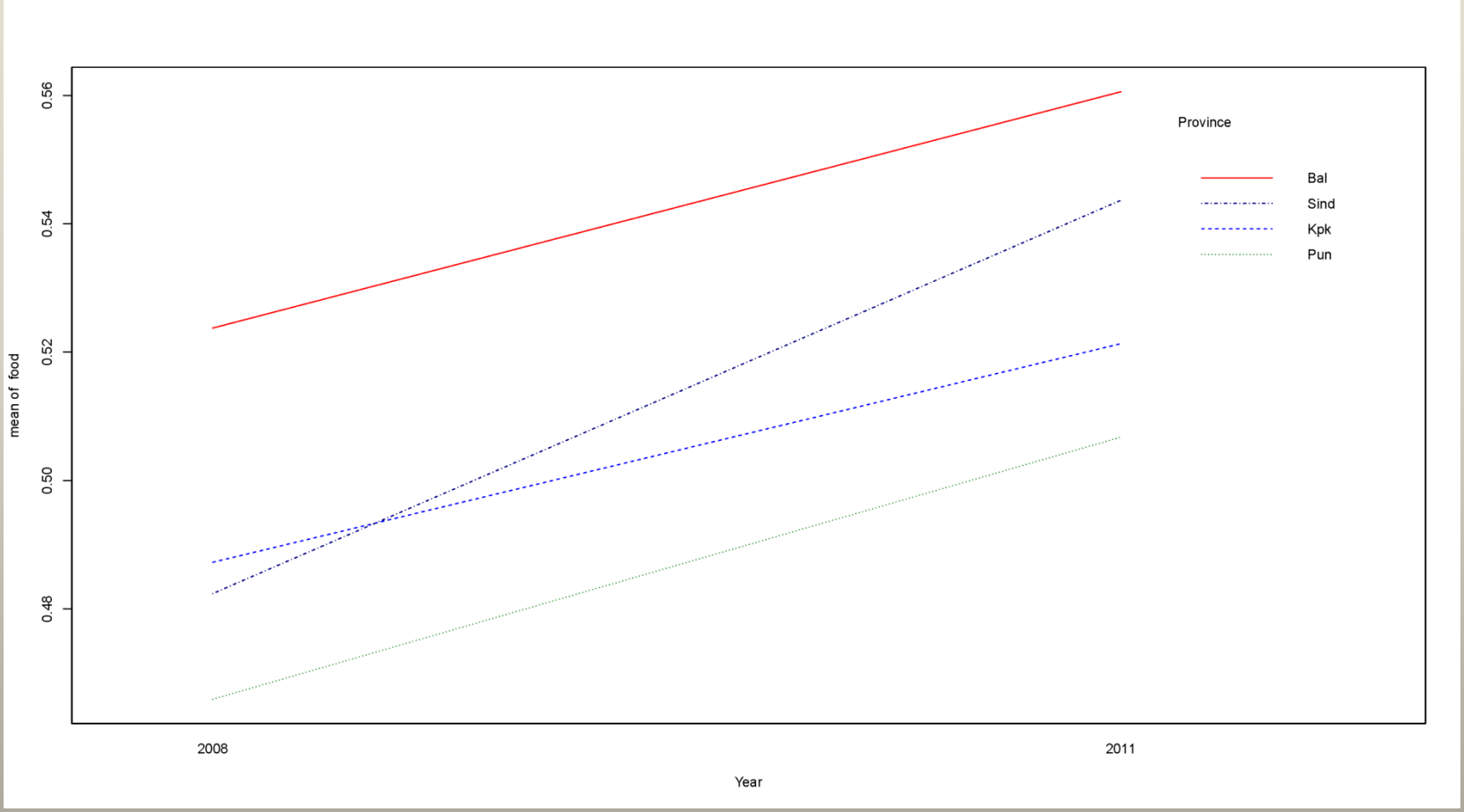
2007-08	Punjab	Sindh	KPK	Balochistan
Net Primary Enrolment Ratio	61	51	49	41
Net Matriculation Enrolment Ratio	13	11	6	5
2010-11				
Net Primary Enrolment Ratio	61	53	51	47
Net Matriculation Enrolment Ratio	14	11	7	6

Source: Pakistan Bureau of Statistics

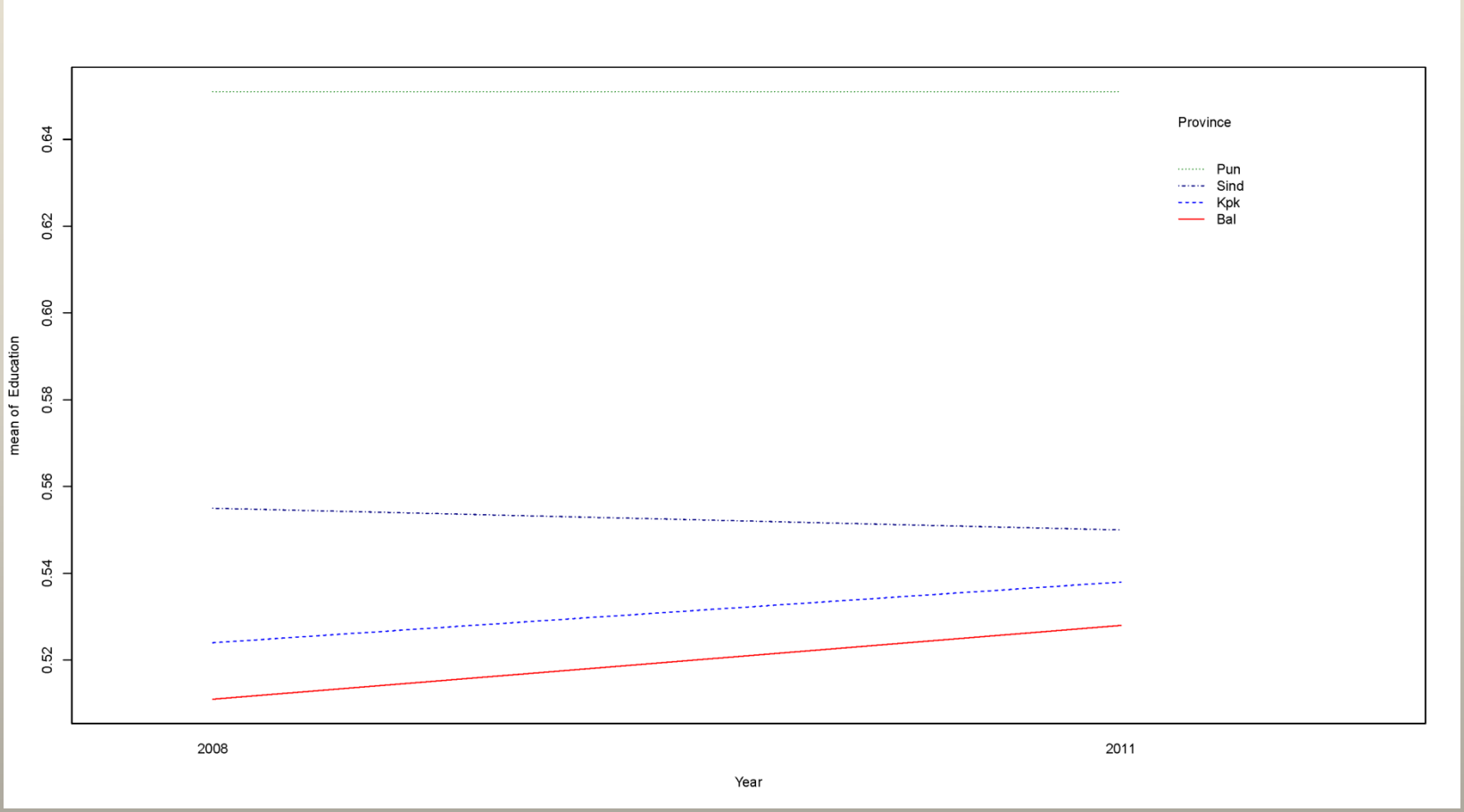
Scatter Plot of Food against Income



Interaction Plot of Provinces and Food against Year



Interaction Plot of Geometric Mean of Education against Year



Results with Hedonic Price Index for 2008

Model 2	Alpha Coefficient	Delta Coefficient	Beta Coefficient
Net Primary Enrolment	0.67***	-0.43***	0.24***
R square	0.66		
Breusch Pagan P value	0.95		
Shapiro-Wilk Normality P value	0.28		
Model 3			
Net Matriculation Enrolment	0.65***	-0.43***	0.22***
R square	0.66		
Breusch Pagan P value	0.76		
Shapiro-Wilk Normality P value	0.31		
Model 4			
Geometric mean Price Index	0.66 ***	-0.43 ***	0.23 ***
R square	0.67		
Breusch Pagan P value	0.78		
Shapiro-Wilk Normality P value	0.18		

Notes: *** Significant at 1 percent

Results with Hedonic Price Index for 2011

Model 2	Alpha Coefficient	Delta Coefficient	Beta Coefficient
Net Primary Enrolment	0.69***	-0.37***	0.32***
R square	0.53		
Breusch Pagan P value	0.12		
Shapiro-Wilk Normality P value	0.19		
Model 3			
Net Matriculation Enrolment	0.67***	-0.39***	0.28***
R square	0.55		
Breusch Pagan P value	0.09		
Shapiro-Wilk Normality P value	0.61		
Model 4			
Geometric mean Price Index	0.68 ***	-0.38 ***	0.30 ***
R square	0.54		
Breusch Pagan P value	0.11		
Shapiro-Wilk Normality P value	0.28		

Notes: *** Significant at 1 percent

Results for Pooled Data with Time Dummy Variable

Model 5	Alpha Coefficient	Delta Coefficient	Beta Coefficient	Time Dummy
	0.65 ***	-0.39***	0.26***	0.08***
R square		0.63		
Breusch Pagan P value		0.36		
Shapiro-Wilk Normality P value		0.08		

Notes: *** Significant at 1 percent

Results of Differential Economic Impact of Education on Provinces through Hedonic Prices

Model	Alpha Coefficient	Delta Coefficient	Beta Coefficient	Punjab Dummy	Sindh Dummy	KPK Dummy	Balochistan Dummy
Education	0.65 ***	-0.39 ***	0.26 ***	0.03	0.10 ***	0.08 ***	0.11 ***
R square		0.66					
Breusch Pagan P value		0.59					
Shapiro-Wilk Normality P value		0.15					

Notes: *** Significant at 1 percent

Conclusion, Policy Implications and Future Research

- Education enhances the ability to purchase things and people with greater access to education were better off
- Upward Movement of Engle Curve from 2008 to 2011 shows that on average people worse off
- People in the 2 lowest quintiles worse off in terms of access to educational opportunities from 2008 to 2011

Policy Implications

- Access to education (primary, matriculation) should be increased for people in the lowest 2 income groups
- Access to education should be increased specifically for Balochistan followed by Sindh and KPK to bring interprovincial harmony
- Access to net matriculation enrolment ratios should be increased across all provinces
- Level of Poverty has increased from 2008 to 2011, so efforts should be made to reduce it
- Update the sampling frames for urban and rural regions to obtain informed predictions

Future Research Areas

- Hicksian Welfare Analysis across income groups and provinces
- Extend the modelling structure to district and regional levels along with demographic extensions by looking at the individual data

Questions and Comments

Thank You