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Human Opportunity Index (HOI) – Provinces

Equality of Children's Opportunities in Pakistan

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Abstract

This paper complements the World Bank's recent report on poverty by providing some additional information on inequality. In contrast to reports that analyze measures of inequality of income or wealth (such as the Gini), this paper focuses on equality of opportunities of children, where "opportunities" refer to access to basic services and goods (access to education, health conditions and basic infrastructure) that improve the likelihood of children to maximize their human potential. It introduces a new metric to Pakistan–the Human Opportunities Index (HOI) that combines the overall coverage rate of the opportunity with a "penalty" for the share of access to opportunities that are distributed in an unequal fashion. The Human Opportunity Index was developed recently at the World Bank and has been estimated now for over 20 countries in Latin America and Africa.

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This paper was motivated by World Bank's extensive support to the design of the new Framework for Economic Growth of Pakistan. These first two sections describing the HOI draws heavily on the description in the World Bank Report entitled, "Opportunities for Children in a Post-Conflict Country: the Case of Liberia", prepared by Ana Abras, Jose Cuesta, Ambar Narayan and Alejandro Hoyos (Poverty Reduction & Equity, PREM Network).

Executive Summary

1. This paper presents information on equality of children's opportunities in Pakistan for two points in time (1998-99 and 2007-08) to illustrate the extent of progress over roughly a decade. A companion report analyzed trends over time in children's opportunities at the national level and compared the situation in Pakistan to that of other countries. This report focuses on how children's opportunities have evolved in the different provinces of Pakistan. The special emphasis on provinces is warranted as Pakistan is embarking on devolution of responsibilities to the provinces with the implementation of the 18th Amendment. While the results are presented only up to 2007-08, there will soon be data available for 2010-11 that could be analyzed in exactly the same fashion to provide an excellent baseline for the current status of the distribution of opportunities for children across provinces. The approach could then be used with future household surveys to monitor how equality of opportunities evolves over time and, importantly, whether any corrective actions need to be taken if greater inequality emerges as a problem.

2. One of the strong features of the approach is that it allows one to identify what factors are important in explaining the inequality. Some interesting patterns are evident. For example, there is evidence that gender is no longer an important factor in explaining inequality in education in Punjab and Sindh. While there has been a noticeable reduction in the weight of gender in explaining inequality in Khyber Pakhtunkhwa (KP), it remains the most important factor.

3. Some additional benefits would be expected from extending the work in different dimensions. One task is to consider additional opportunities or indicators for analysis. For example, it would be possible to define service quality standards—for the social sectors and infrastructure—and then determine how equitable the access to public services of a particular standard is. It would also be possible to deepen the analysis by drilling down to look at opportunities at the district level and analyzing whether differences in equality of opportunities are related to differential patterns of public expenditure or targeting of policy. Finally, the expected benefit of the approach could be enhanced if care is taken in the upcoming surveys to be carried out at the provincial and district levels to capture both the opportunities and circumstances that would be important to consider helping ensure greater equality of opportunity for all children in Pakistan.

Introduction

4. To a large extent, the poverty and inequalities that one observes in Pakistan today are rooted in opportunities that were available to children when they were growing up. If poverty and inequality are to be reduced in the future, there must be greater equality in opportunities to children today. The idea that there should be equality in opportunities for children is a concept that is typically embraced by all—in contrast to the more contentious positions that are taken with respect to inequality of income or consumption. While some may be in favor of equalizing incomes or consumption, others may point out the negative effects this may have on individual incentives and economic growth. However, few would disagree with a guiding principle that there should be equality of opportunity—the "circumstances" a person is born into (e.g. gender, location, parental and economic background) should not determine the individual's access to opportunities.

5. While analyzing inequality of income or consumption can be done using measures such as the Gini, capturing the notion of equality of opportunity requires a different approach and a different metric. A large body of social science literature has been concerned with equality of opportunity for some time. Amartya Sen has been deeply influential in arguing for an equitable distribution of "capabilities," which essentially amount to an individual's ability and effort to convert resources into outcomes they have reason to enjoy. John Roemer's (1998) work "Equality of Opportunity" was the first to formalize an equality of opportunity principle and remains the most relevant piece of academic literature underpinning the analysis described in this paper for Pakistan and other, similar work that the World Bank has been doing on the Equality of Opportunity in Latin America and Africa.[1] Roemer argues that policy should work to equalize opportunities *independent* of circumstances and that outcomes should depend only on effort.

6. The World Bank's 2006 World Development Report "Equity and Development" argues that inequality of opportunity, both within and among nations, results in wasted human potential and weakens prospects for overall prosperity. Conducting an analysis of inequality of opportunity, however, requires a measure or a set of measures that provide a practical way to track a country's progress towards equalizing opportunities for all its citizens. To be useful to analysts and policymakers alike, such a measure must combine a few attractive properties: intuitive appeal, simplicity, practicality (especially in relatively data scarce environments) and sound microeconomic foundations to ensure that it has an interpretation that is consistent with its objective.

7. Much of the empirical work in developing countries till recent times has focused mainly on measuring (and comparing) average rates of access to goods or services in health and education for the population and different subgroups within. What has been lacking for the most part is an intuitive and unified framework to address a range of questions across different types of opportunities, such as: How far away is a country from universalizing each type of opportunity? How unequally are available opportunities distributed across different sub-groups of the population? How important are circumstances to which an individual is born into in determining access to opportunities? Which are the circumstances that matter for access, and in that sense, contribute the most to inequality in access? What would it take,

[1] For a discussion on different definitions of equal opportunities see Abras et al. (2011).

in terms of resources, to reduce inequality in opportunities, when providing universal access is clearly not possible in the near term?

8. These questions have been especially relevant for Pakistan for quite some time. Many observers, both within and outside the country, have noted how poor social indicators have been in Pakistan and, historically, how poor has been the pace of change in the social indicators given its rate of GDP per capita growth over time. Easterly (2003) calls it "growth without development". While Easterly noted that there had not been much progress in social indicators over the 1990s despite the expenditure and effort of the Social Action Program, the results for the decade of the 2000s appear to be better. Certainly, there has been a considerable push for expanding education, especially female education, and there is evidence of an increasing demand for education as evident from the growth in private schooling—even in rural areas.[2] The question of what has happened to the equality of opportunities and what is likely to happen to opportunities in the future becomes increasingly important as the country begins to implement the 18th Amendment. One of the important motivations for the decentralization is to improve delivery of public services, by bringing the government closer to the people and increasing accountability. But there are also risks of exacerbating existing differences, as a result of differences in access to resources, management and implementation capability across provinces and a diminished role of the national government, which otherwise might be called on to carry out needed redistribution so as to equalize opportunities. As opportunities could become either more or less equally distributed, it will be important to track what actually happens over time.

9. World Bank staff and external researchers in recent years have made significant progress in addressing questions such as above in a simple and intuitive framework, as demonstrated by Barros and Ferreira (2009). The report introduced a new metric, the Human Opportunity Index (HOI), which measures how far a society is from universal provision of basic services and goods, such as sanitation, clean water, education, and the extent to which those goods and services are unevenly distributed.[3] A key feature of HOI is that it not only takes into account the overall coverage rates of these services, but also how equally the coverage is distributed—by measuring the extent to which those without coverage are concentrated in groups with particular circumstances (e.g. economic status, gender, parental education, ethnicity and so on), which are conditions a child is typically born into.

10. The 2009 report computed HOI for five indicators: access to clean water, sanitation and electricity, completing sixth grade on time, and attending school from age 10 to 14. The analysis focused on children because unlike adults, children cannot be expected to make the efforts needed to access these goods and services, implying that these indicators can be considered as proxies for opportunities available to a child. The report, and the updated 2010 version, "Do Our Children Have a Chance?" analyzed these five indicators for 19 Latin American Countries using the HOI measure, exploring both changes over time within countries and comparisons across countries.

[2] See the discussion of educational actions and results in the Education for All: Mid Decade Assessment (Government of Pakistan, 2008). For documentation on the growth of private schools see Andrabi et al. (2006).
[3] This discussion draws from three sources: Barros and Ferreira (2009), Barros et al. (2010) and Molinas et al. (2010).

11. This paper introduces the use of the new metric of the HOI for Pakistan. It presents estimates at the provincial level of the HOI for a set of key opportunities, calculated from the 1998-99 and 2007-08 Pakistan Social and Living Standards Measurement (PSLM) surveys. Besides simply tracking how the HOI for different opportunities have changed over time, the paper also analyzes what circumstances appear to be important in explaining the inequality of opportunities and how the relative weight of the different circumstances in explaining inequality has changed over time. The paper does not, however, go into the very important issue of how policies and programs might have influenced these trends. That type of analysis is best carried out by sectoral experts and lies beyond the scope of this paper. Such analyses could be useful complements to the type of work carried out in Economic and Sector Work by the World Bank and in studies conducted by other institutions and independent analysts. The paper concludes with some suggestions on how the use of HOI estimates might be employed to help monitor changes in equality of opportunities as Pakistan implements the 18th Amendment. As suggested above, it will be important to monitor what happens to inequality of opportunities to allow for timely, corrective action to be taken if needed.

Calculation and Interpretation of HOI

12. The HOI provides an inequality-sensitive coverage rate of opportunities. An opportunity is defined to be a good or service that is sufficiently important for a child's future welfare that society considers that it should be available to all children, regardless of their background. In most societies, basic education, health and infrastructure services would be considered opportunities. An opportunity is said to be distributed according to a principle of equality of opportunity if circumstances exogenous to the individual, such as birth place, gender, ethnicity, income and education level of the parents, have no bearing on how the opportunity is distributed in the population.

13. The HOI is defined as the difference between two components:

i. the overall coverage rate of the opportunity (C) ; and
ii. a "penalty" for the share of access to opportunities that are distributed in violation of the equality of opportunity principle (P).

14. To get an intuitive understanding of how the HOI captures this penalty associated with outcomes that are distributed in violation of the equality of opportunity principle, it is useful to go through an example. Box 1 outlines a simple example of how HOI is measured, in a hypothetical situation with two countries with identical populations of children and average coverage rates of primary school enrollment. The example demonstrates how HOI is sensitive to inequality in coverage and how it would change in response to an increase in overall coverage or reallocation favoring the more disadvantaged group.

Box 1 **A Simple and Intuitive Example of HOI**

Consider two countries, A and B, each with a total population of 100 children. Each country has two groups of children, I and II, which consist of the top 50 per cent and bottom 50 per cent by per capita income, respectively. The coverage rate of school enrollment (or the average enrollment rate) for both countries is 0.6, i.e. 60 children attend school in each country. The table below shows the number of children going to school in each group for each country.

Given the total coverage rate, the principle of equality of opportunity will hold true for each country if each of the two groups in each country has the same rate of coverage, i.e. if each group has 30 children going to school. But in reality Group II has 20 enrollments in country A and 25 in country B. This suggests that firstly, opportunities are unequally distributed, and secondly, inequality of opportunities is higher in country A. The D-index is the share of total enrollments that is "misallocated", namely 10/60 and 5/60 for A and B, respectively.

Groups by circumstance (e.g. income)	**No. of children aged 6 to 10 years enrolled in school**	
	Country A (100 children)	**Country B (100 children)**
Group I (top 50% by income)	40	35
Group II (bottom 50% by income)	20	25
Total	**60**	**60**

Therefore,
$HOI_A = C_A (1-D_A) = 0.6 * (1-10/60) = 0.50$ and
$P_A = C_A * D_A = 0.6 * (10/60) = 0.10$;

$HOI_B = C_B (1-D_B) = 0.6 * (1-5/60) = 0.55$ and
$P_B = C_B * D_B = 0.6 * (5/60) = 0.05$

Thus even though both countries have equal coverage rates for enrollment, the higher inequality of opportunity in country A leads to the D-index being higher for A than for B, and HOI being higher for B than for A. It is also easy to see that HOI will increase in a country if: (i) the number of enrollments in each group increases equally (in proportionate or absolute terms); (ii) if enrollment for any group increases without decreasing the coverage rates of the other group; and, (iii) enrollment for Group II increases, keeping the total number of children enrolled unchanged (implying enrollment in Group I reduces by an equivalent amount). These three features relate to the "scale", "Pareto improvement" and "redistribution" properties of HOI, respectively—properties that are intuitively appealing.

15. In this simple example with only one circumstance, the dissimilarity index and the penalty could be calculated by hand. More generally, when there are multiple circumstances, this is not possible and the Dissimilarity Index must be calculated econometrically. Thus, more generally, the HOI is defined as:

HOI = C (1 - D)

Or, equivalently:

HOI = C - P

Where:

P = C*D
C is the average coverage
D is the Dissimilarity Index, formally defined as:

$$D = \frac{1}{2C}\sum_{i=1}^{n} w_i \left| C - \hat{p}_i \right|$$

The term $\hat{p}_i$ is the predicted coverage rate of individual i. It is obtained from a logit model using the circumstances as independent variables.[4] C is the average coverage rate in the population and is the weight.

16. The HOI has a number of attractive features as an index. For example, the HOI is sensitive to:

a. the overall coverage: when the coverage for all groups increases by factor k the HOI increases by the same factor;
b. Pareto improvements: when the coverage for one group increases without decreasing the coverage rates of other groups, the HOI increases; and,
c. redistribution of opportunities: when the coverage rate of a vulnerable group increases for a constant overall coverage rate there is decrease in inequality and an increase in the HOI.

Selection of Opportunities and Circumstances for the Analysis

17. Ideally, the selection of opportunities and circumstances to be monitored would reflect a consensus within the country of what opportunities should be considered universal and what circumstances are sufficiently important to identify to ensure that those who differ in circumstances do not differ in their access to opportunities. Since the objective of this paper is simply to introduce the possibility that the HOI approach could be useful in Pakistan, some common measures for opportunities and circumstances are selected that have been considered in other countries and for which data are available from household surveys in Pakistan.

[4] The calculation of D from a logit model is described in more detail in Annex 1

18. The analysis will make use of data from the 1998-99 and 2007-08 Pakistan Social and Living Standards Measurement (PSLM) Surveys. These two surveys were chosen because they provide observations over roughly a decade, which should be long enough to detect progress. Moreover, HOI calculations have been made for Latin America and Africa over a ten-year period, so this facilitates comparisons. Choosing the 1998-99 and 2007-08 surveys also allows for the inclusion of real per-capita consumption as one of the circumstances to consider. Not all of the PSLM surveys have consumption data.[5]

19. Other opportunities could and should be chosen. For example the selected opportunities capture only enrollments and completion rates. They do not capture dimensions of quality of school. If the educational system is willing to define a measure of what constitutes adequate quality, it would be possible to use the approach to determine the extent to which there is equality in achieving adequate quality schooling. Similarly, the measure of basic infrastructure only captures whether a child is at a home with a connection. It does not reflect whether there is electricity available 24 hours a day. But this is simply a question of availability of data. If the appropriate data were available, this approach could be used to capture the equality in the availability of service.

20. A final point relates to the question of what is considered to be an opportunity. Should the government be content with simply providing a supply of the service and pay no attention to whether the parents take steps to make that service available to their children? This involves considering what it means to supply the service. A service may be "available" but the cost of accessing that may be prohibitive. If a society truly cares about children receiving equal opportunities, this may require going beyond asking whether a service is provided to a particular quality standard to a question of what is happening to the utilization of that service. But both concepts can be important. Society may be interested in having equality in primary completion rates and may also want to know whether one of the reasons for why there is inequality in primary completion rates is because there is inequality (or appropriately compensatory investment) in the use of public funds. Looking at both aspects of the problem could be fruitful. Table 1 presents the opportunities considered in the analysis and Table 2 presents the circumstances used in the analysis at the provincial level.

Table 1 **Definition of Opportunities Used in the HOI Analysis for Pakistan**

	Opportunities
Education	1. Enrollment of children aged 6-10 2. Enrollment of children aged 11-15 3. Primary completion among children aged 15-19 4. Secondary completion among children aged 20-24
Health	1. Did not have diarrhea in the last 30 days for children less than 5 2. Ever received immunization 3. Received full immunization according to a record in a health card or a self-response of the mother 4. Received full immunization as recorded on a health card 5. Received adequate prenatal care, defined as at least 3 prenatal care visits with the

[5] While having a good combination of data for both opportunities and circumstances (including consumption) is the main reason for selecting the particular PSLM surveys, this sort of analysis could be done with any of the household surveys. It could be interesting to do the analysis with the Multiple Indicator Cluster Surveys (MICS) as they allow for greater disaggregation. A listing of the available household surveys in Pakistan is given in Annex 2.

	Opportunities
	first one occurring before the fourth month of pregnancy 6. Received any postnatal care within 6 weeks after birth 7. Attended by some traditional or formal birth attendant (defined as traditional birth attendant, trained *dai*, doctor, lady health visitor, lady health worker, nurse) 8. Attended by formal birth attendant (defined as doctor, lady health visitor, lady health worker, nurse) 9. Institutional birth (defined as being at a government or private hospital/clinic)
Infrastructure	1. Having improved sanitation (defined as improved if from flush to public sewage, flush to pit or pit latrine, unimproved if flush to open drain, raised latrine or no toilet) for children aged 0-16 2. Having improved water (defined as improved if from pipe, hand pump, tube well or closed well, unimproved if from open well, pond, river, spring or other) for children aged 0-16 3. Having an electricity connection for children aged 0-16 4. Having a gas connection for children aged 0-16 5. Having a telephone connection for children aged 0-16

Table 2 List of Circumstances Used in HOI Analysis at Provincial Level

Circumstances		
Provincial Estimates 1. Punjab 2. Sindh a. Karachi[6] b. Other Sindh 3. KP Balochistan	1. Gender[7] 2. Urban 3. Household size 4. Real Per Capita Consumption 5. Highest Education Level of Household Head 6. Gender of Household Head	1. Gender 2. Urban 3. Household size 4. Real Per Capita Consumption 5. Highest Education Level of Household Head

HOI Results at Provincial Level

21. The implementation of the 18th Amendment in Pakistan ushers in a new era in the political and economic life of the provinces. While there are hopes that the increased devolution of services will lead to improved delivery and enhanced welfare, there is also a risk that the opportunities available for citizens (and children) in different provinces will begin to diverge more than they have to date because of differences in management skills and resources. It will be important to monitor what happens in the near future so that some potential corrective actions might be taken. The experience over the recent past can provide a useful baseline for that monitoring system. For this reason, the paper presents all of the key opportunities introduced in the earlier sections in separate tables, showing the results for Pakistan and the four provinces. Because the results for Sindh are heavily influenced by the results for the very large metropolis of Karachi (which are quite different), the results are presented for all of Sindh, for Karachi and for Other (non-Karachi) areas of Sindh.

[6] For Karachi estimates the urban circumstance was dropped because all of Karachi is urban

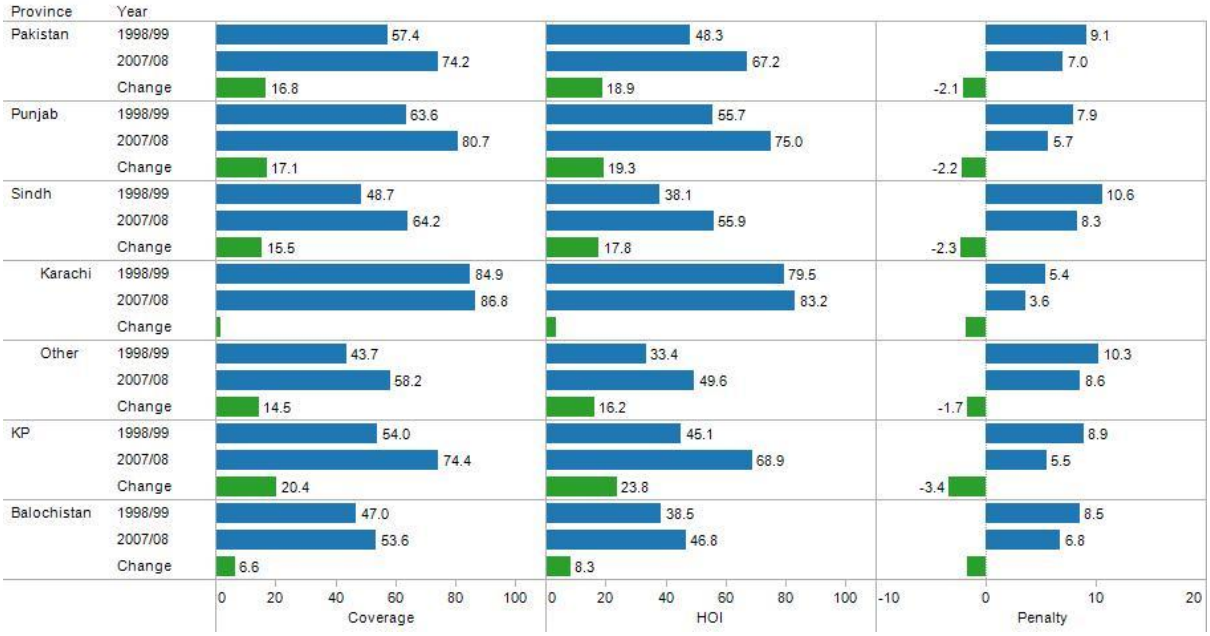
[7] Note: for estimates of Prenatal care, Traditional of Formal Birth Attendant, Formal Birth Attendant, Institutional Births and Postnatal Care, there was not separate information available on gender so it was not included as a circumstance in that case.

HOI Results in Education

22. Figures 1 to 4 present Coverage, HOI and Penalties for Primary School Enrollment for those aged 6 to 10, Secondary School Enrollment for those aged 11 to 15, Primary School Completion for those aged 15 to 19 and Secondary School Completion for those aged 20 to 24. There are several points worth noting: across virtually all provinces, there appears to have been greater improvement in equality of opportunities in primary education than in secondary education.

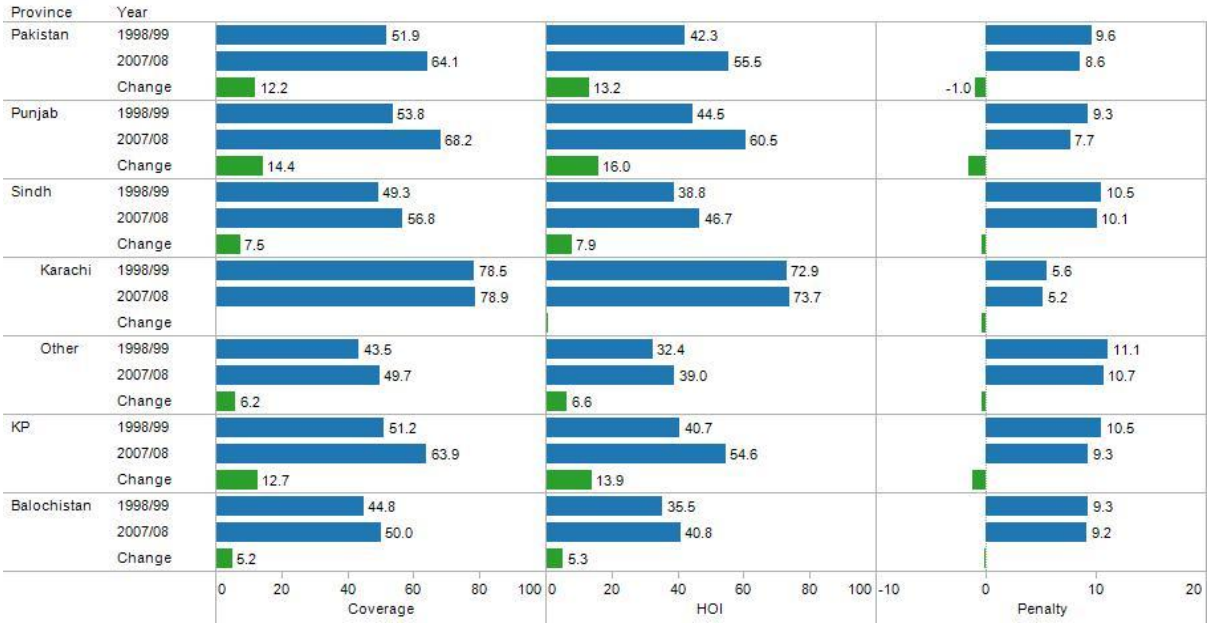
23. Turning to individual provinces, it is encouraging to note the improvement in both the coverage and equality in primary school enrollment and completion in KP and in Punjab. While Balochistan shows some improvement, it is lower than other provinces, which is worrisome given that its initial position was behind other provinces. For example, KP's secondary school enrollment HOI went from 40.7 to 54.6, while that of Balochistan only increased from 35.5 to 40.8. In Karachi, there is some evidence that inequality is lower than in other parts of Sindh and other provinces—this is good news. The bad news is that Karachi shows only a relatively small improvement in primary school enrollment, but a stagnation or deterioration (in case of primary school completion) in other educational outcomes.

Figure 1 **Primary School Enrollment (Ages 6 to 10): Coverage Rates, HOI & Penalty**



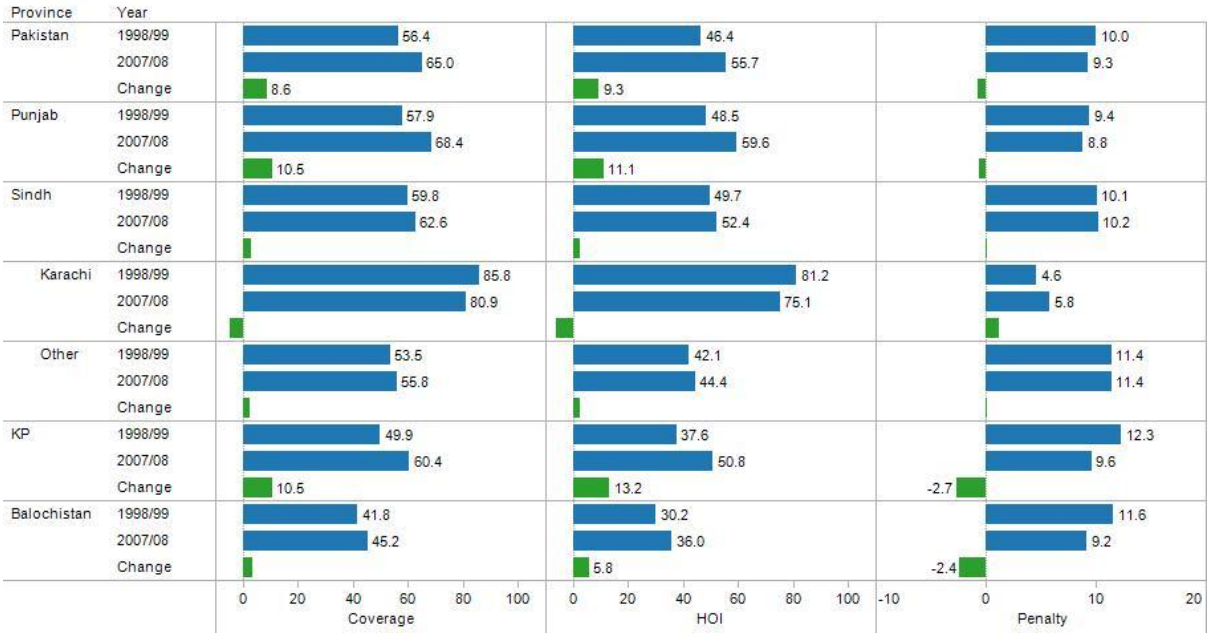
Note: For the change in the indicator, the values are reported only if the change is significant at the 95% level. 95% Confidence Intervals are reported in Annex 3.

Figure 2 **Secondary School Enrollment (Ages 11 to 15): Coverage Rates, HOI & Penalty**



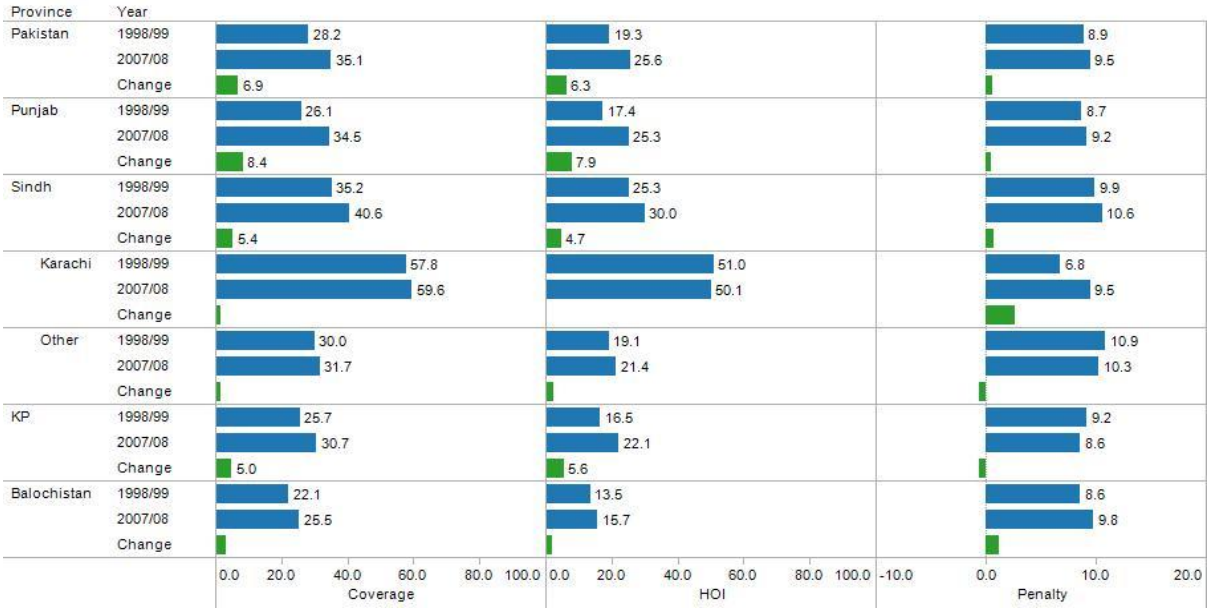
Note: For the change in the indicator, the values are reported only if the change is significant at the 95% level. 95% Confidence Intervals are reported in Annex 3.

Figure 3 **Finished Primary (Ages 15 to 19): Coverage Rates, HOI & Penalty**



Note: For the change in the indicator, the values are reported only if the change is significant at the 95% level. 95% Confidence Intervals are reported in Annex 3.

Figure 4 **Finished Secondary (Ages 20 to 24): Coverage Rates, HOI & Penalty**



Note: For the change in the indicator, the values are reported only if the change is significant at the 95% level. 95% Confidence Intervals are reported in Annex 3.

Relative contribution of different circumstances in determining the penalty in Education

24. While it is useful to know the relative size of the penalty and to track how it changes over time, it is also useful to try to go behind the aggregate penalty and get some idea of what determines the size of the penalty. It is possible to do this using a Shapley decomposition, which is described in Annex 1.

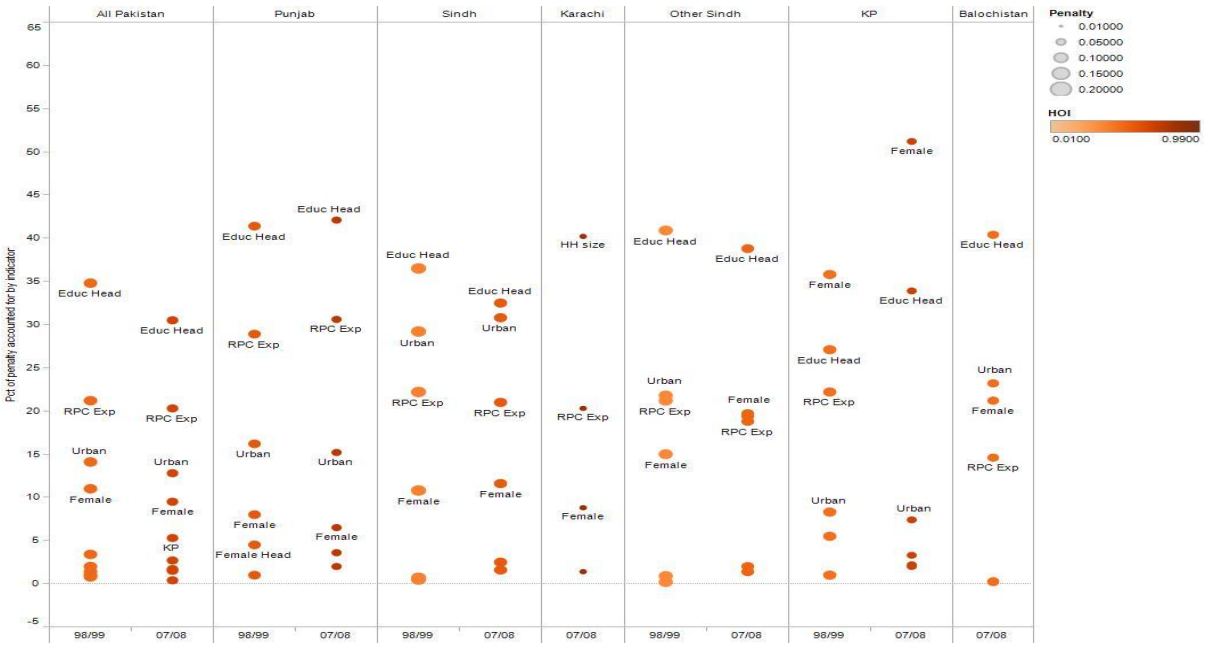
25. Figures 5-8 present the results of Shapley decomposition of the penalty first for the national level results and then separately for the four provinces and Karachi and other parts of Sindh. In each figure, the decomposition is done for two periods, 1998-99 and 2007-08 allowing identification of any shift in the factors explaining inequality of opportunity over the decade. It is important to note that only when the change is statistically significant are results for both years presented. As it is still of interest to view the contribution of the circumstance to the penalty even when the change is not significant, the decomposition is presented for the latest available year (2007-08). In all figures, the position of the circles indicates the relative contribution of the circumstance to explaining the penalty; the size of the circle provides information on the size of the penalty; and the color of the circle provides information on the value of the HOI. Thus, in a figure, one can observe most of what one would like to know about what is happening to the equality of opportunities. The scale for the size of the penalty and the value of the HOI is kept the same across all opportunities in education, health and infrastructure to facilitate comparisons.

26. There are two striking features that can be noted from a perusal of different figures. First, in most provinces the educational level of the head of household appears to be the major factor explaining inequality of opportunities. This is not the case in other countries, where income is often the most important factor. It would be interesting to see how the

effects of having the education of the household head affect the dynamics of the expansion. This is not explored in this paper, but there is a possibility that having a critical mass of educated parents in a community may also encourage education of all kids. Certainly, the finding that income is relatively less important than the education of the parent might explain why Easterly (2003) had observed "growth without development." If it was education of the parent rather than income that is the deciding factor, then it may take time before the expansion of education creates the demand. Simply having growth in incomes would not generate the increase in enrollments and completion rates.

27. Second, there appears to be a declining importance of gender in explaining inequality. This reflects the success of efforts to promote female education. In Punjab and Sindh, the relative importance of gender in explaining observed inequality has diminished over time and is now not a very important determinant of inequality in opportunities. In Balochistan, gender is still one of the most important factors, but except for the effect on secondary enrollment, the relative effect of gender has gone down. The one exception to the pattern is in KP province, where gender discrimination is still the most important factor. But even in KP, while the relative importance in explaining inequality in enrollment has gone up, its relative importance in explaining primary and secondary completion has gone down. This would certainly merit some closer analysis in a subsequent sector-specific report.

Figure 5 **School Enrollment (Ages 6 to 10): % of Penalty Explained by Different Factors**



Note: Results for both years are presented only when the change in the penalty is significant. If not significant, the decomposition is presented only for the most recent year.

Figure 6 School Enrollment (Ages 11-15): % of Penalty Explained by Different Factors

Note: Results for both years are presented only when the change in the penalty is significant. If not significant, the decomposition is presented only for the most recent year.

Figure 7 Finished Primary (Ages 15-19): % of Penalty Explained by Different Factors

Note: Results for both years are presented only when the change in the penalty is significant. If not significant, the decomposition is presented only for the most recent year.

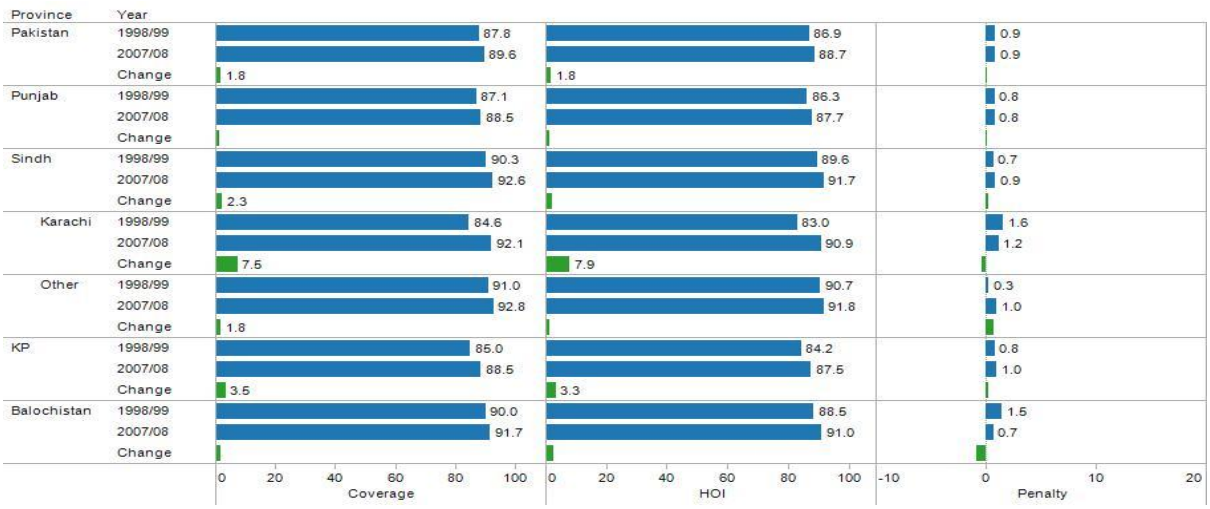
Figure 8 **Finished Secondary (Ages 20-24): % of Penalty Explained by Different Factors**

Note: Results for both years are presented only when the change in the penalty is significant. If not significant, the decomposition is presented only for the most recent year.

HOI Results in Health

28. This section presents similar comparisons across provinces for key health indicators. Figure 9 presents the per cent of children under 5 who did not suffer from diarrhea over the last 30 days at the national level, for the four provinces and Karachi and Other areas of Sindh. The most notable observation is the considerable improvement that took place in Karachi and that in the provinces at the national level, the penalties are quite small. This indicates that while there are between roughly 8 and 13 per cent of the children who suffer from diarrhea, there are not very systematic differences according to the circumstances.

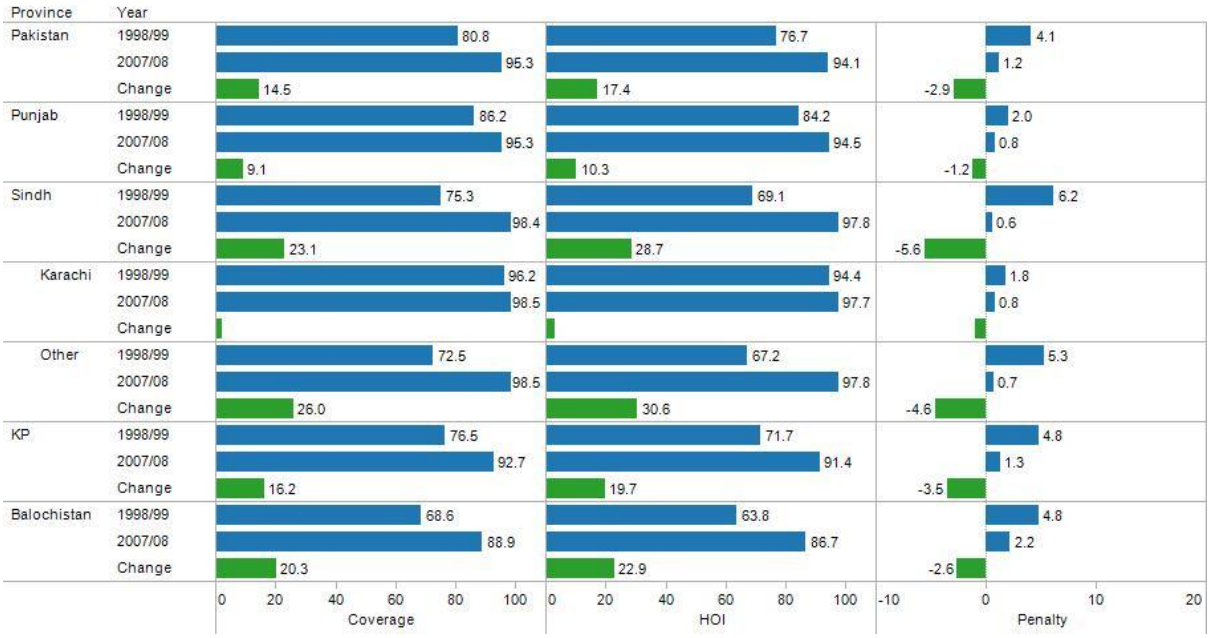
Figure 9 **% of Children under 5 Who Did Not Suffer from Diarrhea over Last 30 Days**



Note: For the change in the indicator, the values are reported only if the change is significant at the 95% level. 95% Confidence Intervals are reported in Annex 3.

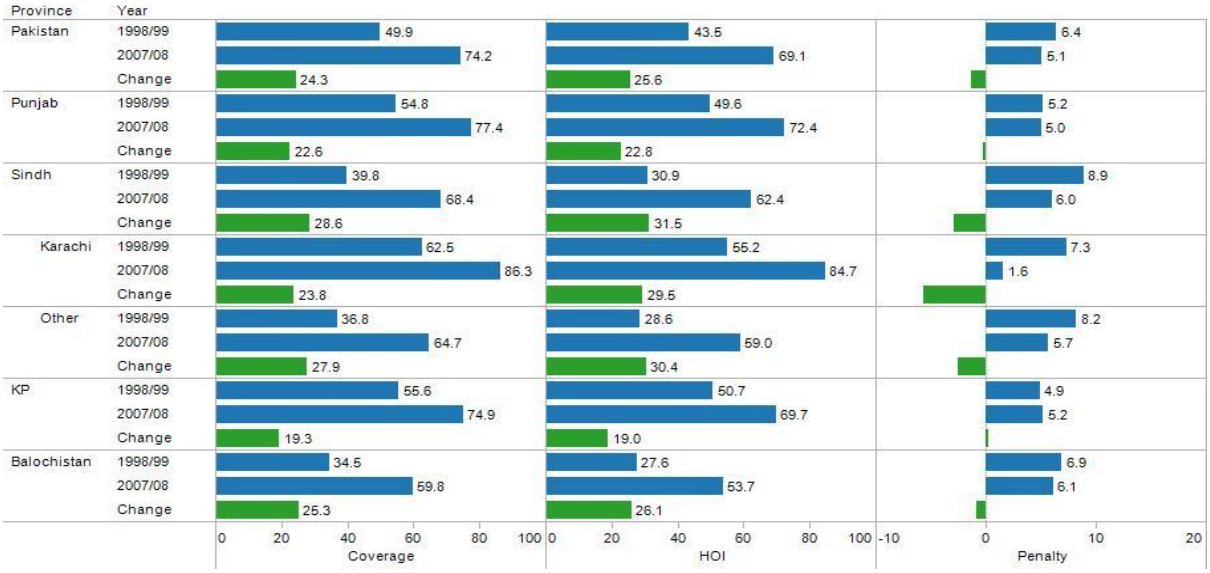
29. Figures 10-12 present data for immunizations. While Figure 10 indicates that there are sizable improvements in whether a child is immunized at all, the improvements are even greater for achieving full immunization. The more than threefold increase in the rate of children who report full immunization and report having a health card in Other Sindh and Balochistan is particularly encouraging, because it suggests a greater presence of the formal health system. However, this improvement is over a very low base–less than 10 per cent–and, as an absolute level, the rates in Other Sindh and Balochistan are still low. In terms of the change in the penalty, there are statistically significant improvements in equality in having any immunization (in all provinces and areas except for Karachi, which is not a problem since immunization rates were already high and the penalty was low). Particularly impressive was the gain in other areas of Sindh as almost all children under 5 received at least one immunization. When coverage approaches universality, the penalty must fall as it did in the case of Other Sindh. For full immunization–whether with or without a health card–there were no statistically significant changes in the penalty.

Figure 10 **Any Immunization: Coverage Rates, HOI and Penalties**



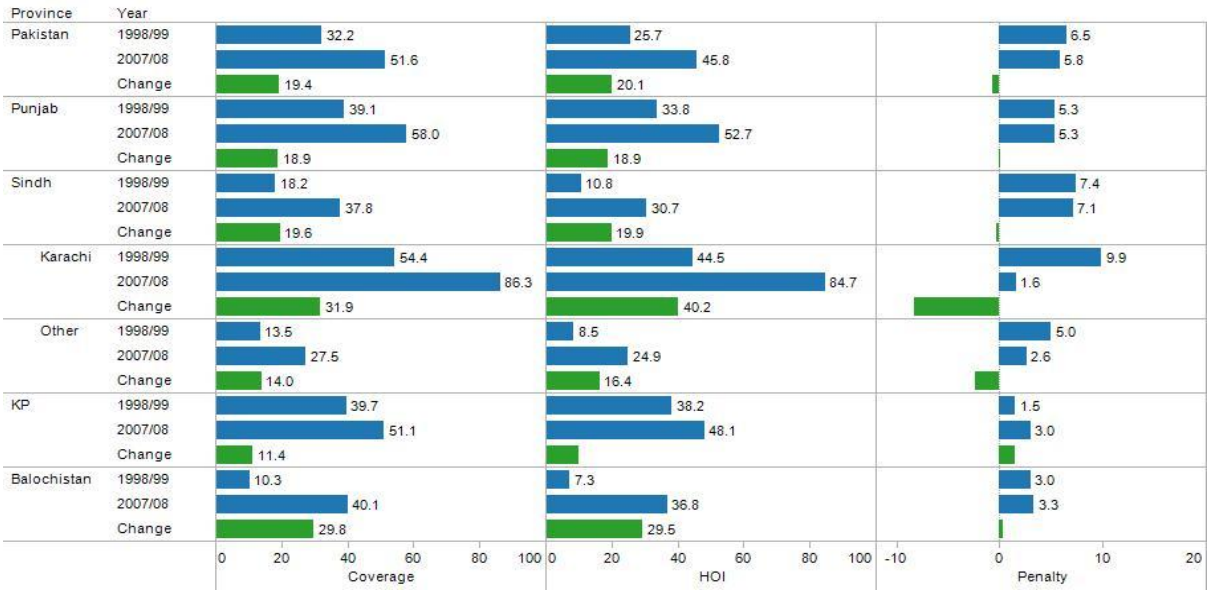
Note: For the change in the indicator, the values are reported only if the change is significant at the 95% level. 95% Confidence Intervals are reported in Annex 3.

Figure 11 **Full Immunization: Coverage Rates, HOI and Penalties**



Note: For the change in the indicator, the values are reported only if the change is significant at the 95% level. 95% Confidence Intervals are reported in Annex 3.

Figure 12 **Full Immunization with Record: Coverage Rates, HOI and Penalties**

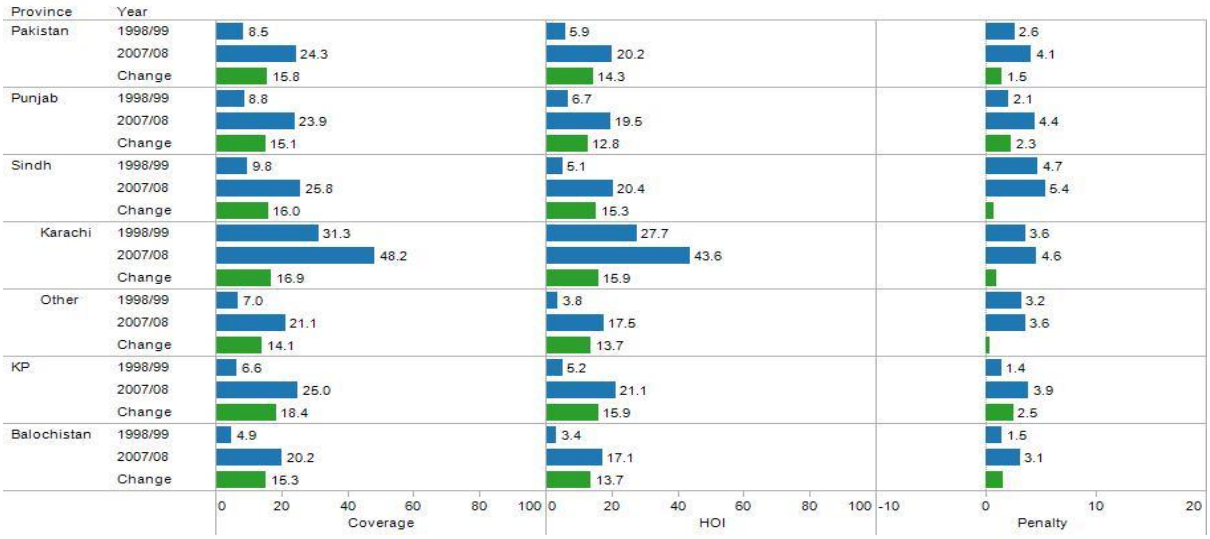


Note: For the change in the indicator, the values are reported only if the change is significant at the 95% level. 95% Confidence Intervals are reported in Annex 3.

30. Figure 13 presents the Coverage Rates, HOI and Penalties for adequate prenatal care, defined as having at least three visits with the first visit occurring before the fourth month of pregnancy. In all provinces in Pakistan and even in the largest city Karachi, the per cent of women receiving adequate prenatal care in 1998-99 was dismal. Across all provinces there has been improvement, but not enough. For all but Karachi, the HOI is hovering around 20 per cent. In Karachi the HOI is 43.6 per cent. This is clearly an area where Pakistan must do better. In contrast to the case with immunization, the improvement in coverage has been

accompanied by a significant increase in inequality in Pakistan as a whole, in Punjab and in KP.

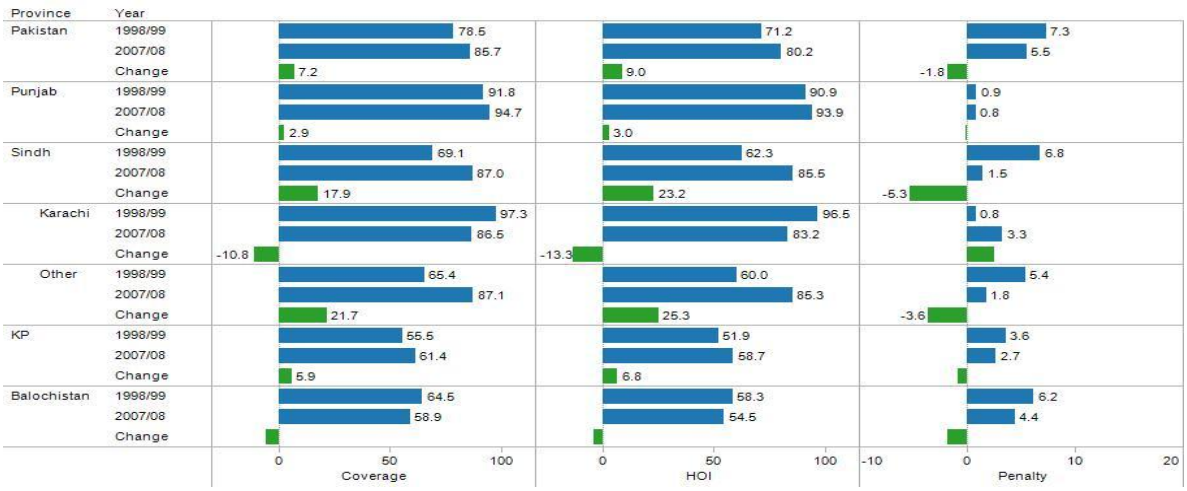
Figure 13 **Prenatal Care: Coverage Rates, HOI and Penalties**



Note: For the change in the indicator, the values are reported only if the change is significant at the 95% level. 95% Confidence Intervals are reported in Annex 3.

31. As can be deduced from Figures 14 and 15, except for Karachi, there is a very large proportion of traditional relative to formal skilled birth attendants in all of the provinces.[8] As with prenatal care, the proportions of formal skilled birth attendants in 1998-99 were very low, particularly in Balochistan with only 5.1 per cent coverage. The size of the penalty in 1998-99 was large relative to the coverage, indicating that formal birth attendants were not very equitably distributed. There was generally a sizable improvement between 1998-99 and 2007-08, but the values are still low and, in some provinces, there was a statistically significant increase in inequality.

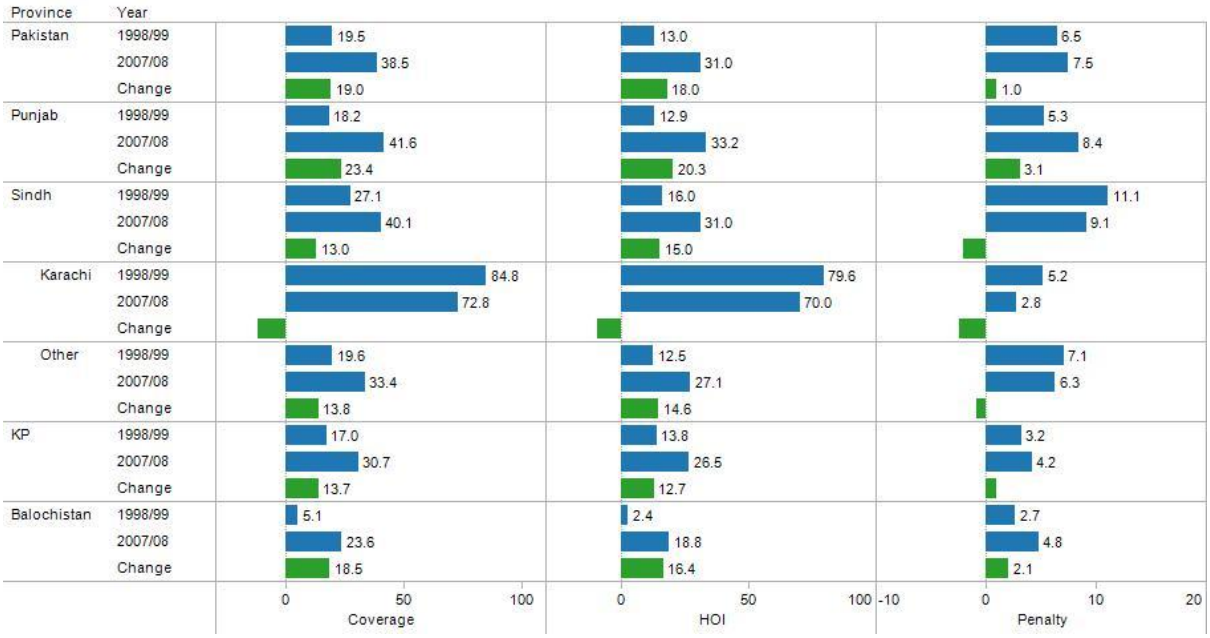
Figure 14 **Attendance by Traditional / Formal Birth Attendant: Coverage Rates, HOI & Penalties**



Note: For the change in the indicator, the values are reported only if the change is significant at the 95% level. 95% Confidence Intervals are reported in Annex 3.

[8] As stated in Table 1 formal birth attendants are doctors, lady health visitors, lady health workers and nurses, while traditional birth attendants are trained *dai* and those classified in the survey as traditional birth attendants.

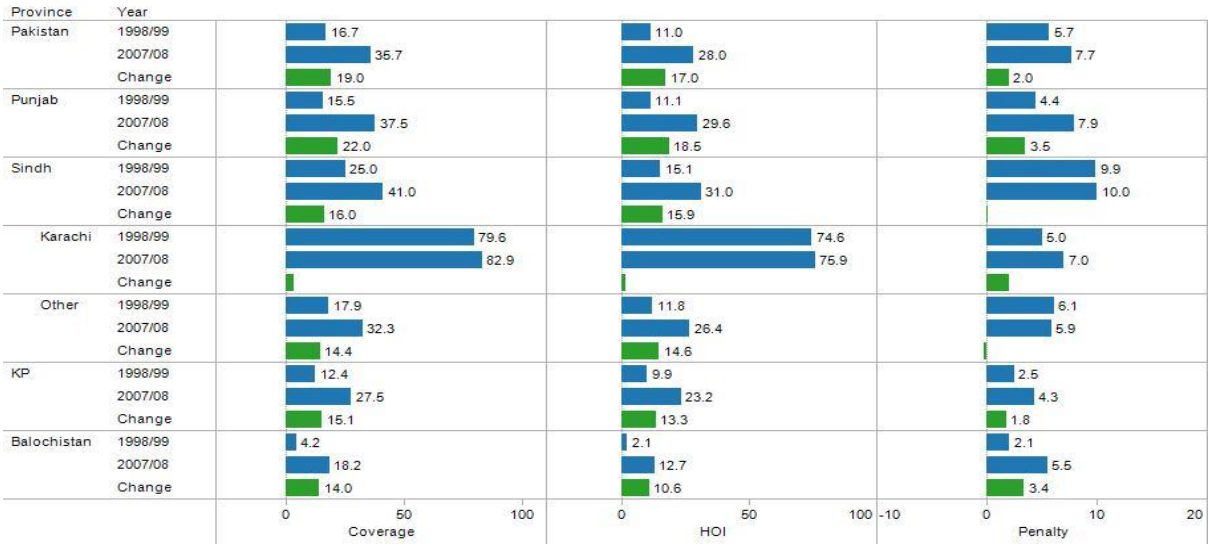
Figure 15 **Formal Birth Attendant: Coverage Rates, HOI & Penalties**



Note: For the change in the indicator, the values are reported only if the change is significant at the 95% level. 95% Confidence Intervals are reported in Annex 3.

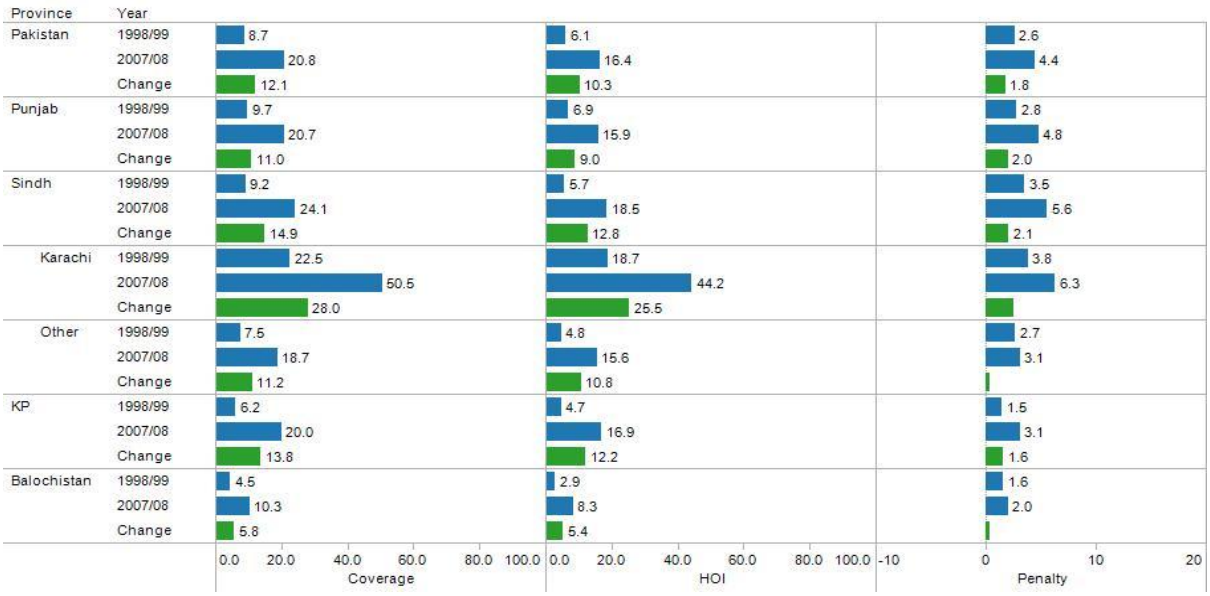
32. Finally, for institutional births and for having any post-natal care at all, there is a similar pattern–overall improvement across the board in all provinces, but Balochistan lags behind other provinces. There are relatively high penalties for institutional births, indicating that the coverage of institutional births has been inequitably distributed. While there has been improvement in coverage, for all cases except for Sindh, Karachi and Other Sindh, there has been a statistically significant increase in inequality. The penalties are somewhat lower for post-natal care, but for Pakistan as a whole, for Punjab and for Sindh, there has been an increase in inequality.

Figure 16 **Institutional Births: Coverage Rates, HOI and Penalties**



Note: For the change in the indicator, the values are reported only if the change is significant at the 95% level. 95% Confidence Intervals are reported in Annex 3.

Figure 17 **Post-Natal Care: Coverage Rates, HOI and Penalties**



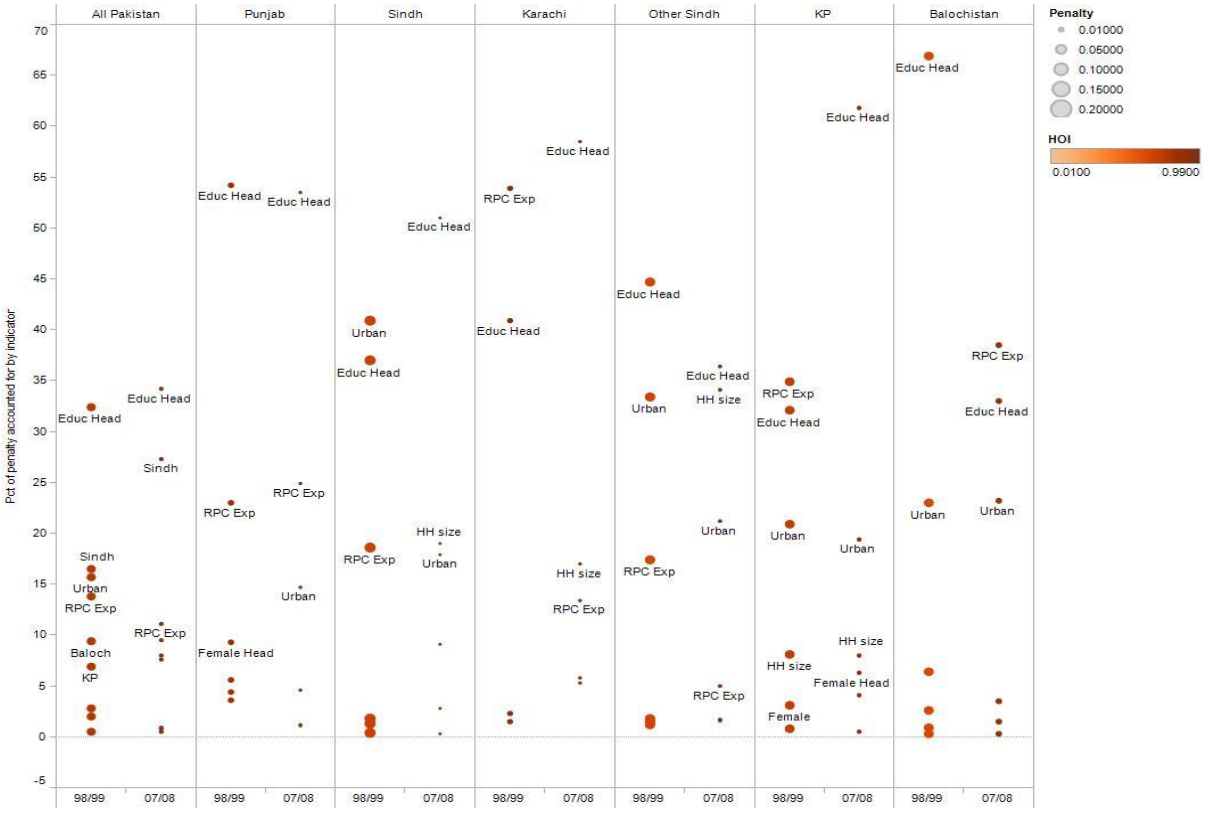
Note: For the change in the indicator, the values are reported only if the change is significant at the 95% level. 95% Confidence Intervals are reported in Annex 3.

Relative Contribution of Different Circumstances in Determining the Penalty in Health

33. As the penalty is very small for the per cent of children under five who did not suffer from diarrhea in the last 30 days, it is not worthwhile exploring what accounts for the size of the penalty in that case. Thus, we move directly to exploring the circumstances that account for the penalty in the case of immunization.

34. While there are some slight variations across the provinces, generally the most important factor accounting for the inequality is the education of the household head. For the national level results for immunization at all, the education of the head is more important than the provincial dummy variables and the urban variable. For the provincial results, there are no dummy variables, but the education level of the head is generally more important than the urban dummy. This information, coupled with the observation that coverage rates are quite high for immunization at all, suggests that the problem of incomplete coverage is not a generalized problem, but rather one of ensuring adequate take-up of the immunization among families at lower educational levels. For full immunization and especially for full immunization with a record, the gap between the education of the head and the other circumstances in accounting for the penalty is diminished, suggesting that some considerations of the supply–rather than the take-up of the supply are affecting the outcomes.

Figure 18 **Any Immunization for Children under 5: % of Penalty Explained by Factors**



Note: Results for both years are presented only when the change in the penalty is significant. If not significant, the decomposition is presented only for the most recent year.

Figure 19 **Full Immunization for Children under 5: % of Penalty Explained by Factors**

Note: Results for both years are presented only when the change in the penalty is significant. If not significant, the decomposition is presented only for the most recent year.

Figure 20 **Full Immunization with Record for under 5: % of Penalty Explained by Factors**

Note: Results for both years are presented only when the change in the penalty is significant. If not significant, the decomposition is presented only for the most recent year.

35. Figure 21 presents the per cent of penalty explained by different circumstances for adequate prenatal care. In this case, the urban dummy is often the important factor (cf. Pakistan as a whole, Sindh, Other Sindh). It is interesting to note that, over time, the importance of both urban and education of the head has diminished, while the role of per-capita real expenditure has increased. This has occurred with an improvement in coverage and deterioration in equality between 1998-99 and 2007-08, suggesting that cost rather than availability or knowledge might be becoming more of a limiting factor.

Figure 21 **Adequate Prenatal Care: % of Penalty Explained by Different Factors**

Note: Results for both years are presented only when the change in the penalty is significant. If not significant, the decomposition is presented only for the most recent year.

36. Except for the case of the penalty for improved water, the only time when the provincial dummies appear important in explaining the penalty is with the case of both traditional and formal skilled birth attendants and skilled birth attendants. The fact that the provinicial dummies are important in both cases suggests it is the results with formal skilled birth attendants that are driving the results for traditional and formal. This could reflect different cultural practices in different provinces or differences in the availability of formal health care workers across provinces. It is noteworthy that the size of the penalty is large relative to the coverage, suggesting that there is considerable inequality.

37. Looking at the individual provincial results, there does not appear to be a single dominant pattern. In KP, education of the head is the most important factor and remained the most important factor across the two years, whereas in Balochistan, the importance of the education of the head fell. Drilling down into the provincial level policies and implementation could possibly explain some of this variation.

Figure 22 **Tradition & Formal Skilled Birth Attendant: % of Penalty Explained by Different Factors**

Note: Results for both years are presented only when the change in the penalty is significant. If not significant, the decomposition is presented only for the most recent year.

Figure 23 **Formal Skilled Birth Attendant: % of Penalty Explained by Different Factors**

Note: Results for both years are presented only when the change in the penalty is significant. If not significant, the decomposition is presented only for the most recent year.

38. Finally, for institutional births and post-natal care, the urban dummy and the real per-capita expenditure appear to be generally the most important circumstances explaining the penalty. This suggests that the availability of the supply (and possibly the price)–rather than acceptance of the notion (which might be influenced more by the education of the head) might be the limiting factors.

Figure 24 **Institutional Births: % of Penalty Explained by Different Factors**

Note: Results for both years are presented only when the change in the penalty is significant. If not significant, the decomposition is presented only for the most recent year.

Figure 25 **Any Post-Natal Care: % of Penalty Explained by Different Factors**

Note: Results for both years are presented only when the change in the penalty is significant. If not significant, the decomposition is presented only for the most recent year.

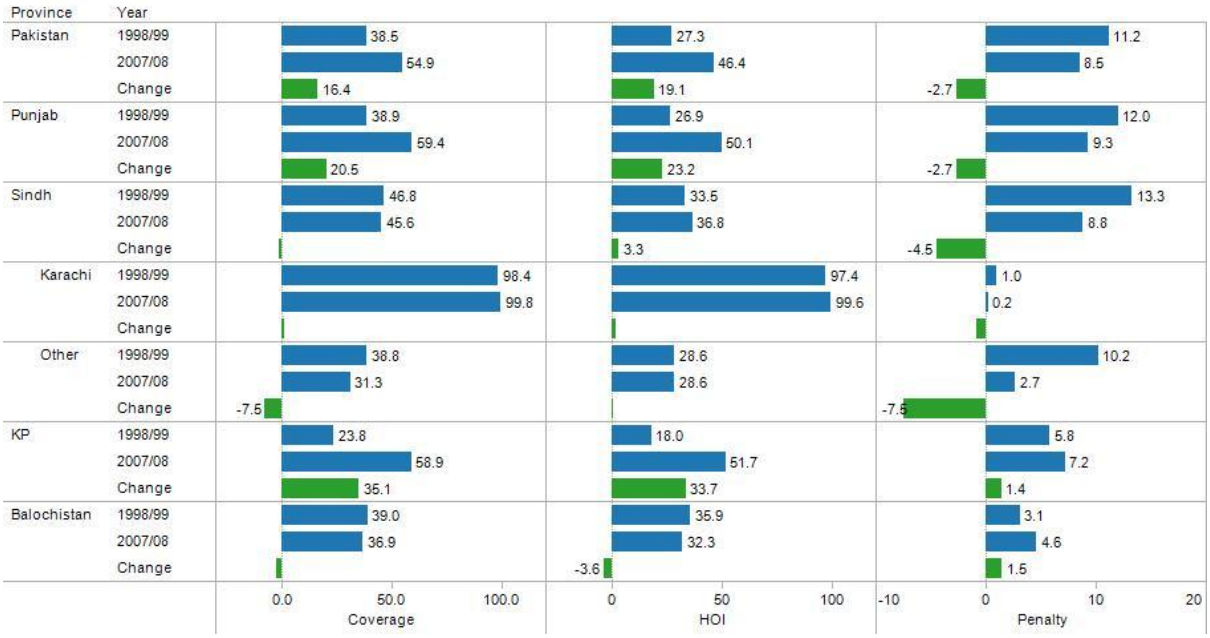
HOI Results in Infrastructure

39. Figure 26 reveals that progress in children receiving improved sanitation is very uneven across provinces–probably exhibiting the greatest variation across provinces of any of the indicators considered in education, health and infrastructure. While there was very good progress in Punjab and KP, coverage actually fell in Sindh, Other Sindh and Balochistan. Considerable different results with regards to equality were observed. There was a statistically significant decrease in inequality (as indicated by the reduction in penalty) in Punjab and in Sindh (driven by the large improvement in Other Sindh). This improvement in equality kept the HOI for Other Sindh constant, despite the fall in coverage. At the same time, inequality increased in both KP and Balochistan–in KP in the presence of a large increase and in Balochistan in the presence of a small decline in coverage. It would appear very different policies were being pursued in the provinces.

40. It is noteworthy that the results for sanitation are almost always considerably poorer than for water–with the exception of Balochistan in 1998-99. In Balochistan, both the coverage of water and sanitation were low and were fairly similar. In all other areas, the coverage for improved water was far better than the improvement for improved sanitation.

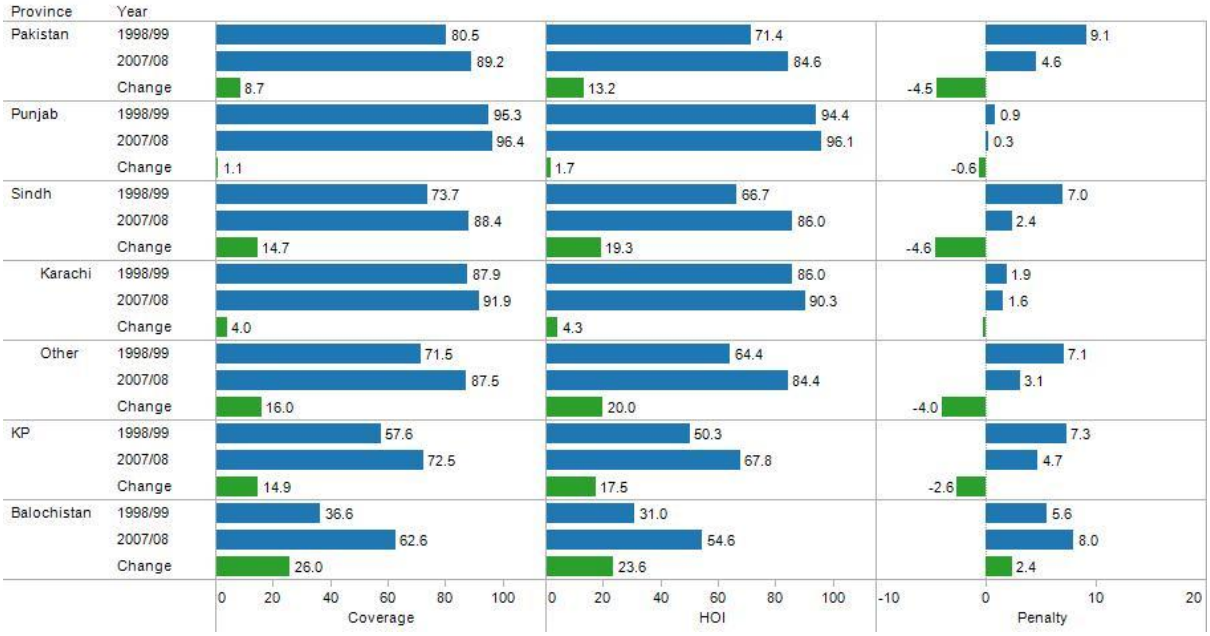
41. As can be seen from Figure 27, coverage rates for water improved significantly (except in Punjab where it was already close to universal and in Karachi where it was also high). In areas where sanitation coverage did not move (Sindh, Other sindh and Balochistan), coverage in water did improve. At the national level, there was a statistically significant improvement in equality in access to improved water, as well as in Sindh, Other Sindh and KP.

Figure 26 Improved Sanitation: Coverage Rates, HOI and Penalties



Note: For the change in the indicator, the values are reported only if the change is significant at the 95% level. 95% Confidence Intervals are reported in Annex 3.

Figure 27 Improved Water: Coverage Rates, HOI and Penalties

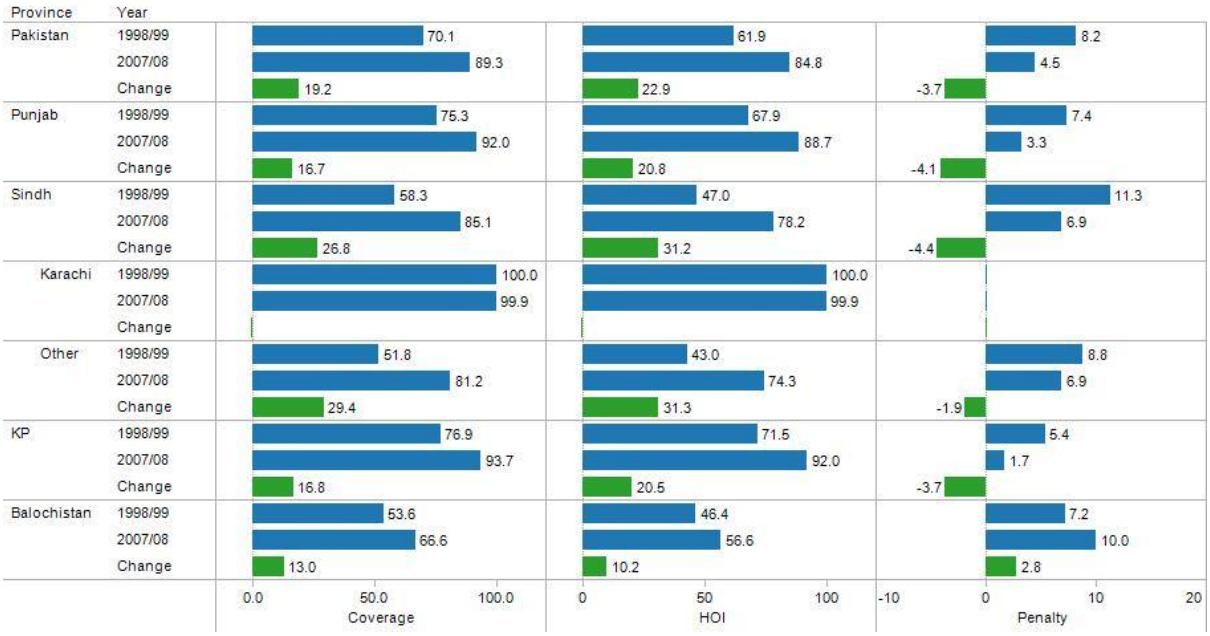


Note: For the change in the indicator, the values are reported only if the change is significant at the 95% level. 95% Confidence Intervals are reported in Annex 3.

42. Figure 28 illustrates that there has been good progress in access to electricity almost everywhere, but with relatively poorer results for Balochistan. However, this refers only to whether there is any electricity at all and not to how many hours it is available. As mentioned previously, Pakistan does suffer from brownouts and insufficient hours of availability. In all case (again, except for Balochistan), there was a significant improvement in equality as the expansion of coverage took place.

43. It is noteworthy that the improvements in coverage in infrastructure tend to be more likely to be accompanied by an improvement in equality than was the case with the improvement of coverage with the health indicators. This may have something to do with a possibly greater role for household behavioral choice with the health indicators than for the infrastructure variables.

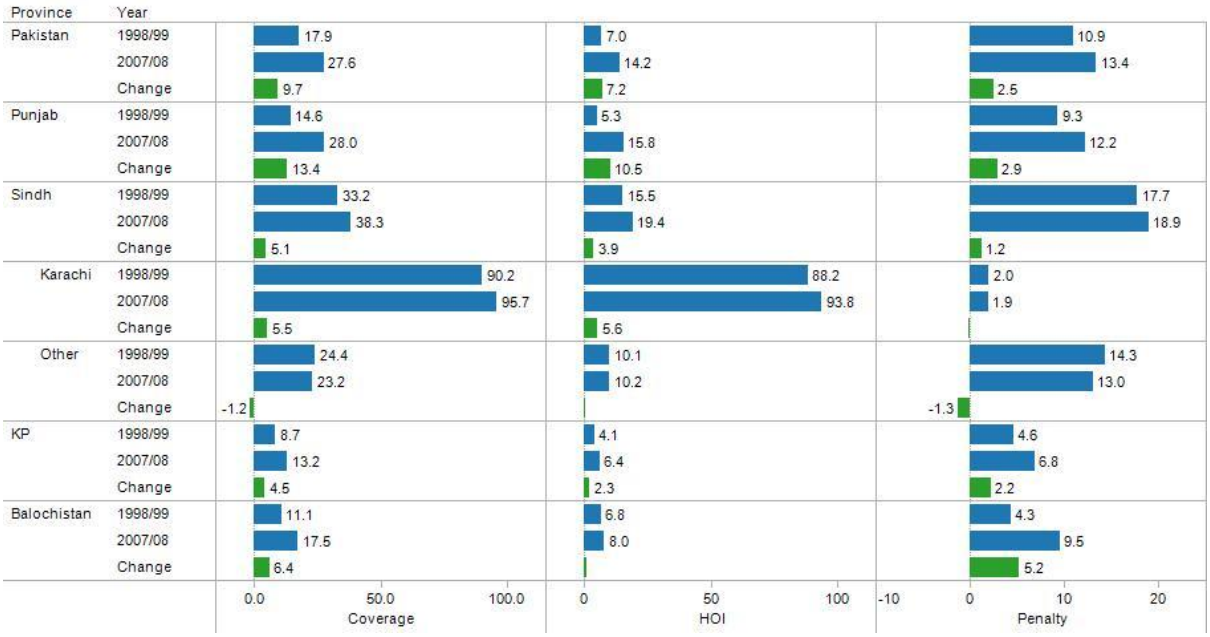
Figure 28 **Electricity: Coverage Rates, HOI and Penalties**



Note: For the change in the indicator, the values are reported only if the change is significant at the 95% level. 95% Confidence Intervals are reported in Annex 3.

44. Figure 29 makes apparent that gas is the infrastructure indicator that, except for Karachi, has the lowest level of coverage and the highest extent of inequality. There is a tendency for coverage to increase, sizably in Punjab and less so in the other provinces. The increase in coverage has been accompanied by an increase in inequality. As will be seen when one examines the circumstances that affect the penalty, consumption of gas is largely an urban phenomenon. It is not a surprise that the greatest degree of inequality is with the gas indicator. Indeed, the results provide some measure of reassurance that the methodology can represent the results for gas as distinct from the other indicators.

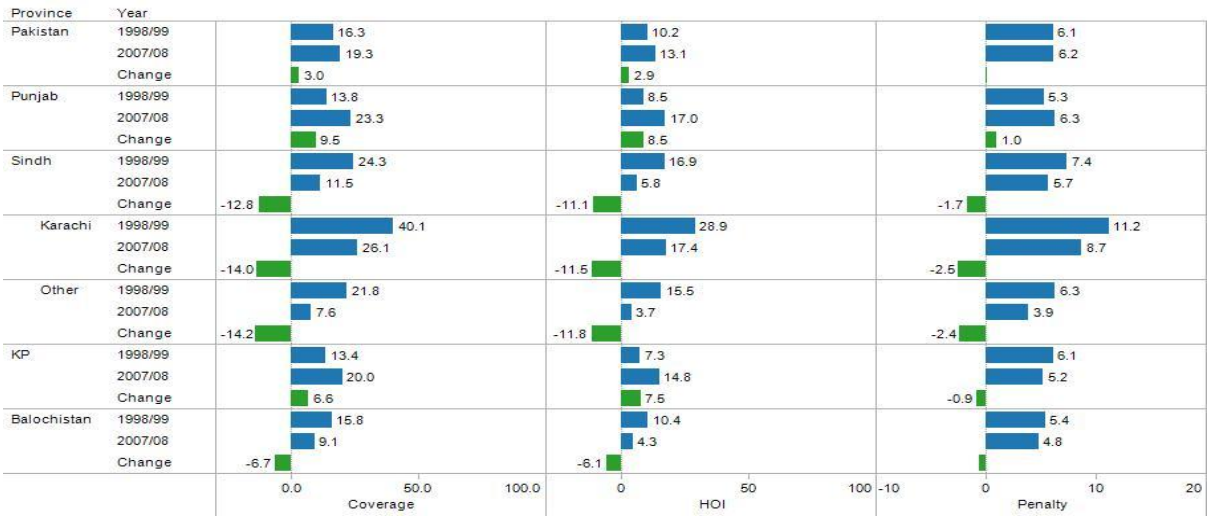
Figure 29 **Gas: Coverage Rates, HOI and Penalties**



Note: For the change in the indicator, the values are reported only if the change is significant at the 95% level. 95% Confidence Intervals are reported in Annex 3.

45. Finally, Figure 30 presents information on use of telephones. The questionnaire asks whether the household has a telephone connection, which would not have been a problem in collecting information in 1998-99, but could have been problematic in the data collection effort in 2007-08. It is possible that some respondents could have interpreted that having a land line might also include a cell phone line. Thus, while the results are presented for the sake of completeness, it is not entirely clear how they should be interpreted. Do the declines in coverage rates for telephones in Karachi and Other Sindh reflect a true decline or a substitution to greater use of cell phones? The 2010-11 survey should provide better indicators of the extent and nature of telecommunication connectivity within the country.

Figure 30 **Telephones: Coverage Rates, HOI and Penalties**



Note: For the change in the indicator, the values are reported only if the change is significant at the 95% level. 95% Confidence Intervals are reported in Annex 3.

Relative contribution of different circumstances in determining the penalty in Infrastructure

46. Figure 31 indicates that, at the national level, the three most important circumstances affecting access to improved sanitation are the urban dummy, education of the head and real per-capita expenditure. Part of the urban effect largely reflects the near universality of sanitation in Karachi, relative to quite low levels in other domains. The decomposition for the penalty is presented, but the value of penalty is very low, almost inconsequential. Beyond the effect caused by the different results for Karachi, only in Punjab is the urban effect the most important factor. In the Other Sindh, KP and Balochistan, the education of the head is the more important factor, with the effect relatively stronger in the later period.

Figure 31 **Improved Sanitation: % of Penalty Explained by Different Factors**

Note: Results for both years are presented only when the change in the penalty is significant. If not significant, the decomposition is presented only for the most recent year.

47. In explaining the penalty for water, Figure 32 indicates that the provincial dummies are the most important at the national level. As mentioned earlier, it is rare for provincial dummies to be the most important circumstances. Only for formal skilled birth attendants was the same case. This pattern, combined with the importance of the urban dummy in Other Sindh and Balochistan, suggests that the availability of supply was an important factor in explaining the inequality.

48. Figure 33 for electricity indicates that, except for KP, the improvement in coverage and reduction in inequality that occurred in electricity was associated with a lower weight of the urban dummy in explaining the inequality. Figure 34 for gas provides the clearest and most understandable message of all the exercises. It clearly shows for all provinces that the most important factor explaining the inequality in gas connections is, by far, the urban dummy. This is exactly what one would expect, given that gas connections through pipes are only economically viable in urban settings. Still, it is reassuring that the empirical approach

is able to capture this reality. Given the difficulties in interpreting the results for telephones, no figure is presented for the percent of penalty explained by different circumstances for telephones.

Figure 32 **Improved Water: % of Penalty Explained by Different Factors**

Note: Results for both years are presented only when the change in the penalty is significant. If not significant, the decomposition is presented only for the most recent year.

Figure 33 **Electrcity: % of Penalty Explained by Different Factors**

Note: Results for both years are presented only when the change in the penalty is significant. If not significant, the decomposition is presented only for the most recent year.

Figure 34 **Gas: % of Penalty Explained by Different Factors**

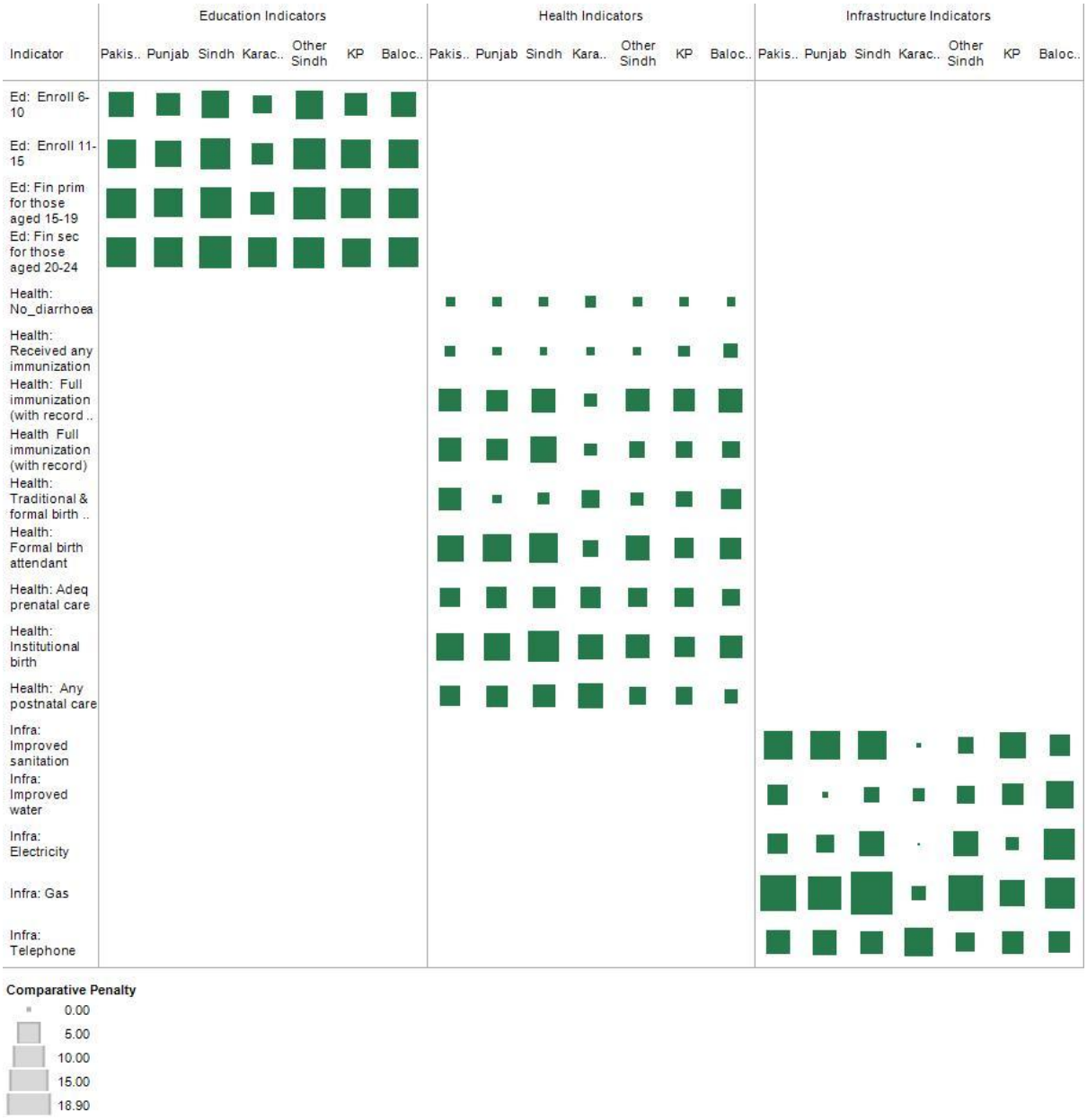
Note: Results for both years are presented only when the change in the penalty is significant. If not significant, the decomposition is presented only for the most recent year.

Summary of Results for all Indicators and Provinces

49. This paper has gone systematically through each one of the key indicators in education, health and infrastructure at the provincial level. It is also useful to take a step back and see the big picture of how the HOI and penalties vary across all indicators and all provinces. That is provided by Figures 35 and 36. They do not present any new information over what has already been presented in the previous figures. However, by presenting all of the indicators together for all provinces, it is readily apparent that the HOI for health indicators related to births (antenatal care, institutional births, having formal birth attendants and post natal care) are quite a bit worse than other indicators (except in Karachi). The areas of greatest inequality are in gas, access to improved sanitation, secondary enrollment and finished primary and secondary school.

Figure 35 **Relative Size of all HOI Indicators and Provinces**

Figure 36 Relative Size of all Penalty for All Indicators and Provinces



Conclusion

50. This paper has introduced to Pakistan a new metric for measuring equality of opportunities in several dimensions of education, health and infrastructure. While the paper selected opportunities that could be readily calculated from the existing PSLM, the approach is capable of being used on a variety of opportunities and indicators that could be important for policy makers. For example, one could define adequacy of test scores by specifying a specific threshold and, by identifying specific circumstances–gender, location, etc.—one could determine how close the country is approaching a goal of having equality opportunity in a measure of the quality of education, not just physical coverage. Similarly, one could define access to electricity by an acceptable number of hours of availability, not just whether a family has a connection. Then, one could carry out the same type of analysis that was carried out in this paper.

51. This suggests that the Human Opportunity Index approach would be an ideal approach to monitor what happens to equality of opportunities as the country begins to implement the 18th Amendment. There is some concern within the country that there could be a risk of greater inequality as the provinces begin to operate with more autonomy and with different levels of investment in social sectors. Several observers have stressed the importance of monitoring what happens to social outcomes and the use of HOI would seem to be an ideal metric, given the concerns. It would be important for monitoring to be carried out by the government, rather than the World Bank. One possible institution to carry out the analysis might be a technical secretariat of the Council of Common Interests or the Planning Commission. It is also possible for the Provincial Governments to track their own HOIs, but given the concern about overall equity in the country, it would be useful to have some oversight taking place at the national level. The HOI is relatively simple to estimate from survey data and the World Bank has prepared canned programs to carry out the analysis which can be shared with government.

52. Besides the task of monitoring, it would be useful for the government to begin to consider instruments that could be used to bring about greater equality of opportunities if the monitoring indicates that a problem is emerging. As the provinces will have considerable autonomy, it is likely that the national government would have to consider instruments that provide incentives for the provincial governments to make investments that would bring about greater equality of opportunities. A natural instrument to consider would be matching grants. Provincial government might be induced to leverage their funds with matching federal funds, with the matching rate set so as to create incentives. For example, provinces might have to put in only 20 per cent of the cost for investments in nutrition if it is felt that there is underinvestment in the provincial governments in nutrition and that this is contributing to greater inequality of opportunities.

53. It would also be possible to create an incentive for results by providing a rebate on the amount of matching funds that the provincial government provides–as long as the province delivers results. The HOI, itself, could be used as a metric to measure results, with the rebate of the matching grant dependent on the improvement in the HOI. This could be an effective metric as, being a calculated measure from a household survey, it is difficult to manipulate.

Annex 1[9]

Computing the Human Opportunity Index from Household Survey Data

In order to construct the HOI, we need to obtain the conditional probabilities of access to opportunities for each child based on their circumstances. In order to do so, one can estimate a logistic model, linear in the parameters β, where the event I corresponds to accessing the opportunity (e.g. access to clean water), and x the set of circumstances, (e.g. gender of the child, education and gender of the head of the household, etc).[10] We fit the logistic regression using survey data:

$$Ln\left(\frac{P\left[I=1\middle|X=(x_1,\ldots,x_m)\right]}{1-P\left[I=1\middle|X=(x_1,\ldots,x_m)\right]}\right)=\sum_{k=1}^{m}x_k\beta_k$$

where x_k denotes the row vector of variables representing the k-dimension of circumstances, hence, $x=(x_1,\ldots,x_m)$ and $\beta'=(\beta_1,\ldots,\beta_m)$ a corresponding column vector of parameters. From the estimation of this logistic regression one obtains estimates of the parameters $\{\beta_k\}$ to be denoted by $\{\hat{\beta}_{k,n}\}$ where n denotes the sample size.

Given the estimated coefficients, one can obtain for each individual in the sample his/her predicted probability of access to the opportunity in consideration:

$$\hat{p}_{i,n}=\frac{Exp\left(x_i\hat{\beta}_n\right)}{1+Exp\left(x_i\hat{\beta}_n\right)}$$

Finally, compute the overall coverage rate, C, the D-Index, the penalty, P, and the HOI using the predicted probability $\hat{p}$ and sampling weights, w:

$$C=\sum_{i=1}^{n}w_i\hat{p}_{i,n} \qquad D=\frac{1}{2C}\sum_{i=1}^{n}w_i\left|\hat{p}_{i,n}-C\right|$$

$P=C*D$; and $HOI=C-P$

[9] This is reproduced from the World Bank Report entitled, "Opportunities for Children in a Post-Conflict Country: the Case of Liberia", prepared by Ana Abras, Jose Cuesta, Ambar Narayan and Alejandro Hoyos (Poverty Reduction & Equity, PREM Network).

[10] Because the value of the HOI depends upon the circumstances chosen, there is not a unique HOI since there is no fixed set of circumstances. As the number of included circumstances is increased, the HOI can only decrease in value. Thus, the computed HOI can always be interpreted as an upper bound of the HOI, subject to the addition of more circumstances.

Shapley Decomposition: identifying how each circumstance "contributes" to inequality[11]

Following Barros et al. (2009) we can measure inequality of opportunities by the penalty (P) or by the dissimilarity index (D), as defined in expressions (1) and (3) above. The value of these two measures–where P is just a scalar transformation of D–is dependent on the set of circumstances considered. Moreover, they have the important property that adding more circumstances always increases the value of P and D. If we have two sets of circumstances A and B, and set A and B do not overlap, then $HOI(A,B) \leq HOI(A)$; and alternatively, $D(A,B) \geq D(A)$. The impact of adding a circumstance A is given by:

$$D_A = \sum_{S \subseteq N \setminus \{A\}} \frac{|S|!\,(n-|S|-1)!}{n!} \left[D(S \cup \{A\}) - D(S)\right] \qquad (4)$$

Where N is the set of all circumstances, which includes n circumstances in total; S is a subset of N that does not contain the particular circumstance A. $D(S)$ is the dissimilarity index estimated with the set of circumstances S. $D(S \cup \{A\})$ is the dissimilarity index calculated with set of circumstances S *and* the circumstance A.

We can define the contribution of circumstance A to the dissimilarity index as:

$$M_A = \frac{D_A}{D(N)} \qquad (5)$$

$$where \sum_{i \in N} M_i = 1$$

[11] The initial idea of carrying out a Shapley decomposition of the HOI is due to Javier Escobal, Ambar Narayan, Alejandro Hoyoos Suarez and Jaime Saavedra. It was first implemented in a background paper prepared for the WDR 2012 (2011) by Alejandro Hoyos Suarez and Ambar Narayan entitled "Inequality of opportunities among children: how much does gender matter?"

Annex 2

Recent Household Surveys Conducted in Pakistan

PSLM—FBS

2004-05	Provincial as well as district level survey. In this round for provincial level survey income data was not collected in detailed format as usually collected in the consumption and income module of PSLM.
2005-06	Provincial level including income and consumption module
2006-07	District level
2007-08	Provincial level including income and consumption module
2008-09	District Level
2009-10	No survey conducted however, as per schedule FBS was supposed to carry out provincial level survey.
2010-11	Provincial as well as district level surveys are being carried out. The field operations will finish by end of June. The data are expected to be available by end of the year.

During first half of 2010 FBS carried out PSLM Panel survey covering 8000 households for the Jan-March and April-June quarters of 2007-08 PSLM. This Panel survey was carried out for the World Bank.

Labor Force Survey (LFS)—FBS

The LFS were carried out in the years 2003-04, 2005-06, 2006-07, 2007-08, 2008-09 and 2009-10.

Pakistan Demographic Survey (PDS)—FBS

The PDS were carried out during 2003, 2005, 2006 and 2007

MICS—Provincial Bureaus

The MICS have been carried by provincial Bureaus of Statistics with the technical support of FBS and UNICEF. The first round of MICS was carried out during 2000-04 and the second round was conducted during 2007-09. All MICS are district based but provinces have conducted them in different periods. In the second round Punjab has carried out MICS at Tehsil level which is further down administrative level within a district.

PDHS—NIPS

PDHS was carried out by National Institute of Population Studies(NIPS) for 2006-07 with the technical support of FBS.

Education Census—FBS / Ministry of Education

In 2005 FBS conducted the first ever Education Census in the entire country covering all types of educational institutions. The census was carried out on behalf of Ministry of Education.

Pakistan Panel Household Survey—Pakistan Institute of Development Economics (PIDE)

PIDE has carried out a panel survey with the technical/financial support of the World Bank in sixteen districts of the country covering approximately 4,000 households. The first round was conducted in 2001, the second in 2004 and the last round was carried out in 2010. This survey collected broad range of data on education, health, employment, agriculture & livestock, expenditure & consumption, migration, crises & shocks etc. This survey also collected data on anthropometrics variables.

Annex 3

In all the following tables, the numbers are highlighted in red when the changes between 1998-99 and 2007-08 are statistically significant at the 95% level.

Table A3.1 Education Indicators – Punjab
95 Percent Confidence Intervals for Estimates in Figures Presented in Main Body

		1998-99		2007-08	
		Lower Bound	Upper Bound	Lower Bound	Upper Bound
Enrollment Aged 6-10	Coverage	62.35	64.88	79.60	81.86
	HOI	54.18	57.19	73.56	76.49
	Penalty	7.38	8.47	5.18	6.23
Enrollment Aged 11-15	Coverage	52.49	55.21	66.82	69.54
	HOI	42.98	46.07	58.94	62.10
	Penalty	8.74	9.90	7.03	8.27
Finished Primary Aged 15-19	Coverage	56.47	59.36	67.10	69.79
	HOI	46.77	50.14	58.01	61.24
	Penalty	8.86	10.07	8.21	9.42
Finished Secondary Aged 20-24	Coverage	24.72	27.53	33.02	36.15
	HOI	16.09	18.71	23.73	26.78
	Penalty	8.09	9.34	8.61	10.06

Table A3.2 Education Indicators – Sindh
95 Percent Confidence Intervals for Estimates in Figures Presented in Main Body

		1998-99		2007-08	
		Lower Bound	Upper Bound	Lower Bound	Upper Bound
Enrollment Aged 6-10	Coverage	47.28	50.12	62.64	65.69
	HOI	36.54	39.66	54.13	57.75
	Penalty	10.02	11.18	7.54	8.90
Enrollment Aged 11-15	Coverage	47.61	50.94	55.03	58.51
	HOI	36.99	40.63	44.73	48.77
	Penalty	9.75	11.18	9.27	10.77
Finished Primary Aged 15-19	Coverage	58.13	61.54	60.83	64.29
	HOI	47.66	51.67	50.39	54.50
	Penalty	9.42	10.92	9.36	10.88
Finished Secondary Aged 20-24	Coverage	33.33	37.13	38.59	42.58
	HOI	23.38	27.24	28.00	32.07
	Penalty	9.06	10.78	9.72	11.38

Table A3.3 Education Indicators – Karachi
95 Percent Confidence Intervals for Estimates in Figures Presented in Main Body

		1998-99		2007-08	
		Lower Bound	Upper Bound	Lower Bound	Upper Bound
Enrollment Aged 6-10	Coverage	81.36	88.36	83.75	89.81
	HOI	74.83	84.12	79.25	87.07
	Penalty	3.64	7.13	2.30	4.94
Enrollment Aged 11-15	Coverage	74.39	82.54	75.06	82.66
	HOI	67.87	77.92	68.93	78.46
	Penalty	3.93	7.21	3.61	6.73
Finished Primary Aged 15-19	Coverage	82.46	89.09	77.39	84.35
	HOI	76.79	85.69	70.49	79.67
	Penalty	2.89	6.18	4.09	7.49
Finished Secondary Aged 20-24	Coverage	52.34	63.19	55.44	63.81
	HOI	44.89	57.07	45.27	54.99
	Penalty	4.63	8.95	7.75	11.23

Table A3.4 Education Indicators – Other Sindh 95 Percent Confidence Intervals for Estimates in Figures Presented in Main Body					
		1998-99		2007-08	
		Lower Bound	Upper Bound	Lower Bound	Upper Bound
Enrollment Aged 6-10	Coverage	42.23	45.25	56.48	59.90
	HOI	32.41	35.61	48.16	52.11
	Penalty	9.12	10.33	7.32	8.78
Enrollment Aged 11-15	Coverage	41.71	45.24	47.86	51.63
	HOI	31.41	35.14	37.32	41.62
	Penalty	9.46	10.93	9.45	11.09
Finished Primary Aged 15-19	Coverage	51.68	55.41	53.86	57.68
	HOI	40.77	44.98	42.72	47.13
	Penalty	9.90	11.44	10.02	11.65
Finished Secondary Aged 20-24	Coverage	28.12	31.84	29.64	33.77
	HOI	17.70	21.28	19.83	23.83
	Penalty	9.68	11.30	9.00	10.74

Table A3.5 Education Indicators – KP 95 Percent Confidence Intervals for Estimates in Figures Presented in Main Body					
		1998-99		2007-08	
		Lower Bound	Upper Bound	Lower Bound	Upper Bound
Enrollment Aged 6-10	Coverage	52.15	55.85	72.93	75.99
	HOI	43.01	47.14	67.02	70.78
	Penalty	8.21	9.64	4.82	6.30
Enrollment Aged 11-15	Coverage	49.26	53.23	62.15	65.73
	HOI	38.52	42.82	52.51	56.75
	Penalty	9.78	11.39	8.50	10.13
Finished Primary Aged 15-19	Coverage	47.82	51.95	58.45	62.31
	HOI	35.38	39.73	48.61	53.06
	Penalty	11.44	13.23	8.75	10.32
Finished Secondary Aged 20-24	Coverage	23.50	27.97	28.61	32.81
	HOI	14.56	18.52	20.03	24.19
	Penalty	8.33	10.07	7.74	9.45

Table A3.6 Education Indicators – Balochistan 95 Percent Confidence Intervals for Estimates in Figures Presented in Main Body					
		1998-99		2007-08	
		Lower Bound	Upper Bound	Lower Bound	Upper Bound
Enrollment Aged 6-10	Coverage	43.47	50.57	51.53	55.67
	HOI	34.92	42.01	44.43	49.13
	Penalty	7.23	9.88	6.03	7.62
Enrollment Aged 11-15	Coverage	41.34	48.29	47.77	52.27
	HOI	32.11	38.80	38.43	43.17
	Penalty	8.13	10.59	8.32	10.12
Finished Primary Aged 15-19	Coverage	38.66	44.95	42.87	47.58
	HOI	27.30	33.10	33.48	38.54
	Penalty	10.64	12.57	8.43	9.99
Finished Secondary Aged 20-24	Coverage	19.17	25.07	23.19	27.73
	HOI	11.11	15.97	13.52	17.85
	Penalty	7.53	9.62	8.81	10.74

Table A3.7 Health Indicators – Punjab 95 Percent Confidence Intervals for Estimates in Figures Presented in Main Body					
		1998-99		2007-08	
		Lower Bound	Upper Bound	Lower Bound	Upper Bound
No diarrhoea	Coverage	86.17	88.02	87.39	89.68
	HOI	85.20	87.34	86.35	89.08
	Penalty	.47	1.18	.37	1.27
Immunized at all	Coverage	85.29	87.21	94.72	95.94
	HOI	82.99	85.34	93.78	95.30
	Penalty	1.65	2.52	.54	1.05
Full Immunization(self-reported and with record)	Coverage	51.27	58.28	74.38	80.49
	HOI	45.61	53.58	68.67	76.17
	Penalty	3.77	6.59	3.59	6.44
Full Immunization (with record)	Coverage	35.75	42.43	54.00	62.05
	HOI	30.18	37.33	48.52	56.91
	Penalty	3.95	6.72	3.58	7.04
Adequate prenatal care	Coverage	7.71	9.87	21.96	25.89
	HOI	5.73	7.76	17.64	21.28
	Penalty	1.56	2.52	3.60	5.33
Skilled Birth Attendant (Traditional and formal)	Coverage	90.73	92.94	93.46	95.95
	HOI	89.56	92.22	92.39	95.47
	Penalty	.49	1.41	.29	1.26
Skilled Birth Attendant (Formal)	Coverage	16.80	19.59	39.47	43.65
	HOI	11.54	14.19	30.92	35.30
	Penalty	4.72	5.93	7.58	9.33
Institutional birth	Coverage	14.16	16.84	35.42	39.59
	HOI	9.87	12.38	27.51	31.78
	Penalty	3.75	5.00	7.02	8.70
Any post-natal care	Coverage	8.62	10.77	18.59	22.73
	HOI	5.92	7.85	14.08	17.81
	Penalty	2.32	3.30	3.85	5.58

Table A3.8 Health Indicators – Sindh 95 Percent Confidence Intervals for Estimates in Figures Presented in Main Body					
		1998-99		2007-08	
		Lower Bound	Upper Bound	Lower Bound	Upper Bound
No diarrhoea	Coverage	89.37	91.24	91.63	93.66
	HOI	88.46	90.70	90.48	92.98
	Penalty	.26	1.19	.42	1.41
Immunized at all	Coverage	73.99	76.57	97.96	98.93
	HOI	67.48	70.70	97.12	98.52
	Penalty	5.65	6.74	.36	.89
Full Immunization(self-reported and with record)	Coverage	36.06	43.46	64.41	72.48
	HOI	27.13	34.67	57.75	67.08
	Penalty	7.27	10.46	4.26	7.80
Full Immunization (with record)	Coverage	15.30	21.01	33.58	41.97
	HOI	8.45	13.16	26.27	35.09
	Penalty	5.79	8.91	5.20	8.98
Adequate prenatal care	Coverage	8.51	11.07	23.45	28.07
	HOI	4.29	5.92	18.28	22.60
	Penalty	3.89	5.47	4.28	6.36
Skilled Birth Attendant (Traditional and formal)	Coverage	67.12	71.07	85.11	88.94
	HOI	59.94	64.69	83.19	87.72
	Penalty	5.98	7.58	0.79	2.36
Skilled Birth Attendant (Formal)	Coverage	25.45	28.73	37.67	42.54
	HOI	14.57	17.39	28.51	35.59
	Penalty	10.23	11.98	7.85	10.26
Institutional birth	Coverage	23.37	26.68	38.68	43.36
	HOI	13.72	16.53	28.50	33.49

Table A3.8 Health Indicators – Sindh 95 Percent Confidence Intervals for Estimates in Figures Presented in Main Body					
		1998-99		2007-08	
		Lower Bound	Upper Bound	Lower Bound	Upper Bound
	Penalty	9.01	10.78	8.94	11.11
Any post-natal care	Coverage	7.92	10.46	21.81	26.46
	HOI	4.74	6.70	16.28	20.79
	Penalty	2.75	4.20	4.50	6.70

Table A3.9 Health Indicators – Karachi 95 Percent Confidence Intervals for Estimates in Figures Presented in Main Body					
		1998-99		2007-08	
		Lower Bound	Upper Bound	Lower Bound	Upper Bound
No diarrhoea	Coverage	80.88	88.33	89.17	95.00
	HOI	78.68	87.31	87.47	94.38
	Penalty	0.1	3.33	.04	2.27
Immunized at all	Coverage	94.37	98.11	97.13	99.77
	HOI	91.68	97.20	95.49	99.69
	Penalty	.70	2.90	-0.06	1.78
Full Immunization(self-reported and with record)	Coverage	49.87	75.05	76.80	95.83
	HOI	40.88	69.47	73.54	95.82
	Penalty	2.50	12.07	-2.92	6.19
Full Immunization (with record)	Coverage	42.05	66.78	76.80	95.83
	HOI	29.72	59.16	73.54	95.82
	Penalty	4.64	15.10	-2.92	6.19
Adequate prenatal care	Coverage	24.51	38.00	40.62	55.85
	HOI	20.89	34.61	35.34	51.77
	Penalty	0.95	6.06	1.62	7.74
Skilled Birth Attendant (Traditional and formal)	Coverage	94.94	99.64	81.26	91.79
	HOI	93.30	99.66	76.41	90.05
	Penalty	.18	1.81	.89	5.70
Skilled Birth Attendant (Formal)	Coverage	79.82	89.85	65.72	79.85
	HOI	72.80	86.42	61.88	78.02
	Penalty	2.89	7.60	.29	5.96
Institutional birth	Coverage	74.05	85.21	77.43	88.30
	HOI	67.64	81.49	68.53	83.30
	Penalty	2.38	7.74	4.22	9.68
Any post-natal care	Coverage	16.45	28.61	42.99	58.02
	HOI	12.72	24.61	35.96	52.38
	Penalty	1.17	6.56	3.11	9.56

Table A3.10 Health Indicators – Other Sindh 95 Percent Confidence Intervals for Estimates in Figures Presented in Main Body					
		1998-99		2007-08	
		Lower Bound	Upper Bound	Lower Bound	Upper Bound
No diarrhoea	Coverage	90.11	91.18	91.70	93.82
	HOI	89.65	91.73	90.54	93.02
	Penalty	0	.71	.52	1.45
Immunized at all	Coverage	71.08	73.95	97.93	98.95
	HOI	65.44	68.89	97.03	98.55
	Penalty	4.76	5.94	0.35	0.96
Full Immunization(self-reported and with record)	Coverage	33.03	40.66	60.23	69.12
	HOI	24.71	32.52	53.84	64.12
	Penalty	6.62	9.85	4.07	7.32
Full Immunization (with record)	Coverage	10.86	16.13	23.47	32.19
	HOI	6.16	10.80	20.80	29.84
	Penalty	3.66	6.37	0.71	4.32
Adequate prenatal care	Coverage	5.88	8.11	18.89	23.40
	HOI	3.04	4.62	15.29	19.64

Table A3.10 Health Indicators – Other Sindh 95 Percent Confidence Intervals for Estimates in Figures Presented in Main Body					
		1998-99		2007-08	
		Lower Bound	Upper Bound	Lower Bound	Upper Bound
	Penalty	2.47	3.87	2.79	4.56
Skilled Birth Attendant (Traditional and formal)	Coverage	63.23	67.62	85.12	89.15
	HOI	57.44	62.48	82.80	87.71
	Penalty	4.63	6.31	1.02	2.73
Skilled Birth Attendant (Formal)	Coverage	17.93	21.22	30.82	35.88
	HOI	11.03	13.88	24.38	29.76
	Penalty	6.24	8.01	5.23	7.35
Institutional birth	Coverage	16.30	19.55	29.29	34.83
	HOI	10.42	13.22	23.79	29.07
	Penalty	5.26	6.95	4.84	6.94
Any post-natal care	Coverage	6.27	8.65	16.42	21.02
	HOI	3.84	5.71	13.29	17.95
	Penalty	2.06	3.31	2.22	3.98

Table A3.11 Health Indicators – KP 95 Percent Confidence Intervals for Estimates in Figures Presented in Main Body					
		1998-99		2007-08	
		Lower Bound	Upper Bound	Lower Bound	Upper Bound
No diarrhoea	Coverage	83.63	86.37	87.15	89.82
	HOI	82.56	85.75	85.87	89.06
	Penalty	.36	1.34	.49	1.55
Immunized at all	Coverage	74.74	78.21	91.68	93.72
	HOI	69.48	73.95	90.16	92.73
	Penalty	3.95	5.58	0.83	1.69
Full Immunization(self-reported and with record)	Coverage	50.48	60.64	71.00	78.88
	HOI	44.82	56.64	64.73	74.69
	Penalty	2.81	6.84	3.53	6.93
Full Immunization (with record)	Coverage	34.66	44.83	46.32	55.90
	HOI	32.46	43.91	42.75	53.47
	Penalty	0.33	3.45	1.28	4.72
Adequate prenatal care	Coverage	5.28	7.93	22.56	27.45
	HOI	3.96	6.45	18.62	23.56
	Penalty	0.92	1.87	2.96	4.87
Skilled Birth Attendant (Traditional and formal)	Coverage	52.68	58.31	58.64	64.14
	HOI	48.62	55.16	55.50	61.81
	Penalty	2.52	4.68	1.68	3.78
Skilled Birth Attendant (Formal)	Coverage	15.12	18.93	28.11	33.24
	HOI	11.84	15.70	23.77	29.25
	Penalty	2.48	4.03	3.20	5.13
Institutional birth	Coverage	10.81	14.08	25.06	29.95
	HOI	8.29	11.53	20.67	25.79
	Penalty	1.89	3.17	3.44	5.11
Any post-natal care	Coverage	4.75	7.63	17.72	22.21
	HOI	3.40	5.93	14.70	19.15
	Penalty	.96	2.08	2.18	3.90

Table A3.12 Health Indicators – Balochistan 95 Percent Confidence Intervals for Estimates in Figures Presented in Main Body					
		1998-99		2007-08	
		Lower Bound	Upper Bound	Lower Bound	Upper Bound
No diarrhoea	Coverage	87.50	92.56	90.15	93.04
	HOI	85.13	91.89	89.34	92.58
	Penalty	0.45	2.59	.17	1.12
Immunized at all	Coverage	64.49	72.63	87.13	90.68
	HOI	59.21	68.40	84.54	88.87

Table A3.12 Health Indicators – Balochistan 95 Percent Confidence Intervals for Estimates in Figures Presented in Main Body					
		1998-99		2007-08	
		Lower Bound	Upper Bound	Lower Bound	Upper Bound
	Penalty	2.93	6.57	1.54	2.85
Full Immunization(self-reported and with record)	Coverage	24.72	44.35	53.88	65.69
	HOI	18.16	37.14	46.97	60.48
	Penalty	3.10	10.68	3.89	8.23
Full Immunization (with record)	Coverage	6.81	13.70	34.37	45.81
	HOI	3.97	10.55	30.61	43.00
	Penalty	1.91	4.07	0.98	5.59
Adequate prenatal care	Coverage	3.45	6.32	17.50	22.98
	HOI	2.22	4.60	14.35	19.94
	Penalty	.91	2.04	1.99	4.18
Skilled Birth Attendant (Traditional and formal)	Coverage	59.90	69.07	55.48	62.36
	HOI	52.55	63.98	50.61	58.48
	Penalty	4.30	8.14	3.12	5.63
Skilled Birth Attendant (Formal)	Coverage	3.98	6.12	20.80	26.48
	HOI	1.65	3.18	15.85	21.66
	Penalty	2.08	3.19	3.71	6.05
Institutional birth	Coverage	3.18	5.25	15.70	20.77
	HOI	1.38	2.86	10.32	15.15
	Penalty	1.55	2.64	4.32	6.67
Any post-natal care	Coverage	3.44	5.53	8.04	12.54
	HOI	2.00	3.82	6.16	10.52
	Penalty	1.11	2.04	1.10	2.80

Table A3.13 Infrastructure Indicators – Punjab 95 Percent Confidence Intervals for Estimates in Figures Presented in Main Body					
		Lower Bound	Upper Bound	Lower Bound	Upper Bound
Improved sanitation	Coverage	38.30	39.56	58.61	60.15
	HOI	26.25	27.58	49.23	51.03
	Penalty	11.76	12.28	8.94	9.56
Improved water	Coverage	95.00	95.63	96.12	96.69
	HOI	93.96	94.75	95.76	96.41
	Penalty	0.83	1.09	0.21	0.43
Electricity	Coverage	74.64	75.96	91.56	92.42
	HOI	67.05	68.79	88.06	89.28
	Penalty	7.09	7.67	3.08	3.56
Gas	Coverage	14.17	14.96	27.18	28.79
	HOI	5.04	5.52	14.89	16.62
	Penalty	9.02	9.55	11.93	12.53
Telephone	Coverage	13.29	14.24	22.57	23.93
	HOI	8.12	8.97	16.40	17.62
	Penalty	4.97	5.46	5.95	6.54

Table A3.14 Infrastructure Indicators – Sindh 95 Percent Confidence Intervals for Estimates in Figures Presented in Main Body					
		Lower Bound	Upper Bound	Lower Bound	Upper Bound
Improved sanitation	Coverage	46.05	47.54	44.69	46.46
	HOI	32.72	34.31	35.81	37.73
	Penalty	12.94	13.63	8.39	9.23
Improved water	Coverage	72.87	74.46	87.74	89.15
	HOI	65.75	67.70	85.06	86.87
	Penalty	6.56	7.31	2.13	2.83
Electricity	Coverage	57.51	59.10	84.43	85.75
	HOI	46.02	47.92	77.29	79.20
	Penalty	10.98	11.69	6.50	7.19
Gas	Coverage	32.68	33.79	37.76	38.83

Table A3.14 Infrastructure Indicators – Sindh 95 Percent Confidence Intervals for Estimates in Figures Presented in Main Body					
		Lower Bound	Upper Bound	Lower Bound	Upper Bound
	HOI	15.12	15.92	18.89	19.87
	Penalty	17.41	18.03	18.63	19.20
Telephone	Coverage	23.54	24.97	10.91	12.05
	HOI	16.28	17.57	5.37	6.16
	Penalty	7.02	7.64	5.38	6.05

Table A3.15 Infrastructure Indicators – Karachi 95 Percent Confidence Intervals for Estimates in Figures Presented in Main Body					
		Lower Bound	Upper Bound	Lower Bound	Upper Bound
Improved sanitation	Coverage	97.59	99.07	98.99	100.0
	HOI	96.00	98.50	98.49	100.0
	Penalty	0.57	1.61	0.03	0.51
Improved water	Coverage	86.07	89.79	90.45	93.29
	HOI	83.73	88.19	88.59	91.96
	Penalty	1.12	2.82	1.10	2.09
Electricity	Coverage	NA (100%)			
	HOI				
	Penalty				
Gas	Coverage	88.67	91.91	94.41	96.47
	HOI	86.05	90.26	91.99	94.98
	Penalty	1.32	2.95	1.39	2.50
Telephone	Coverage	37.76	42.50	24.07	28.08
	HOI	26.37	31.36	15.54	19.29
	Penalty	10.40	12.13	7.66	9.67

Table A3.16 Infrastructure Indicators – Other Sindh 95 Percent Confidence Intervals for Estimates in Figures Presented in Main Body					
		Lower Bound	Upper Bound	Lower Bound	Upper Bound
Improved sanitation	Coverage	37.97	39.64	30.34	32.30
	HOI	27.79	29.45	27.58	29.60
	Penalty	9.80	10.58	2.32	3.14
Improved water	Coverage	70.59	72.32	86.75	88.33
	HOI	63.33	65.45	83.39	85.51
	Penalty	6.70	7.43	2.70	3.48
Electricity	Coverage	50.94	52.76	80.36	82.02
	HOI	41.99	44.01	73.15	75.39
	Penalty	8.46	9.24	6.54	7.31
Gas	Coverage	23.83	24.98	22.60	23.80
	HOI	9.71	10.51	9.68	10.71
	Penalty	13.94	14.64	12.67	13.33
Telephone	Coverage	21.06	22.52	7.15	8.13
	HOI	14.84	16.16	3.33	3.99
	Penalty	5.98	6.61	3.69	4.27

Table A3.17 Infrastructure Indicators – KP 95 Percent Confidence Intervals for Estimates in Figures Presented in Main Body					
		Lower Bound	Upper Bound	Lower Bound	Upper Bound
Improved sanitation	Coverage	22.93	24.64	57.86	59.86
	HOI	17.17	18.85	50.51	52.80
	Penalty	5.43	6.13	6.80	7.60
Improved water	Coverage	55.94	58.17	71.56	73.45
	HOI	49.00	51.64	66.60	68.92
	Penalty	6.30	7.18	4.37	5.12
Electricity	Coverage	75.92	77.96	93.16	94.19
	HOI	70.20	72.80	91.34	92.70

Table A3.17 Infrastructure Indicators – KP 95 Percent Confidence Intervals for Estimates in Figures Presented in Main Body					
		Lower Bound	Upper Bound	Lower Bound	Upper Bound
	Penalty	5.03	5.86	1.41	1.91
Gas	Coverage	8.21	9.20	12.69	13.75
	HOI	3.61	4.55	5.84	6.90
	Penalty	4.38	4.86	6.60	7.09
Telephone	Coverage	12.76	13.95	19.24	20.75
	HOI	6.82	7.83	14.12	15.50
	Penalty	5.73	6.33	4.81	5.55

Table A3.18 Infrastructure Indicators – Balochistan 95 Percent Confidence Intervals for Estimates in Figures Presented in Main Body					
		Lower Bound	Upper Bound	Lower Bound	Upper Bound
Improved sanitation	Coverage	36.55	41.37	35.59	38.11
	HOI	33.25	38.60	30.96	33.68
	Penalty	2.25	3.82	4.03	5.04
Improved water	Coverage	35.00	38.22	61.43	63.79
	HOI	29.19	32.81	53.19	56.02
	Penalty	5.30	5.92	7.59	8.42
Electricity	Coverage	51.36	55.89	65.44	67.74
	HOI	43.57	49.22	55.09	58.03
	Penalty	6.34	8.12	9.60	10.47
Gas	Coverage	10.27	11.92	16.81	18.21
	HOI	5.96	7.60	7.34	8.63
	Penalty	4.07	4.56	9.15	9.90
Telephone	Coverage	14.57	17.02	8.51	9.66
	HOI	9.40	11.42	3.91	4.64
	Penalty	4.98	5.79	4.44	5.18

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