LABOR MARKET IMPACTS OF SOCIAL SECURITY POLICIES IN DEVELOPING COUNTRIES: A CASE STUDY OF PAKISTAN

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This dissertation studies the impact of changes in social security policies on labor market outcomes in Pakistan. In the first chapter, I use a firm-size contingent policy change to examine the effects of Social Security extension to previously uncovered workers in the informal sector. In Pakistan, the social security law that provides for old age pensions and permanent disability benefits, the Employees' Old Age Benefits Act, was enacted on July 1, 1976 and was applicable to all private sector firms employing ten or more workers. Under this law, firms have to make mandatory contributions to the Employees' Old Age Benefits Institution at the rate of 6% of the federal minimum wage for all workers under their employment. In July 2008, the law was amended to include under its jurisdiction all firms employing five or more workers. This setting provides a natural experiment wherein the cost of employment for firms with five to nine employees increased after the policy change while remaining fixed for firms with less than five employees. Using individual level data from the Pakistan Labor Force Survey, I employ a difference-in-differences approach to identify the effects of the cost increase on wages and employment in firms exposed to the law. I find evidence of full cost shifting to wages with negligible effects on employment. My results are consistent with a positive valuation of social security benefits by workers and downward wage flexibility in the Pakistani labor market. The Employees' Old Age Benefits Institution (EOBI) follows a Pay-As-You-Go pension system, which requires the institution to balance its efforts of Social Security extension with the financial constraints posed by these initiatives. The most recent actuarial valuation of EOBI fund shows that the system may not be sustainable in the long run. The threat of long term insolvency coupled with a desire to extend Social Security ben-

efits to a majority of the working population provides the motivation for the second chapter of the dissertation. As Social Security affects labor force participation decisions over the life-cycle, I develop and estimate a dynamic structural life-cycle model to evaluate policy proposals that can help to reduce the EOBI deficit without exerting a negative impact on individual labor supply or aggregate welfare. The preferred policy proposes a reduction in the payroll tax rate accompanied with a reduction in the generosity of pension benefits. The former helps to increase labor force participation at younger ages, while the latter increases labor force participation of older workers. The second chapter uses Social Security coverage to group workers into formal (covered wage employment) and informal (uncovered wage employment and self-employment) sector jobs. The third chapter takes this approach a step further and tests for the existence of labor market segmentation using a more holistic definition of formality and informality. First I offer an analysis of earnings differentials between formal and informal sector wage employees using an endogenous regime switching approach. I find positive earnings differentials between formal and informal sector jobs, and a 10.7% wage premium in the formal sector. In addition, there is evidence of queuing for formal sector jobs; individuals who prefer to work in the formal sector have longer unemployment durations. Second, I examine the patterns of worker mobility across various labor market segments and compare these patterns to the ones predicted by the segmented labor market model. My results suggest that the labor market is only partially segmented along the formal-informal dimension. However, the existence of two distinguishable segments emerges within the informal sector itself.

BIOGRAPHICAL SKETCH

Freeha Fatima was born in Sialkot, Pakistan in 1984. She is the youngest of seven siblings, and the only one in my family who chose to enter the field of social sciences, partly in competition to the others becoming doctors and engineers. She acquired her high school education from the Beaconhouse School System in Lahore. She has been studying Economics since the age of thirteen years. She acquired her undergraduate degree in Economics from the Lahore University of Management Sciences in the year 2006. She then decided to do a Masters degree in Economics, also from the Lahore University of Management Sciences before coming to Cornell. In the year 2009, she consulted at the World Bank where she was involved in survey design and field research. Her research interests are in the areas of Labor Economics, Development Economics and Applied Econometrics. She is particularly interested in conducting field research to analyze policy relevant issues in developing countries. Some of the areas she has investigated include the study of labor market segmentation, payroll tax incidence, and the effect of social security policies on labor supply and welfare. Freeha is inquisitive and curious by nature, and enjoys travelling and questioning a majority of the things she comes across in life. The same desire to question the underlying assumptions in any economic phenomenon drove her to pursue a doctoral degree in Economics.

I dedicate my work to Mansoor Zaib Khan. I hope it is worthy of him!

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0.1 Introduction

Owing to widespread increases in life expectancy all over the world, governments in both developed and developing countries have felt a growing need to evaluate and improve their Social Security systems. In Pakistan, for example, life expectancy at birth has increased by about 5 years in the last decade; from 61.07 in the year 2000 to 66.35 in 2012 (CIA World Fact Book, 2012). In consequence, the population is ageing, and older non-working individuals are putting an increasing burden on the working population. Moreover, a significant proportion of the labor force in Pakistan consists of the working poor, who lack access to any form of Social Security. Thus, the government is faced with the dual responsibility of Social Security extension to previously uncovered workers, and the continuation of improved and enhanced Social Security provision to currently covered workers. This dissertation examines the impact of such government initiatives in the context of Pakistan, where the labor market is characterized by a large informal sector, Social Security institutions are relatively underdeveloped, and there is limited access to capital and insurance markets for a majority of the working population.

Prior to 1976, the Social Security system in Pakistan only covered public sector employees and workers in large incorporated enterprises. Workers in the informal sector were forced to rely on private savings and family help during old-age and sudden death of family members. In an attempt to extend old-age Social Security benefits to previously uncovered workers, the Government enacted the Employees' Old Age Benefits Act on July 1, 1976. At the time of inception, the Act was applicable to all non-agricultural private sector establishments employing 10 or more workers. Under this Act, firms make mandatory contributions to the Employees' Old Age Benefits Institution (EOBI) at the rate of 6% of the federal minimum wage for all workers under their employment. EOBI follows a Pay-As-You-Go (PAYG) pension system, where the current working population makes social security contributions that are used to finance current retiree benefits.

On July 1, 2008, the Employees' Old Age Benefits Act was extended to all firms employing five or more workers. This firm-size-contingent policy change provides a natural experiment wherein the cost of employment for firms with five to nine employees increased after July 2008, while remaining fixed for firms with less than five employees. In the first chapter, I use the July 2008 amendments to provide the first estimates of payroll tax incidence in Pakistan. Using individual level data from the Pakistan Labor Force Survey, I employ a difference-in-differences approach to identify the effects of the cost increase on wages and employment in firms exposed to the law. I find evidence of full cost shifting to wages with negligible effects on employment. My results are consistent with a positive valuation of social security benefits by workers and downward wage flexibility in the Pakistani labor market.

A positive valuation of social security benefits by workers provides an incentive for developing country governments to continue their efforts in extending social security coverage to previously uncovered workers in the informal sector. That said, the provision of Social Security is not costless, and adequate provision involves substantial investments in administrative machinery to ensure enforcement and compliance of firms. In addition, being a PAYG system, EOBI has to balance its efforts of Social Security provision with the financial constraints posed by the extension of coverage. The most recent actuarial valuation of the EOBI fund shows that the Social Security system is not sustainable in the long run. The threat of long term insolvency coupled with a desire to extend Social Security benefits to a majority of the working population provides the motivation for the second chapter of the dissertation.

As Social Security affects labor force participation decisions over the life-cycle, I evaluate future policy proposals that help to reduce the EOBI deficit without creating large distortions in labor supply or negative effects on aggregate welfare. I accomplish this through the use of a dynamic structural life-cycle model of labor supply. The model is formulated to reflect the institutional reality of the current Social Security system, and to represent accurately

the nature of the labor market in Pakistan. Specifically, the model includes; (i) segmented labor market opportunities, whereby individuals may be employed in a job covered by Social Security, employed in a job not covered by Social Security, or may be self employed; (ii) unemployment/non-participation; (iii) the working history and age-related requirements for Social Security eligibility; and (iv) opportunities to simultaneously work and receive Social Security. The parameters of the model are obtained through the method of simulated moments; an estimator that minimizes the quadratic distance between specific moments obtained from the data, and the same moments obtained from a number of simulated data sets. The empirical estimation is performed by drawing samples from the Household Integrated Economic Survey and the Pakistan Labor Force Survey for the year July 2007 to June 2008. I validate the model using restricted access data from the Employees' Old Age Benefits Institution. I then use the model to propose various deficit reduction strategies, with an explicit focus on the labor supply and welfare effects of each policy proposal. The preferred policy proposes a 1.066 percentage point reduction in the payroll tax rate, accompanied by a 15% reduction in the generosity of pension benefits. The former helps to increase labor force participation at younger ages, and the latter encourages older workers to participate in the labor market, reducing the overall EOBI deficit by 14.72%.

Note that the second chapter relies on access to Social Security benefits as the primary distinguishing factor between various sectors of employment, where the existence of separate employment sectors is implicitly equated with the presence of a segmented labor market. The third chapter takes this analysis further and explicitly tests for the existence of labor market segmentation using a more holistic definition of formality and informality.

The segmented view of the labor market rests on earnings differentials between various sectors of employment, commonly known as the formal (primary) and the informal (secondary) sector of employment. Using data from the Pakistan Labor Force Survey (LFS) for the years 1996 to 2011, I test for the validity of the segmentation hypothesis in an endoge-

nous regime switching framework. I find evidence of positive earnings differentials between formal and informal sector wage employees, and a 10.7% wage premium in the formal sector. In addition to earnings differentials, labor market segmentation predicts that workers tend to queue up for formal sector jobs that pay a wage premium. Queuing in turn implies that individuals who prefer formal sector jobs wait longer to find work due to entry barriers and labor demand constraints, increasing the duration of unemployment. In order to test for queuing, I use data on job preferences and unemployment durations for the sample of active job seekers in the LFS. I find that formal sector job preference increases unemployment duration by 0.6 months, while a preference for self-employment over informal wage employment increases unemployment duration by 0.8 months.

Segmentation also predicts specific patterns of worker mobility across different labor market sectors. In a segmented labor market, (i) turnover rates in the formal sector are generally lower than turnover rates in the informal sector, (ii) transitions between formal and informal sector jobs are largely unidirectional and run from the former to the latter, and (iii) the probability of transition from informal sector employment to unemployment is higher than the probability of transition from formal sector employment to unemployment. I test for the existence of these patterns using longitudinal data from the Pakistan Socio-Economic Survey for the years 1998-99 to 2000-01. I find support for the first hypothesis, i.e. there is evidence of lower turnover rates in formal sector employment as compared to informal sector employment. I also find support for the third hypothesis; the probability of transition from formal sector employment to unemployment is lower as compared to the transition probability from informal sector employment to unemployment. However, lack of a definite criteria regarding the magnitude of the difference between the two transition probabilities limits my interpretation of the labor market as being definitely segmented. Lastly, I find that employment flows between formal and informal sector wage employment are largely bidirectional, which is in contrast to the second hypothesis. That said, it is interesting to note that employment flows within the informal sector are more unidirectional; self-employed

individuals find it easier to move to informal wage employment, while the latter find it harder to start their own businesses. This suggests that the informal sector is characterized by its own internal dualism. Overall, my results suggest that the labor market is only partially segmented along the formal-informal dimension. However, the existence of two distinguishable sectors does emerge within the informal sector itself.

Accurate labor market modeling is fundamental to the design of Social Security policies in developing countries. According to the segmented view, workers in the informal sector prefer to work in the formal sector but are unable to obtain formal sector jobs. Unemployment in segmented markets is also a byproduct of individuals queuing for formal sector jobs. In contrast, a more integrated view of the labor market treats informal sector employment as a desirable employment alternative to formal sector jobs. Workers choose to work in the informal sector because the value of independence and casual employment relations exceeds the value of pecuniary and non-pecuniary benefits in the formal sector. This choice-based framework provides a strong motivation to examine the internal dynamics of the informal sector; some workers may be in the informal sector by choice, while others may be pushed to take informal sector jobs due to labor demand constraints. Treating informal sector employment as a desirable alternative for workers with a given set of observable characteristics, and a stepping stone to formal sector jobs for workers with a different set of observable characteristics is also useful for policy purposes. If formality implies access to Social Security benefits, and workers in the informal sector are queuing for formal sector jobs, then the government may decide to extend social security benefits to informal sector workers. If instead, workers in the informal sector are there by choice, and rely on private savings and family help during old-age, then the government may find it more useful to improve access to private insurance markets. If however, individual myopia limits private savings, then regardless of choice-induced informal sector employment, it may be welfare enhancing to institute a forced savings mechanism through Social Security provision.

My results suggest that despite being a low-income developing country with a large informal sector, Social Security provision is not only positively valued by workers in the informal sector in Pakistan, it also increases aggregate welfare over the life-cycle.

CHAPTER 1

THE INCIDENCE OF PAYROLL TAXES IN PAKISTAN: EVIDENCE FROM A FIRM-SIZE-CONTINGENT POLICY CHANGE

1.1 Introduction

Sub-minimum wage workers in developing countries may lack the ability to save for retirement due to credit constraints and under-developed social security institutions. Payroll-tax-financed social security initiatives represent a potential avenue for these workers to insure themselves against a decline in income due to old-age, disability or sudden death (Mahmood and Nasir, 2008). However, from a policy perspective, there are costs involved in extending tax-financed social security benefits to previously uncovered workers. It is therefore important to determine whether these costs are passed on to the workers in the form of lower wages, or result in large disemployment effects. This paper attempts to answer the question in the context of a developing country in South Asia. Exploiting firm-level variation in employment costs induced by an extension of private sector social security benefits across different firm-size categories, I examine the effects of an increase in payroll taxes on labor market outcomes in Pakistan.

There is a substantial and diverse body of work on the labor market effects of payroll tax changes. However, much of this work focuses on the United States and other developed nations, and makes use of theories that rely on perfect compliance and small uncovered sectors.[1] In case of developing countries, most of the analysis of payroll tax incidence derives from policy changes in Latin America. While these nations do not exhibit perfect compliance, a majority of them have a long standing history of social security reform, which makes them a natural candidate for the analysis of payroll tax changes in developing country settings.

[1] see Hamermesh (1979); Holmlund (1983); Gruber and Krueger (1991); Gruber (1994); Anderson and Meyer (1997); **?**.

Moreover, Latin American studies mostly focus on policy changes aimed at formal sector enterprises.[2] Much less is known about the labor market impacts of changes in social security policies aimed at informal sector firms. In particular, the analysis of payroll tax incidence in a low-income developing country in South Asia where social security provision outside of the formal sector is low or non-existent is missing from the current literature. This paper provides the first quasi-experimental estimates of payroll tax incidence in such a setting.

In Pakistan, the social security law that provides for old age pensions and permanent disability benefits, the Employees' Old Age Benefits Act (EOBA), was enacted on July 1, 1976, and was applicable to all private sector firms employing ten or more workers. Under this law, firms have to make mandatory contributions to the Employees' Old Age Benefits Institution at the rate of 6% of the federal minimum wage. On July 1, 2008, the Act was amended to include under its jurisdiction all firms employing five or more workers. This setting provides a natural experiment wherein the cost of employment for firms with five to nine employees increased after the policy change while remaining fixed for firms with less than five employees. Using individual level data from the Pakistan Labor Force Survey, I employ a difference-in-differences approach with workers in 5 or more employee firms as the treated group and workers in 4 or fewer employee firms as the control group. My estimation sample consists of the male working population between the ages of 14 and 60 years.

I find that treated firms pass on about 85% to 100% of the cost increase to their workers in the form of lower wages. Real wages in the treated firms fall by a magnitude of 4.02% to 4.93% across various regression specifications and the effects are statistically significant at the 5% level. The results are robust to the inclusion of industry fixed effects, province fixed effects, and a dummy for urban regions.

In line with full tax shifting to wages, I find a statistically insignificant effect of the policy change on employment and hours worked in the treated firms. This is consistent with

[2]see Gruber (1997) for Chile Adriana and Kugler (2009) for Columbia; Kidyba (2010) for Argentina.

a positive valuation of social security benefits by workers and a strong tax-benefit linkage. This in turn provides a strong incentive for the introduction of such policy initiatives in developing countries. Moreover, I show that the reduction in wages can be attributed to downward wage flexibility in the Pakistani labor market. This is somewhat surprising in the presence of a minimum wage law. However, I find strong evidence of non-binding minimum wages in my study sample.

Identification of the difference-in-differences coefficients requires that wages and hours worked follow similar trends on average in the treated and control firms in the absence of the policy change. I provide evidence in support of the common trends assumption by examining the pre-treatment data. Moreover, I reject the existence of differential compositional shifts in the observable characteristics of workers in the treated and control firms as a result of the policy change. It is important to note that compositional shifts only matter to the extent that they cause violations in the common trends assumption. Thus, evidence against compositional shifts in the observable characteristics of workers further underscores the validity of my empirical strategy.

In order to further establish the credibility of my estimates, I examine firm compliance with the new law using administrative data on firm registrations from the Employees' Old Age Benefits Institution. I indeed find a substantial increase in the registration of firms with 5 to 9 employees after July 2008. I also test for the possible confounding effects of simultaneous amendments made to the Provincial Employees Social Security Ordinance (PESSO) at the same time as the EOBA law change. These amendments may have increased the cost of employment for treated firms over and above the cost increase due to the law change being studied. Here I find that my estimates are robust to the amendments made to PESSO.[3]

The July 2008 amendments also increased the level of social security contributions re-

[3]The Provincial Employees Social Security Ordinance of 1965, the amendments and their potential effects for my estimates are presented in the Appendix.

quired from firms already under the jurisdiction of the law. This was a result of the amendments made to the rate of employers' contribution and the level of the federal minimum wage. On one hand, the rate of employers' contribution was reduced from 6% to 5% of the federal minimum wage. On the other hand, the federal minimum wage was increased from Rs 4600 per month to Rs 6000 per month.[4] These changes led to an increase in the level of social security contributions required from firms with ten or more employees by 10.55% in nominal terms (see Table 1.1). To assess the impact of this cost increase on wages and employment in the treated firms, I employ a difference-in-differences approach with workers in 9 or more employee firms as the treated group and workers in 4 or fewer employee firms as the control group.[5] Here, I find evidence of partial cost shifting to wages with little change in employment. Wages in the treated firms fall by a magnitude of 6% to 7% across different regression specifications. I also find partial evidence of changes in worker composition across treated and control firms as a result of the policy change. My results provide suggestive evidence of positive selection post-treatment; treated firms retain workers with a higher level of human capital after the policy change. That said, the compositional effects lose statistical significance after the inclusion of industry fixed effects.

This paper makes several contributes to the existing literature. First, it adds to the literature on the impact of changes in payroll taxes and mandated benefits in the context of a low-income developing country with a large uncovered sector, and non-binding minimum wages. Second, this is the first paper to study payroll tax incidence in South Asia, as well as the first one to estimate payroll tax incidence in the informal sector. This paper is therefore informative in examining the factors affecting the margin of formal sector entry for small firms in developing countries. Existing studies mostly focus on social security policies targeted at formal sector enterprises, and find that firm-size-contingent increases in employment costs

[4]The federal minimum wage was revised upwards through an amendment made to the Minimum Wages for Unskilled Workers Ordinance, 1969.

[5]The inclusion of workers in firms with 9 employees in the treated group is a data limitation discussed in section IV.

lead to worker and firm movement to the informal sector (Adriana and Kugler, 2009). The policy change I am studying examines potential firm movement in the opposite direction. In Pakistan, all firms with less than 10 employees are considered as a part of the informal sector. Thus, the possibility for treated firms' workers to avoid any possible wage reductions by moving to an unprotected informal sector is limited.

Another feature of the paper that differentiates it from existing work on payroll taxation relates to the specific nature of the policy change being studied. Size-contingent changes in employment policies have mostly been exploited to study the effects of employment protection legislation.[6] There is limited evidence on payroll tax incidence estimates that are derived from firm-size-contingent policy changes. My results are therefore relevant for policy makers targeting social security initiatives through firm-size-based policies.

The paper proceeds as follows. Section II provides a brief review of the related literature. Section III outlines the institutional background and details the amendments being studied. The data is presented in Section IV. Section V details the empirical methodology, and discusses the identification assumptions. The results are presented in Section VI. Section VII examines firm compliance with the law, and addresses the potential effects of measurement error in worker reported firm-size categories, and Section VIII concludes.

1.2 Related Literature

The existing empirical literature offers a variety of estimates on the incidence of payroll taxes. Studies that exploit cross-section and time-series variation in payroll taxes and mandated benefits in developed countries mostly find close to full tax shifting to wages with negligible effects on employment. In the United States for instance, Gruber and Krueger (1991) find that the entire increase in payroll taxes following an increase in the level of workers' compen-

[6]See for instance Boeri (2005); Bauer et al. (2007).

sation insurance is passed on to the workers in the form of lower wages. Gruber (1994) uses a triple-difference estimator and finds that the costs of an increase in mandated maternity benefits are fully passed on to the beneficiaries. Similarly, Anderson and Meyer (1997) find that the entire burden of an increase in the industry level unemployment insurance payroll tax in the US is borne by employees. They do however find that the difference between the firm-level average tax rate and the industry-level average is not fully passed on to the workers. Owing to complete pass through of taxes to wages, all these studies find negligible effects on employment. However, in a more recent study, **?** examine the effects of an increase in payroll taxes brought about by an increase in the covered earnings cap for social security in the US and find partial shifting of payroll taxes to wages.

The aforementioned evidence points to a strong positive relationship between the extent of tax shifting to wages and the worker's perceived tax-benefit linkage.[7] Workers may find it easier to ascertain the benefits of a tax levied to finance maternity benefits, to provide for unemployment insurance or worker's compensation insurance. However, changes in the covered earnings cap for social security is likely to affect workers differentially, depending on their pre-tax earnings, and it might be hard for workers to adequately perceive future social security returns. Evidence from Europe also points towards the importance of a strong tax-benefit linkage. In a cross-country comparison, Ooghe and Flechet. (2003) find that more than half of the burden of social security contributions in European nations is borne by employees and the extent of payroll tax shifting to wages increases with an increase in the tax-benefit linkage.

Despite the availability of rigorous and methodologically relevant studies from developed countries, evidence on the estimates of payroll tax incidence from the US and Europe cannot be generalized to developing countries. There is considerable variation in law enforcement mechanisms and compliance behavior of workers and firms between these countries. More-

[7]The tax-benefit linkage refers to the extent to which current payroll taxes determine the level of future social security benefits.

over, industrial and labor regulations across countries are guided by a diverse set of labor market institutions. Evidence from developed nations relies on perfect compliance and small uncovered sectors while developing countries exhibit partial compliance and larger informal or uncovered sectors. More importantly, the elasticities of labor demand and labor supply, being a critical determinant of tax incidence, vary substantially between countries.

As mentioned earlier, estimates of payroll tax incidence from developing countries primarily derive from policy changes in Latin America.[8] Estimates from these studies cannot be generalized to the Pakistani context or more broadly to other countries in South Asia. This is because Latin American nations have a longer standing history of labor regulations and social security provision as compared to the South Asian region. Moreover, a majority of the studies focus on formal sector firms and labor markets that exhibit downward wage rigidity. In particular, employers find it harder to pass on the entire increase in taxes to workers due to binding minimum wages and the likelihood of workers and firms to move to the informal sector. Owing to this, there is only partial shifting of payroll taxes to wages following a tax increase(see Adriana and Kugler (2009) for Columbia; Kidyba (2010) for Argentina). However, a reduction in payroll taxes in Chile is completely passed on to the workers in the form of higher wages (Gruber, 1997).

This shows that the estimates of payroll tax incidence, even within a certain region, cannot be generalized along every dimension. Even within a country, payroll tax incidence varies with the type of the policy change being studied. Moreover, the magnitude and direction of the tax change affects the ultimate policy conclusions. All these factors provide the motivation for ongoing work on the labor market effects of payroll tax reforms.

[8]There is a recent study by Nielsen and Smyth (2007) that focuses on China. They examine the extent to which additional costs from increases in firm compliance are passed on to the workers in the form of lower wages. They find that increases in firm compliance leads to higher cost shifting to wages.

1.3 Institutional Background

Pakistan does not have universal social security coverage. Prior to 1976, the social security system in Pakistan only covered formal sector workers, particularly government employees and workers in large incorporated enterprises with employer provided mandates.[9] Private sector workers, primarily in the informal sector, were forced to rely on private savings during old-age. In an attempt to extend old-age pension and invalidity (permanent disability) benefits to private sector workers, the government enacted the Employees' Old Age Benefits Act on July 1, 1976.

The Employees' Old Age Benefits Act (henceforth The Act) extends social security benefits to insured employees or their survivors. Under this act, insured employees are entitled to receive old-age pension in the event of retirement, invalidity pension in case of permanent disability and survivor's pension in case an insured employee dies. Pension eligibility requires 15 years of insurable employment, where insurable employment refers the number of years during which social security contributions were paid for the employee. Pension benefits are equal to 2% of the average wage drawn in the twelve month period preceding retirement, for every year of insurable employment above 15 years. If the average wage is higher than the prevailing minimum wage, the benefits are calculated as a percentage of the minimum wage. All pension benefits are subject to a minimum rate of pension specified under the law. Anyone who qualifies for less than the minimum pension after completing 15 years of covered employment receives the minimum pension.[10]

Social security benefits disbursed through this act are funded by contributions from both employers and employees. Contributions by employers are payable at the minimum rates

[9] According to the most common definition of informality used in Pakistan, all firms with 10 or more employees are part of the formal sector. The term social security here refers to old-age pensions, survivors' pensions and permanent disability pensions.

[10] Administrative data from the Employees' Old Age benefits Institution shows that about 90% of the workers earn minimum pension, corroborating the fact that my study sample consists of low-wage workers. A detailed description of the pension system is presented in the Appendix.

of wages notified under the Minimum Wages for Unskilled Workers Ordinance, 1962.[11] The employer's contribution is fixed at 5% of the minimum wage and the employee contribution is fixed 1% of the minimum wage. If the actual wage is lower than the minimum wage then the contribution is paid as a percentage of the minimum wage. Thus, minimum wage serves as the maximum taxable earnings cap for social security contributions. It is the responsibility of the employer to register with the Employees' Old Age Benefits Institution (EOBI), the social security institution responsible for collecting contributions and disbursing pensions, as soon as the number of insured employees meets or exceeds the firm-size threshold specified for the applicability of the law. The law does not cover government employees, workers in agriculture, forestry and fishing, and enterprises with fewer than five employees. EOBI does not receive any mandated financial assistance from the government. The government was mandated to provide contributions at the rate of 5% of the minimum wage during the years 1986 to 1995, thereafter this contribution was abolished. Changes in the base wage at which contributions are payable and the rates of contribution are presented in Table 1.2.

In July 2001, the government decided to actively involve covered employees in the contribution process. Initially, a fixed monthly contribution of 20 ($0.255) rupees per worker was required from all registered employees, irrespective of their wages. In July 2005, the employee contribution was increased to 1% of the federal minimum wage per month per employee.

The next major amendment to the Act was made in July 2006, when the firm-size threshold required for the applicability of the law was increased from firms employing 10 or more workers to firms employing 20 or more workers for all firms established on or after July 1, 2006. This implies that all firms with 10 to 19 employees that started operating between July 2006 and June 2008 were part of my control sample before the policy change. How-

[11]Starting July 1, 2005, contributions for all employees were payable at a fixed percentage of the federal minimum wage specified under the Minimum Wages for Unskilled Workers Ordinance. This amendment made social security contributions completely independent of actual employee wages.

ever, for the purposes of the tax incidence analysis, these firms are included in the treated group. Thus, the difference-in-differences estimates for the second treatment represent a lower bound on the true effects of the policy change.[12]

Starting July 2008, the Employees' Old Age Benefits Act was extended to all private sector firms employing 5 or more workers, irrespective of actual wages, contract type or mode of payment. This was the first time that old-age pension in Pakistan was extended to workers in small informal sector firms at the national level. The July 2008 amendments also brought the carpet industry and the banking industry under the purview of the law. Moreover, the rate of employers' contribution was reduced from 6% to 5% of the federal minimum wage, and the federal minimum wage was increased from Rs 4600 per month to Rs 6000 per month.

These changes are likely to exert differential effects on wages and employment in different firm size categories. First, holding the level of employment constant, the size contingent policy change is likely to increase the fixed cost of employment for firms with 5 to 9 employees. Taking the total employer and employee contribution into account, each worker in firms with 5 to 9 employees becomes Rs 360 (6000*6%) more expensive in nominal terms after July 2008. Second, the cost of employment for firms with 10 or more employees also increased after July 2008; each worker in firms with 10 or more employees became 10.55% more expensive after the policy change (see Table 1.1). A brief summary of these law changes and their potential impacts by firm size categories are presented in Table 1.3.

[12]The second treatment refers to an increase in the level of social security contributions required by firms with 10 or more employees by 11.8%.

1.4 Data

This paper uses individual-level data from the Pakistan Labor Force Survey (LFS) for 20 quarters between July 2006 and June 2011. LFS is a cross-sectional data set designed to gather information about key indicators of the labor market. It is representative at the national, provincial, and rural/urban level. The survey covers all urban and rural areas of Pakistan excluding Federally Administered Tribal Areas, military restricted areas, and protected areas of Kyber-Pakhtunkhwa (KPK) province. The population of excluded areas constitutes about 2% to 3% of the total population in the years under study.[13]

In order to account for the seasonal variation in employment patterns, the Bureau of Statistics decided to conduct the LFS on a quarterly basis starting July 2005. However, consistent information on the primary sampling unit is not available for the July 2005 to June 2006 survey year. I therefore use data starting July 2006. My estimation sample consists of the male working population between the ages of 14 and 60 years employed in non-agricultural private sector establishments.[14]

Table 1.4 shows the distribution of employment by the type of enterprise. About 15% of the workers in my sample are employed in enterprises that are not covered by EOBI. These include federal, provincial and local government employees and workers in public enterprises. For the remaining 85% of the sample, firm-size information is not available for 18% of the workers. These include workers in incorporated public and private limited companies. For the remaining workers, the information on firm-size is available.[15]

I construct the treatment variable using individual-level responses about employment

[13]Details of the survey methodology are presented in the Appendix.

[14]Women are excluded due to low labor force participation rate (17%). The age cutoffs are based on the official working age and the official retirement age in Pakistan.

[15]It is also important to note that my analysis assumes single-unit firms. There is no firm-level data set in Pakistan to determine the exact number of single-unit and multi-unit establishments. However, the likelihood of multi-unit firms, especially in the informal sector, is low.

in various firm size categories. The question about firm size is not asked from all survey respondents. It is asked from workers employed in individual ownerships, partnerships and other forms of establishments. The answer options consist of four firm-size categories, (i) up to 5 employees (ii) 6 to 9 employees (iii) 10 to 19 employees and (iv) 20 or more employees. The question elicits the number of employees including proprietors. As the law does not apply to firm owners, the number of proprietors has to be excluded from the reported firm-size. Due to the non-availability of data on the number of proprietors in partnerships and other forms of establishments, I exclude the sample of workers employed in these categories.[16] This leaves me with the sample of workers employed in individual ownership. As individual ownerships have a single proprietor, workers in individual ownerships with 5 or fewer employees are in fact working in firms with 4 or fewer employees. Similarly, workers in firms with 6 to 9 employees are employed in firms with 5 to 8 employees.

Table 1.5 shows the distribution of employment by firm-size categories, and has two notable features. It shows that a majority of workers are employed in firms with less than 10 employees, which is indicative of the presence of a large informal sector in Pakistan. It also provides suggestive evidence of a reduction in employment in the treated firms after the policy change.

1.5 Methodology

This section separately identifies the effects of the two treatments. The first treatment corresponds to an extension of social security benefits to previously uncovered workers in the informal sector, while the second treatment relates to an increase in the level of social security contributions required from firms already under the jurisdiction of the law.

[16]Partnerships and and other forms of establishments employ about 7.57% of the sample of workers that are asked about their firm-size information.

In order to examine the labor market effects of the first treatment, I use a difference-in-differences approach with two groups and two time periods. The treatment corresponds to an increase in the cost of employment for firms with 5 or more employees. Each worker in the treated firms becomes 360 rupees per month (6% of Rs 6000) more expensive in nominal terms after July 2008. As the data are grouped into firm size categories, the treatment dummy takes a value of one for workers in firms with 5 to 8 employees and a value of zero for workers in firms with 4 or fewer employees.[17] In order to take account of the time lag between the announcement of the new policy and its implementation through firm registration with the social security institution, I assign a value of zero to the time dummy for the quarter of the policy change. The post dummy therefore takes a value of zero for all quarters up to the fourth quarter of the year 2008 and a value of one thereafter.

Furthermore, to test for the labor market effects of the second treatment, I employ a difference-in-differences approach with workers in 9 or more employee firms as the treated group and workers in 4 or fewer employee firms as the control group.[18] The treatment corresponds to an increase in the required level of social security contributions from firms with 10 or more employees by 10.55% in nominal terms. This was a result of the amendments made to the rate of employer contribution and the level of the federal minimum wage.

For the empirical analysis, I run regressions of the form:

$$Y_{ist} = \alpha + \gamma FirmSize_{ist} + \delta Post_{it} * FirmSize_{ist} + X'_{ist}\beta + \sum_{t=1}^{20} \theta_t + \varepsilon_{ist} \qquad (1.1)$$

where Y_{ist} is the log of real wage per week or log of hours worked per week for person i in

[17] Due to the nature of data collection, the treated group does not include workers with exactly 9 employees. However, empirical estimates from the sample of treated workers in 5 to 8 employee firms are more conservative as compared to the estimates from the full sample of treated workers.

[18] Note that the treated group contains workers in 9 employee firms. This is a data limitation whereby workers in firms with 10 or more employees are effectively working in individual ownerships employing 9 or more workers. This is discussed in the previous section.

firm-size-category s at time t.[19] $Post * FirmSize$ is the variable of interest, where $Post$ is the time dummy and $Firmsize$ is the treatment dummy. X'_{ist} is the vector of individual level characteristics including completed years of education, age, a quadratic in age and a dummy for being married, θ_t are quarter fixed effects and ε_{ist} is the error term. I choose to include quarter fixed effects as they help account for the differential trends in wages and hours worked over time. The coefficient of interest is δ, and it is identified under the following assumptions.

1.5.1 Common Trends

Identification of the difference-in-differences coefficients requires that the outcome variables display similar trends on average in the treated and control firms in the absence of the policy change. Figure 1.1 presents evidence in support of the common trends assumption. Panel A shows that on average, wages in the treated and control firms display similar pre-treatment trends. The average wage differential between treated and control firms' workers is decreasing over time, suggesting that the policy had some bite.

The reduction in wages in the post treatment period is more obvious after I control for observable individual level characteristics such as age, education, a quadratic in age and a dummy for being married. Panel B displays the trends in residuals predicted from a least squares regression of wages on observable characteristics, using the pre-treatment data. Given that the observable characteristics of workers did not change significantly across treated and control firms, the reduction in the average wage differential can be attributed to the change in the law.

[19]Income is reported either monthly or weekly along with the periodicity of payment. Individuals paid on a daily, weekly, piece-rate basis or other periodicity report a weekly income measure. I use this measure for weekly wages. Individuals paid on a fortnightly or a monthly basis report a monthly income measure. This is divided by four on the assumption that the individuals work every week during the month. Hours worked are asked for the week preceding the date of enumeration of the survey.

Figure 1.2 tests the common trends assumption for the analysis of the second treatment, where the required level of social security contributions for firms with 10 or more employees increased after July 2008. Panel A shows that on average, wages in firms with 4 or fewer employees follow the trends in wages in firms with 9 or more employees with a time lag. Figure 1.2, panel B shows that after controlling for observable characteristics, the average wage differential between the treated and control firms falls a year after the policy change.

I also test for common trends assumption in a regression framework, where the log of real wage per week is regressed against the treatment status, a linear time trend and the time trend interacted with the treatment status using the pre-treatment data. Table 1.6 shows no statistically significant evidence of differential time trends in real wages in either of the firm size categories before the policy change.

Average trends in hours worked by firm size categories are presented in Figure 1.3. Hours worked per week display similar trends on average in treated and control firms before the policy change. The law change does not seem to exert a substantial impact on hours worked per week in either of the firm size categories. Thus, the average differential in hours worked per week between treated and control firms' workers is negligible post intervention.

1.5.2 Possible Compositional Changes

Validity of the difference-in-differences estimates requires that worker composition across the treated and control firms does not change significantly as a result of the policy change. I test for no compositional changes in the observable characteristics of workers by performing difference-in-differences estimation on predicted wages, where wages in each time period are predicted from a regression of log wages on the observable characteristics of workers using data from the pre-treatment period. The results are presented in Table 1.7.

Panel A presents the results for the size contingent policy change, with 5 to 8 employee firms as the treated group and 4 or fewer employee firms as the control group. The difference-in-differences estimates are small and statistically insignificant, suggesting that the policy did not exert a differential effect on the observable characteristics of workers across treated and control firms.

Table 1.7 Panel B shows the difference-in-differences estimates for predicted wages with 9 or more employee firms as the treated group and 4 or fewer employee firms as the control group. Here, I do observe suggestive evidence of changes in the observable characteristics of workers as a result of the policy change. However, the effects run in the opposite direction to the anticipated effects of the policy. Although the validity of the estimates for the second treatment is partially affected by changes in the composition of workers over time, the statistical significance of the estimates does not hold after controlling for industry fixed effects. Having said that, the estimates for the regression specifications without industry fixed effects suggest that after the policy change, firms with 9 or more employees retain workers with a higher level of human capital as compared to firms with 4 or fewer employees.

1.6 Results

1.6.1 Extension of Social Security to the Informal Sector

Effects on Wages

The difference-in-differences estimates for the size contingent policy change are presented in Table 1.8. The first three columns present average differences in the labor market outcomes of workers in firms with 5 to 8 employees as compared to workers in firms with 4 or fewer employees. Panel A shows that real wages in both the treated and control firms

are decreasing over time. However, after July 2008, workers in the treated firms experience a higher reduction in wages as compared to workers in the control firms (4.52% versus 0.45%). This translates into a negative and significant difference-in-differences estimate for log wages. In the regression specification with no controls, real wages in the treated firms fall by a magnitude of 4.07% on average.

Estimates for the full regression specification in equation (1) are presented in Table 1.9. Column 1 shows that real wages in the treated firms fall by 4.93% in the baseline model. The magnitude of the wage effect falls to 4.58% with the inclusion of provincial and regional dummies. In the full regression specification with industry fixed effects, province fixed effects, and a dummy for urban regions, real wages in the treated firms fall by 4.02% on average.

In order to determine the extent of cost shifting to wages, I estimate the increase in the cost of employment of an average firm in the treated group and compare it to the difference-in-differences estimates presented above. To accomplish this, I divide the post-intervention increase in the treated firms' employment costs (6% of the real minimum wage) by the average real wage paid in these firms before the policy change. I do this for all workers that are earning wages at or above the minimum wage. For workers earning wages below the minimum wage, the cost of employment goes up by 6%. Thus, the overall cost of employment for the average firm in the treated group increases by 4.743% as a result of the policy change.[20] Comparing the cost increase to the difference-in-differences estimates from the wage regressions, a reduction of 4.02% to 4.93% in real wages across different regression

[20]For workers that are earning wages at or above the minimum wage, the increase in employment costs is estimated as 6 percent of the real minimum wage averaged over the July 2008 to June 2009 time period (Rs 745.2996 per week), divided by the average real wage in the treated firms over the July 2007 to June 2008 time period (Rs 1268.635 per week). I do not take the entire pre-intervention period to calculate average wages because minimum wage was increased in July 2007, and firms might have reacted to the change in the legal minimum wage by adjusting wages upwards. For workers earning wages below the minimum wage, the increase in employment cost is 6%, because their social security contributions are based on their actual wage. In the treated sample, 50.78% of the workers are earning wages at or above the minimum wage, while 49.22% are earning wages below the minimum wage. Thus, the increase in the cost of employment for an average firm in the treated group is equal to $[(0.06 * 745.2996)/1268.635] * 0.5078 + (0.06 * 0.4922) = (0.035 * 0.5078) + (0.06 * 0.4922) = 0.0473$.

specifications, implies that 84.7% to 100% of the increase in payroll taxes is passed on to the workers in the form of lower wages.[21]

Effects on Hours Worked

Table 1.8 Panel B presents average differences in hours worked per week between treated and control firms' workers over time. Column 3 shows that the average differential in hours worked is decreasing over time, making the difference-in-differences estimate negative.

The difference-in-differences estimates for the full regression specification in equation (1) are presented in Table 1.9 Panel B. It shows that workers in the treated firms work 0.84% fewer hours per week in the specification without industry fixed effects and 0.44% fewer hours per week in the specification with industry fixed effects. In order to determine the overall reduction in hours worked per week, I compare the regression estimates to the average number of hours worked per week in the treated firms before the policy change. Workers in firms with 5 to 8 employees worked 52.79 hours per week on average before July 2008. Thus the coefficient estimates translate into a reduction of 0.44 hours per week in the specification without industry fixed effects and reduction of 0.23 hours per week in the specification with industry fixed effects. However, these effects are effectively negligible.

Effects on Employment

In order to examine the effects of the policy on aggregate labor input, I run regressions the form:

[21] It is important to note that I do not observe workers in firms with exactly 9 employees. As these firms are a part of the treated group, my estimates represent a lower bound on the true effects of the policy change. In order to determine the extent of this attenuation bias, I use firm registration data from the Employees' Old Age Benefits Institution (EOBI). The data shows that among the sample of workers in firms with 5 to 9 employees that registered with EOBI after July 1, 2008, about 6.94% were employed in firms with exactly 9 employees. Thus, the wage effects of the policy change are likely to be between by $\frac{0.0402}{0.931} = 0.0432$ and $\frac{0.0493}{0.931} = 0.0530$.

$$E_{ist} = \alpha + \lambda Post_{it} + X'_{ist}\beta + \gamma_1 t + \gamma_2 t^2 + \varepsilon_{ist} \tag{1.2}$$

The dependent variable takes a value of 1 for workers employed in firms with 5 to 8 employees and a value of zero for workers employed in firms with 4 or fewer employees. t and t^2 represent a quadratic time trend. All other variables are defined as before, and the coefficient of interest is λ.

I exclude quarter fixed effects from the employment regressions for two reasons. First, there is not enough power to estimate the employment regressions with fixed effects for 20 quarters. This is because the treatment variable is defined at the level of the firm and there is not enough variation between quarters in the treatment status of workers. Second, I intend to examine the employment effects that are comparable to the effects for wages and hours worked presented earlier. I therefore decide to include a dummy variable for the post treatment period. As the post dummy is perfectly collinear with quarter fixed effects, the latter are excluded. However, to capture employment growth over time, a quadratic time trend is included.

The marginal effects from employment regressions in equation (2) are presented in Table 1.10. Employment in firms with 5 to 8 employees as compared to firms with 4 or fewer employees, decreases in all specifications. In Column 2, without industry fixed effects, employment decreases by 0.9%. With the inclusion of industry fixed effects, the negative effects on employment increase to 1.6% (Column 4). Note that the magnitude of the effect decreases substantially with the inclusion of a quadratic time trend. The statistical significance of the employment effects is also wiped out by the time trends.

To ascertain the effects of the policy change on total labor input, I use both the employment and hours worked estimates. Total labor input is given by hours worked per week per employee times the number of employees, and is denoted by L, where $L = H \cdot E$. Thus the

effect of the policy on aggregate employment is equal to the change in employment at the average number of hours worked, plus the change in hours worked at the average level of employment. Mathematically, $dL = H \cdot dE + E \cdot dH$, where H denotes average hours worked and E denotes average employment in the treated firms before the policy change. dE is the marginal effect from the employment regressions and dH is the change in hours worked from the difference-in-differences estimation.

Among the sample of workers employed in firms with fewer than 9 employees, about 13.5% of the workers were employed in the treated firms and 86.5% were employed in the control firms before July 2008. In the employment specification with time trends and industry fixed effects, total employment in the treated firms fell by 1.11% on average. Moreover, workers in the treated firms worked 0.23 fewer hours per week on average after the policy change. These estimates translate into a reduction of 0.62% in the aggregate labor input in the treated firms as compared to the control firms, after the policy change.

Note that the statistical insignificance of the employment estimates supports the finding of close to full tax shifting to wages and a positive valuation of social security benefits by workers.

1.6.2 Increase in the Level of Social Security Contributions

The second treatment refers to the increase in the level of social security contributions required from firms already under the jurisdiction of the law. This was a result of the amendments made to the rate of employer contribution and the level of the federal minimum wage. On one hand, the rate of employer's contribution was reduced from 6% to 5% of the federal minimum wage. On the other hand, the federal minimum wage was increased from Rs 4600 per month to Rs 6000 per month. These changes led to an increase in the level of social security contributions required from firms with ten or more employees by 11.8%.

Recall that contribution for workers earning wages below the minimum wage is based on the actual wage. According to this, the cost of employment increased by 10.55% in nominal terms. Moreover, the inflation rate was at its highest level in Pakistan during the year 2008-09. Thus, in real terms the cost of employment decreased by 9.63% (see Table 1.1).

To assess the impact of this cost increase on wages and employment in the treated firms, I employ a difference-in-difference approach with workers in 9 or more employee firms as the treated group and workers in 4 or fewer employee firms as the control group. The last three columns of Table 8 present average differences in real wages and hours worked between treated and control firms' workers both before and after the policy change. There is evidence of significant wage differentials between the two firm size categories both pre and post intervention. Moreover, the average wage differential between the treated and control firms' workers is falling over time, leading to a negative difference-in-differences estimate for log wages. Table 1.8 Panel B shows that workers in firms with 9 or more employees work a greater number of hours per week on average as compared to workers in the control firms. Note that the average difference in hours worked per week between the treated and control firms' workers is increasing over time, making the difference-in-differences estimate positive. Hours worked in the treated firms increase by 1.55% on average after the policy change.

Effects on Wages

The difference-in-differences estimates for the full regression specification in equation (1) are presented in Table 1.11 Panel A. The coefficient estimate of γ shows that workers in firms with 9 or more employees earn significantly higher wages as compared to workers in firms with 4 or fewer employees. This is not surprising given the underlying differences between workers in the two firm size categories. Moreover, a negative and significant estimate of δ indicates that real wages in the treated firms decrease by about 5.98% to 7.56% on average after the policy change. Compared to the increase in cost of employment of about 10.55%,

the estimates represents less than full cost shifting to wages. Considering the nominal cost of employment is more relevant for policy analysis. This is because firms are more likely to adjust wages based on expected inflation and not the actual inflation. This consideration is particularly important in my case, because the year of the policy change coincided with one of the highest inflation years in Pakistan.[22]

Effects on Hours Worked

The difference-in-differences estimates of hours worked are reported in Table 1.11 Panel B. On average, workers in the treated firms work a greater number of hours per week than workers in the control firms. A positive estimate of δ suggests that the policy change lead to an increase in hours worked in the treated firms. Hours worked in the treated firms increase by 1.47% in the specification without industry and occupation fixed effects (Column 2), and by 1.99% in specification with industry fixed effects (Column 4).

In order to determine the increase in hours worked per week, I compare the change in hours worked to the average number of hours worked per week in the treated firms before the policy change. Workers in firms with 9 or more employees worked 52.93 hours per week on average before July 2008. Thus the coefficient estimates translate into an increase of 0.78 hours per week in the specification without industry and occupation fixed effects and an increase of 1.06 hours per week in the full specification. However, the magnitudes of the effects are quite small and statistically insignificant.

Effects on Employment

In order to examine the effects of the policy change on aggregate labor input, I run a probit model:

[22]This shows up as a reduction in the real cost of employment in Table 1.1.

$$E_{ist} = \alpha + \lambda Post_{it} + X'_{ist}\beta + \gamma_1 t + \gamma_2 t^2 + \varepsilon_{ist} \tag{1.3}$$

The dependent variable takes a value of 1 for workers employed in firms with 9 or more employees and a value of zero for workers employed in firms with 4 or fewer employees. All other variables are defined as before. The coefficient of interest is λ.

The marginal effects from equation (3) are presented in Table 1.12. Employment decreases in all regression specifications. In the specification without industry and occupation fixed effects, employment decreases by 2% (Column 2). With the inclusion of industry fixed effects, the magnitude of the effect increases to 2.1% (Column 4). Note that the statistical significance of the employment effects does not hold after controlling for time trends. However, there is statistically significant evidence that over time, employment in firms with 9 or more employees is decreasing at an increasing rate.

To determine the effects of the policy on total labor input in the treated firms, I use both the difference-in-differences estimates for hours worked and the marginal effects from the employment regressions. If I only take the sample of workers employed in firms with 9 or more employees and compare them to the sample of workers in firms with 4 or fewer employees, I find that about 9.27% of the workers are employed in the treated firms and 90.73% of the workers are employed in the control firms. In the employment specification with time trends and industry fixed effects, employment falls by 1.17%. Hours worked increase by 1.06 hours per week in the specification with industry fixed effects. Taken together, these results imply that as compared to the control firms, treated firms reduce their total labor input by 0.72% after the policy change.

Ideally, one would like to compare labor market outcomes between firms that look similar in terms of observable characteristics other than the differences induced by the policy intervention. It is harder to justify that firms with 9 or more employees were similar to firms

with 4 or fewer employees in all observable characteristics other than the post intervention increase in employment costs. This is because in Pakistan, firms with 10 or more employees have always been covered by some form of industrial and labor regulations, while firms with less than 5 employees have never been exposed to any industrial and labor legislation at the national level.

Moreover, there is evidence of changes in the observable characteristics of workers in firms with 9 or more employees after the policy change. Recall that the difference-in-differences estimates for predicted wages in Table 7 Panel B suggested that firms with 9 or more employees retain workers with a higher level of human capital after the policy change. However, for an employee with a specific set of observable characteristics, the real wage is in fact lower after the change in the law. To the extent that wages are positively correlated with worker productivity, these estimates suggest that after an increase in employment costs, firms with 9 or more employees get rid of their low wage/low productivity workers and shift the increase in the cost of social security contributions to their remaining employees. As the estimates lose statistical significance with the inclusion of industry fixed effects, they are only suggestive of the fact that post-treatment differences in observable characteristics of workers are driven by the policy change.

1.6.3 Possible Mechanisms

The relative reduction in wages after an increase in payroll taxes depends on the tax-benefit linkage and downward wage flexibility in the labor market. The existence of a weak tax-benefit linkage implies that workers are less willing to accept wage reductions today in exchange for higher social security benefits tomorrow. In this case, the labor supply curve shifts outwards by less than the full amount of the tax, leading to disemployment effects(Gruber and Krueger, 1991). However, in the context of this paper, the lack of an employment ef-

fect suggests the existence of a strong tax-benefit linkage and a positive valuation of social security benefits by workers.

Moreover, close to full payroll tax shifting to wages shows evidence of downward wage flexibility in the Pakistani labor market. However, this is somewhat surprising in the presence of a minimum wage law. If minimum wages bind or bind for certain groups of workers, treated firms might not be able to reduce wages by the full amount of the tax. In this case, we expect to find less than full tax shifting to wages. On the contrary, non-binding minimum wages and downward wage flexibility may substantially increase the ability of firms to pass on the cost of social security contributions to their workers in the form of lower wages. Below I provide evidence in support of the latter by examining the level of non-compliance with the minimum wage in all the three firm size categories.

Table 1.13 presents the proportion of workers earning real wages strictly below the minimum wage by firm-size categories. The table has two notable features. First, the level of non-compliance with the minimum wage decreases with increases in firm size. Second, firms react to the increase in the mandated minimum wage with a time lag. It takes firms approximately half a year to adjust wages upwards after an increase in the legal minimum wage.[23]

In addition to establishing non-compliance, it is useful to examine the level of non-compliance with the minimum wage in relation to the average wage paid by the firms before and after the policy change. To accomplish this, I take the proportion of workers earning wages below the minimum wage in each firm size category and compare their average wage to the prevailing minimum wage. The results are presented in Table 1.14. It shows that

[23]Non-compliance with the minimum wage shows an increase in the year the minimum wage is increased and decreases in the following years until the next increase in the minimum wage is announced. This is evident if we compare Table 13 to the increase in the minimum wage over time presented in Table 2. This might not be an increase in non-compliance per se. It might be a sign of firms taking time to adjust to the new minimum wage. Despite the fact that firms take time to adjust to the new minimum wage, a high percentage of workers earning sub-minimum wages confirms that minimum wages do not bind in the sample of firms being studied.

the level of minimum wage non-compliance increases in the post-treatment period for all firm size categories. The average real wage of workers in firms with 5 to 8 employees was 1.3 times the real minimum wage before the policy change, and it decreased to 1.22 times the real minimum wage thereafter. Similarly the average real wage of workers in firms with 9 or more employees was 1.43 times the real minimum wage before the policy change, and it decreased to 1.25 times the real minimum wage thereafter. This reduction is consistent given the difference-in-differences estimate presented earlier. As treated firms shift the cost of social security contributions to workers in the form of lower wages, non-compliance with the minimum wage also increases.

Below I test for the possible distributional consequences of the amendments by examining changes in the probability of workers earning sub-minimum wages in the treated firms after the policy change. Here I regressions of the form:

$$BMW_{ist} = \alpha + \gamma FirmSize_{ist} + \delta Post_{it} * FirmSize_{ist} + X'_{ist}\beta + \sum_{t=1}^{20} \theta_t + \varepsilon_{ist} \qquad (1.4)$$

where BMW_{ist} is a dummy variable that takes a value of 1 if individual i is earning wages strictly below the minimum wage in firm size category s at time t, and equals zero otherwise.[24] All other variables are defined as before. The coefficient estimates for equation (5) are presented in Table 1.15. The results show that after the policy change, the likelihood of workers earning wages strictly below the minimum wage increases by about 2.95% to 3.57% in firms with 5 to 8 employees and by 7.53% to 8.06% in firms with 9 or more employees.

Paying wages below the minimum wage does not affect my estimates as long as the firms are correctly reporting firm size and total contributions. This is because social security contributions are completely independent of the actual wages paid to the workers. When firms

[24]In line with the empirical literature, I also perform the analysis with a dependent variable that takes a value of 1 for workers earning wages 10% below minimum wage, and a value of zero otherwise. The results are qualitatively similar.

make social security contributions, they are neither required to report the aggregate wage bill nor the individual employee wages. Thus, despite paying below minimum wages, firms may well be paying the full contribution amount. Firms can avoid paying full contributions by underreporting the total number of employees though. However, as long as they report the number of employees correctly, their contribution payments are valid.

1.7 Robustness Checks

1.7.1 Firm Compliance

In this section, I use restricted access data from the Employees' Old Age Benefits Institution (EOBI) to establish firm compliance with the July 2008 amendments. All firms that register with EOBI have to report the date of registration along with the total number of employees at the time of registration. Figure 1.4 shows the distribution of firms registered with EOBI as of January 1, 2012, by firm-size categories. Positive rates of compliance can be inferred by examining the registration of firms newly exposed to the law. These include firms with 5 to 9 employees. Before July 2008, only about 8% of the registered firms had 5 to 9 employees, which increased to about 50% thereafter.

It is important to note that firms with fewer than 10 employees were not exposed to the law before July 2008, yet I observe positive registration of firms with fewer than 10 employees in the pre-treatment period. This relates to EOBI's policy on voluntary firm registrations. EOBI allows firms uncovered by the system to register with the institution and apply for social security benefits for their workers if they so desire.

Figure 1.4 also shows that after the policy intervention, firms behave in a manner that is consistent with other studies examining firm-size-contingent changes in labor regulations.

In particular, I observe significant bunching of firms around the size threshold specified for the applicability of the law. Prior to July 2008, there is a spike at the firm-size category of 10 to 19 employee firms (61.8%), thereafter the spike shifts to firms with 5 to 9 employees.[25] Bunching can either correspond to firms laying off their workers or to firms under-reporting the true firm-size. The former can be ruled out due to negligible employment effects in the treated firms after the policy change. The latter is likely to lead to attenuation bias.

In order to determine the exact level of firm compliance, I use data on cumulative firm registrations for firms with 5 to 9 employees between July 2001 and June 2011 and compare it to the data on total number of firms with 5 to 9 employees as reported in the Economic Census of 2005. According to the Economic Census, of all firms that opened after the year 2000, 16536 had 5 to 9 employees.[26] Moreover, of all firms registered with EOBI as of July 2012, 14282 had 5 to 9 employees (Figure 5). This shows that 86.4% of the firms complied with the law.[27] Given partial compliance, my estimates represent an intent-to-treat effect. That said, the intent-to-treat effect may be a better policy analysis tool in the institutional setting being studied. This is because, other things being equal, workers in the control and treated firms are less different in terms of access to social security than workers in treated and untreated firms.

Another way to ascertain the extent of firm compliance with the law is to examine the distribution of treated firms by registration type. In EOBI data, firms are differentiated by five registration types. All firms that comply with the law and register with the institution as soon as the total number of workers meets or exceeds the size threshold are registered with a *mandatory* registration status. Firms that do not come under the jurisdiction of the law are allowed to register voluntarily. The remaining registration types refer either to non-compliant

[25] I perform a detailed analysis and do find evidence of bunching around the firm size of 10 for all firms registered before July 2006. Firms that register between July 2006 and June 2008 bunch around the firm size of 20, which is in line with the July 2006 amendments. From July 2008 onwards, firms bunch around the firm size of 5 workers.

[26] For details of the data see http://www.pbs.gov.pk/sites/default/files/other/ec_2005/appendix-xviii.pdf.

[27] A similar level of firm compliance is observed for firms with 10 to 19 employees.

firms or to firms notified for registration on the orders of the federal government. The former are registered under the *Suo-motu*, *Amnesty* or *Self-Assessment* schemes, while the latter maintain a *Notification* status.[28] Data on firm registrations shows that 79.5% of the firms that were newly exposed to the law complied without any notification or warning. These show up as mandatory registrations. However, a significant proportion (19%) of firms did not comply with the law, unless forced to do so. These were registered under the Suo-motu status.[29]

It is important to note that firms report aggregate employment when making social security contributions and the contributions are paid as a lump sum. Until recently, firms did not provide detailed wage and contribution data for individual employees. This implies that there is a non-zero probability of firms under-reporting the total number of employees at the time of registration. However, it is reassuring to note that compliance levels in informal sector firms (firms with 5 to 9 employees) are sufficiently close to the level of compliance in formal sector firms (10 or more employees).

Effects of Non-compliance on the Difference-in-differences Estimates

Non-compliance implies that the effects of the policy on measured treatment are different from the effects on actual treatment. Here I discuss the extent of the attenuation bias in the difference-in-differences estimates for the firm-size-contingent policy change, due to the difference in measured and actual treatment. Assume that A denotes actual treatment and D denotes intended treatment. Then the correlation between actual and intended treatment

[28]Suo-motu refers to forced registration by EOBI whereby non-compliant firms are forcibly registered into the system and are subsequently sent monthly notices to elicit contribution payments. These account for about 9.4% of total firm registrations. Amnesty registrations were a onetime special concession made for defaulting firms. Similarly, registration under the self-assessment scheme was a onetime offer for defaulters to ascertain their own dues and make payments accordingly. Amnesty scheme was initiated on August 5, 2002 and was ended on November 15, 2002. Self-assessment scheme was also introduced in 2002 and is no longer in place.

[29]The table is available upon request.

is given by $P(A = 1|D = 1)$, and is likely to be equal to the rate of firm-compliance i.e. $P(A = 1|D = 1) = 0.864$. Moreover, due to voluntary firm registrations, some controls receive the treatment. The proportion of control firms that are treated can be inferred by the number of firms registered with 4 or fewer employees. As of July 2012, about 3.21% of the firms that registered with EOBI had 4 or fewer employees. This implies that $P(A = 1|D = 0) = 0.0321$. Thus the coefficient in a regression of actual treatment on measured treatment is approximately equal to $P(A = 1|D = 1) - P(A = 1|D = 0) = 0.8319$. This implies that difference-in-differences estimates need to be scaled up by a factor of 0.8319. In the full regression specification with province fixed effects, industry fixed effects and reginal dummies, the difference-in-differences coefficient was 0.0402. Thus the true effects of the policy change are likely to be about 4.83%.[30]

1.7.2 Possible Measurement Error

The difference-in-differences estimates presented earlier may be affected due to measurement error in worker reported firm-size categories. Given measurement error, my estimates may either be biased towards zero or away from it. The estimates will be biased towards zero if treated firm's workers under-report their true firm-size category, while they are likely to be biased away from zero if control firm's workers over-report their true firm-size category.

In order to account for the possibility of simultaneous under-reporting and over-reporting of the true firm-size categories and their potential effect on my estimates, I assume that 80% of the workers report their true firm-size, while 20% do not. I then randomly reassign the treatment status to latter. I assume that 10% of the workers over-report their actual firm-size category i.e. they are actually employed in the control firms but showed up in

[30] I use the estimate of 0.0402 because the specification with industry fixed effects in Table 9 Column 3 is my preferred specification. This is because the one with occupation fixed effects is too restrictive. This is equivalent to $\frac{0.0402}{0.8319} = 0.0483$.

the treated firms, while 10% of the workers under-report their actual firm-size category i.e. they are employed in the treated firms but showed up in the control firms. I then perform the difference-in-differences estimation with the new treatment variable. I perform 10000 simulations and obtain a 95% confidence interval for the distribution of the difference-in-differences coefficients from the 10,000 regressions. The 95% confidence interval corresponds to a reduction in wages of about 2.14% to 5.53%.[31]

This is equivalent to about 40% to more than 100% of tax shifting to wages. However, I find that tax shifting to wages increases when I decrease the probability of over-reporting firm-size information. It is reasonable to assume that a firm-size-contingent increase in costs is likely to induce under-reporting of firm-size information as opposed to over-reporting, the estimates that correspond to full or close to full tax shifting to wages seem more credible.

1.8 Conclusion

This paper employs a difference-in-difference approach to examine the effects of a firm-size-contingent increase in payroll taxes on labor market outcomes in Pakistan. I find that treated firms pass the full increase in payroll taxes to their workers in the form of lower wages. In line with full cost-shifting to wages I find no effects of the policy change on employment and hours worked in the treated firms. Furthermore, I show that the reduction in wages can be attributed to downward wage flexibility in the Pakistani labor market and a positive valuation of social security benefits by workers. Moreover, I show strong evidence of firm compliance with the law using administrative data from the Employees' Old Age Benefits Institution. However, less than full compliance implies that my estimates represent an intent-to-treat effect.

A positive valuation of social security benefits by workers provides an incentive for devel-

[31] The results are available upon request.

oping country governments to continue their efforts in extending social security coverage to previously uncovered workers in informal sector firms. However, a majority of these workers earn sub-minimum wages, work long hours and are employed on temporary contracts. Thus, payroll tax induced wage reductions in such settings, despite being economically efficient, may not represent an equitable outcome.

Table 1.1: Increase in the cost of Social Security Contributions

Social Security Contributions for Firms with 10 or more Employees		
	Based on Nominal Wages	Based on Real Wages
Before	284.17	187.01
After	314.15	169.24
Change (%)	-10.55%	9.62%

These are calculated using wage data from the Labor Force Survey. Contribution for all employees that are earning wages below the minimum wage are paid as a percentage of their actual wage, while contributions for employees earning wages at or above the minimum wage are paid at the minimum wage. Real wages are based on monthly CPI data from the State Bank of Pakistan.

Table 1.2: Relevant Amendments

To	From	Minimum Wage	Employer Contribution	Employee Contribution
July 1, 2005	June 30, 2006	3000	6%	1%
July 1, 2006	June 30, 2007	4000	6%	1%
July 1, 2007	June 30, 2008	4600	6%	1%
July 1, 2008	June 30, 2010	6000	5%	1%
July 1, 2010	June 30, 2011	7000	5%	1%

Source: Employees Old Age Benefits of 1976 and Minimum Wages for Unskilled Workers Ordinance of 1969

Table 1.3: Summary of the effects of the law change by firm size categories

Firm Size	Summary of Law Changes
1 to 4	No effect due to size contingent change
	No effect due to base wage and percentage contribution change combined
	Effect of increase in minimum wages
5 to 8	Cost of employment increase due to size contingent change
	No effect due to base wage and percentage contribution change combined
	Effect of increase in minimum wages
exactly 9	Cost of employment increase due to size contingent change
	No effect due to base wage and percentage contribution change combined
	Effect of increase in minimum wages
10 or more	No effect due to size contingent policy change.
	Cost of employment increase due to base wage and percentage contribution change combined
	Effect of increase in minimum wages

Source: Finance Act of July 2008

Table 1.4: Percentage Employment by Type of Enterprise

Type of Enterprise	2006-07	2007-08	2008-09	2009-10	2010-11	Total
Federal Government	3.61	3.92	3.31	4.04	2.69	3.51
Provincial Government	10.57	11.37	11.09	9.99	9.58	10.52
Local Government	0.58	0.89	0.42	0.39	0.27	0.51
Public Enterprise	1.10	0.88	1.18	0.88	0.88	0.98
Not Covered	15.86	17.06	16.00	15.3	13.42	15.52
Private Ltd Company	16.93	15.62	15.7	17.05	16.92	16.45
Public Ltd Company	1.46	1.2	1.11	0.75	0.55	1.01
Cooperative Society	0.28	0.46	0.37	0.21	0.34	0.33
Covered with Missing Firm-Size Information	18.67	17.28	17.18	18.01	17.81	17.79
Individual Ownership	59.97	59.60	60.61	60.85	64.28	61.06
Partnership	2.05	2.13	2.32	1.84	2.33	2.13
Other	3.46	3.92	3.89	4.00	2.15	3.48
Covered and Non-missing firm-size information	65.48	65.65	66.82	66.69	68.76	66.67

The estimates are based on employee-reported enterprise type in the Labor Force Survey. All statistics are weighted.

Table 1.5: Percentage Employment by Firm Size Categories

Firm Size Category	2006-07	2007-08	2008-09	2009-10	2010-11	Total
Up to 5	77.65	78.6	79.67	81	80.36	79.48
6 to 9	12.43	12.48	13.96	11.52	11.68	12.4
10 or more	9.92	8.92	6.37	7.48	7.95	8.12

The estimates are based on employee-reported firm-size in individual ownerships. All statistics are weighted.

Table 1.6: Checking for Common Trends Assumption in Real Wages Pre-treatment

	(1)	(2)	(3)	(4)
Panel A: First Treatment				
Time*Firm Size (5 to 8)	0.00390	0.00551	0.00547	0.00793
	(0.00719)	(0.00676)	(0.00698)	(0.00716)
Firm Size (5 to 8)	0.0725*	0.0638*	0.0561	0.0734*
	(0.0377)	(0.0366)	(0.0365)	(0.0378)
Time	0.00803***	0.00800***	0.00706**	0.00688**
	(0.00304)	(0.00307)	(0.00297)	(0.00300)
Observations	20,412	20,412	20,412	20,388
R-squared	0.097	0.094	0.121	0.129
Panel B: Second Treatment				
Time*Firm Size (9 or more)	-0.0127	-0.0130	-0.0122	-0.0117
	(0.0102)	(0.0106)	(0.0101)	(0.0105)
Firm Size (9 or more)	0.201***	0.208***	0.179***	0.232***
	(0.0494)	(0.0508)	(0.0489)	(0.0499)
Time	0.00798***	0.00812***	0.00719**	0.00684**
	(0.00304)	(0.00305)	(0.00296)	(0.00299)
Observations	19,449	19,449	19,449	19,433
R-squared	0.098	0.092	0.118	0.127
Individual Controls	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Region Dummy	No	Yes	Yes	Yes
Province FE	No	Yes	Yes	Yes
Occupation FE	No	No	Yes	No
Industry FE	No	No	No	Yes

The sample size consists of all paid employees in individual ownerships. The estimates are based on the pre-treatment time period. The first treatment refers to the size contingent policy change with workers in 5 to 8 employee firms as the treated group and workers in 4 or fewer employee firms as the control group. the second treatment refers to the increase in the level of social security contributions, with 9 or more employee firms as the treated group and 4 or fewer employee firms as the control group. The dependent variable is log of real wage per week. The time trend is based on quarters. Firm size (5 to 8) takes a value of 1 for all workers employed in firms with 5 to 8 employees and a value of 0 for all workers in firms with 4 or fewer employees. Firm size (9 or more) takes a value of 1 for all workers employed in firms with 9 or more employees and a value of 0 for all workers in firms with 4 or fewer employees. Standard errors, reported in parentheses, are clustered at the level of the primary sampling unit and year. All regressions are weighted. ***,**,* indicates statistical significance at the 1%, 5% and 10% levels, respectively.

Table 1.7: Robustness Checks: Checking for Compositional Changes

	(1)	(2)	(3)	(4)
Panel A: Dependent Variable is Log (Predicted Wage)				
Post*Firm Size (5 to 8)	0.00799	0.00145	-0.000362	-0.00322
	(0.00788)	(0.00799)	(0.00866)	(0.00883)
Firm Size (5 to 8)	0.00178	0.00913	0.0133**	-0.000308
	(0.00601)	(0.00599)	(0.00658)	(0.00676)
Observations	48,269	48,269	48,269	48,245
R-squared	0.001	0.001	0.002	0.001
Panel B: Dependent Variable is Log (Predicted Wage)				
Post*Firm Size (9 or more)	0.0314***	0.0364***	0.0337***	0.0195*
	(0.00940)	(0.00929)	(0.00979)	(0.0102)
Firm Size (9 or more)	0.0157**	0.0203***	0.0392***	0.00815
	(0.00710)	(0.00671)	(0.00739)	(0.00713)
Observations	45,760	45,760	45,760	45,744
R-squared	0.004	0.005	0.007	0.002
Variables included in the First Stage Regressions				
Individual Controls	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Region Dummy	No	Yes	Yes	Yes
Province FE	No	Yes	Yes	Yes
Occupation FE	No	No	Yes	No
Industry FE	No	No	No	Yes

Predicted wages are based on pre-period observations. The first stage regressions do not include quarter fixed effects. The second stage regressions includes firm-size dummy, firm-size dummy interacted with the post period dummy and quarter fixed effects. Post is a dummy variable that takes a value of one starting 2008:4 (a quarter after the policy change). Firm size (5 to 8 or more) takes a value of 1 for all workers employed in firms with 5 to 8 employees and a value of 0 for all workers in firms with 4 or fewer employees. Firm size (9 or more) takes a value of 1 for all workers employed in firms with 9 or more employees and a value of 0 for all workers in firms with 4 or fewer employees. Individual characteristics include completed years of education, age, a quadratic in age and a dummy for being currently married. The regional dummy equals 1 for urban areas and zero for rural areas. The excluded industrial category is manufacturing and the excluded province is Punjab. Standard errors, reported in parentheses, are clustered at the level of the primary sampling unit and year. All regressions are weighted. ***,**,* indicates statistical significance at the 1%, 5% and 10% levels, respectively.

Table 1.8: Average Differences in Labor Market Outcomes with no Controls

Panel A: Log (Real Wage per Week)

	Before	After	Difference		Before	After	Difference
Control (Up to 4)	6.4816	6.4771	-0.0045	Control (Up to 4)	6.4816	6.4771	-0.0045
	(0.0095)	(0.0073)	(0.0109)		(0.0095)	(0.0073)	(0.0109)
	[17615]	[23715]	[41330]		[17615]	[23715]	[41330]
Treatment (5 to 8)	6.5740	6.5289	-0.0452	Treatment (9 or more)	6.6398	6.5841	-0.0557
	(0.0179)	(0.0170)	(0.0226)		(0.0256)	(0.0185)	(0.0306)
	[2832]	[3456]	6288		[1872]	[1951]	[3823]
Difference	0.0925	0.0518	-0.0407*	Difference	0.1582	0.1070	-0.0512*
	(0.0185)	(0.0172)	(0.0238)		(0.0252)	(0.0192)	(0.0308)
	[20447]	[27171]	[47618]		[19487]	[25666]	[45153]

Panel B: Log (Hours per Week)

	Before	After	Difference		Before	After	Difference
Control (Up to 4)	3.9259	3.9180	-0.0079	Control (Up to 4)	3.9259	3.9180	-0.0079
	(0.0034)	(0.0031)	(0.0043)		(0.0034)	(0.0031)	(0.0043)
	[17762]	[23997]	[41759]		[17762]	[23997]	[41759]
Treatment (5 to 8)	3.9425	3.9258	-0.0167	Treatment (9 or more)	3.9414	3.9490	0.0075
	(0.0061)	(0.0072)	(0.0092)		(0.0087)	(0.0091)	(0.0121)
	[2828]	[3478]	[6306]		[1861]	[1948]	[3809]
Difference	0.0166	0.0079	-0.0088	Difference	0.0155	0.0310	0.0155
	(0.0063)	(0.0073)	(0.0093)		(0.0091)	(0.0094)	(0.0125)
	[20590]	[27475]	[48065]		[19623]	[25945]	[45568]

The number of observations are in square brackets. Standard errors are reported in parentheses and are clustered at the level of the primary sampling unit. All statistics are weighted by probability weights.

Table 1.9: Difference in Difference Estimates for Firms with 5 to 8 Employees

	(1)	(2)	(3)	(4)
Panel A: Dependent Variable is Log (Real Wage per Week)				
Post*Firm Size (5 to 8)	-0.0493**	-0.0445*	-0.0408*	-0.0402*
	(0.0246)	(0.0242)	(0.0242)	(0.0241)
Firm Size (5 to 8)	0.0937***	0.0909***	0.0853***	0.115***
	(0.0181)	(0.0178)	(0.0179)	(0.0180)
Observations	47,525	47,525	47,525	47,501
R-squared	0.099	0.103	0.125	0.138
Panel B: Dependent Variable is Log (Hours per Week)				
Post*Firm Size (5 to 8)	-0.00842	-0.00721	-0.00876	-0.00441
	(0.00965)	(0.00950)	(0.00916)	(0.00895)
Firm Size (5 to 8)	0.0138**	0.00679	0.0266***	0.0141**
	(0.00649)	(0.00639)	(0.00629)	(0.00612)
Observations	47,972	47,972	47,972	47,948
R-squared	0.009	0.029	0.130	0.160
Individual Controls	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Region Dummy	No	Yes	Yes	Yes
Province FE	No	Yes	Yes	Yes
Occupation FE	No	No	Yes	No
Industry FE	No	No	No	Yes

The estimates are based on individual level self-reported wages and employee reported firm size information. The sample includes all employees in individual ownerships. 'Post' is a dummy variable that takes a value of one starting 2008:4 (a quarter after the policy change). Firm size (5 to 8 or more) takes a value of 1 for all workers employed in firms with 5 to 8 employees and a value of 0 for all workers in firms with 4 or fewer employees. Individual characteristics include completed years of education, age, a quadratic in age and a dummy for being currently married. The regional dummy equals 1 for urban areas and zero for rural areas. The excluded industrial category is manufacturing and the excluded province is Punjab. Standard errors, reported in parentheses, are clustered at the level of the primary sampling unit and year. All regressions are weighted. ***,**,* indicates statistical significance at the 1%, 5% and 10% levels, respectively.

Table 1.10: Probit Average Marginal Effects: Employment in Firms with 5 to 8 employees

	(1)	(2)	(3)	(4)
Panel A: Without Time Trends				
Post	-0.0101*	-0.00901	-0.00827	-0.0160***
	(0.00598)	(0.00591)	(0.00587)	(0.00577)
Panel B: With Time Trends				
Post	-0.00885	-0.00882	-0.00840	-0.0111
	(0.0127)	(0.0126)	(0.0126)	(0.0118)
Time	0.00370	0.00391	0.00417	0.00273
	(0.00265)	(0.00261)	(0.00261)	(0.00242)
Time Squared*100	-0.0187*	-0.0193*	-0.0204**	-0.0158*
	(0.0102)	(0.0100)	(0.0100)	(0.00938)
Observations	48,269	48,269	48,269	48,243
Individual Controls	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Region Dummy	No	Yes	Yes	Yes
Province FE	No	Yes	Yes	Yes
Occupation FE	No	No	Yes	No
Industry FE	No	No	No	Yes

The sample includes all employees in individual ownerships. Post is a dummy variable that takes a value of one starting 2008:4 (a quarter after the policy change). The dependent variable takes a value of 1 for all workers employed in firms with 5 to 8 employees and a value of 0 for all workers in firms with 4 or fewer employees. Individual characteristics include completed years of education, age, a quadratic in age and a dummy for being currently married. The regional dummy equals 1 for urban areas and zero for rural areas. The excluded industrial category is manufacturing and the excluded province is Punjab. Standard errors, reported in parentheses, are clustered at the level of the primary sampling unit and year. All regressions are weighted. ***,**,* indicates statistical significance at the 1%, 5% and 10% levels, respectively. I also run a probit and logit specification. The results are similar.

Table 1.11: Estimates for Firms with 9 or more employees as the Treated Group

	(1)	(2)	(3)	(4)
Panel A: Dependent Variable is Log (Real Wage per Week)				
Post*Firm Size (9 or more)	-0.0756**	-0.0721**	-0.0747**	-0.0598**
	(0.0302)	(0.0309)	(0.0300)	(0.0300)
Firm Size (9 or more)	0.141***	0.146***	0.118***	0.180***
	(0.0248)	(0.0252)	(0.0246)	(0.0256)
Observations	45,060	45,061	45,060	45,044
R-squared	0.100	0.097	0.124	0.139
Panel B: Dependent Variable is Log (Hours per Week)				
Post*Firm Size (9 or more)	0.0152	0.0147	0.0119	0.0199
	(0.0128)	(0.0129)	(0.0127)	(0.0126)
Firm Size (9 or more) 0.0130	0.0116	0.0374***	0.00974	
	(0.00891)	(0.00924)	(0.00912)	(0.00907)
Observations	45,475	45,476	45,475	45,460
R-squared	0.009	0.027	0.126	0.156
Individual Controls	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Region Dummy	No	Yes	Yes	Yes
Province FE	No	Yes	Yes	Yes
Occupation FE	No	No	Yes	No
Industry FE	No	No	No	Yes

The estimates are based on individual level self-reported wages and firm size information. The sample size consists of all paid employees in individual ownerships. Post is a dummy variable that takes a value of one starting 2008:4 (a quarter after the policy change). Firm size (9 or more) takes a value of 1 for all workers employed in firms with 9 or more employees and a value of 0 for all workers in firms with 4 or fewer employees. Individual characteristics include completed years of education, age, a quadratic in age and a dummy for being currently married. The regional dummy equals 1 for urban areas and zero for rural areas. The excluded industrial category is manufacturing and the excluded province is Punjab. Standard errors, reported in parentheses, are clustered at the level of the primary sampling unit and year. All regressions are weighted. ***,**,* indicates statistical significance at the 1%, 5% and 10% levels, respectively.

Table 1.12: Probit Average Marginal Effects: Employment in Firms with 9 or more employees

	(1)	(2)	(3)	(4)
Panel A: Without Time Trends				
Post	-0.0199***	-0.0200***	-0.0180***	-0.0210***
	(0.00601)	(0.00584)	(0.00545)	(0.00421)
Panel B: With Time Trends				
Post	-0.00853	-0.00871	-0.00759	-0.0117
	(0.0121)	(0.0117)	(0.0109)	(0.00821)
Time	-0.00490*	-0.00527**	-0.00470**	-0.00406**
	(0.00253)	(0.00244)	(0.00229)	(0.00163)
Time Squared*100	0.0187*	0.0205**	0.0182**	0.0156**
	(0.00988)	(0.00954)	(0.00890)	(0.00645)
Observations	45,760	45,760	45,760	45,744
Individual Controls	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Region Dummy	No	Yes	Yes	Yes
Province FE	No	Yes	Yes	Yes
Occupation FE	No	No	Yes	No
Industry FE	No	No	No	Yes

The sample size contains all workers in individual ownerships. Post is a dummy variable that takes a value of one starting 2008:4 (a quarter after the policy change). The dependent variable takes a value of 1 for all workers employed in firms with 9 or more employees and a value of 0 for all workers in firms with 4 or fewer employees. Individual characteristics include completed years of education, age, a quadratic in age and a dummy for being currently married. The regional dummy equals 1 for urban areas and zero for rural areas. The excluded industrial category is manufacturing and the excluded province is Punjab. Standard errors, reported in parentheses, are clustered at the level of the primary sampling unit and year. All regressions are weighted. ***,**,* indicates statistical significance at the 1%, 5% and 10% levels, respectively.

Table 1.13: Percentage of Employees Earning Real Wages Strictly Below the Real Minimum Wage

Firm Size Category	2006-07	2007-08	2008-09	2009-10	2010-11	Total
Up to 4	49.20	52.25	55.36	42.86	51.09	50.10
5 to 8	40.86	44.71	47.72	39.92	47.31	44.23
9 or more	34.85	39.36	42.36	32.95	45.85	38.89

Quantitatively the percentages fall by 3 to 4 percentage points when I take nominal wages and compare them to the nominal minimum wage. All statistics are weighted.

Table 1.14: Level of Non-compliance: Average Real Wage as a Fraction of the Real Minimum Wage

Firm Size Category	Before	After
Up to 4	1.191	1.159
	(1.139)	(1.016)
5 to 8	1.298	1.216
	(1.155)	(1.025)
9 or more	1.429	1.252
	(1.392)	(0.869)

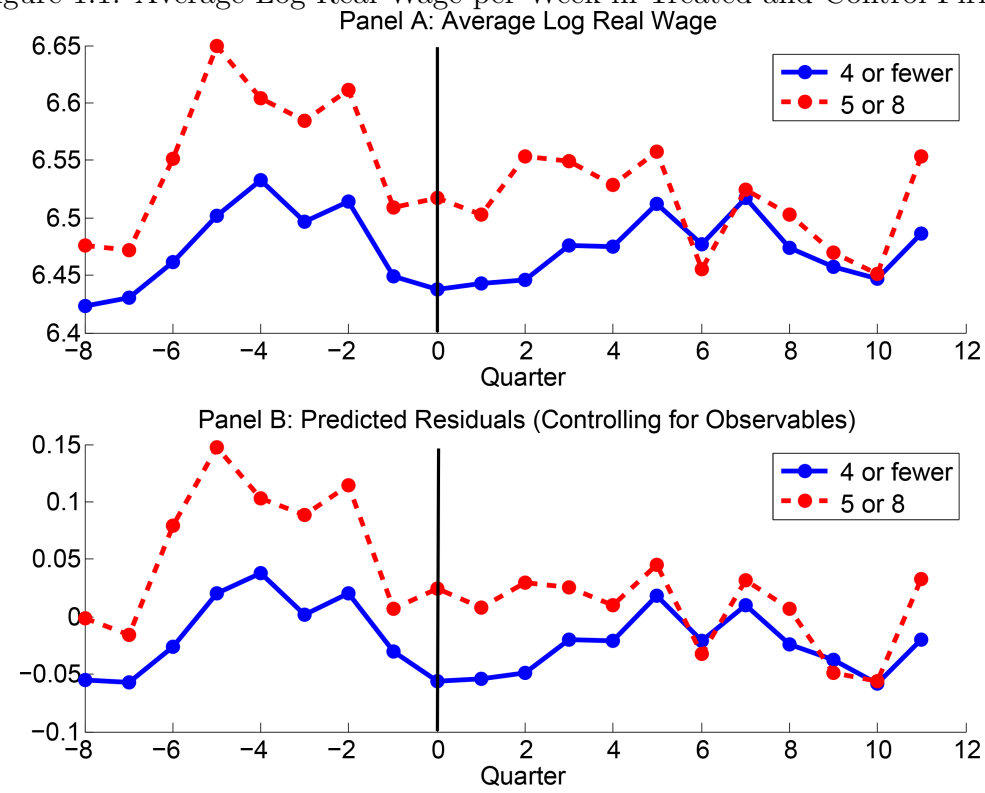
Standard deviation in parentheses. All statistics are weighted.

Table 1.15: Probability of Earning Real Wages Below the Real Minimum Wage

	(1)	(2)	(3)	(4)
Panel A: First Treatment				
Post*Firm Size (5 to 8)	0.0357*	0.0300	0.0291	0.0295
	(0.0214)	(0.0211)	(0.0219)	(0.0216)
Firm Size (5 to 8)	-0.0813***	-0.0776***	-0.0756***	-0.0922***
	(0.0156)	(0.0154)	(0.0162)	(0.0157)
Observations	47,673	47,673	47,673	47,647
Panel B: Second Treatment				
Post*Firm Size (9 or more)	0.0806***	0.0774***	0.0861***	0.0753***
	(0.0271)	(0.0271)	(0.0269)	(0.0270)
Firm Size (9 or more)	-0.136***	-0.140***	-0.116***	-0.150***
	(0.0203)	(0.0200)	(0.0203)	(0.0201)
Observations	45,200	45,201	45,200	45,181
Individual Controls	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Region Dummy	No	Yes	Yes	Yes
Province FE	No	Yes	Yes	Yes
Occupation FE	No	No	Yes	No
Industry FE	No	No	No	Yes

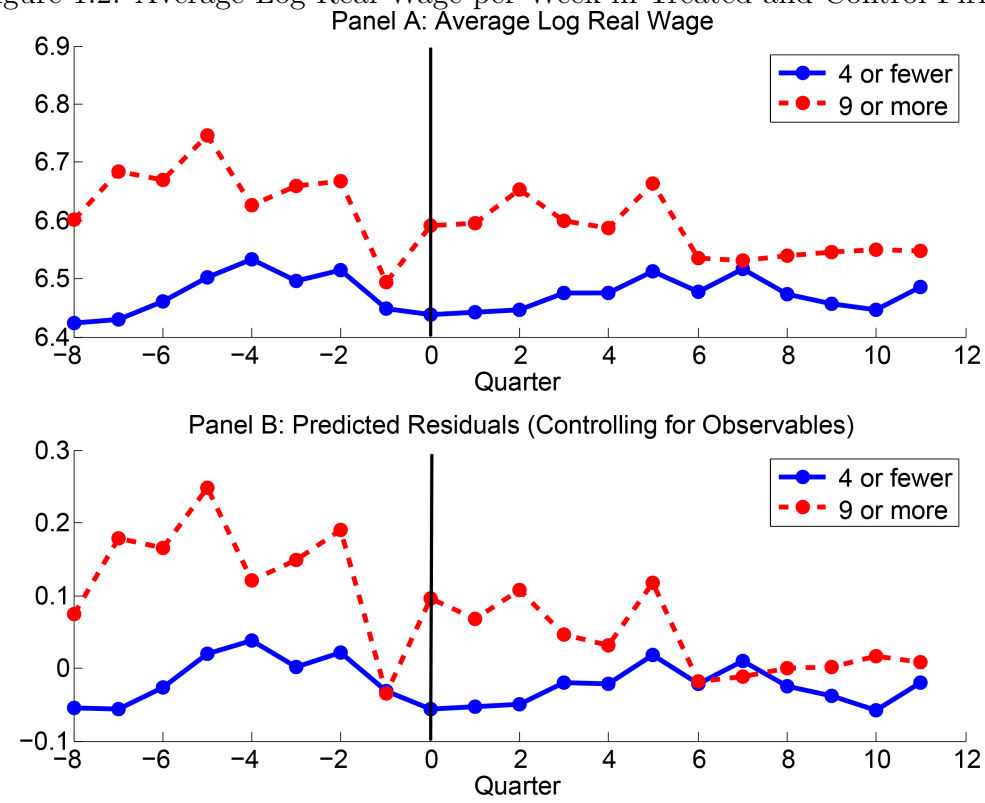
The estimates are based on individual level self-reported wages and firm size information. The dependent variable takes a value of 1 for workers earning wages strictly below the minimum wage and a value of zero for workers earning wages at or below the minimum wage. The first treatment refers to the size contingent policy change with workers in 5 to 8 employee firms as the treated group and workers in 4 or fewer employee firms as the control group. the second treatment refers to the increase in the level of social security contributions, with 9 or more employee firms as the treated group and 4 or fewer employee firms as the control group. Post is a dummy variable that takes a value of one starting 2008:4 (a quarter after the policy change). Individual characteristics include completed years of education, age, a quadratic in age and a dummy for being currently married. The regional dummy equals 1 for urban areas and zero for rural areas. The excluded industrial category is manufacturing and the excluded province is Punjab. Standard errors, reported in parentheses, are clustered at the level of the primary sampling unit and year. All regressions are weighted. ***,**,* indicates statistical significance at the 1%, 5% and 10% levels, respectively.

Figure 1.1: Average Log Real Wage per Week in Treated and Control Firms.



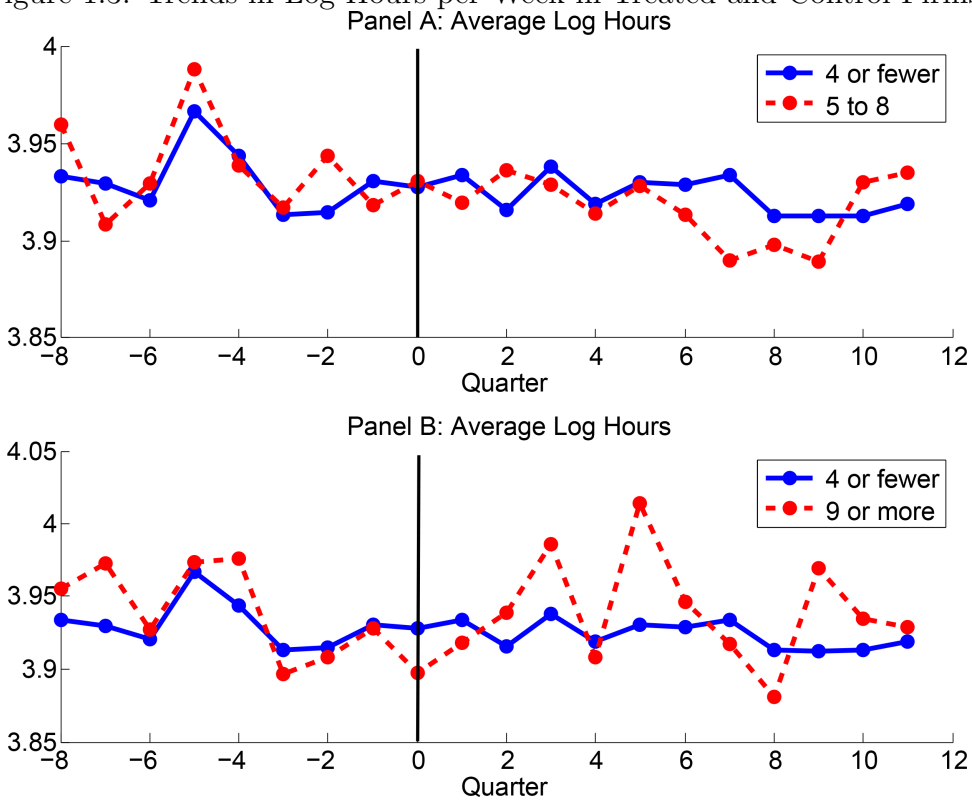
The figure displays average trends. For Panel B, the observable characteristics include age, a quadratic in age, education and a dummy for being married.

Figure 1.2: Average Log Real Wage per Week in Treated and Control Firms.



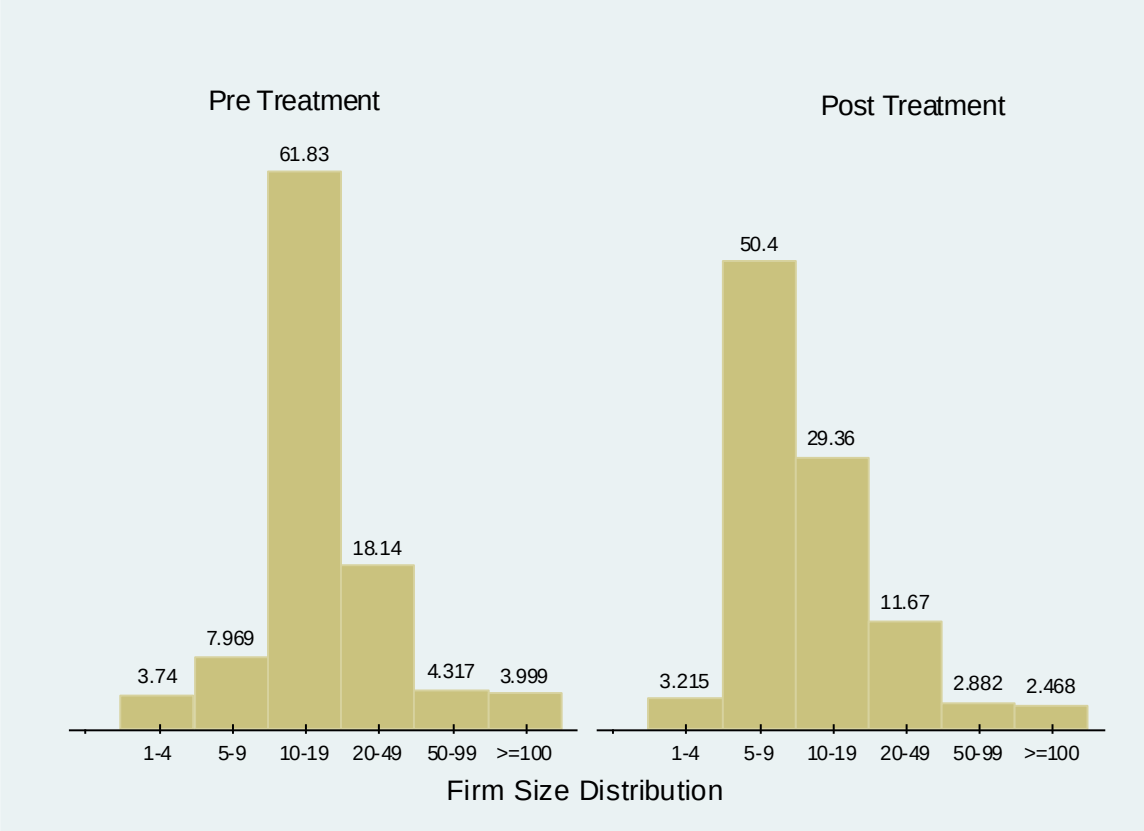
The figure displays average trends. For Panel B, the observable characteristics include age, a quadratic in age, education and a dummy for being married.

Figure 1.3: Trends in Log Hours per Week in Treated and Control Firms.



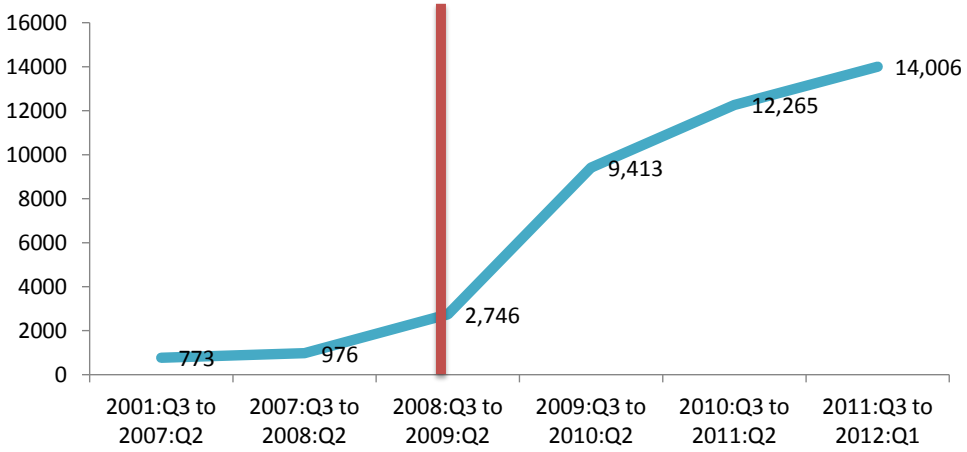
The figure displays average trends. For Panel B, the observable characteristics include age, a quadratic in age, education and a dummy for being married.

Figure 1.4: Firm Size Distribution: EOBI Employer Registration Data



The numbers on the top of the bars represent percentages. Firm-size categories are constructed as such by the author.

Figure 1.5: Cumulative Firm Registrations from July 2001 to June 2012



All firms with 5 to 9 employees are included in the sample. The vertical line indicates the year of the policy change.

CHAPTER 2

SOCIAL SECURITY IN A DEVELOPING COUNTRY: IMPLICATIONS FOR LABOR SUPPLY AND WELFARE FROM A DYNAMIC LIFE-CYCLE MODEL

2.1 Introduction

The aim of a well-designed social security system is to protect individuals from acute deprivation or inadvertent decline in income due to old-age, disability or the death of family members (Mahmood and Nasir, 2008). These concerns are of particular importance in a developing country where the welfare safety net for the elderly is limited, and poverty levels are high. One of the policies proposed in such settings relates to the provision of universal social security, which ensures a minimum level of income for all (Holzmann and Hinz, 2005). The motivation behind the provision of universal social security is well-founded, however, there are financial and practical limitations in implementing it. Moreover, a number of developing countries are already operating social security systems that are not financially sustainable in the long-run (Mahmood and Nasir, 2008). A majority of these countries have pay-as-you-go (PAYG) pension systems, whereby the current young pay contributions that are used to finance social security benefits for the current old. With increases in life-expectancy, these systems are becoming harder to sustain.[1] Provision of universal social protection on top of these systems may lead to a higher social security deficit. Instead, it may be more useful to institute reforms that encourage labor force participation at older ages, and maintain a system where the current young do not bear excessive burdens of social security provisions.

One of the most useful ways to evaluate policy proposals in settings where labor force participation decisions at younger ages affect labor market outcomes at older ages is through the use of dynamic life-cycle models of labor supply (Rust and Phelan, 1997).[2] Against this backdrop, I develop and estimate a dynamic structural model to examine the labor supply effects of social security reforms over the life-cycle. In the model, behavior is rationalized as the outcome of an individual-level optimization problem. It is therefore possible to leverage the individual-level decision-making framework to obtain conclusions concerning the welfare effects of Social Security.

[1] In Pakistan, life expectancy at birth has increased by 4.5 years in the last decade, from 61.07 in the year 2000 to 66.35 in 2012 (see CIA World Fact Book, 2012).

[2] Several papers have examined labor supply behavior using dynamic life-cycle models of individual behavior. See for instance Krueger and Pischke (1992), French (2005), van der Klaauw and Wolpin (2008), **?**, Jimenez-Martin and Sanchez-Martin (2007), Gustman and Steinmeier (2005), Casanova (2010), French and Jones (2011) and Haan and Prowse (2011).

The proposed model is formulated to capture the institutional reality of the current social security system, and to represent accurately the nature of the labor market in Pakistan. Notably, the model includes; (i) segmented labor market opportunities, specifically individuals may be employed in a job covered by social security (covered employment), employed in a job not covered by social security (uncovered employment) or may be self employed; (ii) unemployment or non-participation; (iii) the working history and age-related requirements for social security eligibility; and (iv)opportunities to simultaneously work and receive social security.[3]

Note that I model worker's participation decision at the extensive margin. Figure 2.1 and 2.2 show that even though both margins are important, most changes in life-cycle labor supply occur along the extensive margin.[4] While participation rates drop dramatically between the age of 60 and 64 years, hours worked drop much more modestly. Table 2.1 shows the distribution of hours worked for the sample of older workers. The table reveals that even at ages 60-64, most workers are working full-time, underscoring the importance of examining labor supply at the extensive margin.

In the model, individuals cannot save. Moreover, they cannot borrow against future social security income. Thus, I closely follow the methodology used in Rust and Phelan (1997).[5] Exclusion of savings decisions from the model is justifiable on two grounds. First, for a majority of the individuals in my sample, their only pension is the social security benefit provided by the Employees' Old Age Benefits Institution.[6] Second, due to underdeveloped private insurance and annuity markets in Pakistan, a majority of the individuals are likely to be credit constrained (Mahmood and Nasir, 2008).

[3]The standard model that treats retirement as an absorbing state is unable to explain the labor supply behavior of older credit-constrained individuals who may stay in the labor market or re-enter the labor market after applying for social security benefits (Rust and Phelan, 1997). In a country like Pakistan, this is especially true because re-entering the labor market does not affect the benefit receipt, and if individuals choose to enter covered sector jobs, they are not obligated to pay social security taxes after age 60. However, if non-labor income or transfer income from family and informal social networks are enough to keep older workers from working, they may choose to stay out of the labor market once they claim social security benefits.

[4]French and Jones (2012) assert that low variability along the hours worked margin owes to the fixed cost of working, both for the workers and/or for employers. There exists reasonably robust evidence of labor supply responsiveness to marginal social security benefits at the extensive margin, while evidence on the intensive margin is more mixed (Liebman et al., 2008).

[5]Rust and Phelan (1997) examine labor supply and retirement decisions of individuals in the presence of incomplete insurance markets and credit constraints. They focus on low to middle income workers in the United States whose only pension is Social Security, i.e. individuals do not have the possibility to save for retirement.

[6]These individuals do have access to other sources of income such as non-labor income and transfer income, which is explicitly accounted for in the model estimation.

In a non-stochastic finite horizon model of labor supply, the provision of social security can be welfare enhancing due to two reasons. First, for individuals that are unable to save due to underdeveloped capital and insurance markets, social security provides a mechanism to smooth consumption and insure against negative income shocks in old-age. Second, for individuals that save too little, social security acts as a forced savings mechanism that helps to redistribute income from younger to older ages.[7]

The empirical analysis and estimation is performed by drawing samples from the Household Integrated Economic Survey for the year 2007-08, the Pakistan Labor Force Survey for the year 2007-08, and the Pakistan Socio-Economic Survey for the years 1998-99 and 2000-01. I validate the model using restricted access data from the Employees' Old Age Benefits Institution (EOBI) which contains employer and employee-level information on pension benefits and accumulated covered sector experience. In the estimation, I restrict the sample to male household heads between the age of 25 and 75 years.

I estimate the parameters of the model using the Method of Simulated Moments (MSM), whereby parameter estimates are chosen to minimize the distance between a set of moments that pertain to the values of the endogenous variables observed in the data, and the average values of the same moments in a number of simulated data sets.[8] Each simulated data set is constructed using the empirical distribution of exogenous individual level characteristics, such as age, education and marital status, that are observed in the sample. Given an initial value of the parameter vector θ_t, I use a reduced-form model to simulate the initial values of the endogenous variables. I then use the structural model as the basis for simulating wage offers and employment choices in subsequent time periods. When simulating data sets, the value function is approximated using a Rust (1994) style dynamic programming framework. The advantage of MSM is that it allows for matching moments from different data sets in one unified model. This is particularly useful in my case, as no single data set contains the necessary information on all the variables of interest.

The estimation results provide the basis for policy simulations designed to explore the behavioral effects of social security reform. There are two broad categories of social security reforms that may be implemented in a given setting, namely; parametric reforms, and reforms to the structure of the social security system.[9] For the purposes of this paper, I restrict my attention to parametric reforms. To evaluate the welfare effects of these reforms, I use two different measures. The first is a simple aggregation of utilities across all individuals

[7] I indeed find that removing all social security provisions from the system results in a welfare reduction. The results are available on request.

[8] The solution method has been widely used in life-cycle models of labor supply and retirement (see French (2005), French and Jones (2011), Haan and Prowse (2011).

[9] For a detailed discussion of the various types of reforms, see Holzmann and Hinz (2005).

and all time periods. The second is a money-metric measure of welfare known as intercept-income. Intercept income is used to compare welfare in models with both workers and non-workers, and is equal to the level of income required by the unemployed to obtain a similar level of utility as the employed (Preston and Walker, 1999).

I perform three sets of policy experiments. The first set of policy experiments examine the labor supply effects of the most common reforms made to EOBI rules through the Finance Acts and Bills passed by the government. These include (i) changes in the minimum value of social security benefits payable to entitled individuals, and (ii) increases in the minimum wage. Under the EOBI social security system, minimum wage is equal to maximum taxable earnings level. Moreover, the minimum wage serves as the covered earnings cap for social security benefit calculation. Thus an increase in the minimum wage increases both the costs and benefits of social security.[10]

In case of (i) above, I find that a 50% increase in the real minimum pension increases covered sector employment for workers age 25 to 59 years by 0.026 percentage points. 76.9% of the workers who join the covered sector are drawn from uncovered wage employment, while the remaining 23.1% are drawn from the pool of unemployed and inactive workers. For older workers age 60-75 years, labor force participation falls as a consequence of higher pension benefits. In case of (ii) above, I find that a 25% increase in the real minimum wage decreases labor supply in the covered sector for workers age 25 to 59 years by 0.9 percentage points. A majority of the individuals who leave the covered sector choose to become self-employed, while some join smaller firms in the uncovered sector. Moreover, as a consequence of an increase in pension benefits (due to an increase in the earnings cap for benefit calculation), labor force participation of older workers decreases after the policy change. This implies that higher pension benefits induce early withdrawal from the labor market. Overall, the increase in benefit outgo exceeds the increase in contributions, which increases the deficit by 20%. Note that the experiment abstracts away from the labor demand and wage effects of changes in the minimum wage.

The labor supply effects of changes in the minimum pension benefit are smaller in magnitude as compared to the labor supply effects of an increase in the minimum wage. Thus, deficit increase in the former is much lower than the deficit increase in the latter; 4.29% in the former as compared to 20% in latter. This is because changes in minimum pension only affect workers at the lower end of the experience distribution.

[10]A change in the minimum wage may affect labor demand and in turn actual wages. However, I do not model labor demand explicitly. Thus, all the effects in the paper are partial equilibrium effects. In particular, minimum wage only affects the tax base and the base wage for benefit calculation.

Both experiments show that increasing the generosity of pension benefits decreases labor supply at older ages. Moreover, both policy changes exert a positive impact on welfare. More importantly, an increase in the minimum pension leads to a higher increase in intercept income as compared to the minimum wage increase, while the minimum wage increase leads to a higher increase in aggregate utility.

The second set of policy experiments evaluate social security reforms that are usually proposed to increase labor force participation at older ages. These include (i) an increase in the age of retirement with an actuarial adjustment for delaying the benefit receipt, and (ii) an increase in the number of years required for pension eligibility. In case of delay in the benefit receipt, if individuals at the participation margin are compensated for delaying the benefit receipt, they are likely to respond by working more. If however, there are other health related costs to working at older ages, they may choose to stay out of the labor force. In case of changes to the eligibility requirements, individuals who value pension benefits are likely to increase labor force participation to acquire the extra years needed for social security eligibility. This is also true because each extra year adds more to the benefit receipt than it does to the cost. However, individuals may choose to stop working once they acquire the minimum number of years for social security eligibility, in which case we may not witness an increase in labor force participation.

I find that an increase in the age of benefit entitlement does not help to increase labor force participation at older ages. Instead, the policy encourages workers to leave the labor force earlier than they otherwise would have. However, I do find that making pension eligibility requirements more stringent increases labor force participation at older ages. Moreover, both policies help to reduce EOBI deficit, but the lower deficit comes at the cost of welfare reduction. In terms of magnitudes, I find that both deficit reduction and welfare reduction are higher in the policy that increases the retirement age, as compared to the policy that increases required covered sector experience for social security eligibility.

The third set of policy simulations are guided by the financial concerns of the social security institution, and the potential threat to the insolvency of the EOBI fund in the long run. Given that the status quo is not sustainable over the long term, I propose various deficit reduction strategies, with an emphasis on the behavioral and welfare effects of the proposed policy changes. I examine four policies that reduce the deficit by the same amount, but exert differential effects on labor supply and welfare. These include (i) a two year increase in the age of benefit entitlement; (ii) a reduction in the generosity of pension; (iii) an increase in the payroll tax rate, and (iv) removal of the maximum earnings cap for social security contributions along with a downward adjustment to the payroll tax rate.

I find that increasing the age of benefit entitlement reduces welfare the most, irrespective of the measure of welfare used. Second, raising the payroll tax rate reduces welfare by less than the welfare reduction under the retirement age change, but more than the reduction in the other two policies; one that reduces the generosity of pension benefits, and the other that eliminates the earnings cap for social security contributions while adjusting the payroll tax rate downwards. Third, the results vary by the metric used to evaluate welfare changes. If the sum of utilities is the preferred welfare measure, the policy that eliminates the earnings cap for social security contributions along with a downward adjustment to the payroll tax rate serves as the best policy solution. However, in terms of intercept income, a reduction in the generosity of pension benefits is the best alternative.

This paper makes several contributes to the existing literature. First, it adds to the literature on dynamic life-cycle models of labor supply in the context of a low income developing country in South Asia. Much of the previous work has focused on Social Security in the United States and other developed countries(see for instance Rust and Phelan (1997); French (2005); van der Klaauw and Wolpin (2008); Gustman and Steinmeier (2005); Casanova (2010); Haan and Prowse (2011); Heiland and Li (2012)), or on major Social Security reform episodes in Latin America (see Joubert (2012)). Second, this paper adds to the literature on segmented labor market models. Segmentation is an important feature of developing country labor markets, and separately modeling employment choices for formal and informal sector jobs, as well as the recognition of the internal duality of the informal sector has important consequences for policy analysis (see **?** for a review). Third, this is the first paper that studies social security policies in Pakistan in the context of a structural model of labor supply. Structural estimation of preference parameters helps to evaluate future policy proposals, with an explicit recognition of variation in labor supply elasticities over the life-cycle, and the welfare effects of social security reform. Previous studies on the topic have either taken a more descriptive focus, detailing social security rules and provisions currently in place (see **?**), or have proposed optimal asset allocation decisions for the EOBI pension fund (see Rehman (2010)). The former provide a holistic view of the social security system in Pakistan, identifying the areas that need greater attention by the government. The latter studies recognize the long term insolvency threats faced by the Social Security Institution, and realize the need to reform the structure of the system in a way that makes it financially sustainable over the long run. None of the studies evaluate social security policies with a supply side focus. This paper is a modest attempt to fill this gap in the literature.

The rest of the paper is organized as follows. Section II details the institutional context and social security rules. Section III describes the model and the solution method, while Section IV describes the data

used in the estimation. The estimation method and results are presented in Section V, Section VI describes the policy experiments, and Section VII concludes.

2.2 Institutional Context

Prior to 1976, the Social Security system in Pakistan only covered workers employed in the formal sector; mainly government employees and workers in large incorporated enterprises. Workers employed in the informal sector were thus forced to rely on private savings and family help during old-age. In an attempt to extend Social Security coverage to the uncovered working population, the Government introduced the Employees' Old Age Benefits Act on July 1, 1976. At the time of inception, the Employees' Old Age Benefits Act was applicable to all non-agricultural private sector establishments employing 10 or more workers. On July 1, 2008 the law was extended to all firms employing 5 or more workers.

Following the enactment of the Act, the government established The Employees' Old Age Benefits Institution (EOBI); the social security institution responsible for collecting contributions and disbursing pension benefits. EOBI follows a pay-as-you-go pension system where both employers and employees in the covered sector pay social security contributions at a fixed percentage of the actual wage, or the minimum wage, whichever is lower. A summary of the amendments to the contribution rate is presented in the Table 2.2. As I use data for the year 2007-08 for model estimation, I consider workers in firms with 10 or more employees as part of the covered sector, and take the payroll tax rate as 7% (6% by the employer and 1% by the employee).

Conditional on 15 years of covered sector employment, individuals are entitled to receive an old-age pension equal to 2% of the average wage drawn during the last year of insurable employment or the average minimum wage, whichever is lower, times the number of years of insurable employment. Individuals are eligible to receive social security benefits starting age 60. Retirement is not an absorbing state and an individual can choose to continue working after retirement. Retired individuals are not required to pay social security contributions if they choose to re-enter covered sector employment. In addition to old-age pension, EOBI also provides a lump-sum payment at the time of retirement to all individuals with 3 to 14 years of insurable employment. The lump-sum is a one-time payment equal to the lower of the average monthly wage drawn in the last year of insurable employment, or the minimum wage, times the number of years of insurable employment.

2.3 Model

Following Rust (1994), French (2005) and Casanova (2010), I propose a discrete-time finite-horizon model where decisions are made at yearly intervals. Individuals are forward-looking and make labor supply decisions with full understanding of the likely implications of their current decisions for future income streams. Individuals are indexed by $i = 1, ..., N$, and age is indexed by t. The maximum possible age to which an individual can live is denoted by T. Agents in the model are male household heads between the age of 25 and 75 years (i.e. $T = 76$). Survival probabilities are set equal to one, and individuals can neither save nor borrow against future social security income. Moreover, labor demand is held fixed in the model.

Although conceptually simple, the model is a powerful analytical tool. The structural nature of the model allows for a tractable exploration of the impact of pension reforms on individual labor supply decisions and aggregate welfare.

2.3.1 Choice Set

At each discrete time period t, individuals make discrete choices which represent the labor force participation decision. Non-participation is not an absorbing state, and individuals can go back to work after periods of inactivity. However, in each time period, if the individual decides to work, he works full time. At each time period t, given the institutional and labor market constraints, an individual has the choice of working in three labor market segments; covered wage employment denoted by c, uncovered wage employment denoted by uc, self-employment denoted by se, or to remain unemployed/out of the labor force, denoted by ue.[11] Thus, the set of four discrete alternatives available to individual i at time t is defined by

$$\mathcal{D}_t^i = \{c, uc, se, ue\} \quad for \quad i = 1, ..., N \quad and \quad t = 1, ..., T-1$$

[11] In the analysis that follows, I use unemployment to mean all workers that are unemployed or out of the labor force. Thus, all retired individuals are part of the unemployment category.

2.3.2 State Space

The state space in period t consists of variables that are observed by the agent and the econometrician, as well as the variables that are observed by the agent, but not by the econometrician. The vector of observed state variables is given by:

$$x_t = \{\mu_t, \psi_t, w_t, E_{Rt}, age_t\}$$

where μ_t denotes non-labor income, ψ_t denotes net transfer income, and w_t denotes real wage in the covered and uncovered sectors, and real income in self-employment. E_{Rt} denotes covered sector experience at the time of retirement, and age_t is individual $i's$ age in years, where $t = 1$ corresponds to age 25, and $t = T - 1$ corresponds to age 75.

The unobserved state variables are given by a vector of preference shocks associated with each discrete alternative chosen by the individual.

$$\varepsilon_t = \{\varepsilon_t(d_t) \mid d_t \in D\}$$

where $\varepsilon_t(d_t)$ affects the utility derived from alternative d at time t, and is known to the individual when making decisions.

2.3.3 Preferences

Consider an individual who seeks to maximize his expected lifetime utility at each age $t = 1, 2, ...T - 1$. Each period an individual receives utility, $U_{i,t}$, from consumption $C_{i,t}$, and leisure $L_{i,t}$, plus an unobserved component $\varepsilon_t(d_t)$, associated to the discrete choice and assumed known to the individual. Leisure is set equal to zero for all employed individuals, and equal to one for the unemployed. Thus, $L_{i,t} = 0$ for $d = c, uc, se$ and $L_{i,t} = 1$ for $d = ue$.

Utility Function

Within-period utility function for each individual is assumed non-decreasing and twice differentiable in consumption, $C_{i,t}$, and is given by

$$U(C_{i,t}, x_t, \theta_u) = \alpha log C_{i,t} - \Phi_{i,t}(d,t) + \rho_d \cdot 1.[P(d_{i,t} = k \mid d_{i,t-1} = k) = 1] + \varepsilon^d_{i,t} \tag{2.1}$$

where θ_u is the vector of preference parameters, and α determines the relative share of consumption in the utility function. Below I describe $\Phi_{i,t}(d,t)$ and ρ_d

Cost/Benefit of Employment versus Non-employment and Employment Persistence

In order to account for the demand side factors as well as institutional constraints in the labor market, I include a sector and age-specific cost/benefit of employment, represented by Φ^d_t. Φ^d_t is subtracted from the flow utility in each time period that a worker chooses to work. Note that Φ^d_t can take on both positive and negative values at different ages. If Φ^d_t is positive, it captures the monetary, psychological and time costs associated with finding a job after periods of inactivity, of continuing to work in the same sector of employment, or of moving between various sectors of employment. In self-employment for instance, a positive Φ^d_t may represent high start-up costs, or the cost of running and maintaining a business every year. In the wage sector, for workers who continue working in the same sector from one time period to the next, a positive Φ^d_t represents the cost of maintaining a job with changing labor market conditions. For workers who transition between sectors, Φ^d_t is a useful way to account for search and matching costs in the labor market.

If Φ^d_t is negative, it increases the individual's flow utility over and above the utility from earned income and non-labor income and transfers. Thus, at every age t, Φ^d_t captures the non-pecuniary and unobserved returns from labor force participation in case of workers who decide to seek employment in sector d after periods of inactivity, or for workers who decide to continue working in sector d, or switch to sector d from other sectors.

Once an individual reaches the age of 60 years, Φ^d_t is augmented to take into account the additional

disutility of working at older ages. This can be thought of as health-related cost of working for the elderly and helps explain the low labor force participation rates after the age of 60 years (t=36).

$$\Phi_{i,t}(d,t) = \delta_0^d + \delta_1^d \frac{t}{50} + \delta_2^d (t-35).1[t \geq 36]$$

where δ_0^d is an employment-state specific intercept, δ_1^d captures the age-specific component, and δ_2^d captures the additional constraints associated with working at older ages.

Employment persistence, denoted by ρ_d, where $d = c, uc, se$, is modeled as a fixed parameter that is constant over time and enters the utility function additively.

Permanent Unobserved Heterogeneity in Wage Employment

As stated previously, the cumulative covered sector experience is the primary determinant of social security benefits. However, finding a job in the covered sector is not costless. At each time period t, the individual bears a positive cost of working in the covered sector. Despite the high cost, workers who value social security benefits choose to stay in the covered sector for longer time periods both to fulfill the pension eligibility criteria, and to take advantage of higher pension benefits for every extra year of insurable employment. In order to explicitly model this, I add permanent unobserved heterogeneity to covered sector preferences. The permanent unobserved heterogeneity captures the fact that certain individuals are willing to pay a higher cost of staying or entering covered sector employment in anticipation of future social security benefits.

Permanent unobserved heterogeneity is also an important feature of uncovered sector preferences, and helps to capture a key aspect of segmented labor markets. These theories state that despite barriers to entry in the desirable formal/covered sector, some workers may choose to remain in the unregulated informal sector for longer time periods due to non-pecuniary benefits associated with the job.

Thus, the utility function for individuals in covered and uncovered employment is given by:

$$U_{i,t}^d = \alpha log C_{i,t}^d - \Phi_{i,t}^d + \rho_d \cdot 1.[P(d_{i,t} = k \mid d_{i,t-1} = k) = 1] + \varepsilon_{i,t}^d + \sigma_u^d \zeta_{i,d}$$

where $\zeta_{i,d}$ captures permanent unobserved heterogeneity in sector d, and $d = c, uc$.

2.3.4 Budget Constraints

Individuals receive income from different sources, namely (i) labor income, $w_{i,t}$ if employed; (ii) non-labor income $\mu_{i,t}$; (iii) net transfer income, $\lambda_{i,t}$, and (iv) social security income, $ss_{i,t}$ conditional on fulfilling the eligibility criteria. In the model income is equal to consumption. Below I describe the state specific budget constraints.

Covered Sector

All individuals working in the covered sector are required to pay a monthly contribution towards Social Security at the rate of 7% of the federal minimum wage or the actual wage, whichever is lower. Conditional on 15 years of covered sector employment, individuals are eligible to apply for social security benefits at age 60. Moreover, all workers with 3 to 14 years of covered sector experience are eligible to receive an old-age grant at the time of retirement. In the model, the retirement age is fixed at 60 years (corresponds to $t = 35$ in the model). Retirement however, is not an absorbing state. All retired individuals may choose to continue working after age 60. If individuals choose to work in the covered sector after retirement, they are neither required to make further social security contributions, nor do they receive any additional benefits over and above the ones determined at the age of retirement.

Thus, the budget constraint for an individual i working in covered wage employment at time t is given by:

$$C^c_{i,t} = w^c_{i,t} + \mu^c_{i,t} + \lambda^c_{i,t} - contribution_{i,t}.1[t < 36] + pension_{i,t}.1[t \geq 36] \tag{2.2}$$

where contribution is equal to:

$$contribution_{i,t} = \tau_p.min(w^c_{i,t}, minwage_t)$$

and pension is given by:

$$pension_{i,t} = ss_{i,t}.1[t \geq 36].1[E^c_{i,Rt} \geq 15] + grant_{i,t}.1[t = 36].1[3 \leq E^c_{i,Rt} \leq 14] \tag{2.3}$$

where $w_{i,t}$ denotes real wages net of taxes, $\mu_{i,t}$ represents real non-labor income, and $\lambda_{i,t}$ represents real income from transfers. τ_p is the social security payroll tax, $minwage_t$ is the real minimum wage at time t.

$ss_{i,t}$ denotes pension benefits paid throughout the individual's retired life, while $grant_{i,t}$ denotes the lump-sum payment at the time of retirement. The indicator functions $1[t < 36]$ and $1[t \geq 36]$ capture the fact that social security contributions stop at age 60, and pensions start as soon as the individual retires. The lump-sum grant is a one time payment paid right at the time of retirement, hence the indicator function $1[t = 36]$. $E_{i,Rt}$ denotes covered sector experience at the time of retirement. The indicator function $1[E_{i,Rt} \geq 15]$ captures the requirement of 15 years of covered employment for pension eligibility, and $1[3 \leq E_{i,Rt} \leq 14]$ captures the requirement of 3 to 14 years of covered employment for grant eligibility.

Social security benefits are equal to the maximum of the minimum pension benefit or the benefits calculated through the social security formula, i.e. $ss_{i,t} = max(minpen_t, forpen_{i,t})$, where $minpen_t$ denotes the minimum rate of pension and $forpen_{i,t}$ denotes the pension benefit derived from the social security benefit formula, which is given by:

$$forpen_{i,t} = \frac{min(w_{i,Rt-1}, minwage_t).E^c_{i,Rt}}{50}$$

where $w_{i,Rt-1}$ represents the average monthly wage earned during the last twelve months of insurable employment.

Grant payment is also based on the average wage in the last year of insurable employment, or the minimum wage, whichever is lower. Grant is calculated as the number of years of insurable employment times the average wage. If the grant based on the average monthly wage is less than the grant based on minimum pension, the individual receives the latter payment. Thus, grant is given by:

$$grant_{i,t} = max(min(w_{i,Rt-1}, minwage_t).E^c_{i,Rt}, minpen_t.E^c_{i,Rt})$$

Uncovered Sector

The budget constraint for an individual i employed in the uncovered sector at time t is given by:

$$C^{uc}_{i,t} = w^{uc}_{i,t} + \mu^{uc}_{i,t} + \lambda^{uc}_{i,t} + pension_{i,t} \tag{2.4}$$

Self-Employed

The budget constraint for a self-employed individual i at time t is given by:

$$C_{i,t}^{se} = w_{i,t}^{uc} + \mu_{i,t}^{se} + \lambda_{i,t}^{se} + pension_{i,t} \tag{2.5}$$

where $w_{i,t}^{se}$ is self-employed income for individual i at time t.

Unemployed

The budget constraint for an individual i who is unemployed or out of the labor force at time t is given by:

$$C_{i,t}^{ue} = \mu_{i,t}^{ue} + \lambda_{i,t}^{ue} + pension_{i,t} \tag{2.6}$$

2.3.5 Distributions of State Variables

The following section discusses the distributions for the state variables w_t^d, μ_t^d, and λ_t^d.

Wages and Self-Employment Income

The logarithm of real monthly wage (income) for individual i at time t in covered and uncovered wage employment (self-employment) is given by:

$$ln(w_{i,t}^d) = \beta_0 + \beta_1 X_{i,t} + \epsilon_{i,t}^d \tag{2.7}$$

where $X_{i,t}$ includes age, a quadratic in age, completed years of education and a dummy for being married. Note that education and marital status are taken as exogenous in the model. $\epsilon_{i,t}^d = \eta_i^d + \upsilon_{i,t}^d$, and $\epsilon_{i,t}^d \sim N(0, \sigma_\epsilon^2)$. The values for $\epsilon_{i,t}^d$ are obtained from a least squares regression of wages on observable characteristics. η_i^d denotes the individual-specific, time invariant component of $\epsilon_{i,t}^d$, and $\upsilon_{i,t}^d$ denotes the individual-specific, time-variant component of $\epsilon_{i,t}^d$. The fraction of the variance in $\epsilon_{i,t}^d$ accounted for by η_i^d, as well as the fraction of the variance in $\epsilon_{i,t}^d$ accounted for by $\upsilon_{i,t}^d$ is taken from a random effects regression of log monthly real wage on individual level characteristics using panel data from the PSES. The estimates

of β_0 and β_1 are obtained from a least squares regression of log monthly real wage on individual level characteristics.

Non-Labor Income

The logarithm of real monthly non-labor income for individual i at time t in sector d is given by:

$$ln\mu_{i,t}^{d} = \gamma_0 + \gamma_1 X_{i,t}^{d} + \nu_{i,t}^{d} \tag{2.8}$$

where $X_{i,t}$ includes age, a quadratic in age, and an indicator for the spouse's labor force participation status, and $\nu_{i,t}$ is the error term (assumed measurement error). The estimates of γ_0 and γ_1 are obtained from a least squares regression.

Transfers

Real monthly net transfer income for individual i at time t in sector d is given by:

$$\psi_{i,t}^{d} = \lambda_0 + \lambda_1 X_{i,t}^{d} + \omega_{i,t}^{d} \tag{2.9}$$

where $X_{i,t}$ includes age and a quadratic in age, and $\omega_{i,t}$ is the error term (assumed measurement error). The estimates for δ_0 and δ_1 are obtained from a least squares regression.

2.3.6 Deficit

In the model, EOBI receives income consists of contributions received from all workers who ever enter covered employment, and expenditures include grant payments to individuals at age 60 and social security payments from age 60 to age 75. Thus, the deficit is given by:

$$\Sigma_{t=1}^{Rt-1} N_y.contribution_{i,t} - N_{grant}.grant_{i,t}.1[t = Rt] - \Sigma_{t=Rt}^{T} N_{ss}.ss_{i,t}$$

where $contribution_{i,t} = E_{i,Rt}.\tau_p.min(w^c_{i,t}, minwage_t)$, Rt is the time of retirement and N is the total population. The working population, between the age of 25 and 60 years is given by N_y, and the old population is given by N_o. The retired population eligible for social security benefits is given by N_{ss}, and the retired population eligible for old age grants is given by $N_{grant} = N_o - N_{ss}$.

2.3.7 Welfare

The welfare function is defined by the sum of utilities over all individuals in all time periods:

$$W = \sum_{i=1}^{N} \sum_{t=1}^{T} U_{i,t}$$

However, aggregate utility is an ordinal concept and may not be readily interpretable. In particular, it is hard to interpret in a model with non-workers, i.e. individuals with zero consumption/income. I therefore use a welfare measure that is easy to interpret and that can be used to compare welfare in models with both workers and non-workers, known as intercept income. Intercept income is a money-metric equal to the level of income required by the unemployed to obtain a similar level of utility as the employed. This is the intercept of the indifference curve with the consumption axis, hence the name intercept income (see (Preston and Walker, 1999)). Thus it is equal to actual income for non-workers. Intuitively, when reference hours are chosen to be zero then one is effectively numbering each indifference curve according to its intersection with the consumption axis, a choice which has an appealing interpretation as the amount required by someone not working to reach the utility level concerned. There are various advantages of using intercept income as a welfare measure. First, it can be compared with net income, second, it can be meaningfully aggregated, and third, it appeals to policy makers concerned with replacement ratios.

2.3.8 Model Solution

The objective of the paper is to use the observed realizations of household choices and states, $\{(d_t; z_t\}$, to estimate the vector of unknown parameters $\theta = (\theta_u; \theta_y; \theta_x)$, which includes preference parameters, θ_u, and the parameters that determine the data generating process for the state variables, (θ_y, θ_x).

In a dynamic setting, individuals are forward-looking and make labor supply decisions with full understanding of the likely implications of their current decisions for future income streams. In particular, an individual understands how his current labor supply decision will affect his entitlement to Social Security later in life. The model thus captures the primary inter-temporal incentives associated with Social Security. Optimizing behavior on the part of the individual implies that at each discrete time period, given current wages, non-labor income and the existing institutional environment, an individual will choose his labor market status in the following time period in order to maximize the expected discounted value of his remaining lifetime utility.

In this setting, individual's beliefs about uncertain future states can be represented by a first-order Markov probability density function. There is an extensive literature dealing with the solution and estimation of stochastic Markov processes (see Rust and Phelan (1997) and Casanova (2010)).

Optimization Problem

In order to solve the finite-horizon Markovian decision problem, individuals choose a sequence of decision rules $\Pi = [\pi_0, \pi_1, ..., \pi_T]$ where $\pi_t(x_t, \varepsilon_t) = d_t$, to maximize expected discounted utility over the life-cycle.[12] The value function is defined as:

$$V(x_t, \varepsilon_t, \theta) = sup\{\sum_{j=t}^{T} \beta^{j-t}[U(d_t; x_t; \theta_u)] \mid x_t; \varepsilon_t; \theta_y; \theta_x\}$$

where the expectation is taken with respect to x_t and ε_t, and the probability distribution function is given by:

$$f(x_{t+1}, \varepsilon_{t+1} \mid x_t, \varepsilon_t, d_t, \theta_y, \theta_x)$$

Since this is a finite horizon problem, the feasible set of household choices is compact, and the utility function continuous, the value function $V_t(x_t; \varepsilon_t; \theta_u)$ defined above always exists and is the unique solution to the Bellman equation given by:

[12]The description of the optimization problem is taken from Casanova (2010).

$$V_t(x_t, \varepsilon_t, \theta) = \max_{d_t} U_t(x_t, \varepsilon_t, d_t, \theta_u) + \beta \int V_{t+1}(x_{t+1}, \varepsilon_{t+1}, d_t, \theta) f(x_{t+1}, \varepsilon_{t+1} \mid x_t, \varepsilon_t, d_t, \theta_y, \theta_x) \tag{2.10}$$

In order to simplify the solution procedure, I make two of the key assumptions introduced by (Rust, 1994). First, that the unobserved state variables in ε_t are independently and identically distributed over agents and over time (IID) with CDF $G_e(\varepsilon_t)$, which has finite first moments and is twice differentiable. Second, I assume conditional independence of future state variables (CI). This implies that x_{t+1} is a sufficient statistic for ε_{t+1}, i.e. any statistical dependence between ε_t and ε_{t+1} is transmitted entirely through the vector of observed states x_{t+1}. Moreover, it implies that the probability density of x_{t+1} depends only on x_t and not on ε_t. Note that IID and CI together imply that:

$$f(x_{t+1}, \varepsilon_{t+1} \mid d_t, x_t, \varepsilon_t) = g(\varepsilon_{t+1} \mid x_{t+1}, \theta_y) f(x_{t+1} \mid d_t, x_t, \theta_x)$$

Following (Rust, 1994), I assume a multivariate extreme value distribution for $g(\varepsilon \mid x, \theta_y)$:

$$g(\varepsilon \mid x, \theta_y) = \prod_{k \in \mathcal{D}} exp{-}\varepsilon(k) + \theta_y exp{-}exp{-}\varepsilon(k) + \theta_y$$

where $\theta_y = 0.577216$ is Euler's constant.

Under the CI assumption and the extreme value distribution assumption, the integral EV_{t+1} with respect to ε_{t+1} has a closed-form solution. This renders the problem computationally tractable, and the size of the state space X is the only relevant measure of computational complexity. In what follows, I drop ε_{t+1} from the conditioning set for EV_{t+1} to indicate that it has been integrated out using the functional form restrictions Casanova (2010).

The Bellman equation can now be written as:

$$V_t(x_t; \varepsilon_t; \theta) = max_{d_t} \left[[U(k; z_t; \theta_u) + \beta EV_{t+1}(x_{t+1}; k; \theta_y; \theta_x) \mid d_t = k] + \varepsilon_t(d_t) \right] \tag{2.11}$$

The maximization is based on a random utility model. Proceeding backwards, the solution for the optimal control d_t is given by the discrete option that yields the highest value given the draw of the unobservable states.

The specification above differs from the static random utility model through the addition of the term $EV_{t+1}(z_{t+1}; k; \theta)$ to the static utility $U(k; z_t; \theta_u)$ in the choice-specific value functions.

Under the assumption that ε follows an extreme value distribution, the conditional choice probabilities are given by the multinomial logit formula.

$$P(k \mid x_t, \theta) = \frac{expr(x_t, k, \theta)}{\Sigma_{k \in \mathcal{D}} expr(x_t, k, \theta)} \tag{2.12}$$

2.4 Data

For the estimation of the model, I use four sources of data, namely (i) The Pakistan Labor Force Survey for the year 2007-08 (LFS), (ii) the Household Integrated Economic Survey for the year 2007-08 (HIES), (iii) Pakistan Socio-Economic Survey for the years 1998-99 and 2000-01, and (iii)administrative data from the Employees' Old Age Benefits Institution (EOBI).

2.4.1 Labor Force Survey (LFS)

LFS is a cross-sectional data set collected at the individual level to gather information on key indicators of the labor market. It is representative at the national, provincial, and rural/urban level and is conducted on a quarterly basis. The survey covers all urban and rural areas of Pakistan excluding Federally Administered Tribal Areas, military restricted areas, and protected areas of KPK province. The population of excluded areas constitutes about 3 to 4 percent of the total population.

Labor force survey classifies workers into three broad categories, the employed, the unemployed, and out of the labor force. All individuals who work a positive number of hours for pay, profit or family gain in the month preceding the survey are classified as employed. Individuals who do not work but are actively searching for jobs are unemployed, while individuals who do not work and are not searching for a job are out of the labor force.

All employed individuals are asked to report their employment category. There are 5 broad categories of employment as defined in the survey; paid employees, employers, self-employed, unpaid family workers and workers in agriculture. Agricultural workers are not covered by the EOBI Social Security system. Thus

all workers in agriculture, fishery or forestry, whether skilled or unskilled are excluded from the analysis. Employers and unpaid family workers are also excluded from the sample. The former only constitute about 0.2% of the labor force and the latter do not report any wages in cash or in kind.

Among the aforementioned employment categories, paid employees are required to report the type of enterprise they work for. The type of enterprise includes federal, provincial or local government employment, public enterprises, private and public limited companies, individual ownerships, partnerships and other forms of establishments. The EOBI Social Security system does not cover government and public sector employees, therefore all government employees are excluded from the analysis. In order to classify the remaining private sector employees into covered and uncovered employment, I use information on firm size categories. Workers in firms with 10 or more employees are in the covered sector, while workers in firms with less than 10 employees are in the uncovered sector. Firm size information is not available for workers employed in public and private limited companies. A majority of public and private limited companies in Pakistan employ 10 or more workers, and are therefore included in the covered sector.[13]

Workers who work outside of wage employment may choose to become self-employed. Self-employment is an important feature of developing country labor markets (see Fields, 2007). I therefore take self-employment in the non-agricultural sector as the third employment category. Workers outside of wage work or self-employment are considered to be unemployed or out of the labor force. In this paper, I restrict my attention to male household heads between the age of 25 and 75 years. The proportion of individuals in each of the four employment categories namely, covered wage employment, uncovered wage employment, self-employment and unemployment is taken from the labor force survey.

Labor Force Survey elicits information on monthly wages conditional on working in the month prior to the date of enumeration of the survey. To estimate the parameters of the wage equation, I regress the log of monthly real wage on age, a quadratic in age, completed years of education and marital status. The residuals from the wage regressions are used to estimate the variance of the wage shocks. I further differentiate between the persistent and transitory component of the wage shocks using panel data from the Pakistan Socio Economic Survey. Using a random effects model, I run a wage specification similar to the one used to obtain the wage parameters from the LFS. The fraction of the variance in the wage shocks accounted for by the permanent unobserved component of wages in the covered (uncovered) sector is equal to 0.1149 (0.5785).

[13]The caveat is that workers in public and private limited companies may have access to employer-provided social security in old-age, that is not modeled explicitly.

Income data for the self-employed is not available in the Labor Force Survey. I therefore use data from the household survey for self-employment income.

2.4.2 Household Integrated Economic Survey (HIES)

HIES also classifies working individuals into three employment categories; the employed, the unemployed, and those out of the labor force. To keep the primary sample of individuals consistent with the sample from the LFS, I exclude agricultural employees, government employees, employers and unpaid family workers from the analysis. Here also, I restrict the sample to male household heads between the age of 25 and 75 years. Below I describe the data taken from the household survey.

Self-employment Income

To model the self-employment income process, I regress the log of monthly real self-employment income on age, a quadratic in age, completed years of education and marital status. The residuals from the regressions are used to estimate the variance of the income shocks.[14] I further differentiate between the persistent and transitory component of the income shocks using panel data from the Pakistan Socio Economic Survey. Using a random effects model, I run an income specification similar to the one used to obtain the income parameters from the HIES. The fraction of the variance in the income shocks accounted for by the permanent unobserved component of income in the self-employed sector is equal to 0.2992.

Non-labor Income

Non-labor income is estimated by taking the aggregate income of all household members who contribute fully towards household income, excluding the household head, and is divided by the number of household members between the ages of 15 and 80 years. The age cutoff at 15 is based on the legal working age in Pakistan. Household members less than 15 years of age do not contribute significantly to household income. Moreover, I expect them to have little control over the income of other household members. The household

[14]The household survey also gathers information on income and expenditures of enterprises owned by the self-employed. For all individuals in the sample, profit and income are similar.

survey does not differentiate wage employees by covered and uncovered employment. I therefore use the same value of non-labor income for all wage employees, i.e. $\mu^c_{i,t} = \mu^{uc}_{i,t}$.

In a majority of the sample households, the male head of household is the sole earner. Thus, for all such individuals in the sample, non-labor income is set equal to zero throughout the life-cycle. About 55% of the individuals in wage employment have zero non-labor income, 57.31% of the self-employed have zero non-labor income, and 24.56% of the unemployed have zero non-labor income. For the remaining sample, the parameters of the non-labor income process are estimated through a least squares regression of monthly real non-labor income on age, a quadratic in age, and the labor force participation status of the spouse. Errors in non-labor income are taken as measurement error.

Transfer Income

Data on transfers is elicited at the level of the household. Transfers include income from remittances, Zakat (legally binding charity for muslims), other charities, gifts and help provided and received from family members. Net transfer income is taken as the difference between aggregate inflows and outflows of transfers. Aggregate net transfer income is then divided equally among all household members between the age of 15 and 80 years.[15] As stated previously, the household survey does not differentiate wage employees by covered and uncovered employment. I therefore use the same value of net transfer income for individuals employed in covered and uncovered wage employment, i.e. $\psi^c_{i,t} = \psi^{uc}_{i,t}$.

In the data, net transfers can be positive, negative or zero. In the study sample, 54.08% of the wage employees have negative transfer income, while 28.04% have zero transfer income. Similarly, 60.91% of individuals that are self-employed have negative net transfer income, while 20.48% have zero net transfer income. Among the individuals that are unemployed, 45.54% have negative net transfer income, and 19.66% have zero net transfer income. To estimate the parameters of the net transfer income process, I regress monthly real net transfer income on age and a quadratic in age. Any error in reported net transfer income is taken as measurement error. I run the net-transfers regressions in levels rather than logs to account for non-positive values.

[15]Dividing net transfer income equally between household members age 15 to 80 years may understate the amount available to the household head, especially when the household head is the primary decision maker. This is more likely to be the case for middle-age individuals. However, for consistency with non-labor income division, I divide transfer income equally.

2.4.3 Pakistan Socio-Economic Survey

Pakistan Socio-Economic Survey (PSES) is a longitudinal survey conducted during the years 1998-99 and 2000-01. The universe of the PSES consists of all urban and rural areas excluding military restricted areas, and protected areas of KPK province. The population of the excluded areas constitutes about 4% of the total population.[16] The advantage of using PSES data are two-fold. First, it helps to determine the level of persistence between various sectors of employment, which helps to identify three key parameters in the model. Second, it helps to disentangle the fraction of the variance in wage and income shocks due to permanent and transitory errors in the wage and income process. The caveat is that the time period of the PSES survey is different from the time period for the labor force survey and the household survey; the latter are from the year 2007-08. However, the sampling scheme and the survey design used in the PSES is similar to the one used in the household and labor force survey. More importantly, it is the only panel data set available for the analysis of labor market transitions, which makes it one of the most useful data sets for the analysis.[17]

Similar to other survey samples, I restrict the PSES sample to male household heads between the age of 25 and 75 years, working in non-agricultural private sector establishments. Both rounds of the PSES elicit information on wage employment, self-employment, and unemployment. However, the distinction between covered and uncovered wage employment is only available in the first round of the survey. As I cannot distinguish between covered and uncovered wage employment in the second round, I am unable to precisely estimate employment persistence among covered and uncovered sectors. I therefore take all covered employees in the first round and examine their sectoral transitions. The proportion of covered wage employees from the first round who choose to stay in wage employment in the second round is used to identify ρ_c. Similarly, the proportion of uncovered wage employees from the first round who choose to stay in wage employment in the second round is used to identify ρ_{uc}. Despite being imperfect, these two separate measures are better than using a single persistence parameter within the two sectors. Self-employment persistence and unemployment persistence obtained from the PSES sample is used to identify rho_{se}.

[16] see Arif and Bilquees (2006) for a detailed overview of the sampling methodology used in PSES.

[17] Sample attrition in the PSES sample due to the 9/11 attacks are briefly discussed in the Appendix. For details see Arif and Bilquees (2006).

2.4.4 Administrative Data from EOBI

Data from the social security administration contains employee-level information on the date of birth, date at which the worker joined EOBI, the date of retirement and/or date of death if deceased, pension amount, gender and type of pension. I use the data from the pension award file to match the average years of covered sector experience. I restrict the sample to male old-age pensioners who joined EOBI between the age of 25 and 59 years and retired at age 60. For all pensioners with non-missing joining and retirement dates, I estimate covered sector experience as the difference between the date of joining EOBI and the date of retirement. When both the date of retirement and date of death are non-missing, I use the earlier of the two to determine aggregate experience. All records with missing information on joining dates, retirement dates and/or date of death are excluded from the analysis. For the remaining sample, the average years of experience is 20.78 years, with a standard deviation of 0.0512 years. The average aggregate covered sector experience is used to identify the parameter capturing permanent unobserved heterogeneity in covered sector preferences; i.e. $sigma_u^c$.

2.5 Estimation and Results

2.5.1 Method of Simulated Moments

The model presented earlier simplifies to a typical Rust and Phelan (1997) style model, and has an analytical solution for the choice probabilities. I estimate the parameters of the model using the Method of Simulated Moments (MSM).[18] MSM is a minimum distance estimator, whereby parameter estimates are chosen to minimize the distance between a set of moments that pertain to the values of the endogenous variables observed in the data and the average values of the same moments in a number of simulated data sets. Each simulated data set is constructed using the empirical distribution of exogenous individual level characteristics, such as age, education and marital status, observed in the sample.

Given an initial value of the parameter vector θ_t, I use a reduced-form model to simulate the initial values of the endogenous variables, namely wages, non-labor income, net transfer income, consumption and

[18]The method has been used by several papers focusing on dynamic structural life-cycle models of labor supply, retirement, consumption and savings decisions. See for instance French (2005); French and Jones (2011); Haan and Prowse (2011).

employment choices. I then use the structural model described above as the basis for simulating wage offers, employment and consumption choices in subsequent time periods. When simulating data sets, the value function is approximated using a (Rust and Phelan, 1997) style dynamic programming framework.[19]

Assume that a total of p moments are used in the MSM estimation. Let M_d denote the p-by-1-dimensional vector of moments constructed from the sample observations. Further, let $M_s^k(\theta_t)$ denote the same vector of moments constructed from the $k_t h$ simulated sample obtained using the parameter vector θ_t. Then, the MSM parameter estimates are defined to be the value of θ_t that minimizes the weighted quadratic distance $(\bar{M}_s(\theta_t) - M_d)\prime W(\bar{M}_s(\theta_t) - M_d)$, W is a fixed p-by-p-dimensional positive semi-definite weighting matrix, and $\bar{M}_s(\theta_t)$ denotes the value of the vector of simulated moments averaged over K simulated data sets, each obtained using the parameter vector θ_t. Pakes and Pollard (1989) state the conditions under which the MSM estimator is consistent and asymptotically normally distributed.

MSM allows for matching moments from different data sets in one unified model. This is particularly useful in my case, as no single data set contains the necessary information on all the variables of interest.

2.5.2 Identification

My estimation procedure uses 60 moments and I estimate 15 parameters. Coefficient estimates obtained from an OLS regression of wages on age, education and marital status are used to identify the distribution of wages. Education represents the number of years of completed education. In the model, I include four moments based on education, namely (i) the proportion of workers in the covered sector with high education, (ii) the proportion of workers in the covered sector with low education, (iii) the proportion of workers in the uncovered sector with high education, and (iv) the proportion of workers in the uncovered sector with low education. Workers with 12 or more years of education are counted in the high education category, and workers with less than 12 years of education are in the low education category. Moments from PSES data for employment persistence provide identifying information for the persistence parameters $\rho_d, where d = c, uc, se$. The share of consumption in utility α and the cost parameters in the ϕ_t^d functions are identified through age effects. In addition, average covered sector experience at the time of retirement is used to identify σ_c. In order to match the level of aggregate covered sector experience, I only take the sample of individuals who ever entered the covered sector.

[19] see Casanova (2010); Aguirregabiria and Mira (2010); Haan and Prowse (2011) for a review of the methodology.

2.5.3 Goodness of Fit and Structural Parameter Estimates

This section demonstrates that the structural model is able to replicate important aspects of individuals' observed behavior. In particular, the model matches life-cycle labor supply behavior particularly well (see Figure 2.3). Moreover, the most important factor in pension eligibility i.e., the accumulated covered sector experience, matches well with the average experience from the administrative data. The model estimates an average covered sector experience of 20.5 years. This is lower than the 20.8 years of experience in the model. However, according to EOBI rules, a period of employment over 6 months is counted as a year of employment for pension calculations. Thus, 20.5 years and 20.8 years both represent 21 years of covered sector experience. Moments for high and low education and marital status in covered and uncovered wage employment also match well with the data (see Table 2.3).

Table 4 shows the parameter estimates used to simulate the model. The coefficient on consumption, α is equal to 5.09 with a standard deviation of 0.0135 which implies that individual behavior is significantly influenced by the financial incentives associated with employment in various sectors. The estimates for the parameters in ϕ_t^c show that the cost of finding a job in covered sector employment is significantly high at all ages. The negative estimates of ϕ_t^{uc} and ϕ_t^{se} reveal that workers do not choose to stay out of the labor force at younger ages, both due to lower asset levels and lower non-labor income and transfers.

The persistence parameter, ρ_d, is positive in all sectors of employment, showing that employment persistence increases utility. In order to match the labor supply accurately over the life-cycle of individuals, the model overestimates covered and self-employment persistence. Uncovered wage employment persistence matches well with the data.

A high positive value of σ_u^c shows that permanent unobservable heterogeneity is an important component of covered sector preferences. Workers with a high draw of σ_u^c stay in covered employment for a longer period of time, also because the higher σ offsets the reduction in utility due to high values of ϕ_t^c. On the contrary, the estimate of σ_u^{uc} is close to zero, which shows that permanent unobserved heterogeneity is not an important feature of uncovered sector preferences.

Model simulation helps to determine the replacement rate of social security both before and after the age of retirement. These are briefly discussed below.

2.5.4 Replacement Rates

As stated earlier, EOBI provides two types of social security benefits. An old-age grant that represents a lump-sum payment at the time of retirement or a stream of social security benefits over the retired life of the individual. The former is based on three to fourteen years of insurable employment, and the latter is based on acquiring 15 or more years of insurable employment. In the model simulations, I find that about 25% of the workers ever enter the covered sector. Within these workers, about 59.8% qualify for old-age pensions, and 22.5% qualify for an old-age grant. Thus, within the total population of workers, about 14.96% are eligible to receive pension benefits, and 5.63% qualify for an old-age grant. Among workers who qualify for pension benefits, about 56% attain 35 years of covered sector experience. The distribution of covered sector experience for workers that qualify for any kind of social security benefit is given in Figure 2.4. The figure shows that a majority of workers that qualify for an old-age grant attain lower levels of experience. Once workers cross the threshold experience of 15 years to qualify for old-age pension, a majority of them choose to stay in the covered sector throughout the life-cycle.

In case of workers that are eligible for old-age pensions, social security replaces about 9.6 to 18.8% of pre-retirement earnings, and replacement rates increase with increases in covered sector experience. In case of aggregate income, where income includes earned income, non-labor income and net transfer income, social security replaces about 7.3% to 14.9% of aggregate income earned before the age of retirement. As retirement is not an absorbing state, replacement rates may also be calculated for workers age 60 to 75 years. For these workers, conditional on working a positive number of years after age 60, social security replaces as much as 146% of their post-retirement wages and 94% of their post-retirement income. On average, social security replaces about 28.99% of aggregate income in the post-retirement period.

As social security benefits are fixed over the post-retirement period, replacement rates tend to fall with increases in post-retirement income. The data shows that lower replacement rates are associated with high labor force participation in the post-retirement period; i.e. individuals with higher social security benefits tend to work less at older ages, and this holds true in for sectors of employment.

Grants replace about 13.9% of pre-retirement earnings for workers with 3 to 14 years of covered sector experience, and the replacement rate increases with the the number of years of acquired experience.

2.6 Policy Experiments

2.6.1 Why might Social Security affect Labor Supply over the Life-Cycle

Prior to a discussion of current and proposed reforms to social security policy parameters, this section briefly discuss the mechanisms through which social security reform is thought to affect labor supply. In addition, as I examine the effect of pensions on labor supply in a life-cycle context, I provide a discussion of labor supply elasticities over the life-cycle, as it helps to determine the effectiveness of tax reforms for stimulating labor supply at various ages.

The EOBI social security system is likely to create behavioral incentives that can affect labor supply decisions for multiple reasons. First, as pensions are funded by taxes on labor, the substitution effect may encourage workers to work less, especially when old. Second, social security helps to redistribute income from younger to older ages, thus it may increase or decrease wealth at a given time in the life cycle. These wealth effects are likely to induce labor force participation at younger ages, and reduce the incentive to work at older ages. Third, EOBI pension benefits are illiquid, in that individuals cannot borrow against future social security benefits. As a result, individuals may not be able to finance their retirement until pension benefits become available. In case of short-sighted (myopic) individuals, the tendency of EOBI pension program to leave them liquidity-constrained is likely to be amplified. These constraints may induce them to leave the labor force as soon as the benefits become available (liquidity effects).

In addition, behavioral norms are likely to affect retirement/participation decisions around a certain age cutoff. In Pakistan, a majority of the individuals are likely to exit the labor market around the age of 60 years because it is a natural focal point. Ignoring these norms may lead to an understatement of the possible effects of changes in pension rules.

Two other factors that may affect labor supply in response to social security reforms in developing countries context relate to information asymmetries, and compliance behavior of workers and firms. For instance, if firms are aware of the EOBI system and their workers are not, then information asymmetry on the supply side helps to sustain non-compliant behavior on the demand side of the labor market. If on the other hand, both workers and firms are aware of the pension program and enter an implicit agreement where

the firm compensates the workers in other ways, strategic behavior and non-compliance on the demand and supply side may limit our ability to find any meaningful effects on labor market outcomes. In other cases, both workers and firms may be unaware of the social security rules and proposed reforms and it may help to invest in reducing these information asymmetries to get at the intended policy outcomes.[20] Identifying the quantitative effects of these factors is difficult because it is hard to measure non-compliance and information asymmetries. Moreover, even in a world with full compliance and perfect information, public pension programs like EOBI have complex rules that may not be discernable by each and every worker covered by the law. Thus labor supply effects of changing the public pension system may either be muted due to information asymmetries, or even reversed in cases where individuals do not have enough information about their potential future benefits to incorporate it into their current working life. Labor supply distortions due to information asymmetries are enhanced when the workforce is less-educated or uneducated, is poor and political instability is common.

Life-cycle labor supply elasticities

Intensive Margin This section examines life-cycle labor supply elasticities at the intensive margin. To accomplish this, I perform a reduced-form analysis using labor force survey data for the years 1996-97 to 2010-11. In the LFS, workers report the number of hours worked in the reference week along with the number of days worked during the week. This helps to construct a measure of hours worked per day. Conditional on working on any day, hours worked per day vary from 4 hours to 12 hours a day for 98% of the workers in the sample, with an average of about 8.2 hours worked per day. Self-employed workers work the highest number of hours on average, followed by covered wage employees and uncovered wage employees.

I regress the log of hours worked per week on log of real wage per week, controlling for education, age, a quadratic in age and year fixed effects, separately for covered and uncovered wage employees. I find that in the covered sector, labor supply elasticity, i.e. percentage change in hours worked due to a 1% change in real wages, is highest for workers age 25-29 years. At the age of 30 years, the elasticity starts to fall, decreasing up to 49 years of age. Thereafter, labor supply elasticity begins to increase and reaches its highest level between the age of 60 and 64 years. In the covered sector, older workers, age 60-70 years, have the highest labor supply elasticities. In the uncovered sector, labor supply elasticity increases with age, up to 55 years

[20] In the last few years, particularly after the July 2008 amendments, EOBI has actively sought to inform both workers and firms and to take legal action against non-compliant firms. These efforts have significantly increased firm registrations with EOBI. However, there is still a long way to go.

of age. Starting age 55, labor supply elasticity starts to decrease, and continues to fall till age 59. At age 60, labor supply elasticity starts to increase again, and reaches its highest level between the age of 60 and 69 years.

Extensive Margin

Covered Wage Employment In order to examine labor supply elasticities at the extensive(participation) margin, I use the dynamic life-cycle model described above. Holding everything else constant, I increase real wages in the covered sector by 10%. Below, I discuss the labor supply and welfare effects of the wage change.

For workers age 25-44 years, covered wage employment increases by 17.2 percentage points. Only 4.3% of these workers are new entrants into the labor market. The remaining 54% and 41.7% transition from self-employment and uncovered wage employment. In comparison, for workers age 45-59 years, covered wage employment increases by 10.8 percentage points. In this case, 18% of the workers are new entrants into the labor market, while the remaining 56% and 26% are drawn from self-employment and uncovered wage employment. In case of older workers age 60-75, covered sector employment increases by 3.83 percentage points. 42.3% of these workers are new labor market entrants, while the remaining 39.5% and 18.2% transition from self-employment and unemployment. This shows that an increase in real wages leads to an increase in labor force participation at all ages, and the highest increase is observed for workers age 60 to 75 years. As more workers enter the covered sector, the aggregate social security contributions increase by 6.58%, while the aggregate grants and pensions disbursed increase by 8.16% and 6.3% respectively. This leads to an increase in the deficit of about 6.26%. Overall, the increase in wages increases welfare; the sum of utilities increases by 0.497% and the average intercept income increases by 1.55%.

Estimates of labor supply elasticity by age confirm that older workers are more responsive to wage changes. For workers age 55-59 years, labor supply elasticity in the covered sector equals 0.53, while labor supply elasticity for workers age 65-69 is equal to 0.72, and for workers age 70-75, the elasticity increases to 0.82.

Uncovered Wage Employment Here, I do a similar experiment and increase real wages in the uncovered sector by 10%. I find that for workers age 25-44 years, labor supply in the uncovered sector

increases by 97.6 percentage points. 83.8% of these workers leave self-employment and join the uncovered sector, while 7.7% leave the covered sector for the uncovered sector. Moreover, 8.4% of the workers previously unemployed also join the uncovered sector. For workers age 45-59 years, uncovered wage employment increases by 71.8 percentage points. 22.9% of these workers were previously unemployed, while the remaining 71.8% and 5.3% transition to the uncovered sector from self-employment and covered wage employment. The highest increase in labor force participation is observed for older workers age 60-75 years; their overall labor force participation increases by 13.99 percentage points.

The aforementioned experiment shows that labor supply is more responsive to wage changes in the uncovered sector as compared to a similar changes in the covered sector. This is corroborated by the estimates of labor supply elasticity in uncovered wage employment; the elasticity ranges from 1.22 to 2.69 over the life-cycle. Second, elasticity increases with age, i.e. for workers age 35-39 years, the elasticity is equal to 1.41, for workers age 55-59 years, it is equal to 2.03, and for workers age 65-69 years, the elasticity is equal to 2.59. This is important for policy makers trying to extend social security benefits to informal sector workers. In the informal sector, younger workers may be willing to accept higher payroll taxes as compared to older workers.[21]

An increase in real wages in the uncovered sector increases welfare. Welfare as measured by the sum of utilities increases by 1.05% and intercept income increases by 2.72%. As fewer individuals enter the covered sector, aggregate pensions and grants disbursed fall by 2.11% and 3.27% respectively. Alongside the fall in benefits disbursed, aggregate contributions fall by 2.17%. Due to these changes, the EOBI deficit decreases by 2.13%.

Self-Employment To examine labor supply elasticities in self-employment, I increase real self-employment income by 10%. Here I find that for workers age 25-44 years, labor supply in self-employment increases by 109.4 percentage points. 80.9% of these workers leave uncovered wage employment and join self-employment, while 8.5% leave the covered sector to join self-employment. Moreover, 10.6% of the workers previously unemployed also become self-employed. For workers age 45-59 years, self-employment increases by 85.67 percentage points. 34.4% of these workers are new labor market entrants, while the remaining 78.1% and 7.5% transition from uncovered and covered wage employment into self-employment. Labor force participation increases the most for older workers age 60-75 years. There is an increase of 31.8 percentage points in the labor force participation of older workers. All these workers become self-employed. At the

[21] In another paper, I find that workers age 14-60 years bear the full burden of social security taxes.

same time workers from wage employment also enter self-employment, increasing self-employment at older ages by 51.7 percentage points.

The aforementioned evidence shows that labor supply is most responsive to changes in self-employment income. This is also confirmed by the estimates of labor supply elasticities in self-employment. Labor supply elasticity ranges from 1.22 to 2.69 over the life-cycle, and is increasing with age. For workers age 35-39 years, the elasticity is equal to 1.41, for workers age 55-59 years, it is equal to 2.03, and for workers age 65-69 years, it is equal to 2.59.

Overall an increase in self-employment income increases welfare the most. Welfare as measured by the sum of utilities increases by 1.67% and intercept income increases by 3.82%. As fewer individuals enter the covered sector, pension and grant disbursement falls by 3.26% and 0.94% respectively, which helps to decrease the deficit by 3.27%.

Below I explore the effects of changing the social security policy parameters on EOBI deficit and aggregate welfare, while emphasizing the labor supply effects of these policy changes.

2.6.2 Common Changes to Social Security Policy Parameters

Increase in the Minimum Wage

In the EOBI social security system, minimum wage features as the value of maximum taxable earnings for social security contributions, as well as the maximum earnings cap for social security benefit calculation. On one hand, an increase in the minimum wage increases required contributions, which is likely to reduce covered sector employment. On the other hand, an increase in the minimum wage increases social security benefits for workers with retirement wages above the minimum wage.[22] If workers value the additional benefits by more than the increase in contribution payments, they are likely to increase labor supply in the covered sector. However, if workers value the additional benefit at less than the cost of social security provision, they are likely to reduce labor supply in the covered sector. It is important to note that changes in the minimum wage do not affect actual wages or labor demand in the model. The only effects of minimum wage changes are generated through its effects on taxable income and benefit receipt.

[22]Retirement wage refers to the average wage drawn during the last year of covered sector employment.

In the policy experiment, I increase the real minimum wage by 25%. This leads to a reduction in labor supply in the covered sector (see Figure 2.5). For workers age 25-45 years, covered sector employment falls by 0.904 percentage points. All these workers join the informal sector. In addition, labor force participation of workers age 25-44 years increases by 0.028 percentage points. None of the new labor market entrants join the covered sector, they all choose to be self-employed or join uncovered wage employment. This shows that an increase in the minimum wage increases the size of the informal sector.

For workers age 44-59 years, covered wage employment falls by 0.582 percentage points, and uncovered wage employment falls by 0.386 percentage points. 62.8% of the workers who leave wage employment choose to become self-employed, while 37.2% exit the labor market. This leads to a reduction in labor force participation of workers age 45-59 years by 0.36 percentage points. In case of older workers age 60-75 years, labor supply effects in the covered sector are almost negligible. Older workers respond to the policy change by decreasing labor force participation, by 0.17 percentage points. This owes to the increase in benefit receipt. At older ages, the replacement rate of social security is highest for unemployed workers. Thus, higher benefits induce them to stay out of the labor force.

As an increase in the minimum wage increases the maximum taxable earnings level, which in turn leads to higher revenues. This shows up as an increase in aggregate contributions of about 20.25%. In addition, a higher minimum wage increases the maximum earnings cap for benefit calculation, which leads to higher expenditures. In the policy simulation, average pension benefits disbursed increase by 20.45%, and average old-age grants disbursed increase by 20.85%. As benefit disbursement exceeds the additional contributions, EOBI deficit increases by 20.03%. Despite the increase in deficit, welfare in the economy increases. Welfare as measured by the sum of utilities increases by 0.057%, and average intercept income increases by 0.017%.

2.6.3 Increase in Minimum Pension Benefit

Under the EOBI system, all employees that qualify for less than the minimum pension benefits are awarded minimum pension conditional on fulfilling the eligibility requirements. Minimum pension is periodically revised upwards.[23] A worker in the covered sector may be eligible for minimum pension benefits for two reasons; (i) the worker acquires 15 or 16 years of covered sector experience and his retirement wage is at or above the minimum wage, or (ii) the worker has 17 or more years of experience and his retirement wage

[23]Increases in minimum pension over time are presented in Table 5.

is strictly below the minimum wage. For instance, for a worker with 35 years of experience, retirement wage needs to be 47% of the minimum wage in order for him to qualify for the minimum pension benefits. However, about 90% of the workers in the covered sector earn above minimum wages and about 93% acquire more than 16 years of covered sector experience. Thus, a majority of workers qualify for more than the minimum pension. This implies that the labor supply effects of an increase in minimum pension are likely to be small.

I find that the labor supply effects of a 50% increase in real minimum pension are almost negligible (see Figure 6). For workers age 25-44 years, covered sector employment increases by 0.022 percentage points, uncovered wage employment increases by 0.008 percentage points, and self-employment decreases by 0.018 percentage points. The overall labor force participation of workers age 25-44 years increases by 0.012 percentage points. Note that all these workers join wage employment. Workers age 45-59 years are less responsive to the policy reform as compared to younger workers. For these workers, covered sector employment increases by 0.004 percentage points, uncovered wage employment and self-employment fall by 0.002 and 0.008 percentage points, and the overall labor force participation also falls by 0.006 percentage points.

The overall labor force participation response is highest for workers age 60-75 years; their labor force participation falls by 0.056 percentage points. This is accounted for by a reduction in uncovered sector employment of 0.024 percentage points and a reduction in self-employment of 0.036 percentage points. However, all the wage employees who quit their jobs do not leave the labor force; some of them join covered wage employment.

The policy change increases the deficit by 4.57%. This owes to the increase in aggregate pensions disbursed of about 3.59%, and an increase in the aggregate grant, of about 0.015%. More interestingly, the total number of workers between the age of 25 and 60 years, that ever enter covered sector employment does not change after an increase in the minimum pension benefits. Moreover, changes in the number of workers receiving social security benefits or old-age grant, aggregate contributions and aggregate grant disbursements are not affected by the policy change. The reform exerts positive effects on welfare, the sum of utilities increases by 0.018%, while average intercept income increases by 0.023%.

In conclusion, the policy experiments show that an increase in the generosity of pension through an increase in the minimum wage or an increase in the level of minimum pension benefit decrease labor force participation. This is important because the government tries to increase the minimum wage and the

minimum pension benefits to gain popular support. However, it is clear that increasing pension for the current old creates disemployment effects. Although the magnitude of the reduction in labor force participation is small in the current policy experiment, it is only because minimum pension affects a small proportion of workers. If government tries to increase pension benefits for all workers, we may observe larger disemployment effects.[24] However, in a country like Pakistan, it is harder for the government to restrict increases in the minimum wage. Thus, it may be useful for EOBI to set the maximum taxable earning level at a wage that is different from the minimum wage

2.6.4 Can we Increase Labor Force Participation at Older Ages?

In Pakistan, labor force participation of older workers between the age of 60 and 75 has been falling in the past few years.[25] This coupled with a 4.5 year increase in life expectancy in the past decade implies that older non-working individuals are putting an increasing burden on the working population. The reduction in labor force participation of older workers has been partially compensated by higher participation rates of workers age 55-59 years, however, there is a growing need to institute social security reforms that help to enhance labor force participation at older ages. This section analyzes two such policies. First I examine whether changes in the time of benefit receipt increase labor force participation at older ages. I accomplish this by an increase in the retirement age along with an actuarial adjustment that keeps the present value of social security benefits fixed at the time of retirement. Second, I analyze the effects of changes in social security eligibility requirements on labor supply of older workers. This is done by increasing the required years of covered sector experience for grant and pension eligibility, both with and without a payroll tax adjustment, where the latter is a revenue-neutral reform and can therefore be compared to the current social security system.

[24]Starting the year 2007-08, every year that the minimum pension is increased, it is coupled with a 15% increase in benefits for all pensions above the minimum pension level. Till now, these reforms have not exerted large disemployment effects because inflation has been increasing. However, if inflation does not increase as much, the government may be creating higher unemployment.

[25]Estimated using Labor Force Survey data for the years 1996-97 to 2010-11. The results are available on request.

(i) Change in the Time of Benefit Receipt

In the model, delaying the time of benefit receipt corresponds to an increase in the retirement age. In the policy experiment, I increase the retirement age by five years; from age 60 to age 65. The policy change leads to a reduction in the labor force participation of workers age 25-44 by 7.98 percentage points (see Figure 2.7). Moreover, covered wage employment increases by 1.34 percentage points and uncovered wage employment increases by 1.51 percentage points. All workers who leave the labor force, as well as workers who join wage employment are drawn from self-employment. Thus, self-employment decreases by 10.84 percentage points.

Labor force participation also falls for workers age 45-59 years. For these workers, the negative labor supply response is much higher as compared to younger workers. In this case workers from all sectors exit the labor market, which leads to a reduction in labor force participation by 32.93 percentage points. 64.5% of these workers leave uncovered sectors jobs, 21.5% leave self-employment, and 0.14% leave covered wage employment. Similar labor supply responses are observed for workers age 60-64 years. These workers are now exposed to payroll taxes in the covered sector and are not eligible for social security benefits till they reach the age of 65 years. Their labor force participation falls by 12.7 percentage points. In addition, self-employment and wage employment for workers age 60-64 also fall by 3.65 and 9.05 percentage points respectively.

A majority of the labor supply response is observed for workers between the age of 50 and 60 years; with highest withdrawal rates at age 59 and age 60. This happens despite an increase in retirement age from age 60 to age 65. Thus, the results are consistent with the literature emphasizing the importance of behavioral norms in retirement decisions; whereby retirement at age 60 represents a natural focal point for a majority of workers in Pakistan. The overall labor force participation of older workers age 65-75 also decreases, however by a much smaller magnitude (0.126 percentage points). A majority of the older workers who exit the labor market are drawn from the uncovered sector (61.9%), followed by the self-employed (30.2%) and covered wage employees (7.9%).

The results suggest that an increase in the retirement age decreases the marginal return to work, inducing workers to exit the labor force earlier than they otherwise would have. These results are in contrast to the ones generally found in the literature. An increase in the retirement age usually helps to increase labor force participation at older ages. A possible explanation for these findings relates to the reduction in the number of years for which workers get these benefits. Below I examine the effects of the policy on EOBI deficit, with an emphasis on changes in the experience distribution after the policy change.

I find that an increase in the retirement age increases the proportion of workers in the middle of the covered sector experience distribution. To qualify for an old-age grant, workers have to work for at least 3 years in the covered sector. When the retirement age is fixed at 60 years, the proportion of workers with 3-6 years of covered sector experience falls, while the proportion of workers with 7-10 years of experience increases. Moreover, workers at the margin of grant eligibility respond by increasing labor supply just enough to be able to qualify for the maximum possible amount of the old-age grant paid out at retirement. Thus, the proportion of workers with 14 years of covered sector experience increases by 1.68 percentage points.

Moreover, fewer workers accumulate 15 and 16 years of covered sector experience. These workers qualify for minimum pension benefits under the current pension system. It is possible that the receipt of minimum pension for 5 fewer years is not enough to compensate them, thus they either stop at 14 years of experience or continue to work in the covered sector beyond the 16th year. This also shows up as an increase in the proportion of workers with 17 to 30 years of covered sector experience. Another interesting effect of the policy change relates to the proportion of workers that acquire the highest possible level of experience in the covered sector. This corresponds to 35 years of experience in the original setting, and 40 years of experience in the policy simulation. Previously, when the retirement age was fixed at 60 years, a majority of the individuals obtained 35 years of experience (about 54.76% of all eligible pensioners). After an increase in the retirement age, workers with the maximum possible years of experience (40 years) falls to 35.64%, i.e. the spike at the highest possible level of experience decreases by almost 20 percentage points.

Due to the aforementioned changes in the experience distribution, the total number of workers eligible for a grant increases by 8.9%, while the aggregate grants disbursed increase by 11.3%. Despite the increase in grant payments, the EOBI deficit falls by 36.44%. This owes to the reduction in aggregate pensions disbursed of about 27.06%, coupled with an increase in aggregate contributions received by about 7.19%. A greater number of workers are getting pension, but as the aggregate pensions fall, average pension also falls.

The reduction in labor force participation as well as the reduced social security benefits available to workers over the retired lifetime exert a negative impact on welfare, both in terms of the aggregate utility and intercept income. Average intercept income falls by 0.922% while the sum of utilities falls by 0.45%.

(a) With Actuarial Adjustment Policy reforms aimed at increasing labor force participation at older ages through a delay in benefit receipt, are usually coupled with an actuarial adjustment that leaves the present value of social security benefits fixed at the time of retirement. The adjustment is made to

compensate workers who are willing to work and pay the additional social security contributions with higher social security benefits. To make an adjustment that keeps the present value of social security benefits fixed at retirement, I increase social security benefits by 14.2%.

Qualitatively, the labor supply effects of the policy with the actuarial adjustment are similar to the one without the adjustment (see Figure 2.7). In terms of magnitudes however, the effects are larger in the former. This implies that actuarial adjustment decreases labor force participation over and above the decrease brought about by an increase in the retirement age. This is consistent with the earlier observation, where higher benefits induced workers to exit the labor market earlier than they otherwise would have. Higher social security benefits increase the utility of the outside option, i.e. the state of being unemployed in the model, and therefore lead to a higher unemployment.

With the actuarial adjustment, the labor force participation of workers between age 25-44 years falls by 8.03 percentage points, while labor supply in covered and uncovered wage employment increases by 1.79 percentage points and 1.7 percentage points respectively. As in the previous policy change, all the workers who join wage employment or exit the labor market are drawn from self-employment. Thus, self-employment falls by 11.53 percentage points. For workers age 45-59 years, the negative labor supply response is higher than the response at younger ages; labor force participation falls by 33.23 percentage points. Workers from all sectors exit the labor market, 65.5% leave uncovered wage employment, 21.8% leave self-employment, and 0.13% leave covered wage employment. 93% of the reduction in labor force participation for workers age 45-60 is accounted for by the reduction in labor supply of workers between the age of 50 and 60 years. As stated earlier, despite an increase in the age of retirement to age 65, a majority of the workers withdraw from the labor force at age 59 and age 60. Similarly, for 60-64 year old workers that are now exposed to payroll taxes in the covered sector, and are not eligible for social security receipt till they reach the age of 65 years, labor force participation falls by 12.97 percentage points, while self-employment and wage employment fall by 3.7 and 9.27 percentage points respectively.

Labor supply responses beyond the age of 65 years are lower in magnitude as compared to labor supply responses at younger ages. The overall labor force participation falls by 0.23 percentage points. Workers from all sectors exit the labor market, 55.7% leave the uncovered sector, 31.3% leave self-employment, and 0.13% leave covered wage employment.

Due to the actuarial adjustment to pension benefits, the reduction in aggregate pensions disbursed is lower as compared to the policy without the adjustment. Aggregate benefit outgo falls by 16.62% in the

former, as opposed to 27.06% in the latter. As a consequence, the reduction in deficit is also lower than before; 23.14% in the former as compared to 36.44% in the latter. The reduction in welfare is also smaller as compared to the previous policy change. Welfare as measured by the sum of utilities decreases by 0.406% and average intercept income falls by 0.87%.

The policy simulations suggest that an increase in the retirement age does not work towards increasing labor force participation at older ages. Moreover, when coupled with an actuarial adjustment that keeps the present value of benefits fixed at retirement, labor supply reduces even further. This result seems counterintuitive, however, below I find that an adjustment to the cost of employment at older ages along with an increase in the retirement age leads not only to higher labor force participation at older ages, it also helps to increase welfare.

(b) With Cost of Employment Adjustment Here I increase the age of retirement along with a reduction in the cost of employment between age 60 and 65 years. Previously, all individuals had to bear an additional cost of working after age 60. In the experiment, the extra cost is borne starting age 65, i.e.

$$\Phi_{i,t}(d,t) = \delta_0^d + \delta_1^d \frac{t}{50} + \delta_2^d (t-40).1[t \geq 41]$$

The reduction in employment cost coupled with an increase in the retirement age helps to increase labor force participation at older ages (see Figure 2.8). In particular, a majority of the workers between the age of 60 and 75 years enter the labor market; labor supply of workers age 60-75 years increases by 153.7 percentage points. A majority of these workers become self-employed, followed by covered wage employment.

For younger workers, the labor force participation response is smaller and negative. The overall labor force participation between the age of 25-59 years falls by 27.9 percentage points. All these workers leave uncovered wage employment. A major difference between the aforementioned policy experiments and the experiment with the cost of employment adjustment is the increase in self-employment at all ages. Self-employment between the age of 25-59 years increases by 83.69 percentage points. As stated earlier, all these self-employed individuals are drawn from uncovered wage employment.

The policy generates positive welfare effects; aggregate utility increases by 1.11% and intercept income increases by 1.26%. In addition, a greater number of individuals enter the covered sector. Thus, average experience increases by about 2 years and aggregate contributions go up by 12.62%. The increase in contributions, coupled with a reduction in social security benefits of about 22.65% leads to a 32.6% reduction in

EOBI deficit.[26]

The results suggest that an increase in the retirement age on its own is unlikely to increase labor force participation at older ages, unless the government invests in reducing the cost of employment for older workers and encourages them to participate in the labor market.

Below I discuss the policy change that may help to increase labor force participation by making pension eligibility requirements more stringent.

(ii) Increase in Required Covered Sector Experience

In order to make social security eligibility more stringent, I increase the required number of years of insurable employment for pension and grant eligibility by 5 years. Here I find that the policy change does not affect labor supply between the age of 25 and 60 years (see Figure 2.9). For older workers age 60-75 years however, the policy change leads to an increase in labor force participation by 0.094 percentage points. All the workers who decide to enter the labor market either become self-employed or join uncovered wage employment. Labor supply response in the covered sector is negative and small; covered sector employment for workers age 60-75 falls by 0.002 percentage points. Thus, increasing the experience requirement has a positive effect on the labor force participation of older workers, however, the magnitude of the response is quite small.

It is important to note that the experience requirement is increased by 5 years for both old-age grant eligibility and pension eligibility. Thus, after the policy change, workers with 8 to 19 years of covered sector experience qualify for a grant, while workers with 20 or more years of experience qualify for old-age pension. Consequently, average covered sector experience of workers eligible for old-age grants increases from 6.95 years to 12.84 years. Moreover, for workers receiving old-age pensions, covered sector experience increases from 31.3 to 32.45 years on average. An analysis of the average benefit outgo by the level of experience shows that pension benefits decrease for workers with 20 to 32 years of experience, and increase for workers with 34 and 35 years of covered sector experience. These higher benefits increase the proportion of workers with 35 years of experience by about 4.38 percentage points.

Moreover, workers with 15-19 years of experience that previously received old-age pensions from age 60 to age 75, are now eligible for a one-time grant receipt at age 60. Thus, the present value of social security

[26]The reduction in aggregate pension disbursements owes to the reduction in the number of years for which social security benefits have to be paid put out.

benefits at the time of retirement falls significantly for these workers. In addition, the average grant amount received by workers with 8 to 13 years of experience also decreases after the policy change. Only workers with 14 years of experience earn a higher grant amount on average. Workers with 3 to 7 years of covered sector experience also lose retirement benefits after the policy change; they are no longer eligible to receive the lump-sum grant at age 60.

Thus, the overall effects of the policy work towards reducing pension coverage. However, for workers who manage to satisfy the new eligibility requirements, the average pension benefits increase. Although the policy helps to reduce the deficit by 5.92%, it exerts negative welfare impacts. Welfare as measured by the sum of utilities falls by 0.028%, while intercept income decreases by 0.033%.

Revenue Neutral In order to make the aforementioned policy change revenue-neutral, I make an adjustment to payroll taxes.[27] I change payroll taxes differentially for young and old workers. As labor supply is more inelastic at younger ages, I reduce the tax by 1 percentage point for workers age 25 to 45 years, and by 1.7 percentage points for workers above the age of 45 years.[28]

A reduction in the payroll tax leads to an increase in labor force participation in the covered sector (see Figure 2.10). For workers age 25-45 years, covered sector employment increases by 0.892 percentage points. 40.6% of these workers are drawn from uncovered wage employment, 54.9% leave self-employment to join the covered sector, and 4.5% of the workers who enter the covered sector were previously unemployed or out of the labor force. Recall that without the tax reduction, labor supply for workers age 25-45 was unchanged. However, the reduction in taxes increases labor supply in the formal sector, and increases the overall labor force participation of workers.

Tax reduction also induces older workers to work more; labor force participation of workers between the age of 45 and 60 years increases by 0.122 percentage points, which is higher than the labor supply response to the change in eligibility requirement without the tax reduction. All workers who enter the labor force join the covered sector. Moreover, workers from self-employment and uncovered wage employment also transition to the covered sector, increasing covered sector employment by 0.8 percentage points.

For older workers age 60-75 years, labor force participation increases by 0.084 percentage points; which is

[27] There are several policy parameters that can be used to make the policy revenue neutral. For instance, an increase in the minimum pension, an increase in the minimum wage, an increase in the generosity of pensions etc.

[28] see the Appendix for an analysis of labor supply elasticities in the model.

lower than the increase without the revenue neutral policy change. All these workers enter wage employment, with a majority choosing to join the uncovered sector. A few of the older workers also leave self-employment for wage employment. A major difference in the policies with and without the tax reduction is the sector of employment chosen by older workers who decide to participate in the labor market after the policy change. In the policy without the tax reduction, workers who were encouraged to participate in the labor market chose to join the informal sector, i.e. uncovered wage employment and self-employment. However, with the tax reduction, workers either choose uncovered wage employment or covered wage employment.

Despite more workers entering the covered sector, the reduction in taxes reduces the aggregate contributions received by 17.68%. Recall that the increase in experience requirements for a lump-sum grant led to an increase in grants disbursed per worker. In the aggregate, grant disbursement increases by 15.7%. Moreover, the requirement for higher covered sector experience leads to fewer workers qualifying for old-age pensions. As a result, social security benefit outgo falls by 4.6%. The reduction in contributions and pensions balances the increase in grant payments, which helps to keep the deficit at its original level.

Unlike the non-neutral increase in experience requirements, the revenue neutral policy is a welfare-enhancing policy change. Lower taxes and higher labor force participation helps to increase aggregate utility and intercept income by 0.015% and 0.11% respectively.

The aforementioned analysis suggests that stringency in social security eligibility can help to increase labor force participation at older ages. Moreover, if younger workers are simultaneously compensated through a tax reduction, they will be encouraged to work towards fulfilling these stringent requirements.

2.6.5 Proposed Deficit Reduction Strategies

This section examines changes in life-cycle labor supply and welfare in case of four different deficit reduction strategies.

(i) Raise the Retirement Age

A two year increase in the age of retirement (from age 60 to age 62) reduces EOBI deficit by 14.72%. This owes to the increase in aggregate contributions received, and the reduction in aggregate pensions disbursed.

The aggregate benefit outgo decreases by 11.12% and the contributions received increase by 2.4%. The distribution of covered sector experience shows that more workers acquire lower levels of experience after the policy change. Thus, the number of workers eligible to receive an old-age grant increases by 6%. This in turn increases the aggregate grants disbursed by 7.9%. Despite the increase in grant payments, the reduction in aggregate pensions is enough to reduce the overall deficit.

The policy experiment shows that an increase in the retirement age exerts a significant impact on labor force participation rates (see Figure 2.11). First, for workers age 25-44 years, labor force participation decreases by 4.29 percentage points. Workers that decide to exit the labor market are drawn from covered wage employment and self-employment. Thus, covered sector employment falls by 2.63 percentage points, and self-employment falls by 2.87 percentage points. In addition, there is an increase in labor force participation in informal sector wage employment, i.e. uncovered wage employment increases by 1.204 percentage points. Thus, the reform increases informality and unemployment for workers age 25-44 years.

Second, the overall labor supply response of workers age 45-61 is significantly larger in magnitude as compared to the response of younger workers age 25-44 years. Labor force participation of workers age 45-59 years decreases by 18.73 percentage points. 59.4% of the workers who exit the labor market are driven from uncovered wage employment, while 32.6% leave the covered sector. The remaining 7.95% move out of self-employment. This is because an increase in the retirement age reduces the present value of social security benefits at each age. If the reduction in benefits decreases workers' valuation of pension benefits, they may choose to exit the labor market after completing a certain number of years of insurable employment.

Labor supply responses beyond the age of 62 years are much smaller as compared to labor supply responses mentioned above. The overall labor force participation falls by 0.09 percentage points. 60% of these workers leave covered wage employment, 20% leave the uncovered sector and 20% are drawn from the self-employment sector.

Due to a reduction in the number of workers covered by social security, a reduction in labor force participation, and a decrease in benefit outgo, the policy exerts a negative impact on welfare. The sum of utilities falls by 0.199%, while the average intercept income falls by 0.433%.

(ii) Reduce the generosity of pension

Another way to reduce the deficit is through the reduction in the generosity of pension benefits. Recall that for the policies to be comparable, the defcit needs to be decreased by 14.72%. To accomplish this, I decrease pension benefits and grant payments by 11.29%. This leads to a reduction in covered sector employment for workers age 25-44 years by 0.062 percentage points (see Figure 2.12). 67.7% of the workers who leave the covered sector become unemployed, 35.5% move to smaller firms in the uncovered sector, and the remaining 3.2% choose to become self-employed. In case of workers age 45-59 years, labor force participation falls in all sectors, except the uncovered sector. Uncovered wage employment for workers age 45-59 increases by 0.44 percentage points. 27.3% of these workers are new entrants into the labor market, while 63.2% leave self-employment for uncovered wage employment. The remaining 9.5% of the workers leave larger firms in the covered sector and move to smaller firms in the uncovered sector. For older workers age 60-75 years, labor force participation increases by 0.074 percentage points, and covered wage employment falls by 0.04 percentage points. Thus, older workers choose to work in the informal sector after the policy change. This increases uncovered wage employment by 0.094 percentage points and self-employment by 0.02 percentage points (see Figure.

The proposed reduction in deficit is particularly attributable to the reduction in benefit outgo. Total social security benefits disbursed fall by 11.27%, and total grants disbursed fall by 11.71%. Due to smaller distortions in labor supply, the welfare reduction of the proposed policy are significantly smaller as compared to the policy that increases the age of retirement. Welfare as measured by the sum of utilities falls by 0.052%, while average intercept income decreases by 0.068 percent. Despite the lower negative welfare impact, the policy leads to an increase in informal sector employment at middle ages.

(iii) Raise the Payroll Tax

Deficit reduction may also be achieved through an increase in the payroll tax rate. To reduce the deficit by 14.72%, payroll tax has to be increased by 3.213 percentage points. The reduction in taxes increases aggregate contributions by 44.67%. In addition, aggregate pensions and grants disbursed decrease by 0.83% and 1.06% respectively.

As for the labor supply effects of the policy change, I find that covered sector employment for workers age 25-44 years falls by 2.8 percentage points (see Figure 2.13). 35.77% of the workers who leave covered

sector jobs move to smaller firms in the uncovered sector, while 57.58% choose to become self-employed. The remaining 6.65% of the workers either become unemployed or leave the labor force. Thus, labor force participation of workers age 25-44 falls by 0.186 percentage points. Workers between the age of 45 and 60 years also move out of the covered sector; labor supply in the covered sector falls by 1.62 percentage points. 56.1% of these workers choose to become self-employed, and 24.4% choose to work in the uncovered sector. The remanning 19.5% become unemployed or leave the labor force. Note that younger workers are more responsive to a tax increase in the covered sector, whereas older workers are more responsive to payroll tax changes at the overall participation margin. For workers age 60-75 years, labor force participation increases by 0.018 percentage points. Covered sector employment falls by 0.036 percentage points, while uncovered wage employment and self-employment increase by 0.004 and 0.05 percentage points.

Social security taxes distort labor supply in the covered sector. A reduction in the labor force participation of workers age 25-59 years leads to reduction in welfare. The average intercept income falls by 0.264%, and the sum of utilities falls by 0.083%.

(iv) Remove the cap on Taxable Earnings and Reduce the Payroll Tax

As stated before, in the EOBI system, the maximum taxable earnings are set at the level of the minimum wage. Here, I remove the cap on taxable earnings by making contribution payments independent of the minimum wage. In the experiment, contributions are based on the actual wage. This leads to a significant increase in contributions and helps to decrease the deficit substantially. However, to achieve a deficit reduction of 14.72%, such that the proposed policy change is comparable to the aforementioned policy changes, I reduce the payroll tax rate. In order to achieve the desired reduction in deficit, the payroll tax rate has to be decreased by 2.285 percentage points; from 7% to 4.715%.

Firstly, the proposed changes lead to a reduction in covered sector employment (see Figure 2.14). For workers age 25-44 years, labor supply in the covered sector falls by 0.596 percentage points. 51.7% of the workers who leave the covered sector become self-employed, while 45% move to smaller firms in the uncovered sector. The remaining 3.3% of the workers leave the labor force or become unemployed. As compared to workers age 25-44 years, labor supply of workers age 45-59 years is more responsive to the proposed policy change. For these workers, covered sector employment falls by 0.79 percentage points. 46.9% of the workers who leave the covered sector become self-employed, while 37% move to the uncovered sector. The remaining 16.1% of the workers exit the labor market. Note that the reduction in labor force participation of older

workers is higher as compared to younger workers. This is because wages are highest at middle ages, thus removal of maximum taxable earnings increases the required contribution most for middle-age workers.

Labor supply of older workers does not vary with the policy change. Overall labor force participation does not change. A few of the workers move from wage employment into self-employment.

Due to the elimination of the taxable earnings cap, aggregate contributions received increase by 47.4%. In addition, the aggregate pension and grant disbursement decreases by 0.18% and 1.29% respectively. The proposed policy exerts a negative impact on welfare. Welfare as measured by the sum of utilities falls by 0.028%, while intercept income falls by 0.095%.

A comparison of the four policy options reveals interesting results. First, increasing the age of benefit entitlement reduces welfare the most, irrespective of the measure of welfare used. This owes to the significant reduction in labor force participation between the age of 50-60 years as a result of the policy change. Second, raising the payroll tax rate reduces welfare by less than the welfare reduction under the retirement age change, but more than the reduction in the other two policies; one that reduces the generosity of pension benefits, and the other that eliminates the taxable earnings cap and adjusts the payroll tax rate downwards. Second, the results vary by the metric used to evaluate welfare changes. If the sum of utilities is the preferred welfare measure, the policy that eliminates the taxable earnings cap along with a reduction in the the payroll tax rate serves as the best policy solution. However, in terms of intercept income, a reduction in the generosity of pension benefits is the best alternative. Below I provide some possible explanations consistent with the observed welfare effects.

The reduction in intercept income is lower when I reduce pension generosity because workers respond by increasing labor supply at older ages. Thus, there is a reduction in unemployment. The reduction in unemployment is responsible for the lowest reduction in intercept income among all the policy alternatives. This however, is not true for the policy that eliminates the taxable earnings cap for social security and adjusts the payroll tax. In case of the latter, labor force participation falls, reducing intercept income by more than the reduction in intercept income in the benefit reduction policy.

Another important distinction between the two policies is the age-based variation in labor supply responses (see Table 6). The policy that reduces pension generosity does not exert significant effects on the labor supply of workers age 25-44 years; a majority of the labor supply effects kick in after the age of 45 years. However, with the elimination of the maximum taxable earnings cap and downward tax adjustment,

the labor supply response at younger ages (24-44) is close to the labor supply response at older ages (age 45-59).

If the government's desire is to increase labor force participation at older ages, even if it comes at the cost of higher informality, it should aim to reduce the generosity of pension. However, if the government aims to increase aggregate utility despite the reduction in labor force participation and the increase in informality, eliminating the maximum taxable earnings cap for social security contributions and reducing the payroll tax rate is the way to go. Note however, that informality is increasing in both policy changes. In the former, the government can at least achieve a higher participation rate.

These policies together provide the motivation for the proposed policy solution that simultaneously reduces the generosity of pension and the payroll tax rate.

(v) Proposed Policy Solution

In order to achieve a 14.72% reduction in the EOBI deficit, the proposed policy reduces the generosity of pension by 15% and the payroll tax rate by 1.066 percentage points. The reduction in taxes increases covered sector employment between the age of 25 and 44 years by 0.9 percentage points. A majority of these workers are driven from uncovered wage employment and self-employment (see Figure 2.15). For workers age 45-59 years, covered sector employment increases by 0.5 percentage points. More importantly, labor force participation for workers age 45-59 years increases by 0.32 percentage points. The reduction in pension generosity helps to increase labor force participation of older workers. For workers age 60-75 years, the overall labor force participation increases by 0.13 percentage points.

The welfare effects of the policy change are reassuring. Intercept income only falls by 0.005%, which is significantly lower than the welfare reduction in the aforementioned policy proposals. In addition, aggregate utility falls by 0.043%. Note that the reduction in aggregate utility is less than the reduction in case of the policy change that only reduces the generosity of pension by 11.2%, and holds the payroll tax rate fixed. However, it it is greater than the reduction in aggregate utility in case of the fourth policy proposal; one that delimitates the maximum taxable earnings cap and reduces the payroll tax rate. The reason for the latter is that payroll tax reduction is higher in the fourth policy proposal. There, taxes are reduced by 2.3 percentage points, whereas the current policy reduces taxes only by 1.1 percentage points. I still recommend the policy of benefit reduction and payroll tax reduction as the proposed policy because the reduction in

intercept income is almost negligible, labor force participation increases at middle and older ages, and most importantly, the increase in informality is not as high as compared to the second and fourth policy proposals.

2.6.6 July 2008 Amendments to EOBI Rules

This section examines labor supply and welfare effects of July 2008 amendments to EOBI rules. On July 1, 2008, EOBI extended social security coverage to informal sector firms with 5 to 9 employees. Thus, part of the uncovered sector became covered. In addition, the rate of employers' contribution towards social security was decreased from 6% to 5% of the minimum wage. Also, both the minimum wage and the minimum pension were increased.

The reforms led to an 8% increase in the real minimum wage, a 10.4% increase in the real minimum pension, and reduced the total payroll tax by one percentage point. Moreover, social security benefits for workers receiving more than the minimum pension benefit were increased by 15%. However, inflation during the period was at 20%. Thus in real terms, the benefits decreased by 5%. However, after the policy change, the 5% reduction in social security benefits has to be applied to the new (higher) benefit level, the one calculated at the new minimum wage. Thus, for any given level of covered sector experience, the combined effect of the increase in the minimum wage and the reduction in the value of the real minimum pension led to an increase in pension benefits of 2.6 percent.

(i) Without Extension of Coverage

Here I test for the labor supply effects of July 2008 amendments without incorporating the extension of coverage (see Figure 2.16). In the model, the amendments lead to an increase in labor force participation of workers age 25-44 years by 0.052 percentage points. All these workers join the covered sector. In addition, workers from uncovered wage employment and self-employment also enter the covered sector. This leads to an increase in covered sector employment of about 0.586 percentage points.

For workers age 45-59 years, labor force participation does not change as a result of the policy change. However, there is a movement of workers from uncovered wage employment and self-employment into covered wage employment. This shows that covered sector employment presents itself as a better alternative after the policy change. Overall, covered wage employment increases by 0.32 percentage points. 52% of the workers

who join the covered sector were previously working in smaller firms in the uncovered sector, while 48% were self-employed.

Older workers age 60-75 years do not respond much to the reforms. For these workers, pensions become more generous, and they respond by decreasing labor force participation. As the benefit increase is small (2.6%), the reduction in labor supply is also small (about 0.03 percentage points).

Overall. the policy change leads to a modest increase in benefit outgo. Aggregate grants paid increase by 1.97% and pensions disbursed increase by 1.89%. These changes coupled with a reduction in aggregate contributions of about 8.22% lead to an increase in the deficit of about 4.97%. Despite the increase in deficit, the amendments exert positive welfare effects. Welfare as measured by the sum of utilities increases by 0.024%, while average intercept income increases by 0.063%.

The current simulation provides a partial view of the full effects of the amendments, because the policy simulation does not take into account the extension of EOBI coverage to establishments with 5 to 9 employees. What we do however observe is an increase in labor supply in establishments already under the jurisdiction of the law, as well as an overall increase in labor force participation of workers between the age of 25 and 60 years.

(ii) With Extension of Coverage

Here I simulate the model to account for the extension of social security coverage to firms with 5 to 9 employees. I split the sample of workers in the uncovered sector into two sub-sectors based on firm-size categories. The first sector incudes workers in firms with 5 to 9 employees, while the second consists of workers in 4 or fewer employee firms. For the policy simulation, I introduce taxes and benefits in the budget constraint of the first sub-group. All other amendments are modeled as before.

The results show that the amendments lead to a reduction in labor supply in the new covered sector; in firms with 5 to 9 employees (see Figure 2.17).[29] For workers age 25-44 years, labor supply in firms with 5 to 9

[29]These findings are in contrast to the ones in the first chapter. There I find that the July 2008 amendments lead to reduction in wages in firms with 5 to 9 employees, with no effects on employment. This is due to three reasons. First I do not model the labor demand effects of social security extension in the structural model. Second, the reduction in wages due to social security extension is not taken into account. Third, the sample of workers used to estimate the parameters of the model is different from the sample of workers used to examine the effects of social security extension on wages and employment. The former is based on a sample of male household heads between the age of 25 and 75 years, while the latter uses data on male

employees falls by 7.122 percentage points. A majority of these workers move to smaller firms with 4 or fewer employees (42.94%) or become self-employed (42.91%), while 11% join larger firms in the covered sector, and the remaining 2.67% become unemployed or leave the labor force. For workers age 45-60 years, labor supply in firms with 5 to 9 employees falls by 3.03 percentage points. A majority of these workers become self-employed (46.5%), 25.5% move to smaller uncovered sector firms, and 12.4% move to larger firms in the covered sector. The remaining 15.6% of the workers become unemployed or leave the labor force. Note that as compared to younger workers, older workers respond more at the participation margin. Workers between the age of 60 and 75 years are the least responsive. For these workers, there is some movement from wage employment into self-employment and unemployment, however, the effects are quite small.

An analysis of the experience distribution in covered employment reveals interesting results. Experience distribution in the new covered sector displays a spike at 3 years of experience. This shows up both through the reduction in average covered sector experience and a two-fold increase in the number of workers eligible to receive an old-age grant. Moreover, the spike at 35 years of experience is much smaller in the new covered sector as compared to the spike in the old covered sector. This implies that in firms with 5 to 9 employees, a majority of workers respond to the July 2008 amendments by attaining just enough experience to qualify for positive social security benefits, even if they come in the form of a lump-sum grant at the time of retirement.

Owing to a two-fold increase in grant disbursement, EOBI deficit increases by 51%. Aggregate pensions disbursed also increase by 43.35%. Despite the increase in deficit, the policy exerts a positive impact on welfare. Aggregate utility increases by 0.037% and intercept income increases by 0.538%.

Labor supply responses to the extension of coverage call for information based initiatives on the part of EOBI. Workers may not perceive the true tax-benefit link at each age, and may therefore reduce labor supply in the short-run. Social security provision under EOBI is actuarially unfair, i.e. the present value of benefits at each age exceed the costs of social security contributions. Conveying these cost and benefit calculations to workers may help to encourage higher labor force participation in covered sector firms. In summary, reducing information asymmetries regarding social security rules and future benefits, and delivering on future promises needs to take priority.

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workers between the age of 14 and 60 years.

2.7 Conclusion

This paper pursues a modest goal of studying the sensitivity of labor supply to social security policies in Pakistan. Specifically, I examine how parametric reforms to the social security system instituted through the Employees' Old Age Benefits Act, affect life-cycle labor supply in the presence of segmented labor market opportunities. This is done in the context of a dynamic structural model of individual behavior and aggregate welfare. I then use the model to conduct policy simulations aimed at evaluating three broad categories of reform.

First, I perform a detailed analysis of the most common changes made to the social security rules in Pakistan, i.e., increases in the minimum pension benefits, and increases in the minimum wage. The former increases pension generosity for workers at the lower end of the income distribution, while the latter increases the social security tax base and the generosity of pension for a majority of the workforce. Consequently, labor supply distortion, deficit reduction and welfare increases are higher in case of the latter.

Second, I examine one of the most pressing questions in social security policy that asks how older workers can be encouraged to work more in the face of increasing life-expectancy. I examine two policies that are likely to induce higher labor force participation by older workers. These include a delay in the time of benefit receipt, and an increase in the stringency of social security eligibility requirements. I find that delaying the time of benefit receipt induces workers to work more only when it is coupled with a reduction in the cost of employment at older ages. If instead, employment costs are held constant, workers choose to exit the labor market earlier than they otherwise would have. Moreover, I find that making the eligibility requirements more stringent encourages workers to work more at older ages. The latter, coupled with a payroll tax reduction that keeps the deficit at its original level, encourages labor force participation at all ages.

Third, I propose various deficit reduction strategies that may help to ease the financial situation faced by the social security institution in Pakistan. Being a PAYG pension system, EOBI fears the threat of insolvency in the coming years. I suggest that reforms that reduce the generosity of pension for older workers can help to reduce the deficit, without creating large labor supply distortions or welfare losses. Moreover, if the deficit has to be maintained at its original level, the reform that reduces pension benefits can be coupled with a small reduction in payroll taxes. The latter will encourage labor force participation at younger ages, while the former will encourage older workers to work more.

Table 2.1: The Intensive Margin of Labor Supply for Older Workers

Age	50 to 54	55 to 59	60 to 64	65 to 69	70 to 75
1-7 hours	0.08	0	0.01	0	0.89
8-14 hours	0.28	0.47	0.5	0.79	0
15-28 hours	1.96	1.98	4.35	3.92	2.9
29-42 hours	17.56	19.07	22.8	24.89	24.65
43-56 hours	49.01	49.84	43.82	42.08	44.24
57-70 hours	25.23	23.69	24.71	23.95	20.23
71-84 hours	4.23	3.69	2.59	3.18	4.34
More than 84 hours	1.64	1.26	1.21	1.18	2.74

Table 2.2: Social Security Payroll Tax and Minimum Wage Over Time

From	To	Base Min Wage	Contribution Employer	Contribution Worker
July 1 1976	June 30 1985	1000	5%	-
July 1 1986	Sep 24 1993	1500	5%	-
Sep 25 1993	-	3000	5%	-
July 1 2001	-	3000	5%	Rs 20
July 1 2005	-	3000	6%	1%
July 1 2006	June 30 2007	4000	6%	1%
July 1 2007	June 30 2008	4600	6%	1%
July 1 2008	June 30 2010	6000	5%	1%
July 1 2010	To date	7000	5%	1%

Table 2.3: Moments from the Dynamic Model

MOMENTS	Data	Model
Covered Sector Experience	20.783	20.466
Covered Employment Persistence	0.782	0.851
Uncovered Employment Persistence	0.730	0.731
Self-Employment Persistence	0.517	0.769
Unemployment Persistence	0.742	0.845
High Education Covered	0.242	0.246
High Education Uncovered	0.047	0.0527
Married Covered	0.958	0.957
Married Uncovered	0.957	0.958

Table 2.4: Estimated Parameters from the Dynamic Model

Parameter	Estimate (se)
α	5.0905 (0.0135)
Cost Parameters	
δ_{0c}	7.2706 (0.0115)
δ_{1c}	11.2525 (0.0285)
δ_{2c}	1.1124 (0.0041)
δ_{0uc}	-3.4609 (0.0063)
δ_{1uc}	7.9245 (0.0131)
δ_{2uc}	0.2266 (0.0017)
δ_{0s}	-2.7101 (0.0094)
δ_{1s}	5.4614 (0.0074)
δ_{2s}	0.2783 (0.0012)
Persistence Parameters	
ρ_c	1.3837 (0.0257)
ρ_{uc}	1.7399 (0.0073)
ρ_{se}	0.9869 (0.0082)
Permanent Unobserved Heterogeneity	
σ_c	12.0575 (0.0156)
σ_{uc}	0.0004 (0.0123)

Table 2.5: Increase in The Minimum Pension Benefit Over Time

From	To	Minimum Rates of Pension in Nominal Rupees
7/1983	6/1986	90
7/1986	6/1987	306
7/1987	6/1988	323
7/1988	6/1989	349
7/1989	6/1990	374
7/1990	6/1991	400
7/1991	31/1999	425
1/2000	10/2001	630
1/2001	12/2004	700
1/2005	6/2001	1000
7/2006	6/2007	1300
7/2007	6/2008	1500
7/2008	6/2010	2000
7/2010	7/2012	3000
7/2012	To date	3600

Table 2.6: A Comparison of the Preferred Policies (Proposal 2 and 4)

Age	25-44		45-59		60-75	
	BR	EEC & Tax	BR	EEC & TAX	BR	EEC & TAX
Covered	-0.062	-0.596	-0.042	-0.794	-0.04	-0.008
Uncovered	0.022	0.268	0.44	0.294	0.094	-0.006
Self-employed	-0.002	0.308	-0.278	0.372	0.02	0.014
Unemployed	0.042	0.02	-0.12	0.128	-0.074	0.000

BR = Benefit Reduction, EEC & TAX = Elimination of Earnings Cap
for contribution payments and tax reduction.

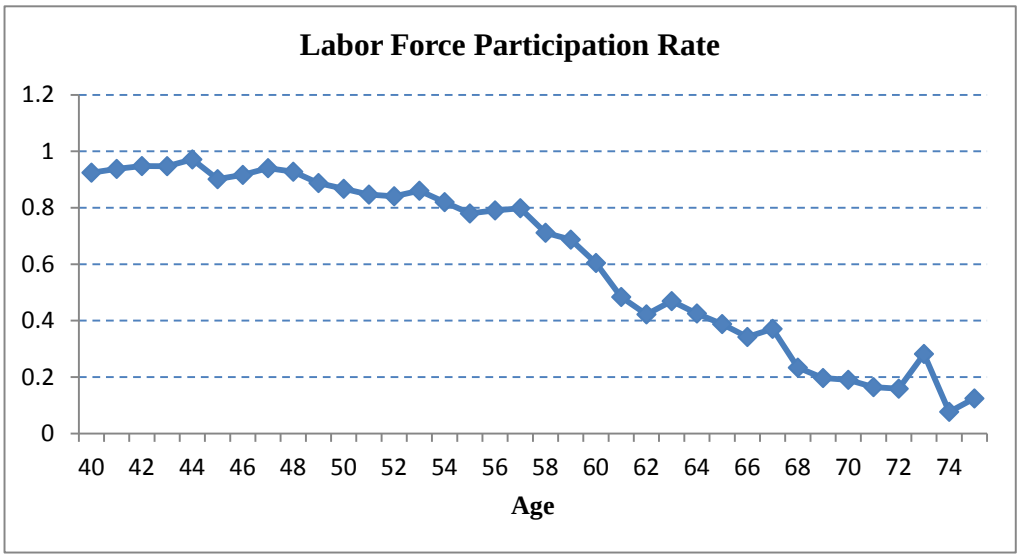


Figure 2.1: Life cycle profiles for Labor Force Participation

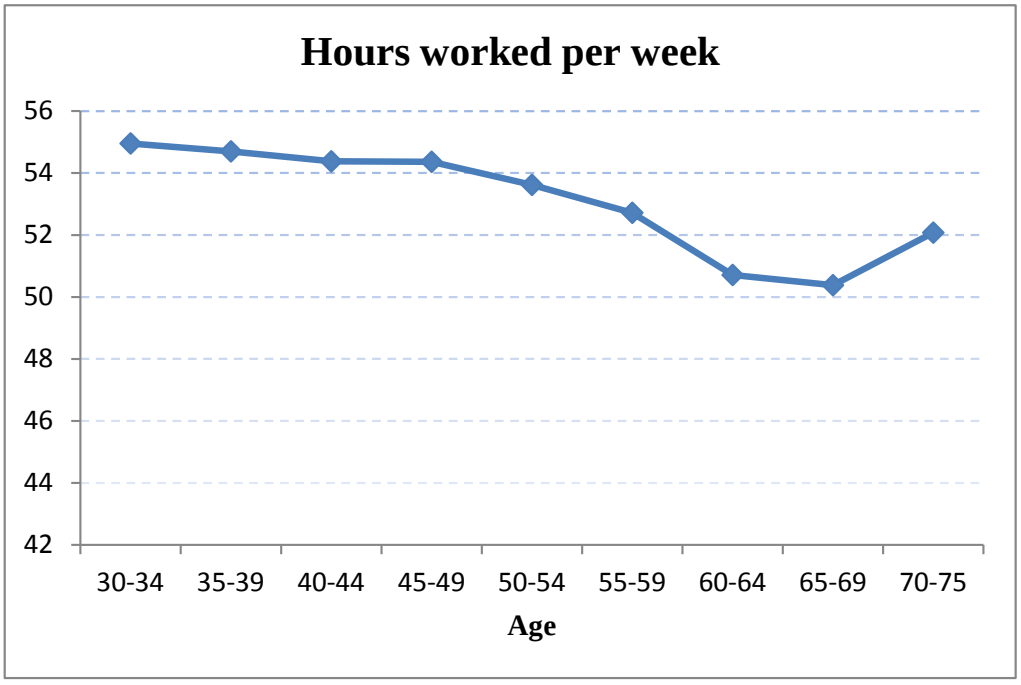


Figure 2.2: Life-cycle profiles for Weekly Hours Worked

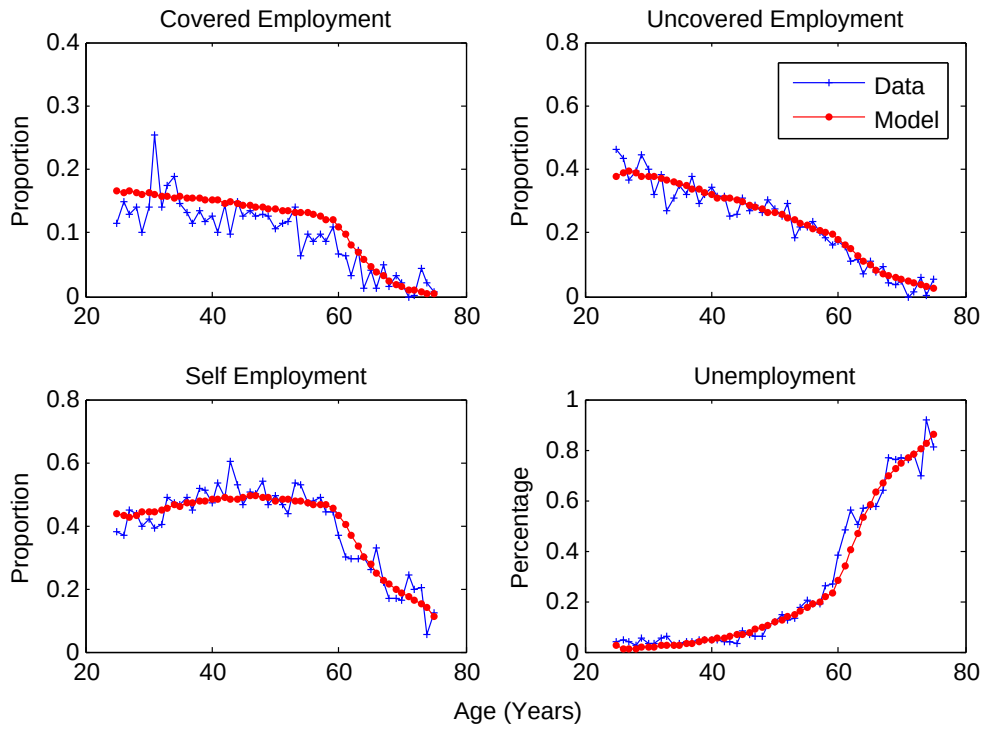


Figure 2.3: Labor Supply Over the Life-Cycle

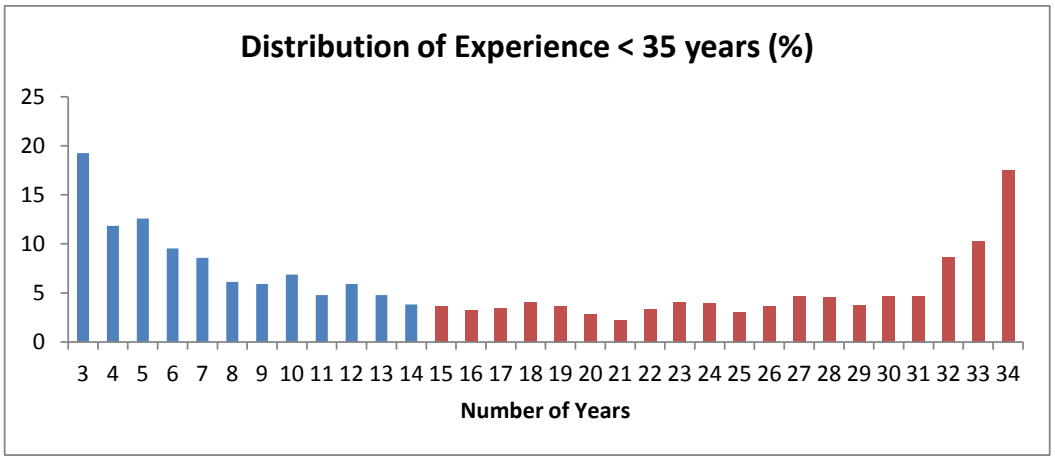


Figure 2.4: Distribution of Covered Sector Experience

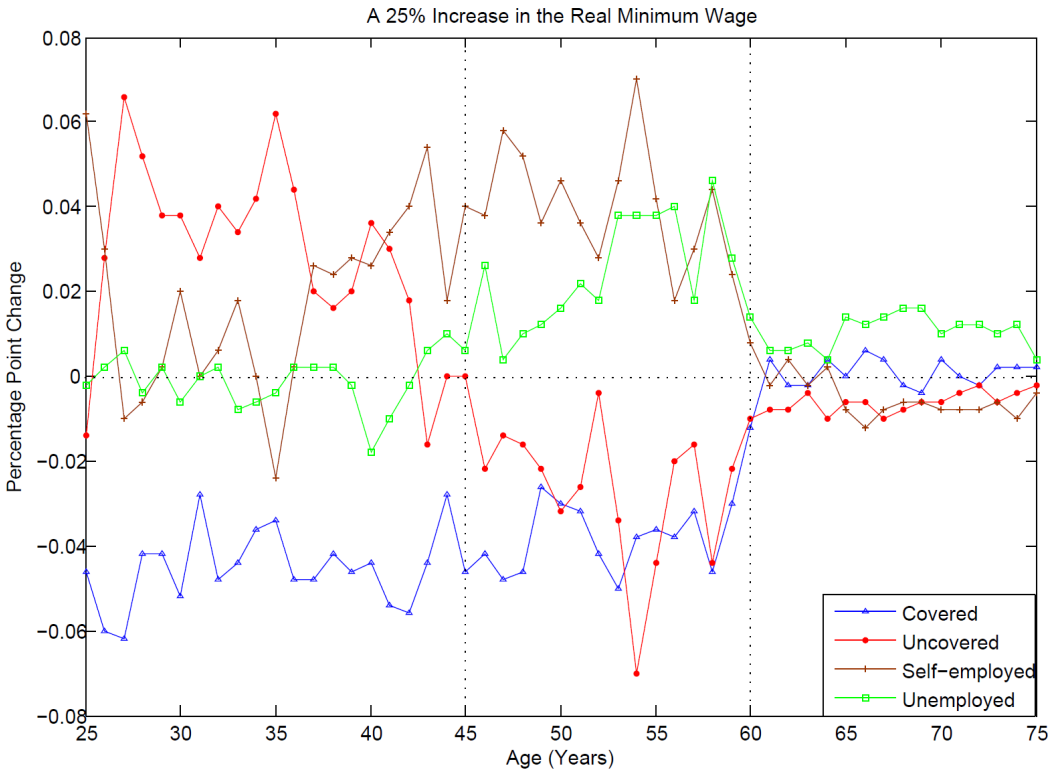


Figure 2.5: Increase in the Minimum Wage

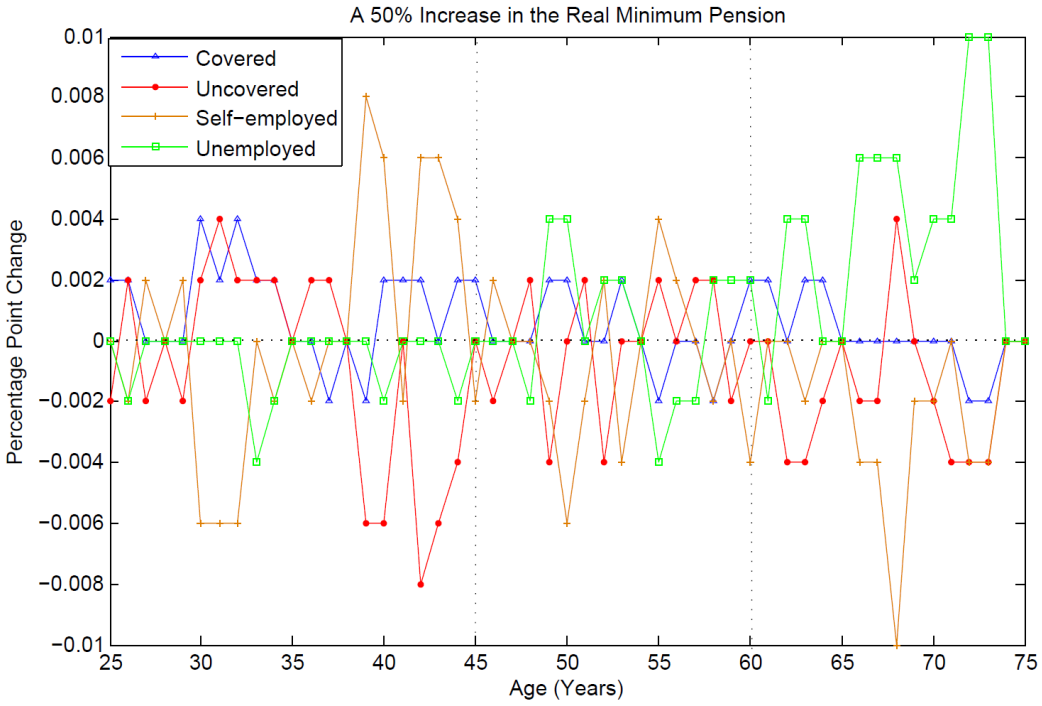


Figure 2.6: Increase in the Minimum Pension Benefit

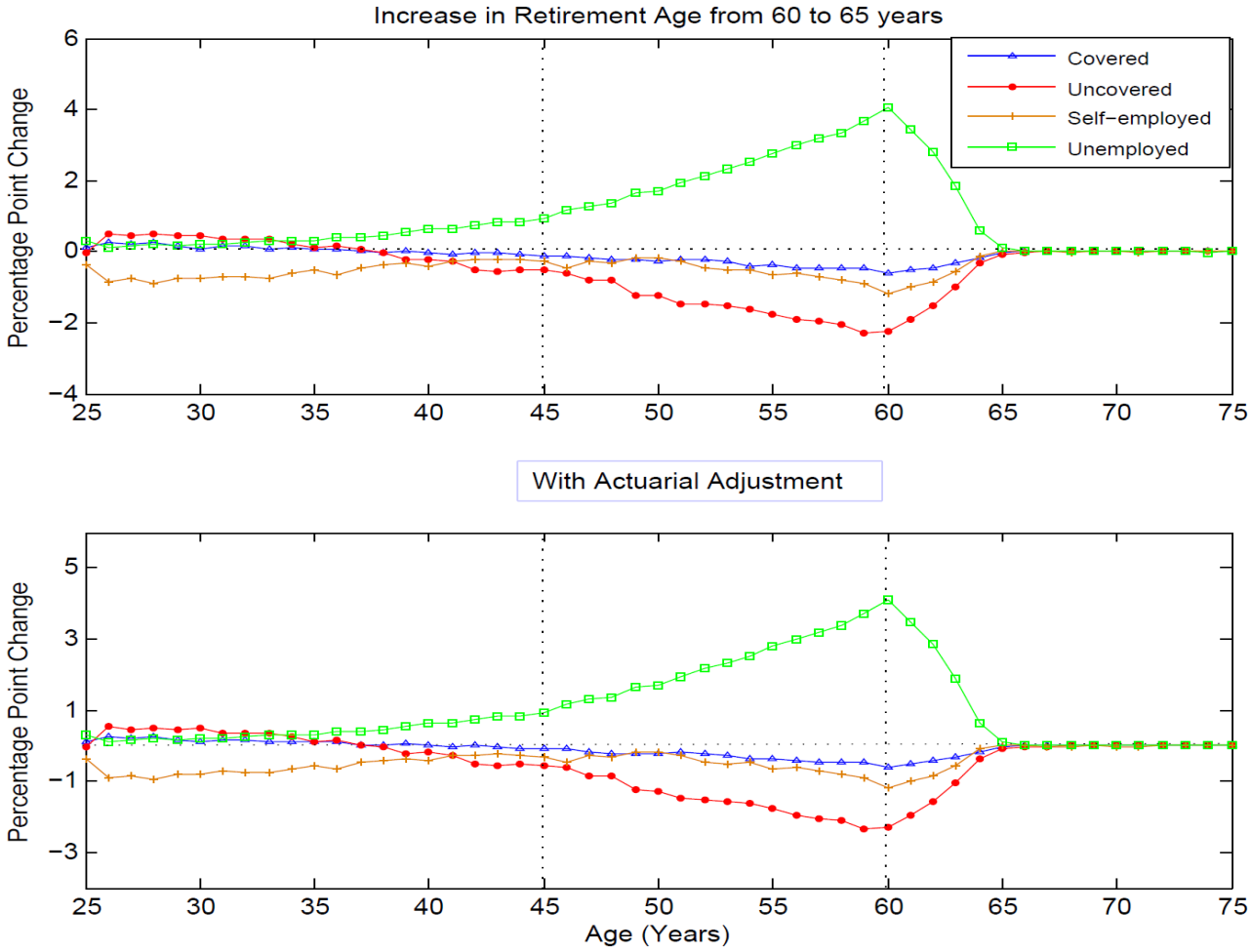


Figure 2.7: Delaying the Age of Benefit Entitlement

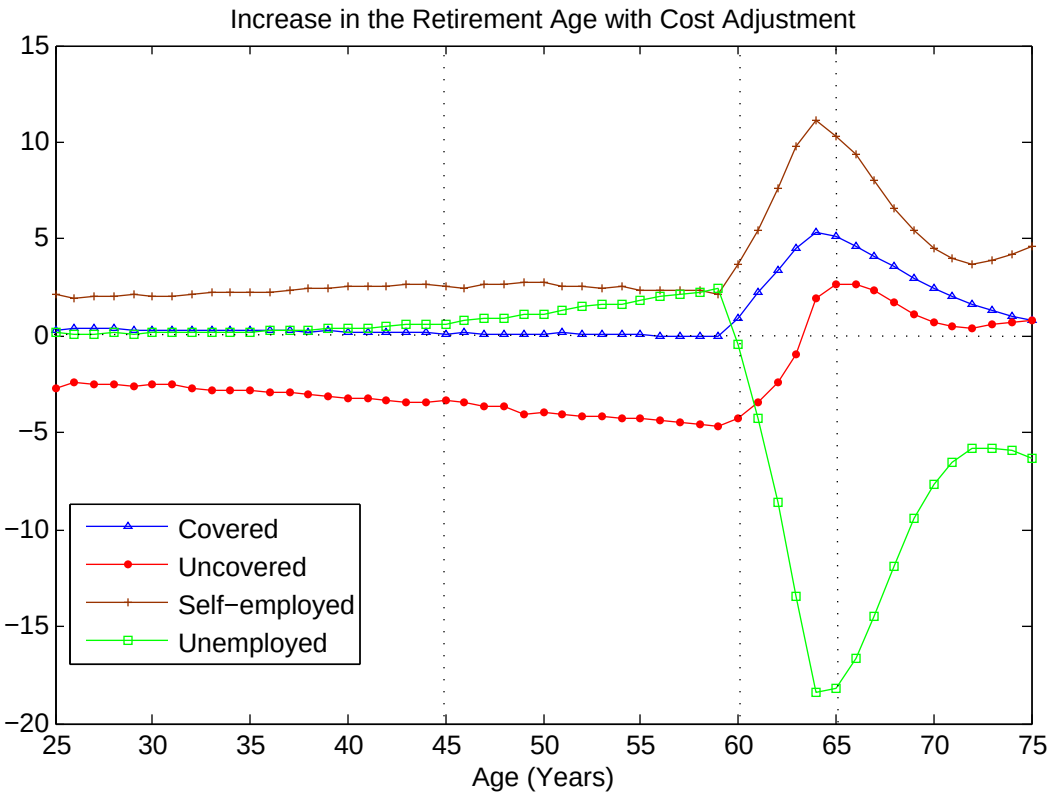


Figure 2.8: Cost Change and Delay in the Age of Benefit Entitlement

Figure 2.9: Increase in Eligibility Requirements

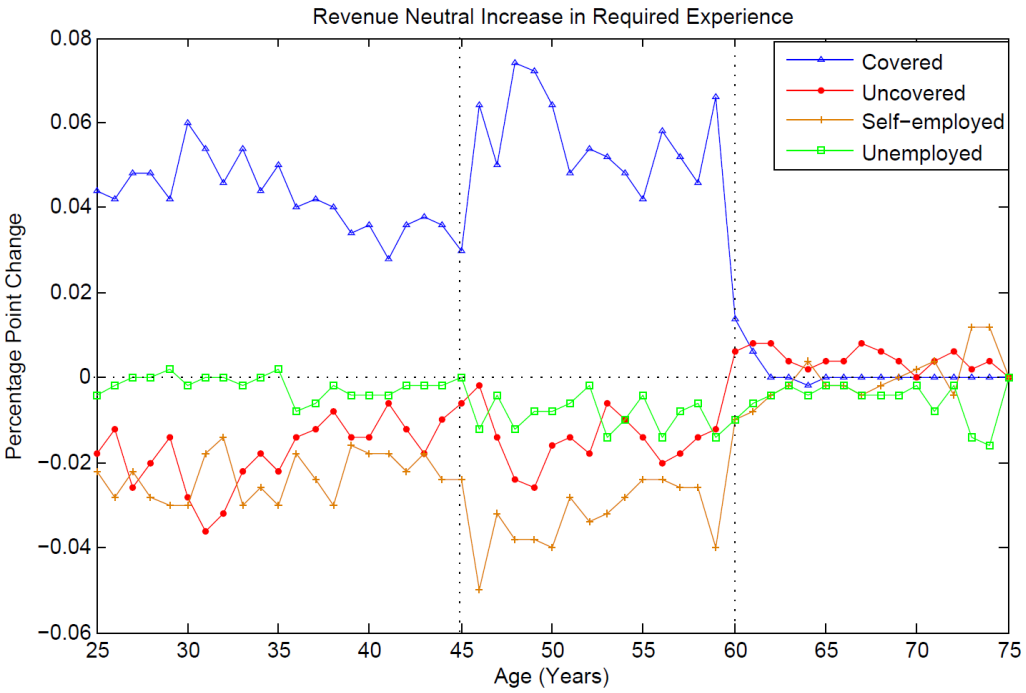


Figure 2.10: A Revenue-neutral Increase in Eligibility Requirements

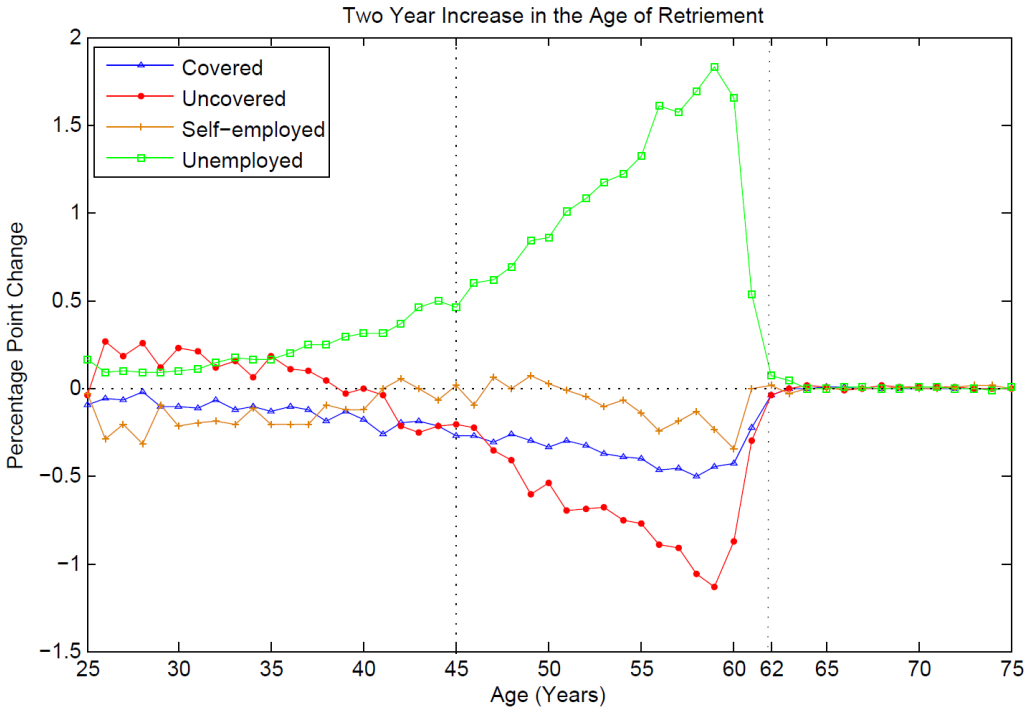


Figure 2.11: Raise the Retirement Age

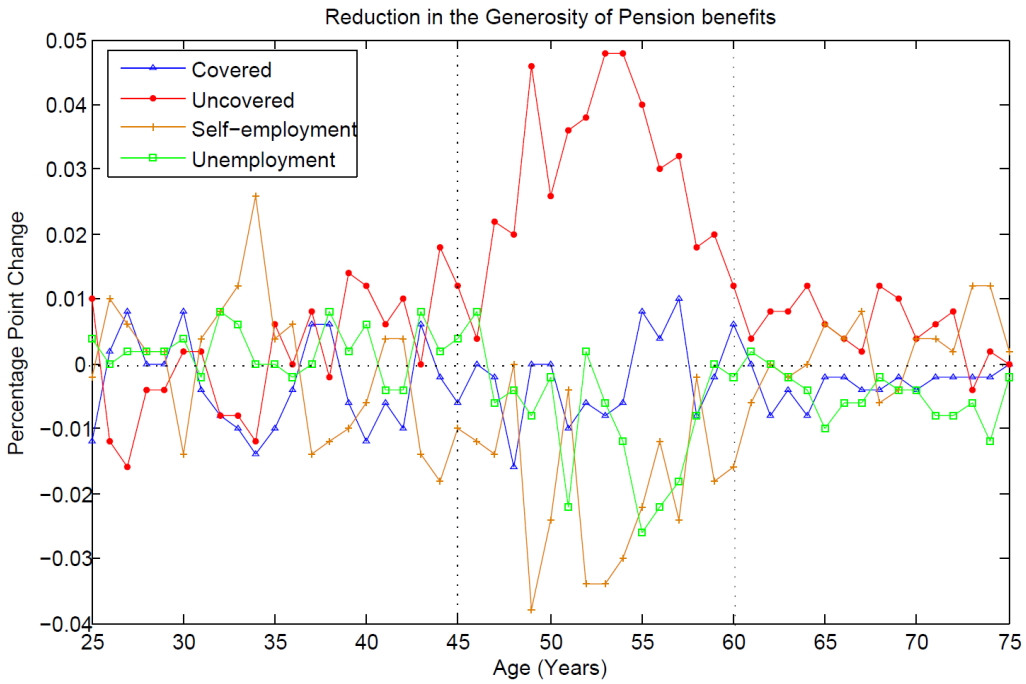


Figure 2.12: Reduce the Generosity of Pension

Figure 2.13: Raise the Payroll Tax Rate

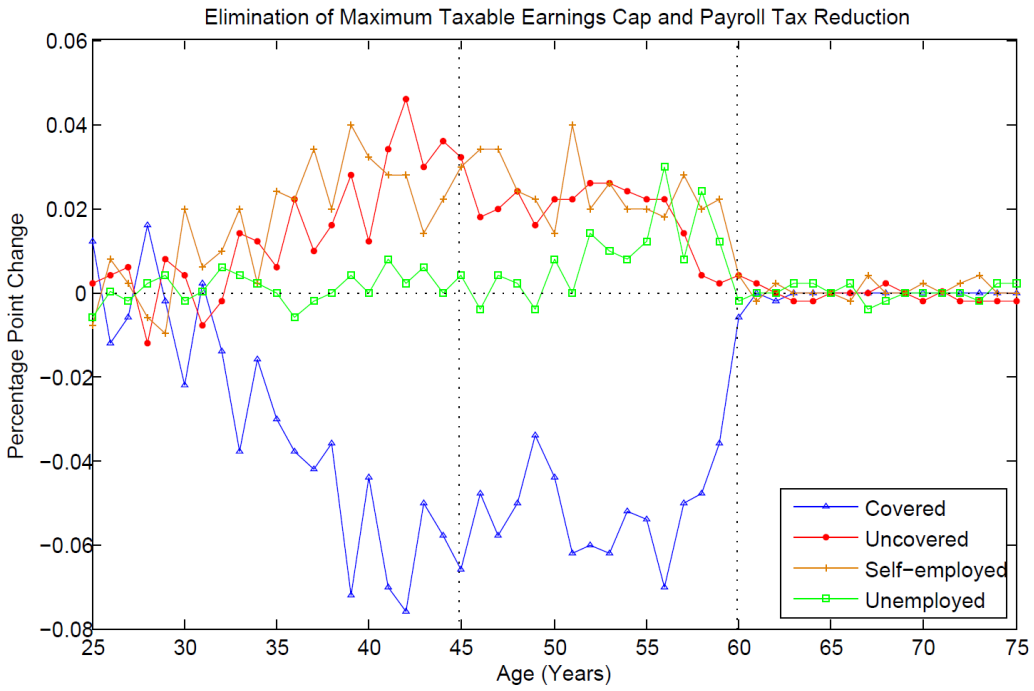


Figure 2.14: Eliminate Maximum Taxable Earnings Cap & Reduce Payroll Tax

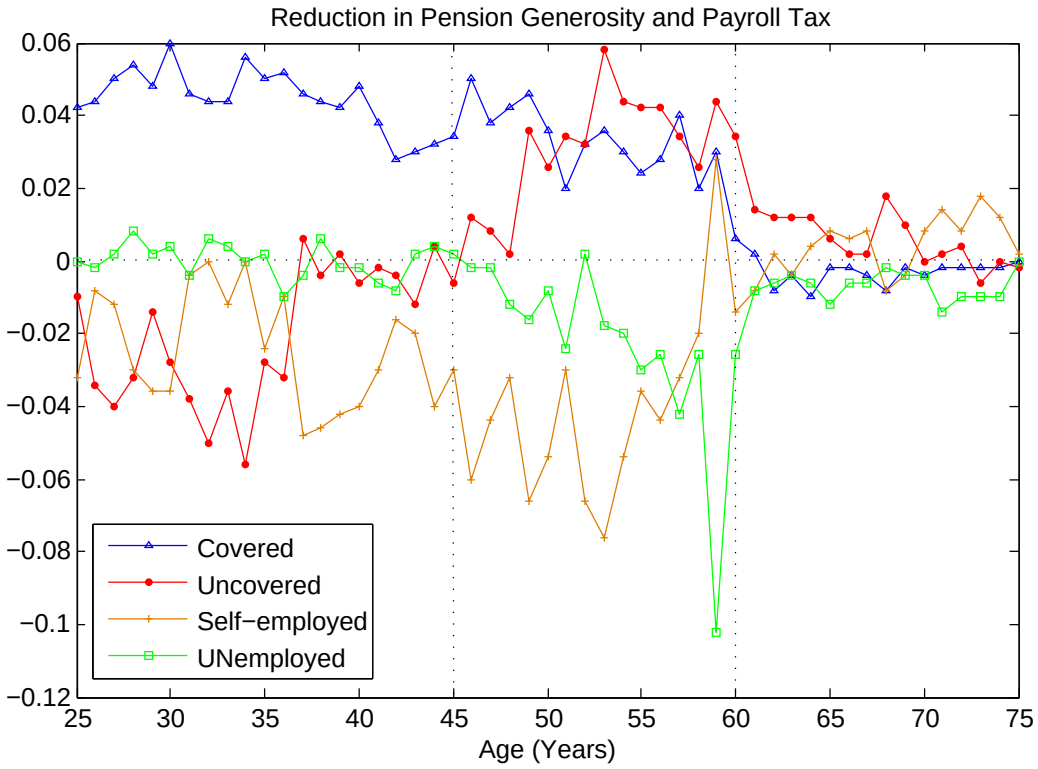


Figure 2.15: Eliminate Maximum Taxable Earnings Cap & Reduce Payroll Tax

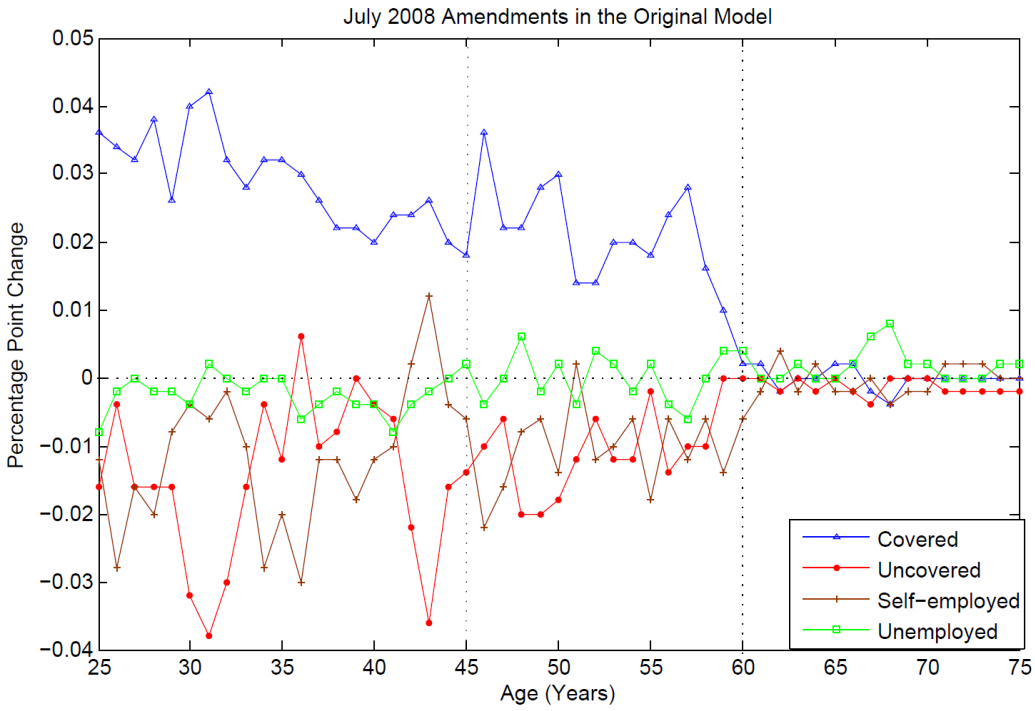


Figure 2.16: July 2008 Amendments in the Original Model

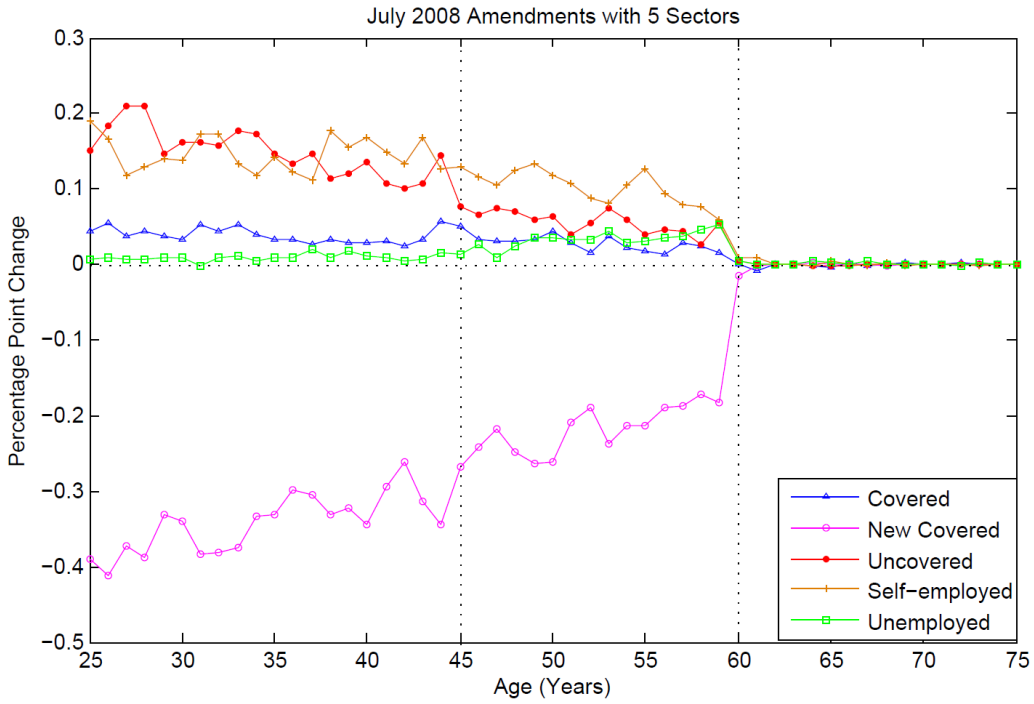


Figure 2.17: July 2008 Amendments with Benefit Extension

CHAPTER 3

TESTING FOR LABOR MARKET SEGMENTATION: EVIDENCE FROM PAKISTAN

3.1 Introduction

It has long been recognized that observationally equivalent workers earn different wages. Early empirical studies regarded the existence of these cross-sector earnings differentials as evidence of segmentation, where the simplest form of segmentation refers to the existence of two sectors, commonly known as the formal sector and the informal sector.[1] Traditional theories of labor market segmentation define the informal sector as a low-wage, easy entry sector that is a possible fall-back option for workers queuing to find jobs in the formal sector, unable to do so due to job rationing and labor demand constraints. Later advances in segmented labor market theory have stressed the internal duality of the informal sector, stating that both the type of employment and the extent of entry barriers tend to vary within the informal sector itself. The basic idea of internal dualism states that workers who choose informal employment as a last resort, easy-entry sector need to be differentiated from those who choose informal employment due to their respective preferences (Fields, 2007).

Despite extensive advances in the study of labor market segmentation, empirical evidence on the existence of segmented versus integrated labor markets is inconclusive. Recent advances in theoretical modeling show that the data used to identify the existence of labor market segmentation can be fully supported by either a dualistic or an integrated labor market model (Barros and Ulyssea (2011); Ulyssea (2011). This primarily owes to identification issues and the lack of knowledge about an individual's choice set. The establishment of choice-based selection requires data on preferences, which may not exist in existing surveys (Fields, 2007). A possible solution then is to examine the patterns of worker mobility over time, and to see whether these patterns are similar to the ones implicitly predicted by the segmented labor market model (Maloney, 1999).[2] Segmented labor markets assume that labor turnover is lower in the formal sector, both because workers are reluctant to leave their jobs, and because it is costly for the firms to fire workers. The latter relates to the existence of employment protection legislation in the formal sector, and the absence of any coverage by

[1] Studies that focus on developed country labor markets mostly use the primary and the secondary sector distinction, while a majority of the studies on developing country labor markets focus on various forms of employment that can be generally classified as formal and informal sector jobs.

[2] Other studies rely on responses to questions that elicit worker's preferences about employment in one sector versus the other (Alcaraz et al., 2012). This helps identify whether informal sector workers are there by choice, or are forced to take informal sector jobs due to labor demand constraints and entry barriers.

industrial and labor regulation in the informal sector. Moreover, it assumes that transition probabilities from the formal to the informal sector are higher than the transition probabilities from informal to formal sector jobs. This is a by-product of entry barriers in the formal sector, and free entry in the informal sector. Lastly, segmentation predicts a higher transition probability between informal sector work and unemployment as compared to formal sector work and unemployment.

This paper follows the aforementioned approaches to test for labor market segmentation in Pakistan. I provide a detailed analysis of earnings differentials and sectoral transitions to examine the validity of the segmentation hypothesis. Using pooled cross-section data from the Pakistan Labor Force Survey (LFS) for the years 1996 to 2011, I first examine the factors affecting selection into various labor market segments. These include (i) regular paid employment (ii) casual paid employment (iii) self-employment, and (iv) unemployment. I treat regular paid employees as a part of the formal sector, while casual paid employment and the self-employment are considered as informal sector employment. The distinction between informal wage employment and self-employment helps to capture the internal duality of that sector (Fields, 1975). Moreover, inclusion of the individuals that are actively seeking work (unemployed) helps to examine queuing for formal sector jobs. Throughout this paper, I restrict my attention to the sample of males between the age of 14 to 65 years who are either operating or working for non-agricultural private sector establishments.

Although all self-employed individuals are regarded as part of the informal sector in Pakistan, the distinction between formal and informal wage employment is unclear.[3]. Depending on the particular context, various job-level characteristics may be used to identify an individual as a part of the formal or the informal sector. The most common definitions of formality rely on coverage by industrial and labor regulations that are in turn contingent on firm size, registration status of the employer, the status of employment, the place of work, and/or the nature of the contract. Recognizing the importance of all these factors, and to avoid the subjectivity involved in weighting one factor more than the other, I use an endogenous regime-switching approach to determine the formal-informal status of workers. The estimation of earnings differentials between formal and informal sector workers is based on a three-step procedure. First, I run a model of sector choice on the sample of workers that can be clearly identified as belonging to the formal or the informal sector (see Figure 3.1). The sector choice model is used to obtain the predicted probability of formal sector employment for all workers that could not be identified as part of the formal and the informal sector. Second, I take a threshold probability of formal sector employment and assign a value of 1 to all workers whose predicted probability from the first step is greater than the threshold probability, and a value of 0 to

[3]See Hyder (2007); Irfan (2008); LFS (2009)

all workers whose predicted probability is less than the threshold probability. A value of 1 denotes formal sector employment and a value of 0 denotes informal sector employment. Then, controlling for selection and observable characteristics of workers, I estimate the wage differentials using maximum likelihood. The procedure is repeated for all possible values of the threshold probability between 0 and 1, and the probability that gives the maximal likelihood value is used in the final estimation of earnings differentials.[4].

My results are consistent with the first hypothesis of labor market segmentation. Controlling for selection and the observable characteristics of workers, formal sector jobs pay more than informal sector jobs. About 85% of the workers in the formal sector would have been worse off working in the informal sector. Moreover, 55% of informal sector workers would have earned more in the formal sector. As the method estimates two separate wage equations, it is possible to determine the wage premium that the formal sector promises. I find that the formal sector promises a 10.8 percent wage premium to informal sector workers. For workers in the formal sector, the average wage predicted by the informal sector wage equation is 26.1 percent lower than their true average wage. Thus, formal sector workers would have been clearly worse off in the informal sector.

The second hypothesis of labor market segmentation predicts that workers tend to queue up for formal sector jobs that pay a wage premium.[5] Queuing in turn implies that individuals who prefer formal sector jobs wait longer to find employment due to entry barriers and labor demand constraints. This in turn leads to longer unemployment durations. In order to test for queuing, I use data on job preferences and unemployment duration for the sample of active job seekers in the LFS. I focus on the sample of individuals that report full-time paid employment as their preferred alternative to part-time paid employment, contract work or daily wage work.[6] I find that a positive preference for full-time paid employment increases unemployment duration by 0.6 months. My analysis assumes that preferences are exogenous. However, job preferences might be endogenous and may depend on the predicted wage differential between formal and informal sector jobs. Here I find that after controlling for individual characteristics, the predicted wage differential between formal and informal sector employment is neither a significant determinant of preferences for full-time paid

[4]See Roig (1999); Hotchkiss and Pitts (2005)

[5]See Fields (2007); Maloney (1997); Maloney (1999); Dickens and Lang (1985).

[6]Data on preferences is elicited in terms of full-time or part-time paid employment. If full-time work is regarded as regular paid employment, then 71.6% of regular paid employees are in the formal sector. Thus, the association between full-time paid employment and formal sector employment is about 0.7. Full-time paid employment may also be interpreted by workers as monthly paying jobs. In that case, 63.5% of the jobs that pay monthly wages are in the formal sector. This shows that the estimate of the effect of preferences for full-time paid employment on unemployment duration will be a lower bound on the estimate of the effect of formal sector job preference on unemployment duration (see Table 3.4).

employment, nor does it affect unemployment duration through its effect on job preferences.

Furthermore, I examine the association between unemployment duration and preferences for self-employment over part-time paid employment. I find that workers who prefer self-employment over part-time paid employment wait 0.8 months longer in search of self-employment opportunities.[7] The analysis suggests that the informal sector has its own internal dualism.

The existence of earnings differentials and queuing for full-time paid employment is not in itself evidence of segmentation. This is because the unobserved characteristics of individuals may be correlated with both sector choice and earnings. Moreover, the value of all the characteristics of a job are hard to capture, and may be unobserved. These caveats motivate the analysis of earnings differentials for individuals that switch between sectors. However, due to unobserved characteristics of the job, even these differences cannot prove or disprove segmentation. An alternative approach is to examine the patterns of worker mobility over time, and to see whether these patterns are similar to the ones implicitly predicted by the segmented view of the labor market. Segmentation predicts lower turnover rates in the formal sector, a higher probability of transition from formal to informal sector employment as compared to the transition from informal to formal sector employment, and a higher probability of transition from informal sector employment to unemployment as compared to the transition from formal sector employment to unemployment (Garz, 2013). I test for the presence of these transition patterns using longitudinal data from the Pakistan Socio-Economic Survey for the years 1998-99 and 2000-01. I also use multinomial logit model to determine the factors that affect these transitions. Although no particular theoretical model of transition is offered, the logit analysis is a more statistically rigorous way of asking if, given the initial sector, a worker is more or less likely to move to another sector if he has more education, experience, social or physical capital, or has lost employment (see Maloney (1999) and Packard (2007)).[8]

I do find evidence of lower turnover rates in formal sector employment. Formal sector employment persistence is about 7 percentage points higher than informal sector employment persistence. However, I find that movements between formal and informal sector wage employment are largely bidirectional, which is in contrast to the segmented view of the labor market. More interestingly, employment flows within the informal sector are more unidirectional; self-employed individuals find it easier to move to informal wage

[7] I cannot determine how the wage differential between self-employment and informal sector wage employment affects the stated preferences. This is because the LFS does not elicit income data for the self-employed.

[8] Analysis of worker transitions focuses on three paid and three unpaid labor market segments. The paid segments include regular paid employment, casual paid employment, and self-employment, while unpaid sectors include, unpaid family work, unemployment and non-participation.

employment, while the latter find it harder to start their own businesses. This suggests that the informal sector has its own internal dualism (Fields, 2007). Lastly, I find that the probability of transition from the informal sector to unemployment is 3.1 percentage points higher than the transition probability from formal sector to unemployment. Overall, the transition patterns indicate the labor market is not as rigid as suggested by the segmentation hypothesis.

Results from the multinomial logit analysis suggest that individual's endowment of human capital (proxied by age and education) is a significant determinant of movement between sectors.Individuals that successfully make a transition to regular paid employment are more educated on average.[9] Social capital is also a strong determinant of movement to formal sector jobs, where social capital is defined as the number of other household members that are in the same sector of employment as the respondent (Packard, 2007). In addition, a higher endowment of physical capital is a significant determinant of either moving to self-employment over informal wage employment, or staying in self-employment over time.

The pattern of transitions between sectors is also likely to be influenced by earnings in the initial sector of employment. Controlling for initial earnings shows that relative to workers that stay in regular paid employment, those that transition to casual employment have lower initial earnings. Moreover, relative to workers that continue to work in casual paid jobs, workers who transition to regular paid jobs had higher incomes in the first time period. Thus, casual paid employees with higher incomes are more likely to find formal sector jobs, while casual paid employees with lower incomes are more likely to become unemployed or exit the labor market. However, the transition to unemployment or inactivity is a function of access to other sources of income; particularly non-labor income and transfer income. In addition, relative to workers that continue to operate their own businesses, workers who leave self-employment for casual employment had lower incomes in the initial time period. This shows that casual paid employees with low incomes try and switch sectors. If they have the required human capital, they are likely to find regular paid employment. Similarly, if they have access to higher physical capital, they are likely to start their own businesses. However, they may decide to actively seek work, or to exit the labor market completely, which is made possible through access to other household resources.

Moreover, earnings in the post period are likely to be affected by a given switching pattern. I find that individuals who enter casual paid employment from any of the other labor market sector experience

[9]In the multinomial logit analysis, regular paid employment is a proxy for formal sector employment and casual paid employment is a proxy for informal sector wage employment. This is because employment status is not defined in terms of formality and informality.

the largest reduction in income. Moreover, individuals who join the labor force after periods of inactivity earn the most in self-employment, followed by regular paid employment and casual paid employment. More interestingly, more educated individuals who actively sought work in the first round earn more if they find a regular paid job. This partially indicates that workers with higher education may be queuing for formal sector jobs. In contrast, individuals outside of the labor force are less educated on average as compared to the pool of unemployed individuals. Thus, conditional on getting access to the start-up capital, they earn more in self-employment ex post.

Lastly, I compare the change in earnings generated by transitions between sectors, holding individual level characteristics constant. This leaves the variation in characteristics of the work itself as the residual explanatory factor. These results also show that movement to casual paid employment from any other sector of employment is associated with a significant decline in income. Moreover, persistence in regular paid employment leads to a significant increase in earnings. However, persistence in self-employment is associated with a decline in income. None of the other transitions has a significant effect on earning differentials. Overall, the results suggest that casual paid employees are part of the lower-tier informal sector, while the self-employed tend to operate in the upper-tier informal sector. I find that regular paid employees that decide to start their own businesses are not necessarily worse off than the individuals who transition from self-employment to regular paid employment. This suggests that self-employment is a desirable sector on its own, and workers in self-employment are not necessarily queuing for formal sector jobs.

This paper makes various contributions to the literature. First, it adds to the existing literature on labor market segmentation in the context of a low-income developing country in South Asia. Labor markets in developing countries have been studied extensively, however, a majority of the existing work on segmentation focuses on India, China and Latin America (see Maloney (1999) for Mexico, Barros and Ulyssea (2011) for Brazil, and Packard (2007) for Chile). The conclusions from these studies cannot be generalized to Pakistan due to differences in the definition of formality and informality, differential compliance and enforcement of labor and industrial regulations, and most importantly, the number of different sectors that tend to exist in a given labor market. Moreover, the economies of India, China, Chile, Brazil and Mexico are more developed as compared to Pakistan, thus workers may be facing different labor demand constraints.

Second, it adds to the empirical work on labor markets in Pakistan. The general structure of the labor market in Pakistan has been extensively studied. In case of earnings differentials, much of the work has focused on differential returns in public and private sector employment.[10] Among studies that focus on private

[10]See for instance Nasir (2000), Hyder (2002), Hyder and Reilly (2005), Bilquees (2006), and Hyder (2007).

sector employees only, a majority have recognized the existence of a large and low-paying informal sector, which has been growing over time and the trend looks set to continue, particularly in the face of increasing contractual employment.[11] None of these studies however, have used a holistic definition of formality and informality, specifically one that is determined within the model of earnings differentials. Moreover, none of the previous studies have analyzed queuing for private sector jobs in the formal sector, or queuing for self-employment in the informal sector.[12] Moreover, worker transitions between employment, unemployment and inactivity, and the individual characteristics that determine these transitions have been analyzed in case of Pakistan before (see Arif et al. (2001a)). However, a detailed analysis of sectoral transitions within various categories of paid and unpaid work, and the determinants of these transitions in the context of segmentation has not been studied previously.

The paper proceeds as follows. Section II briefly examines the determinants of sector choice, and tests for wage differentials between the formal and the informal sector workers. Furthermore, it provides an analysis of queueing for jobs in the preferred sector of employment. Section III examines the patterns of worker mobility to examine whether the trends in the data support an integrated or a segmented labor market model, and Section IV offers some concluding remarks.

3.2 Testing for Segmentation using Cross-Section Data

This section uses the Pakistan Labor Force Survey (LFS) for the years 1996 to 2011 to examine the determinants of sector choice and wage differentials between formal and informal sector employees. LFS is a cross-sectional data set collected at the household level to gather information on key indicators of the labor market. It is representative at the national, provincial, and rural/urban level. The survey covers all urban and rural areas of Pakistan excluding Federally Administered Tribal Areas, military restricted areas, and protected areas of KPK province. The population of excluded areas constitutes about 3 to 4 percent of the total population (LFS, 2009).

[11] see Irfan (2008) for an analysis of the structure of the labor market in Pakistan.

[12] Hyder (2007) is the only other study that tests for queuing. However, she focuses on the preference for public sector jobs.

3.2.1 Determinants of Sector Choice

I examine the determinants of sector choice using a multinomial logit model, where sector choice is a function of individual level variables, household characteristics and regional controls. I restrict my sample to the male working and non-working population between the age of 14 and 65 years. I run regressions of the form:

$$S_{i,t} = \beta_1 X_{i,t} + \beta_2 HH_{i,t} + \beta_3 Region_{i,t} + \theta_t + \varepsilon_{i,t} \tag{3.1}$$

where $S_{i,t}$ is a categorical variable that denotes sector choice. Individuals may be employed as regular paid employees, casual paid employees, may be self-employed, or unemployed. $X_{i,t}$ is the vector if individual characteristics including education, age, a quadratic in age, a dummy for being married, and a dummy for being the head of the household. $HH_{i,t}$ captures the effect of household level characteristics, which include the number of dependents in the household, where dependents consist of all household members below the age of 14 years, and above the age of 65 years. The second set of household level variables include the number of regular paid employees, casual paid-employees, and self-employed members in the household other than the individual. These proxy for the level of social capital (Packard, 2007). $Region_{i,t}$ includes a dummy for urban regions, province fixed effects, and a dummy that equals 1 if the individual is located in his district of birth, and zero if the individual relocated to the current district of residence. The latter controls for location-specific human capital and social networks that may affect sectoral choice. θ_t are quarter fixed effects and $\varepsilon_{i,t}$ is the error term.

In the model estimation, I take casual wage employment as the base category. This is done for two reasons. First, it helps to analyze the differences between informal sector wage employees and the self-employed i.e. the internal duality of the informal sector. Second, it helps to ascertain the differences between the individuals that decide to search for work full-time versus individuals who take up informal sector jobs, where the former may be ones queuing for formal sector employment.

The results are presented in Table 3.1. All coefficients should be interpreted with reference to the base category. The results shows that workers with the lowest levels of education select into casual employment. Within the employment categories, those with the highest levels of education join regular paid employment, followed by self-employment and unemployment. However, individuals with professional degrees or more than 12 years of education either join regular paid employment or continue searching for work. Workers with more than 12 years of education that decide to work in the informal sector usually choose casual paid

employment over self-employment. This implies that higher levels of education increase the desire to work in wage employment in general. It also shows that conditional on finding a job, education promises high returns in the labor market. The coefficients on age show that the oldest workers tend to self-employed, followed by regular paid employees. Moreover, there are no significant differences between the age effects for casual paid employees and those that are actively searching for work.

Moreover, married individuals and household heads are more likely to be employed. Within employment categories, they are most likely to select into self-employment, followed by regular paid employment, and casual paid employment. Also, an increase in the number of dependents increases the probability of becoming self-employed as opposed to working in casual paid jobs. However, an increase in the number of dependents reduces the likelihood of selecting into regular paid employment over casual employment. This indicates that individuals with more family members to support may not be able to wait longer to find regular paid employment, which suggests the existence of entry barriers in formal sector jobs. In addition, workers with fewer dependents can afford to actively search for work than to take up casual paid jobs. This suggests that individuals with greater household responsibilities cannot afford to stay unemployed for long periods of time.

The coefficient on the relocation effect shows that workers located in their district of birth are more likely to work in the informal sector, i.e. self-employment and casual wage employment. Within the informal sector, they are more likely to be self employed. This implies that social networks are more valuable for individuals who choose to work in the informal sector. Moreover, regular paid employees and the unemployed are less likely to still be living in their district of birth, which indicates that workers who select into the formal sector may choose to relocate for better employment opportunities. Moreover, it shows that individuals that are actively searching for work may have the time and resources to relocate to other districts for better paying employment opportunities.

An interesting finding emerges from examining the effect of the social capital variables on sector choice. An individual's endowment of social capital is captured by the number of household members other than the individual who work in the same sector as himself. If for instance, having other household members in self-employment fails to act as a conduit to employment opportunities with greater returns, and keeps workers trapped in informal sector jobs, this social capital may become more of a liability than an asset (Packard, 2007). My results indicate that families tend to select into similar kinds of jobs. This may be useful for workers in regular paid employment and self-employment, but may create a lock-in effect for workers in casual paid employment. Consistent with intuition, a higher number of other household members that are self-employed implies higher access to physical capital and entrepreneurial skills required to run a

business. Similarly, an increase in the number of other household members in regular paid employment may help individuals to secure regular paid jobs through connections and networking opportunities. These results also show that if household members help each other secure jobs in the sectors they are already working in, and if that constitutes the best outcome, these variables proxy social assets. However, given innate skills and family characteristics, if household members are not very different from each other in terms of ability and labor market opportunities, they might get locked into the same sector for generations.

3.2.2 Earnings Differentials between the Formal and Informal Sector

A comparison of labor market returns across the formal and the informal sector assumes a particular definition of formality. The issue is that in Pakistan, as in most other developing countries, the boundary between formal and informal sector is not well-defined Hyder (2007). This owes to a number of different dimensions and definitions of informality, as well as the researcher's choice of the preferred definition. This section attempts to incorporate various dimensions of informality in a unified model. I estimate the wage differential between formal and informal sector workers using an endogenous regime switching approach, where the relative status of each worker is decided based on the comprehensive set of employer-level and employee-level characteristics.[13] To motivate the analysis, I briefly discuss the commonly used definitions of informality in Pakistan below.

The first definition of informality is based on coverage by industrial and labor regulations. Workers that are covered by any form of industrial and labor regulations are considered to be part of the formal sector. Note that a majority of the industrial laws in Pakistan apply to workers in establishments with 10 or more employees. By this definition then, workers in firms with 10 or more employees can be regarded as formal sector workers. However, recent changes in social security laws have made the size-based definition less reliable.[14]

[13]Endogenous regression switching model was pioneered by Quandt (1972). Dickens and Lang (1985) and Roig (1999) use these techniques to test for labor market segmentation. For implementation see Lokshin and Sajaia (2004), and Lokshin and Sajaia (2006)

[14]In recent years, social security coverage has been made available to workers in firms with 5 or more employees. Social security provision is available through the Provincial Employees Social Security Ordinance of 1965, and the Employees' Old Age Benefits Act of 1976.

The second definition of informality is based on the employment status of workers. The most common categorization of employment status includes (i) regular paid employees with a fixed wage, (ii) casual paid employees, (iii) paid workers by piece-rate or work performed, (iv) paid non-family apprentice, (v) own-account workers, (vi) unpaid family workers, (vii) workers in agriculture, and (viii) others. Within these categories, regular paid employees with a fixed wage are considered as part of the formal sector, while casual paid employees, workers paid on a piece-rate basis and apprentices are considered to be informal sector workers. Moreover, the self-employed, unpaid family helpers and workers in agriculture are also part of the informal sector.

The third definition incorporates job-level characteristics into the formal-informal sector classification. If individuals work with an employer that maintains written accounts, has a positive number of employees on regular contracts, and the workplace consists of a shop, office, business or industry, then they are considered as part of the formal sector. Workers in firms that do not keep written accounts, have no regular paid employees and operate in any location other than a shop, office, business or industry, are a part of the informal sector workforce. Note however, that there exist workers with different combinations of these characteristics, where a certain criterion of informality is satisfied while another is not. In such cases, it becomes harder to classify workers into a particular sector. This is where the endogenous switching model becomes useful. The model is described below.

Empirical Specification

The model presented in this section helps to test for the first hypothesis of labor market segmentation. Recall that the hypothesis predicts that workers in the formal and the informal sector differ with respect to the wage determination process, observable characteristics of workers and job-level characteristics. Thus, each worker faces two wage rates, the formal sector wage rate and the informal sector wage rate. The model assumes full interaction of the chosen sector. [15]:

$$W_{Fi} = X_{Fi}^{'}\beta_F + \epsilon_{Fi} \quad if \quad I_i^* \geq \hat{I} \tag{3.2}$$

$$W_{Ni} = X_{Ni}^{'}\beta_N + \epsilon_{Ni} \quad if \quad I_i^* < \hat{I} \tag{3.3}$$

[15]Self-employed individuals are not included due to lack of information on self-employment income in the LFS.

where F denotes formal and N denotes informal. $W_{ji}, j = (F, N)$ is the log of hourly wage in sector j, X_i are determinants of wages in each of the sectors, β_j are the mechanisms through which individual characteristics are translated into earnings, and ϵ_{ji} are the sector-specific error terms, assumed to follow a random normal distribution. For a majority of the workers, the threshold at which their wage is determined by the formal sector, i.e. the value of $\hat{I}$, is unknown (see Figure 3.1).

Let the worker's propensity to have his wages determined in the formal sector be given by:

$$I_i^* = (W_{Fi} - W_{Ni})\theta + Y_i^{'}\tau + u_i = Z_i^{'}\gamma + u_i \tag{3.4}$$

This shows that a worker's propensity to be in the formal sector is determined by the expected difference in wages across sectors, and other factors Y_i that are not expected to influence earnings in either sector. Moreover, the observed realization I_i of the latent variable I_i^*, which determines whether individual i is employed in a particular sector has the following form:

$$\begin{aligned} I_i &= 1 \quad if \quad I_i^* \geq \hat{I} \\ I_i &= 0 \quad if \quad I_i^* < \hat{I} \\ I_i &\quad otherwise \quad unobserved \end{aligned} \tag{3.5}$$

An Index for informal Sector Employment

Any measure of informality should reflect the contract type, regularity of the job, working hours, access to employer and government provided benefits, the likelihood of the employer to maintain a record of written accounts, and the characteristics of the workplace. One possibility is to treat each of these variables separately in the wage determination equation for each sector. However, each variable would need to be treated as endogenous and there is no information that can potentially be used to identify the parameters of these separate equations. Moreover, such an approach ignores the mutual interdependence of each factor in it's contribution to an individual's labor market status. Taking all the dimensions of informality together simplifies the multi-dimensional impact of these factors on an individual's decision to work in either sector.

As stated above, a well-defined criterion for participation in the formal sector does not exist for all workers, and in the absence of such criteria, I cannot determine the parameters of the model. However,

for certain workers I can determine whether they work in the formal or the informal sector with more certainty. Figure 1 shows the classification procedure used in the analysis. The figure shows that regular paid employees with a fixed wage that work in incorporated enterprises located in a shop, office, business or industry are working in the formal sector. Similarly, there exists a group of workers that can be clearly identified as informal sector employees. These include casual paid employees, workers paid on piece rate basis and apprentices working in small enterprises that do not keep written accounts, none of the workers in their enterprise is on a regular paid contract, and the work location is also informal.[16]

Parameter estimates in Equations 3.2 - 3.4 are obtained through a multi-step procedure. First, I create a dichotomous variable that takes a value of 1 for all individuals that are classified as formal sector workers in Figure 1, and a value of 0 for individuals that are classified as informal sector workers. For the remaining sample of workers, the respective status is not determined.

Second, I estimate a worker's propensity to have his wages determined in the formal sector using the sample of workers that were classified into one of the two sectors in the first step. This is done using a probit model, where an indicator for formal sector employment is regressed against individual level characteristics, household characteristics, regional controls, and provincial dummies. I then estimate the predicted probability of formal sector employment for workers that could not be classified as being in either sector. Figure 2 shows that the model predicts the formal and informal status extremely well. A majority of the workers that were assigned a value of 1 have a high probability of working in a formal sector job, while a majority of the workers that were assigned a value of zero have a low probability of being observed in the formal sector. Given the predicted probabilities, an initial value of I_i is now available for all workers.

Third, using the initial value of I_i obtained above, I estimate the threshold probability of being in the formal sector via maximum likelihood methods introduced in (Quandt, 1972). The method is used to obtain estimates in a switching regression framework where the switch point is unknown. To estimate the switch point that best describes the data, the entire process is repeated for different values of $\hat{I}$, and the value of $\hat{I}$ which yields the maximal likelihood function value is determined as the appropriate threshold.[17] The threshold value helps define the appropriate cutoff point such that all workers with $I_i^* \geq \hat{I}$ are classified as formal sector workers, and all workers with $I_i^* < \hat{I}$ are classified as informal sector workers. Finally, the

[16]Small firms include all firms with fewer than 10 employees before the year 2001-02 and all firms with fewer than 5 employees after the year 2001-02. The distinction based on years owes to the survey responses on the question that elicits firm size. Location of work is informal if workers work at their own house, at the employer's house, on the country side, or on a street or road. See Table 3.2.

[17]$\hat{I} = 0.58$ gives the maximum value of the likelihood function

wage differential is estimated within the model.

Table 3.3 presents the results for the two wage equations and the selection equation. First, as compared to workers with a lower level of education, workers with higher education and professional degrees are more likely to select into formal sector jobs. Moreover, workers with low levels of education get higher returns in the informal sector, while 10 or more years of education and professional degrees are valued more in the formal sector. Moreover, the coefficients on age indicate that experience is valued more in the formal sector as compared to the informal sector. Married individuals and household heads are less likely to join the formal sector. However, conditional on finding a job in the formal sector, both the married individuals and the household heads earn more on average.

An analysis of the exclusion restrictions reveals that an increase in the number of household dependents negatively affects selection into the formal sector. This is likely when workers with larger families cannot afford to remain unemployed for longer periods of time to search for formal sector jobs, and suggests possible entry barriers for these jobs. Moreover, an increase in the number of household members in regular paid employment has a positive effect on selection into formal sector employment. This implies that family members in high-paying private sector jobs serve as an asset for workers, either through connections or career and professional advice. Similarly, an increase in the number of household members in casual paid employment generates a positive effect on selection into informal sector employment; in line with the lock-in effect mentioned earlier.

Inclusion of occupational dummies (last 3 columns of Table 3.3) and industry fixed effects shows that senior officials and managers earn more in the formal sector, while workers in elementary occupations, craft and trade, and services and sales earn more in the informal sector. Industry fixed effects reveal that workers in the utility industry, and finance and banking earn higher wages in the formal sector. In comparison, construction workers, workers in wholesale and retail, and transport and communication earn higher wages in the informal sector.

Note that the correlation coefficient between the unobservables in the selection equation u_i and the unobservables in the formal sector wage equation, ϵ_{Fi}, denoted by ρ_F, is positive and significant. This suggests that individuals who choose to work in the formal sector earn lower wages in that sector than a random individual from the sample would have earned (Lokshin and Sajaia, 2004). A positive ρ_F also shows that conditional on finding a job in the formal sector, the observable characteristics are highly valued in that sector.

Moreover, a negative and significant estimate of ρ_N suggests that individuals who choose to work in the informal sector earn higher wages in that sector than a random individual from the sample would have earned. This shows that the observable characteristics are not as highly valued in the informal sector. However, individuals with lower average values of observable characteristics are better off if they are able to find work, despite the nature of the work being informal.

The aforementioned analysis may suggest traces of a segmented labor market. If the value of the unobservable characteristic of workers that select into informal sector jobs is lower than a random worker in the labor market, then these workers do not queue for formal sector jobs. Instead, they take up a lower-paying job in the informal sector. This implies that a random individual in the sample who does not join informal sector employment expects to earn more in a formal sector job, and may therefore wait for better employment opportunities, i.e. remain unemployed.

In order to provide credibility to the definition of formality used in the analysis, the model estimated in Table 3.3 is used to calculate the probability of formal sector employment conditional on the observed wage and personal characteristics (Roig, 1999). Figure 3.3 shows that the predicted probability of being in the formal sector has a clear bimodal distribution. Although some workers are not perfectly sorted into either sector, a majority of the workers belong to one of the two sectors. Note that the predictions of the model are consistent with the presence of a large and low-paying informal sector in Pakistan; a considerable number of workers have a high probability of being observed in the informal sector.

Taking into account the average value of the probability of formal sector attachment for all workers (around 35.8%), I find that 37.64% of the workers have a higher than average probability of being located in the formal sector. Furthermore, taking as reference the aforementioned average probability (35.8%) of assigning workers to the formal and informal sector, Table 3.4 shows the average characteristics of workers in each sector (Column 1 and 2), and the percentage in each sector of the total number of workers with a common trait (Column 3 and 4). A majority of the results in the table are consistent with theory and intuition. First, conditional on attaining a positive level of education, workers with five years of education are mostly located in the informal sector, while a majority of workers with more than 10 years of education are working in the formal sector. Second, older married workers, and household heads are more likely to be in the informal sector. Moreover, a majority of the formal sector workers work in urban areas.

An analysis of job characteristics such as contract length, periodicity of payment, workplace and the size of the worker's establishment also shows interesting results. Among the set of variables used to determine

the value of the index, employment status is the strongest predictor of formality and informality, followed by the type of enterprise, and the periodicity of payment. Periodicity of payment being a strong predictor of formal sector employment provides further credibility to the criteria used to identify workers into the formal and the informal sector. This is because the periodicity of payment was not included in the determination of the threshold value of I_i^*, and is one of the factors that is commonly used to classify workers as formal and informal employees in Pakistan.[18]

Furthermore, the difference between formal and informal employees in terms of record-keeping is not that significant. A considerable proportion of formal sector workers work in firms that either do not keep written accounts, and even if they do, their workers are unaware of the record-keeping procedures. Although a majority of informal sector workers are not covered by social security, social security coverage for formal sector workers is also low; 48% of the formal sector workers are not covered. The dichotomous variable for workplace shows that a majority of the workers in the formal sector work in a shop, office, business or industrial establishment, as opposed to more informal locations like a friend's or employer's house, on the road, or on the country side. However, 46.04% of the workers working in shops, offices, businesses and industries are informal sector workers. In terms of occupation, a majority of senior officers and managers are classified as formal sector workers, while workers in more elementary occupations are classified as a part of the informal sector workforce. Lastly, the construction industry is one of the largest employers of informal sector workers. All these factors indicate that the index used for the analysis is reliable.

Wage Advantage and Decomposition of the Wage Differential

Using the coefficients from the model, I estimate the predicted wage differential between formal and informal sector employment for all workers in the sample. I find that the wage differential is positive for 85.8% of the workers in the formal sector, and is negative for the remaining 14.2% of formal sector workers. This shows that a majority of the formal sector workers would be worse off in informal sector employment. The difference between the average wage of formal sector workers and their predicted wage in the informal sector shows that workers in the formal sector would earn 26.1% less on average if they were employed in the informal sector.

Moreover, I find that 55.3% of the workers in the informal sector would earn more in the formal sector,

[18]See LFS (2009). This is important for the analysis of queuing where full-time paid employment is used as a proxy for formal sector employment, while part-time paid employment is used as a proxy for informal sector employment.

while the remaining 44.7% of the workers are better off working in the informal sector. Thus, given the observable characteristics of workers and the wage structure of the labor market, a considerable proportion of informal sector workers do not have a wage advantage in the formal sector. These workers may be in the informal sector by choice. However, the lack of information about job preferences and the reason for informal sector employment constrains the provision of conclusive evidence in favor of the choice-based framework. An analysis of the difference between the average wage for informal sector workers and their predicted formal sector wage gives an estimate of the wage premium in the formal sector. Here I find that the formal sector promises a 10.7% wage premium.

Below I decompose the average wage differential using the conventional Blinder-Oaxaca decomposition for non-linear models (Bauer et al., 2007). The wage differential ΔW can be expressed as:

$$\Delta W = \beta_F(X_F - X_N) + (\beta_F - \beta_N)X_N \tag{3.6}$$

where the first term on the RHS captures the differences in average characteristics of formal and informal sector workers, evaluated at formal sector returns, commonly known as the composition effect or the endowment effect. The second term represents the differences in labor market returns for formal and informal sector workers evaluated at informal sector means. This can be thought of as a wage structure effect.

I find that the differences in average characteristics of formal and informal sector workers evaluated at formal sector returns is equal to 0.2759, while the differences estimated at informal sector returns is equal to 0.0163. Moreover, the differences in labor market returns for formal and informal sector workers, evaluated at informal sector means is equal to 0.0058, and the differences in returns estimated at formal sector means is equal to 0.2654. This implies that both the average endowments, and the returns to these endowments on average, are higher in the formal sector.

In addition to the existence of earning differentials, labor market segmentation requires the existence of entry barriers in formal sector employment. Below I present test for entry barriers using data on unemployment durations and stated job preferences.

3.2.3 Job Preferences and Queuing

A possible way to test for positive entry barriers is to establish the existence of queuing for jobs in the preferred sector of employment. The idea is that if a labor market is segmented along the formal-informal dimension, then workers who are in the informal sector should be there due to demand constraints, not because they prefer to be in the informal sector. Thus, queuing occurs when individuals are able to work in the informal sector, but are unwilling to do so due to a wage premium in the formal sector. These workers keep searching for formal sector employment in the hope of better wage prospects. Thus, queuing is likely to increase unemployment duration in the labor market.

In addition to the information on unemployment durations, the labor force survey elicits job preferences from all workers that are unemployed and actively seeking work. However, the survey responses to the question about job preferences are not based on the formal-informal distinction. The possible responses include (i) full time paid employment, (ii) part time paid employment, (iii) self-employment, (iv) preference for contract jobs, daily wage work and other kinds of paid employment.[19] Table 3.4 shows that a majority of the full-time paid employees are part of the formal sector, while a majority of part-time paid employees belong to the informal sector. Thus, preferences for full-time paid employment are likely to be strongly correlated to preferences for formal sector jobs, while preferences for part-time paid employment, employment on commission, and daily wage work, are likely to be strongly correlated to preferences for informal sector jobs.[20] In the analysis that follows, I use the distinction between full-time and part-time paid employment as a proxy for the distinction between formal and informal sector employment.[21]

Below I present a reduced-form model that helps determine the relationship between stated job preference and unemployment duration. The intention is to test for the queuing hypothesis, which states that barriers to entry in formal sector employment causes workers to wait longer while searching for jobs, which increases the duration of unemployment.

[19]The survey also elicits preferences for public sector employment, which is excluded from the analysis.

[20]If full-time paid employment refers to payment of monthly wages, then 63.5% of full-time workers are in the formal sector. However, if full-time paid employment is similar to regular paid employment with a fixed wage, then 71.6% of regular paid employees are in the formal sector. Similarly, if part-time paid employment refers to daily, weekly or piece-rate based compensation, then 88.8% of part-time paid employees are in the informal sector. If however, part-time paid employment is regarded as casual paid employment, employment on a piece-rate basis or on the basis of work performed, then 88.5% of part-time paid workers are in the informal sector (see Table 3.4).

[21]Note that this is only used in the model where wage differential is expected to affect the duration of unemployment.

Let job preference be denoted by $Z_{i,t}$, and unemployment duration be denoted by $UD_{i,t}$, then:

$$UD_{i,t} = \alpha_0 + \beta_0 X_{i,t} + \gamma Z_{i,t} + \theta_t + \nu_{i,t} \tag{3.7}$$

Unemployment duration is defined as the length of time an individual spends actively looking for work. Data on unemployment duration is gathered in intervals. These include: (i) less than 1 month, (ii) 1 to 2 months, (iii) 3 to 6 months, (iv) 7 to 12 months, and (iv) more than a year. $Z_{i,t}$ is a dummy variable that takes a value of 1 if an unemployed individual who is actively seeking work states full-time paid employment in the private sector as the preferred job, and a value of zero if the stated preference is part-time paid employment, contractual work or daily wage work. If preferences are exogenous, then γ captures the effect of preferences on unemployment duration. $X_{i,t}$ includes individual level characteristics, household characteristics that may push certain individuals to work and others to continue searching for work, and geographic factors that account for differential job arrival rates in a region and/or province, θ_t are quarter fixed effects and $\nu_{i,t}$ is the error term.

Due to nature of the dependent variable, equation 3.7 is implemented as an interval regression. The results are presented in Table 3.5. It shows that individuals who prefer full-time paid employment over part-time paid employment spend 0.62 months longer searching for jobs as compared to similar individuals who do not have a preference for full-time paid employment.

In terms of individual level characteristics, education is one of the strongest predictors of unemployment duration. This is consistent with previous findings where more qualified individuals spend more time searching for jobs. Moreover, individuals who attain any kind of vocational or technical training wait longer to find the job that suits their acquired skills. The coefficients on age terms show that younger individuals spend more time searching for work. Individuals that are married or heads of households cannot afford to be unemployed for long periods of time, hence the negative coefficients on the respective dummy variables. Note that household level variables such as the number of household members below the age of 14 years, and social capital variables such as the number of other self-employed individuals in the household do not affect the duration of unemployment. The number of other wage employees in the household does not seem to affect unemployment duration either.

As stated in the analysis of sector choice, self-employment represents an important alternative to wage employment in Pakistan. Thus, some individuals that are actively seeking work may prefer self-employment

over wage employment, and they may be waiting to accumulate the required financial and physical capital to start up their own businesses. Thus, there may exist barriers to entry into self-employment. Testing for these entry barriers helps to determine whether the characterization of the informal sector into an upper-tier and a lower-tier informal sector is relevant in the context of the Pakistani labor market.

I indeed find a positive and significant association between preferences for self-employment and unemployment duration. The second row of Table 3.5 show that individuals who prefer self-employment over informal wage employment tend to wait 0.81 months longer to acquire the resources to start their own businesses. This implies that entry barriers may not just be a formal sector phenomenon. In particular, it underscores the validity of internal dualism in the informal sector (Fields, 1975).

Does the Wage Differential affect Preferences

The aforementioned analysis assumes that preferences are exogenous. However, preferences may be endogenous and may depend on the difference between the reservation wage in the preferred and the non-preferred sector of employment. To test this, I use the estimated wage differential between formal and informal sector employment as a regressor in the preference equation, and the standard errors are adjusted using bootstrapping techniques. Here I run regressions of the form:

$$Z_{i,t} = \beta X_{i,t} + \delta W\hat{D}_{i,t} + \epsilon_{i,t} \tag{3.8}$$

where $W\hat{D}_{i,t}$ is the predicted wage differential, $X_{i,t}$ are the conventional controls, and $\epsilon_{i,t}$ is the error term. All other variables are defined as before. δ is the variable of interest and is estimated using a logit model.

I find that in the model with regional controls and quarter fixed effects, δ is positive and significant; a one unit increase in the predicted wage differential increases the preference for formal sector employment by 0.257. Note that this model without individual level controls makes a strong assumption about preferences. It assumes that human capital variables and other individual level characteristics affect preferences only through their effects on the wage differential. However, there may also be a direct effect of individual level characteristics on job preferences. To test that, I control for human capital variables and household characteristics in the estimation of the preference equation.

I find that controlling for human capital variables makes the effect of the wage differential small and statistically zero. Similar results are seen in the model with regional controls, human capital variables and social capital controls. A more detailed analysis shows that among all the control variables, the dichotomous variable of whether the individual has obtained a professional degree is a significant determinant of preference for full-time paid employment.

An analysis of unemployment duration that takes into account the wage premium an unemployed individual expects to receive by working in the formal sector may be more informative about the existence of entry barriers into formal sector employment as compared to an analysis of the effects of preferences on unemployment duration alone. This can be done using a two-step estimation procedure where instead of controlling for actual preferences in equation 7, the predicted preferences from equation 3.8 are used in the unemployment duration equation 3.7.[22]

In order to estimate equation 3.7 with the predicted preference variable, I run an interval regression model, bootstrapping the standard error on the predicted preference variable. First, I run the regression of unemployment duration on human capital variables and predicted preference, $\hat{Z_{i,t}}$, excluding regional controls and quarter fixed effects. I find that $\hat{Z_{i,t}}$ is significantly and positively related to unemployment duration in the model. Preference for formal sector employment increases unemployment duration by 1.8 months. However, controlling for quarter fixed effects and regional controls makes the coefficient on predicted preferences statistically zero.[23]

Overall, my results suggest that controlling for the observable characteristics of workers, the predicted wage differential between formal and informal sector employment is neither a significant determinant of job preferences, nor does it affect unemployment duration through its effect on job preferences. That said, I do observe partial evidence of queuing in the labor market.

3.3 Testing for Segmentation using Labor Market Transitions

The cross-sectional analysis of earnings differentials is a useful starting point to test for the existence of segmented versus integrated labor markets. However, static comparisons of earnings differentials is not in

[22]This may also be done using an instrumental variable regression where the predicted wage differential is used to instrument for stated preferences.

[23]The results are available on request.

itself evidence of segmentation. Moreover, traditional earnings comparisons may not be a reliable measure of segmentation even when viewed over time (Maloney, 1999). A possible way around this is to test the competing hypotheses of labor market dualism by examining the patterns of worker mobility across time and to see if the patterns are consistent with the ones predicted by the segmentation hypothesis. I test for the patterns of worker mobility using longitudinal data from the Pakistan Socio-Economic Survey for the years 1998-99 and 2000-01. PSES is representative at the national, provincial and the rural-urban level and the sampling frame is similar to other nationally representative household and labor force surveys.[24] There is one caveat to using PSES data though, which relates to sample attrition between the two survey rounds.[25] To maintain consistency with the previous analysis, I restrict the sample to male workers and non-workers between the age of 14 and 65 years.

3.3.1 Patterns of Mobility

Segmentation predicts lower turnover rates in the formal sector, a higher probability of transition from formal to informal sector employment as compared to the transition from informal to formal sector employment, and a higher probability of transition from informal sector employment to unemployment as compared to the transition from formal sector employment to unemployment (Garz, 2013). This section tests for the presence of these patterns in two ways. The first subsection presents a detailed analysis of the transitions between sectors, and the second presents a multinomial logit analysis of the factors that determine these transitions.

Individuals may choose to work in four sectors of employment. These include: (i) regular paid employment (formal), (ii) casual paid employment (lower-tier informal), (iii) self-employment (upper-tier informal), and (iv) unpaid family work. Individuals may also decide not to work. Among non-workers, individuals that are actively seeking work are unemployed, and the rest are inactive or out of the labor force.

3.3.2 Sectoral Composition Over Time

Changes in the sectoral composition of the labor market over the two rounds of the PSES shows an 5.3 percentage point increase in paid employment across the two survey rounds; the proportion of paid employees

[24] see Arif and Bilquees (2006) for a detailed overview of the sampling methodology.

[25] Arif and Bilquees (2006) provide a comprehensive analysis of sample attrition, type of attrition and the examination of any systematic differences between attritors and non-attritors in the PSES sample.

increased from 63.57% in the year 1998-99 to 68.87% in the year 2000-01. This primarily owed to a reduction 4 percentage point reduction in the proportion of unpaid family workers; from 7.7% in the year 1998-99 to 3.7% in the year 2000-01. More interestingly, a significant proportion (39.71%) of individuals that were inactive in the year 1998-99 decided to participate in the labor market in the year 2000-01. Overall, unemployment increased from 4.39% to 10.43%, and the proportion of inactive individuals declined from 24.25% to 16.98% across the two rounds of the survey.[26]

Analysis of Worker Transitions

Following the approach used in Maloney (1999), Table 3.6 provides a summary of transitions across employment sectors between the two rounds of the PSES. Panel A lists the conditional probability of finding an individual in sector j in the second time period, given that he was in sector i in the first time period, i.e. P_{ij}. The row percentages sum to a hundred, and the totals at the bottom represent the share of workers in each category at the end of the period, $P_{.j}$. The diagonal entries reflect employment persistence. The table shows that within any employment category, individuals are more likely to persist in the same type of employment than to switch to other sectors. Moreover, employment persistence is highest for regular paid employees. This is consistent with the first hypothesis of labor market segmentation, which states that turnover rates in the formal sector tend to lower than the turnover rates in the informal sector.

The diagonal entries in Panel A also help to determine the average time spent in a particular labor market segment. As the two surveys were conducted almost two years apart, the mean time spent in a sector is equal to $2/(1 - P_{ii})$.[27] Using this formula, the mean time spent in regular employment is about 5.2 years, in casual employment is 4.4 years, and in self-employment is about 3.9 years. The table shows that about 25.5% of the unemployed did not find a job in the second round, and were still searching for work. Thus, the average time spent looking for work is about 2.7 years. Whether these workers are queuing for formal sector jobs cannot be determined without more comprehensive information on employment flows and voluntary and involuntary separations. However, it is important to note that a significant proportion of these workers might get discouraged and exit the labor force. Note that 21.9% of the unemployed left the labor force in

[26]Irfan (2008) states that the unemployment rate in Pakistan worsened particularly in the year 2000-01. However, if a majority of the unemployed were drawn from the pool of inactive workers, it may not be the most undesirable outcome and may represent new entrants into the labor market that are fictionally unemployed. Arif et al. (2001a) also shows that a majority of the unemployed individuals in the PSES sample were transitory unemployed or short-term unemployed, as opposed to the chronically unemployed.

[27]This assumes that workers did not switch jobs between the two rounds of the survey.

the second time period.

Next I try and determine whether flows into a given sector are particularly high or low. This cannot be done using Panel A because in a random shuffling of workers, P_{ij} increases with the size of the terminal sector, $P_{.j}$. Thus, Panel B standardizes the transition probabilities by the size of the terminal sector. Here, each row indicates whether flows into any j are high as compared to a purely random distribution. The values help to examine symmetry in employment flows between any two sectors. For instance, the table shows that employment flows between regular and contractual employment are bidirectional and close in magnitude. This provides evidence against the segmentation hypothesis, showing that controlling for the size of the terminal sector, it is quite probable for casual paid employees to move to regular paid employment as it is for the latter to join the former. However, to make a stronger statement about a segmented versus an integrated labor market, I need data on voluntary and involuntary separations from regular paid employment. It is interesting to note that within the informal sector, employment flows between self-employment and contractual employment are more unidirectional. Transition patterns suggest that the classification of self-employment as the upper-tier informal sector, and casual employment as the lower-tier informal sector is appropriate in case of the Pakistani labor market. This is because transition probability from casual paid employment to self-employment is about two-thirds of the transition probability from self-employment to casual paid employment. The results also suggest that it may be easier to transition within wage employment, as opposed to making a transition from wage employment to entrepreneurship. The latter may require high investments in physical and financial capital.

As stated earlier, segmentation suggests that transitions from informal sector employment to unemployment tend to be higher than the transitions from formal sector employment into unemployment. I do find partial support in favor of this hypothesis. Table 4 Panel A shows that the probability of moving from regular employment to unemployment is 3.1 percentage points higher than the probability of moving from casual employment to unemployment. When standardized by the size of the terminal sector in Panel B column 4, the difference in the transition probabilities is starker; 88.5% from casual employment to unemployment as compared to 58.1% from regular employment to unemployment.

Although Panel B helps compare transition patterns between a specific initial and terminal sector, it is still not possible to compare employment flows more generally across the table. Any such measure needs to account for the separation rate from the initial sector, and the likelihood of a job offer in the terminal sector (Maloney, 1999). This is captured by the disposition of a worker to leave the initial sector and move to the terminal sector, where disposition is denoted by V_{ij}. V_{ij} is determined by normalizing the probabilities

presented in Panel B by the turnover rate in the terminal sector, $(1 - P_{jj})$, and the desire to leave the initial sector, i.e. $(1 - P_{ii})$.[28]

First, the symmetry of Vs across regular and casual employment provides suggestive evidence against the segmentation hypothesis. Conditional on job availability, casual paid employees are almost as likely to take on regular paid jobs as regular paid employees are likely to take on casual paid jobs. Second, the disposition of casual paid employees to move to unemployment is greater than the disposition of regular paid employees to move into unemployment. This may suggest traces of segmentation. However, lack of an established criteria on the magnitude of the difference between the two transition probabilities limits my ability to make a definite statement about the labor market being segmented or an integrated.

Three important general findings are immediately apparent. First, the table displays high levels of mobility, with turnover rates in the formal sector similar to other emerging economies and developing countries (Maloney, 1999). Second, the symmetry of Vs between regular paid employment and casual paid employment seems to imply that the labor market is more fluid along the formal-informal dimension than the segmentation hypothesis suggests. Third, it may be relatively easier for informal sector wage employees to join formal sector wage employment instead of becoming self-employed. This suggests that for certain workers, casual wage employment may act as a stepping stone into regular wage employment. It also suggests that despite being a part of the informal sector, self-employment may represent a sector with positive barriers to entry, for instance, start-up costs and access to financial and physical capital.

Below I examine the determinants of sectoral transitions using a multinomial logit model.

Determinants of Sectoral Transitions

Here I run regressions of the form:

$$Prob(l_i^t \mid l_i^{t-1}) = \alpha_{i,j} + \beta_{1,j}X_{i,j} + \beta_{2,j}E_{i,j} + \beta_{3,j}K_{i,j} + \beta_{4,j}S_{i,j} + \gamma_t + \varepsilon i, j, t \tag{3.9}$$

The choice of sector is denoted by j. l is a discrete variable that takes a value j to indicate individual $i's$ labor market outcome in period t, conditional on $i's$ sector of employment in period $t-1$. E is the individual's endowment of human capital, K is his endowment of physical capital, including assets and

[28] $P_{ij}/P_{.j} = [(1 - P_{ii}).V_{ij}.(1 - P_{jj})]$

financial resources that can be used as a collateral to secure a loan, S is the individual's endowment of social capital, specifically other household members that may increase the likelihood of access to employment opportunities or overcome information asymmetries in the labor market. X is a vector of individual level characteristics that influence sector choice, γ_t are quarter fixed effects and $\varepsilon i, j, t$ is the error term.

Table 3.7 shows the results of a single multinomial logit estimated on the sample of individuals interviewed in the second round of the survey, excluding unpaid family workers. The dependent variable is the individual's sector of employment, unemployment or inactivity in the year 2000-01, and the omitted category is casual paid employment. All the variables in the model are interacted with dummies to control for the sector of employment, unemployment or inactivity in the year 1998-99.[29] All marginal probabilities can be interpreted with reference to the base category i.e., casual paid employment in the year 2000-01.[30]

The results show that controlling for individual and household level characteristics, few of the variables are significant to individuals' switching patterns. However, some interesting findings do emerge from the analysis. Panel A shows that workers who transition from regular paid jobs to casual paid jobs tend to be less educated and have lower levels of experience as compared to workers who continue to work as regular paid employees. Moreover, the former are more likely to be married, and tend to have fewer number of other household members in regular employment. This shows that individuals with a lower level of human capital and/or social capital are more likely to be pushed towards informality. Moreover, in terms of human capital variables, regular paid employees that become self-employed in the second round are not significantly different from regular paid employees that join casual paid employment in the second round. However, those who become self-employed have higher real assets as compared to those who join casual employment, and the former are more likely to reside in urban areas. These results suggest that differential access to physical capital is one of the major determinants of choosing self-employment over casual paid employment.

Panel B shows that compared to casual paid employees that persisted in casual employment across the two survey rounds, those who joined regular employment were likely to be more educated, and had access to more physical assets. This suggests that informal sector workers with a higher level of education have a greater chance of being selected into regular employment. However, education may also cause workers to wait longer to obtain the desired job, which is likely to increase unemployment. Moreover, casual paid employees who became self-employed in the second round either had more assets (physical capital), or had a

[29] I run a single regression in order to use the small sample size more efficiently. See Packard (2007).

[30] The entire analysis assumes that individuals did not change their labor market status between the two survey rounds.

higher number of other household members in self-employment (social capital) as compared to workers that continued to work in casual paid jobs. Average levels of education however, was similar for workers that became self-employed or stayed in casual paid jobs in the second round.

Panel C shows that respondents who left self-employment for regular paid employment had a higher level of human capital on average than their counterparts who left self-employment for casual paid jobs. Moreover, individuals with higher asset levels continued to operate their own businesses, instead of being pushed to take casual paid jobs. In addition, relative to self-employed workers that took casual paid jobs in the year 2000-01, workers who left self-employment to actively search for work had access to higher non-labor income from other household members that were self-employed.

Panel D shows that inactive individuals who took up casual paid employment in the second round were likely to have lower levels of social capital as compared to inactive individuals that joined regular paid employment or self-employment. Moreover, as compared to inactive individuals that joined casual paid employment in the second round, those that were still seeking work were more likely to be the heads of their household, reside in urban areas, and had a greater number of other household members in regular paid employment. This shows that individuals tend to spend more time looking for work when they have access to higher non-labor income, where the number of regular paid employees in the household can be thought of as a proxy for non-labor income. It also points to the fact that individuals that did not participate in the labor market initially, and decided to join regular employment instead of casual employment, might afford to stay out of the labor force because they were more likely to have family support. In comparison, workers with fewer family members in regular employment may not afford to be unemployed for long periods of time, and might decide to take up casual paid jobs in the second round. It also shows that younger individuals in rural areas are more likely to join casual paid employment after periods of inactivity, while older individuals in urban regions may face greater demand constraints, and continue to search for work. Finally, as compared to individuals that took casual employment after periods of inactivity, workers that stayed inactive were likely to possess lower levels of human capital, i.e. were likely to be younger and less educated.[31]

The results show that individual's endowment of human capital, proxied in the model by age and years of education, is a significant determinant of movement between sectors. Workers who transition to regular wage employment from other sectors, as well as workers who persist in regular wage employment between the two survey rounds, are likely to be more educated as compared to workers who take casual paid jobs in the second

[31]Coefficients for individuals who were actively seeking work in the first round could not be well-identified due to a small number of observations.

round. Moreover, respondent's age is a significant determinant of persistence in regular paid employment as compared to a transition from regular to casual paid employment. Also, an increase in the number of other household members that are self-employed increases the likelihood of becoming self-employed as opposed to taking casual paid employment in the second survey round. Social capital also plays a positive role in finding regular paid employment for workers who decide to participate in the labor market in the second time period. In addition, a higher endowment of physical capital is a significant determinant of either moving to self-employment over casual wage employment, or staying in self-employment over time.

Thus, an individual's endowment of human capital and physical capital are significant determinants of movement to regular wage employment and self-employment respectively. However, higher levels of human capital increases the likelihood of queuing for formal sector jobs.

Earnings in the Initial and the Terminal Sector

The pattern of transitions between sectors is likely to be influenced by earnings in the initial sector of employment. Controlling for initial earnings shows that relative to workers that stay in regular paid employment, those that transition to casual employment had lower initial earnings.[32] Moreover, relative to workers that continued to work in casual paid jobs, workers who were able to make a transition to regular paid employment were likely to have higher incomes in the first round. Thus, casual paid employees with higher incomes are more likely to find formal sector jobs, while casual paid employees with lower incomes are more likely to become unemployed or exit the labor market. This is consistent with the stepping-stone hypothesis, which states that for workers with a given level of human capital, casual paid employment may serve as a stepping stone into regular paid employment. However, the stepping stone hypothesis does not hold for workers with lower human capital. Moreover, relative to workers that continued to operate their own businesses, workers who left self-employment for casual employment had lower incomes in the initial time period.

The results suggest that casual paid employees with low incomes try and switch sectors. If they have the required human capital, they are likely to find regular paid employment. Similarly, if they have access to higher physical and social capital, they are likely to start their own businesses. However, they may decide to actively seek work, or to exit the labor market completely, which is made possible through other household resources such as transfer income and non-labor income.

[32]This is consistent with the lower human capital stated earlier.

The pattern of transitions is also likely to exert differential effects on earnings in the post period. Here I examine how income in the post-period was affected by a given switching pattern. I find that individuals who enter casual paid employment from any of the other labor market sector experience the largest reduction in income. Moreover, individuals who join the labor force after periods of inactivity earn the most in self-employment, followed by regular paid employment and casual paid employment. Similarly, unpaid family workers earn more with a transition into self-employment as compared to a transition into regular paid employment. In addition, unemployed individuals earn more with a transition to regular paid employment. This is consistent with the queuing hypothesis.

Lastly, I compare the change in earnings generated by transitions between sectors holding individual level characteristics constant. This leaves the variation in job characteristics as the residual explanatory factor. The results are presented in Table 3.8. These results show that movement to casual paid employment from any other sector of employment is associated with a significant decline in income. Moreover, persistence in regular paid employment leads to a significant increase in earnings. However, persistence in self-employment is associated with a decline in income. None of the other transitions has a significant effect on earning differentials.

3.4 Conclusion

This paper provides an analysis of earnings differentials and sectoral transitions to examine the existence of labor market segmentation in Pakistan. First, I test for earnings differentials between formal and informal sector wage employees using an endogenous regime switching approach. I find that controlling for selection and observable characteristics of workers, formal sector pays more than the informal sector.

Second, I test for possible queuing for formal sector jobs using data on job preferences and unemployment duration. Here I find that a preference for full-time paid employment over part-time paid employment increases unemployment duration by 0.6 months, while a preference for self-employment over part-time pais employment increases unemployment duration by 0.8 months.

Third, I examine the patterns of worker mobility over time to see whether these patterns are similar to the ones predicted by the segmented view of the labor market. I find lower turnover rates in formal sector employment, which is consistent with the segmentation hypothesis. I also find that the probability

of transition from formal sector employment to unemployment is lower as compared to the probability of transition from informal sector employment to unemployment. This is also consistent with the segmentation hypothesis, however, lack of a definite criteria about the magnitude of the difference limits my interpretation of the labor market as definitely segmented. Lastly, I find that employment flows between formal and informal sector wage employment are largely bidirectional, which is in contrast to the segmented view of the labor market. More interestingly, employment flows within the informal sector are more unidirectional; self-employed individuals find it easier to move to informal wage employment, while the latter find it harder to start their own businesses. This suggests that the informal sector is characterized by its own internal dualism.

Results from the multinomial logit suggest that individual's endowment of human capital and physical capital are significant determinants of movement to regular wage employment and self-employment respectively. Thus, the lack of human capital is a significant entry barrier to formal sector employment, and the lack of physical capital represents a barrier to entry into self-employment. Moreover, any transition into casual paid employment is associated with a reduction in earnings.

My results suggest that casual wage employment is the lowest paying segment of the Pakistani labor market. Thus, it seems reasonable to characterize casual wage employees as part of the lower-tier informal sector. Self-employment presents itself as a high-paying segment of the informal sector, which is desirable in and of itself, and may be more desirable for certain workers who value independence, and do not have the professional education to signal their worth in the formal sector. Thus, I consider self-employment is a part of the upper tier informal sector. Whether the labor market in Pakistan is segmented or integrated requires an analysis of sectoral transitions over a longer period of time, however, the existence of three distinguishable sectors as characterized in Fields (1975) does emerge.

Table 3.1: Average Marginal Effects from a Multinomial Logit Model

Dependent Variable: Sector Choice			
	Regular	Self-Employed	Unemployed
Primary (5 years)	0.0229	0.0464	-0.0153
	(0.0032)***	(0.0033)***	(0.0018)***
Middle (8 years)	0.0291	0.0430	0.0028
	(0.0032)***	(0.0039)***	(0.0025)
Matriculation (10 years)	0.0495	0.0638	0.0178
	(0.0038)***	(0.0043)***	(0.0024)***
Intermediate Degree (12 years)	0.0817	0.0496	0.0503
	(0.0064)***	(0.0066)***	(0.0045)***
Degree (14 or more)	0.1844	-0.0172	0.0574
	(0.0098)***	(0.0079)**	(0.0061)***
Training = 1	0.0314	-0.0069	-0.0300
	(0.0045)***	(0.0061)	(0.0033)***
Age	0.0013	0.0076	-0.0090
	(0.0007)**	(0.0008)***	(0.0004)***
Age Squared	-0.0058	-0.0018	0.0143
	(0.0009)***	(0.0010)*	(0.0005)***
Married	0.0166	0.0465	-0.0533
	(0.0034)***	(0.0039)***	(0.0028)***
Head of Household	0.0127	0.0091	-0.0562
	(0.0035)***	(0.0039)**	(0.0024)***
hhmem_less14	-0.0045	0.0098	-0.0016
	(0.0005)***	(0.0007)***	(0.0004)***
hhmem_over65	-0.0103	0.0136	-0.0007
	(0.0025)***	(0.0029)***	(0.0016)
Since Birth	-0.0394	0.0426	-0.0151
	(0.0035)***	(0.0038)***	(0.0028)***
Self Employed Members	-0.0182	0.0668	-0.0081
	(0.0019)***	(0.0025)***	(0.0010)***
Regular Employed Members	0.1406	-0.0964	-0.0032
	(0.0015)***	(0.0022)***	(0.0011)**
Casual Employed Members	-0.0288	-0.1170	-0.0076
	(0.0019)***	(0.0025)***	(0.0012)***
Urban	0.0189	0.0377	-0.0146
	(0.0039)***	(0.0053)***	(0.0026)***
Province FE	Y	Y	Y
Quarter FE	Y	Y	Y
Observations per Sector	50971	85447	14400

The excluded category is casual paid employment, paid employment on piece-rate basis and apprentices. The regressions are weighted. Standard errors in parentheses are clustered at the level of the primary sampling unit and year. The total number of observations is 218351. $***p < 0.01, **p < 0.05, *p < 0.1$.

Table 3.2: Variables in the Index for the Regime Switching Model (Source: LFS)

Variables used to Create the Index (Percent)	
Employment Status	
Regular Paid Employees with Fixed Wage	43.01
Casual Paid Employees	35.84
Paid by piece-rate or work performed	19.84
Apprentices	1.31
Observations	115,230
Enterprise	
Public Limited Companies	19.29
Private Limited Companies	1.66
Cooperatives	0.48
Individual Ownerships	69.37
Partnerships	2.96
Other form of establishments	6.24
Observations	115,228
Written Accounts	
Yes	17.27
No	62.15
Don't Know	20.58
Observations	89,957
Any Regular Employees	
Yes	36.59
No	63.41
Observations	89,955
Firm Size	
Large	19.95
Small	80.05
Observations	89,955
Workplace	
Own house	1.49
Family or friend's house	0.58
Employer's house	19.92
Street/Road	9.24
Country side	9
Shop,business,office,industry	57.07
Other	2.7
Observations	115,230

Table 3.3: Earnings Differentials in an Endogenous Regime Switching Model

Dependent Variable		(1)			(2)	
Log of Real Wage per Hour	Informal	Formal	Selection	Informal	Formal	Selection
Primary (5 years)	0.0420***	0.0332***	0.373***	0.0384***	0.0239**	0.336***
	(0.00658)	(0.0113)	(0.0251)	(0.00633)	(0.0108)	(0.0290)
Middle (8 years)	0.0936***	0.0945***	0.846***	0.0885***	0.0797***	0.826***
	(0.00814)	(0.0109)	(0.0438)	(0.00777)	(0.0101)	(0.0482)
Matriculation (10 years)	0.102***	0.174***	1.755***	0.0872***	0.150***	1.770***
	(0.0112)	(0.0119)	(0.0488)	(0.0104)	(0.0115)	(0.0535)
Intermediate Degree (12 years)	0.139***	0.366***	2.703***	0.0852***	0.287***	2.748***
	(0.0269)	(0.0169)	(0.0437)	(0.0259)	(0.0157)	(0.0496)
Degree (14 or more)	0.449***	0.999***	3.658***	0.362***	0.711***	3.592***
	(0.105)	(0.0252)	(0.0846)	(0.103)	(0.0185)	(0.104)
Training = 1	0.157***	0.114***	-0.105***	0.106***	0.0758***	-0.170***
	(0.0127)	(0.0150)	(0.0261)	(0.0129)	(0.0137)	(0.0278)
Age	0.0505***	0.0537***	0.0335***	0.0459***	0.0492***	0.0377***
	(0.00199)	(0.00245)	(0.00428)	(0.00191)	(0.00220)	(0.00472)
Age Squared ÷ 100	-0.0572***	-0.0551***	-0.0350***	-0.0520***	-0.0516***	-0.0406***
	(0.00247)	(0.00311)	(0.00542)	(0.00235)	(0.00278)	(0.00600)
Married	0.0441***	0.0264***	-0.0408**	0.0403***	0.0231**	-0.0393*
	(0.00786)	(0.00953)	(0.0204)	(0.00788)	(0.00898)	(0.0219)
Head of Household	-0.0241***	0.0395***	-0.0836***	-0.0241***	0.0250***	-0.0820***
	(0.00720)	(0.0104)	(0.0209)	(0.00683)	(0.00970)	(0.0221)
Urban = 1	0.0202*	0.101***	0.437***	0.0480***	0.102***	0.389***
	(0.0121)	(0.0161)	(0.0262)	(0.0116)	(0.0140)	(0.0225)
Household Members < 14			-0.0305***			-0.0343***
			(0.00340)			(0.00373)
Household Members > 65			-0.0778***			-0.0778***
			(0.0185)			(0.0200)
Since Birth = 1			-0.359***			-0.364***
			(0.0228)			(0.0232)
Self Employed Members			0.0276**			0.0156
			(0.0119)			(0.0128)
Regular Employed Members			1.158***			1.220***
			(0.0160)			(0.0169)
Casual Employed Members			-0.797***			-0.853***
			(0.0163)			(0.0183)
Constant	1.754***	1.166***	-1.965***	2.486***	2.231***	-0.828*
	(0.0971)	(0.105)	(0.234)	(0.207)	(0.119)	(0.465)
Quarter FE	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y
Industry FE	N	N	N	Y	Y	Y
Occupation Categories	N	N	N	Y	Y	Y
Observations	112,724	112,724	112,724	112,512	112,512	112,512
σ_N			0.6019			0.5855
			(0.0054)			(0.0056)
σ_F			0.6381			0.6056
			(0.0055)			(0.0059)
ρ_N			-0.0098			-0.0739
			(0.0187)			(0.0163)
ρ_F			0.0869			0.0405
			(0.0138)			(0.0141)
$\chi^2(2)$			39.97			31.63
Log-likelihood			-129895.42			-121592.52

Table 3.4: Average Characteristics of Workers in Each Sector

Personal Characteristics	Distribution of Sector by Characteristics		Distribution of Characteristics by Sector	
	Informal	Formal	Informal	Formal
Primary = 0	76.97	87.55	59.3	40.7
Primary = 1	23.03	12.45	75.4	24.6
Middle = 0	86.25	83.86	63.02	36.98
Middle = 1	13.75	16.14	58.54	41.46
Matric = 0	94.57	72.34	68.42	31.58
Matric = 1	5.43	27.66	24.55	75.45
Inter = 0	99.57	88.66	65.05	34.95
Inter = 1	0.43	11.34	5.87	94.13
Degree = 0	99.96	85.06	66.07	33.93
Degree = 1	0.04	14.94	0.48	99.52
Married = 0	40.13	45.05	59.62	40.38
Married = 1	59.87	54.95	64.35	35.65
Household Head = 0	51.27	60.55	58.38	41.62
Household head = 1	48.73	39.45	67.18	32.82
Urban = 0	62.83	27.21	79.28	20.72
Urban = 1	37.17	72.79	45.83	54.17
Job Characteristics				
Regular Worker= 0	80.21	17.29	88.49	11.51
Regular Worker = 1	19.79	82.71	28.39	71.61
Accounts = Yes	12.19	30.4	49.68	50.32
Accounts = No	67.19	48.32	77.4	22.6
Accounts = Don't know	20.63	21.28	70.47	29.53
Firm Size Small = 0	8.79	15.64	58.07	41.93
Firm Size Small = 1	91.21	84.36	72.7	27.3
Covered = 0	78.53	48.47	72.86	27.14
Covered = 1	21.47	51.53	40.84	59.16
Workplace = 0	57.94	16.68	85.2	14.8
Workplace = 1	42.06	83.32	45.54	54.46
Incorporated Enterprise = 0	89.35	60.11	71.12	28.88
Incorporated Enterprise = 1	10.65	39.89	30.68	69.32
Monthly Pay = 0	70.36	14.7	88.8	11.2
Monthly Pay = 1	29.64	85.3	36.54	63.46
Hours Worked < 35	5.63	2.6	78.18	21.82
Hours Worked ≥ 35	94.37	97.4	61.62	38.38
Occupation				
Senior Officer and Manager = 1	0.73	7.77	13.48	86.52
Service and Sales = 1	9.28	19.35	44.29	55.71
Craft and Trade = 1	36.98	25.93	70.27	29.73
Elementary Occupations = 1	41.57	14.24	82.86	17.14
Industry				
Manufacturing = 1	25.76	45.29	67.35	32.65
Construction = 1	40.1	3.34	95.24	4.76
Wholesale and Retail = 1	7.94	17.16	43.51	56.49
Transport and Communication =1	13.02	10.46	67.45	32.55

All statistics are calculated using a reference probability of formal sectors employment is 35.8%. Incorporated = 1 for public limited companies, private limited companies and cooperatives. Incorporated = 0 for individual ownerships, partnerships and other forms of establishments. Workplace = 1 if the individual works in a shop, office, business or industry. Covered = 1 if the worker is covered by social security under the Employees' Old Age Benefits Act.

Table 3.5: Marginal Effects from an Interval regression

Dependent Variable: Unemployment Duration	(1)	(2)	(3)
Preference Full Time = 1	0.746***	0.609***	0.615***
	(0.201)	(0.201)	(0.201)
Preference Self Employment = 1	0.848***	0.808***	0.810***
	(0.272)	(0.274)	(0.274)
Primary (5 years)		0.363*	0.320
		(0.213)	(0.213)
Middle (8 years)		0.647***	0.608***
		(0.209)	(0.209)
Matriculation (10 years)		0.885***	0.826***
		(0.212)	(0.214)
Intermediate Degree (12 years)		0.594*	0.513
		(0.325)	(0.326)
Degree (14 or more)		0.880***	0.798***
		(0.302)	(0.309)
Age		-0.0861**	-0.0881**
		(0.0397)	(0.0397)
Age Squared ÷ 100		0.139***	0.141***
		(0.0514)	(0.0515)
Any Training		0.0686	0.0636
		(0.278)	(0.278)
Married		-0.535**	-0.479**
		(0.227)	(0.230)
Head of Household		-0.472*	-0.487*
		(0.245)	(0.250)
Since_Birth	0.451**	0.299	0.301
	(0.183)	(0.187)	(0.187)
Household members < 14			-0.0480
			(0.0336)
Self-Employed Members			0.0835
			(0.116)
Regular Employed Members			0.0406
			(0.0921)
Casual Employed Members			-0.142
			(0.0972)
Quarter FE	Y	Y	Y
Province FE	Y	Y	Y
Dummy (Urban)	Y	Y	Y
Observations	3,027	3,027	3,027
lnsigma	1.129***	1.114***	1.112***
	(0.0190)	(0.0189)	(0.0189)

The excluded category is preference for part-time paid employment, contract work or daily wage work. Robust standard errors in parentheses, $***p < 0.01, **p < 0.05, *p < 0.1$

Table 3.6: An Analysis of Sectoral Transitions

Panel A: Probability of moving from initial to terminal sector (Pij) percent

Initial/Terminal	Regular Employees	Contract Employees	Self Employed	Unpaid Family	Unemployed	Inactive
Regular Employees	61.8	20.2	8.9	0.4	6.1	2.7
Contract Employees	17.8	54.8	11.0	2.2	9.2	5.0
Self Employed	10.2	28.4	48.3	1.0	6.4	5.8
Unpaid Family Worker	13.1	24.7	21.4	24.3	7.1	9.5
Unemployed	19.6	27.4	4.6	1.2	25.3	21.9
Inactive	11.3	9.9	6.0	4.2	17.1	51.5
P.j	24.9	27.7	16.3	3.7	10.4	17.0

Panel B: Probability Standardized by size of the terminal sector (Pij/P.j) percent

Initial/Terminal	Regular Employees	Contract Employees	Self Employed	Unpaid Family	Unemployed	Inactive
Regular Employees		73.0	54.4	11.3	58.1	15.8
Contract Employees	71.7		67.7	57.9	88.5	29.4
Self Employed	40.8	102.6		26.3	61.1	34.3
Unpaid Family Worker	52.6	89.1	131.2		67.6	56.1
Unemployed	78.6	99.0	28.2	33.0		129.2
Inactive	45.2	35.9	36.9	112.9	163.7	

Panel C: Disposition to move to a sector (Vij) percent

Initial/Terminal	Regular Employees	Contract Employees	Self Employed	Unpaid Family	Unemployed	Inactive
Regular Employees		422.0	275.1	38.9	203.3	85.5
Contract Employees	414.5		289.1	169.1	261.8	134.0
Self Employed	206.4	438.4		67.1	158.0	136.9
Unpaid Family Worker	181.8	260.0	335.0		119.5	152.9
Unemployed	275.1	292.9	72.8	58.3		356.5
Inactive	243.9	163.6	147.3	307.5	451.7	

Inactive is defined as out of the labor force. Vij is defined as (Pij/P.j)/[(1-Pii).(1-Pjj)]. See Maloney (1999).

Table 3.7: Multinomial Logit Model of Sectoral Transitions

	Regular		Casual		Self-Employed		Unemployed		Out of the Labor Force	
	Coefficient	Std. Err.	Coefficient	Std. Err.	Coefficient	Std. Err.	Coefficient	Std. Err.	Coefficient	Std. Err.
Regular_98	-0.1767	(0.1490)	0.2593	(0.4016)	-0.0423	(0.2860)	0.0346	(0.2373)	-0.0749	(0.3572)
Self_98	0.2489	(0.7455)	-0.1414***	(0.0346)	0.0222	(0.0342)	0.2076	(0.7437)	-0.3373***	(0.0464)
Unemployed_98	-0.3076***	(0.0616)	-0.2327	(0.0131)	-0.2278	(22.2212)	-0.0435	(22.2193)	0.8116***	(0.0097)
OLF_98	-0.0369	(0.3443)	-0.0725	(0.3350)	-0.1420	(0.2375)	-0.1977**	(0.0457)	0.4490	(0.4697)
Panel A: Regular 1998-99										
Age	0.0285**	(0.0131)	-0.0105	(0.0176)	0.0075	(0.0150)	0.0005	(0.0078)	-0.0260	(0.0178)
AgeSquared ÷ 100	-0.0377**	(0.0159)	0.0048	(0.0221)	-0.0058	(0.0179)	-0.0018	(0.0095)	0.0405**	(0.0194)
Education	0.0115***	(0.0043)	-0.0150**	(0.0062)	-0.0001	(0.0049)	0.0005	(0.0029)	0.0032	(0.0066)
Head of Household	-0.0792	(0.1042)	0.0658	(0.1454)	-0.1232	(0.1051)	0.0562	(0.0698)	0.0803	(0.2398)
Married	-0.1648*	(0.0992)	0.0448	(0.1384)	-0.0621	(0.0976)	0.0442	(0.0669)	0.1380	(0.2316)
Urban	-0.0223	(0.0438)	0.0788	(0.0608)	-0.1024**	(0.0512)	-0.0085	(0.0278)	0.0545	(0.0691)
Self-emp HH Members	0.0508	(0.0572)	0.0010	(0.0760)	-0.0441	(0.0707)	-0.0008	(0.0366)	-0.0068	(0.0915)
Regular HH Members	-0.0415*	(0.0216)	0.0109	(0.0297)	-0.0223	(0.0251)	0.0178	(0.0120)	0.0351	(0.0293)
Real Assets ÷ 100000	0.0080	(0.0063)	-0.0025	(0.0098)	0.0115**	(0.0050)	0.0021	(0.0037)	-0.0190	(0.0148)
Panel B: Casual 1998-99										
Age	0.0050	(0.0189)	0.0111	(0.0139)	-0.0024	(0.0140)	0.0036	(0.0080)	-0.0173	(0.0119)
AgeSquared ÷ 100	-0.0340	(0.0298)	-0.0126	(0.0192)	0.0149	(0.0180)	-0.0003	(0.0105)	0.0321**	(0.0146)
Education	0.0169***	(0.0065)	0.0008	(0.0059)	-0.0036	(0.0064)	-0.0088	(0.0056)	-0.0054	(0.0071)
Head of Household	0.1396	(0.0932)	0.0590	(0.0810)	-0.1165	(0.0900)	-0.0740	(0.0650)	-0.0081	(0.1045)
Married	-0.1089	(0.0786)	-0.0188	(0.0723)	-0.0595	(0.0759)	0.0454	(0.0531)	0.1419	(0.0941)
Urban	0.0133	(0.0519)	-0.0088	(0.0448)	-0.0317	(0.0480)	0.0451	(0.0371)	-0.0178	(0.0472)
Self-emp HH Members	0.0409	(0.0560)	-0.0593	(0.0624)	0.0924*	(0.0523)	0.0086	(0.0350)	-0.0826	(0.0861)
Regular HH Members	-0.0051	(0.0520)	0.0817*	(0.0420)	0.0140	(0.0399)	-0.0138	(0.0407)	-0.0768	(0.0770)
Real Assets ÷ 100000	0.0167*	(0.0090)	-0.0030	(0.0106)	0.0148**	(0.0065)	-0.0105	(0.0128)	-0.0179	(0.0172)
Panel C: Self-employed 1998-99										
Age	-0.0591**	(0.0266)	0.0276	(0.0211)	0.0204	(0.0138)	-0.0086	(0.0117)	0.0197	(0.0209)
Age Squared ÷ 100	0.0622**	(0.0302)	-0.0308	(0.0237)	-0.0253	(0.0156)	0.0105	(0.0127)	-0.0167	(0.0220)
Education	0.0308***	(0.0095)	-0.0159**	(0.0071)	-0.0085*	(0.0045)	-0.0015	(0.0043)	-0.0049	(0.0062)
Head of Household	0.0865	(0.1519)	-0.1879	(0.1170)	0.0821	(0.0773)	-0.0667	(0.0665)	0.0860	(0.1354)
Married	-0.0968	(60.0026)	0.1952	(50.2523)	0.1751	(30.4633)	-0.8192	(188.0668)	0.5457	(47.3497)
Urban	0.0394	(0.0794)	0.0086	(0.0606)	-0.0635	(0.0390)	0.0530	(0.0400)	-0.0375	(0.0545)
Self-emp HH Members	-0.1480	(0.1564)	0.1665*	(0.0886)	-0.0123	(0.0639)	0.0928**	(0.0368)	-0.0989	(0.0912)
Regular HH Members	0.0012	(0.0942)	-0.0332	(0.0702)	0.0073	(0.0423)	-0.0130	(0.0498)	0.0376	(0.0352)
Real Assets ÷ 100000	-0.0150	(0.0160)	-0.0044	(0.0113)	0.0140**	(0.0066)	0.0001	(0.0059)	0.0053	(0.0062)
Panel D: Out of the Labor Force 1998-99										
Age	0.0048	(0.0221)	0.0200	(0.0221)	-0.0161	(0.0233)	0.0082	(0.0230)	-0.0169*	(0.0095)
Age Squared ÷ 100	-0.0142	(0.0322)	-0.0215	(0.0299)	0.0259	(0.0282)	-0.0133	(0.0497)	0.0231	(0.0157)
Education	0.0144	(0.0112)	-0.0090	(0.0118)	0.0070	(0.0120)	-0.0015	(0.0041)	-0.0109***	(0.0040)
Head of Household	-0.1341	(0.2036)	-0.2722	(0.1806)	0.2588	(0.1720)	0.1331**	(0.0661)	0.0144	(0.0650)
Married	-0.4947	(39.5635)	-0.2233	(33.1348)	-0.0098	(20.0881)	0.7964	(124.0030)	-0.0687	(31.2203)
Urban	-0.0991	(0.0746)	-0.0170	(0.0836)	0.0553	(0.0832)	0.0759**	(0.0306)	-0.0151	(0.0284)
Self-emp HH Members	0.1769**	(0.0782)	-0.3468**	(0.1250)	0.1519*	(0.0793)	0.0399	(0.0249)	-0.0220	(0.0324)
Regular HH Members	0.1208***	(0.0454)	-0.1369**	(0.0610)	-0.0010	(0.0601)	0.0378**	(0.0150)	-0.0207	(0.0187)
Real Assets ÷ 100000	-0.0124	(0.0088)	0.0038	(0.0048)	0.0049	(0.0032)	0.0021	(0.0014)	0.0016	(0.0017)
Number of Observations	881									
Log Likelihood	-903.6757									
LR χ^2 (196)	824.77									
$Prob > \chi^2$	0.0000									
Pseudo R^2	0.3133									

The table presents average marginal effects. Base category is casual employment in year 2000-01. Standard errors in parentheses.
$***p < 0.01, **p < 0.05, *p < 0.1$.

Table 3.8: Earning Differentials due to Sectoral Transitions

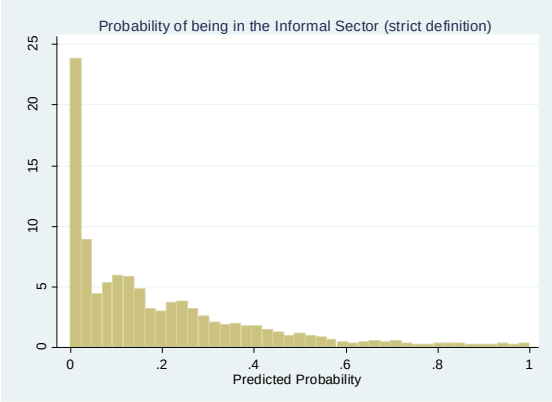
Initial/ Terminal	Regular	Casual	Self
Regular	0.114**	-0.276**	0.138
	(0.0507)	(0.1200)	(0.1440)
Casual	0.0907	0.00932	0.0921
	(0.1030)	(0.0514)	(0.1530)
Self	-0.108	-0.191**	-0.112**
	(0.1710)	(0.0896)	(0.0529)
Observations			1,500
R-squared			0.018

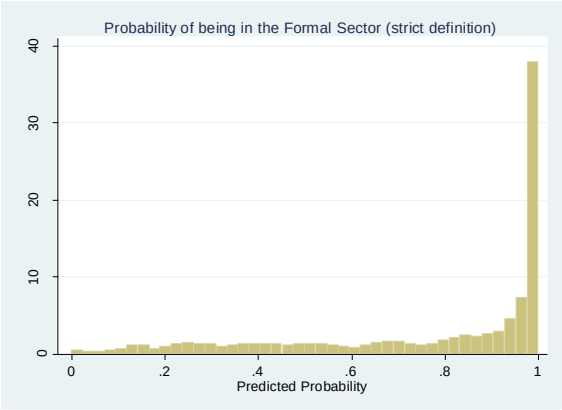
The results are from a single regression on all transitions. The dependent variable is the difference between the predicted residuals from the wage equation in period 2 and the wage equation in period 1. Bootstrapped standard errors in parentheses. $***p < 0.01, **p < 0.05, *p < 0.1$

Employment Status	Enterprise	Enterprise Keeps Written Accounts	Any Regular Paid Employees in the Enterprise	Firm Size	Workplace	Status
Regular Paid Employees with Fixed Wage	Public Limited Companies, Private Limited Companies, Cooperatives	NA	NA	NA	Business, shop, office, industry	Formal
					Not a business, shop, office, industry	DN
	Individual Ownerships, Partnerships, Others	Yes/No/DN	Yes/No	Large/Small	Any	DN
Casual Paid Employees, Paid by piece-rate or work performed, Apprentices	Public Limited Companies, Private Limited Companies, Cooperatives	NA	NA	NA	Any	DN
		Any Other Combination				DN
	Individual Ownerships, Partnerships, Others	No	No	Small	Not a business, shop, office, industry	Informal

This represents the most conservative approach to defining formality and informality. DN = don't know. NA = the question was not asked.

Figure 3.1: Determination of the Index





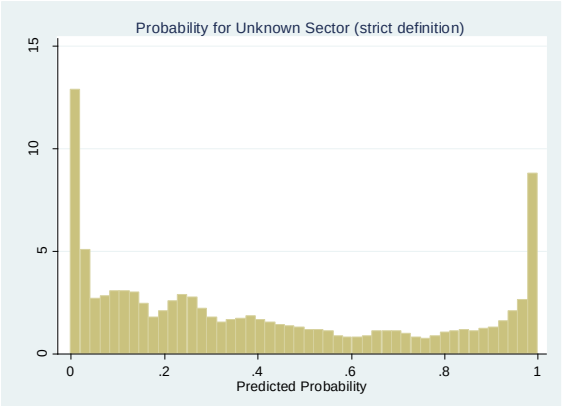
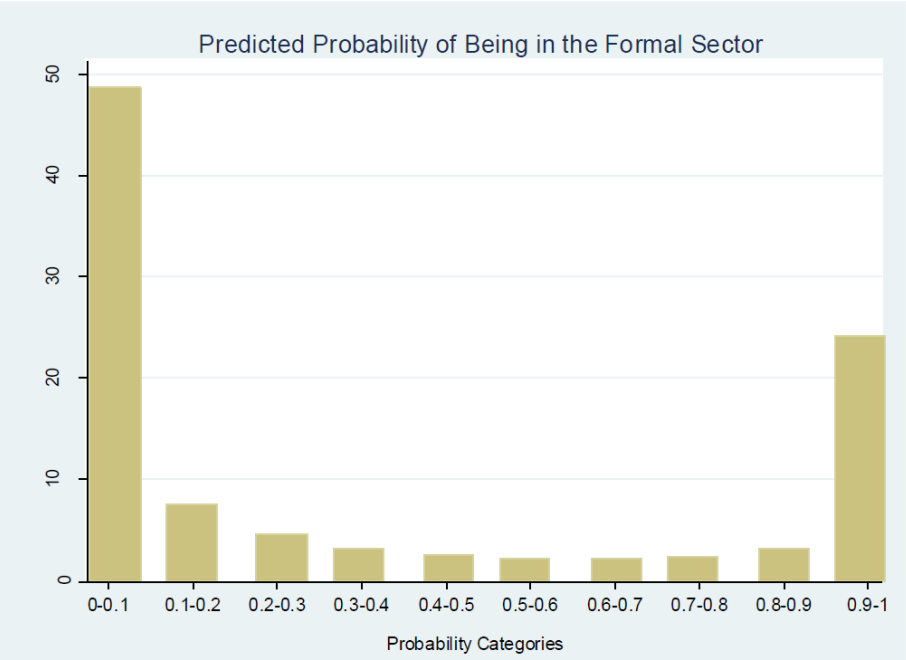


Figure 3.2: Validity of the Index



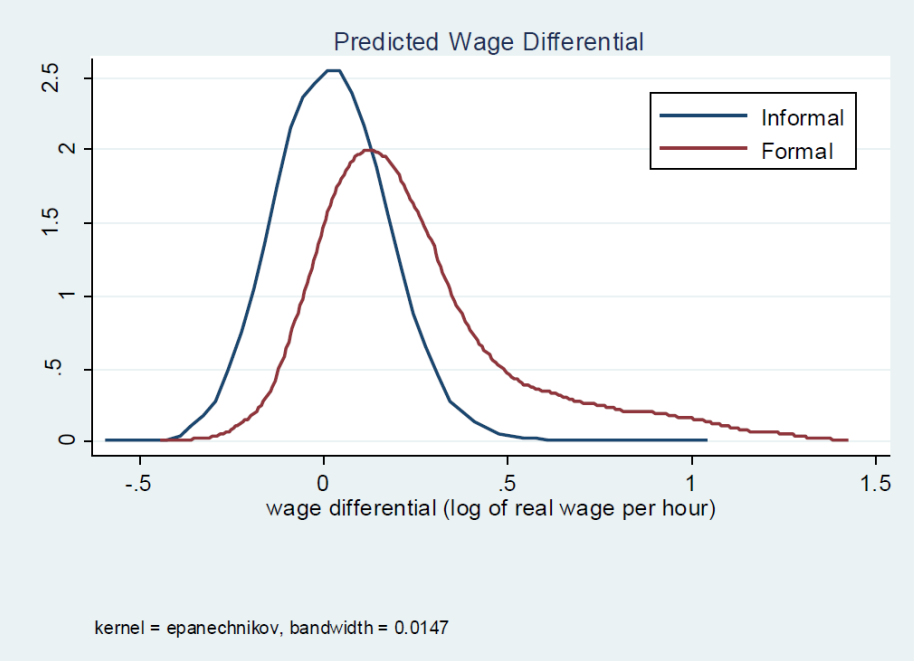


Figure 3.3: Formal Sector Probability and Distribution of the Wage Differential

APPENDIX A

CHAPTER 1 APPENDIX

A.0.1 LFS Sampling Methodology

The Pakistan Labor Force Survey (LFS) is conducted by the Federal Bureau of Statistics (now known as the Pakistan Bureau of Statistics). The first LFS was carried out in the year 1963. However, the computerized records are available starting the financial year 1990-91. Since then, the survey has been revised periodically to take account of the changing labor market conditions. The questionnaire was revised in 1990 to include questions on marginal economic activities that are likely to be carried out by females and that may not be accounted for in conventional questions. The questionnaire was further improved in year 1995-96 to determine the size and composition of the informal sector. In 2001-02 the scope of the survey was extended to take the stock of occupational safety and health of workers. The most recent change to the survey methodology was made in the year 2005-06.

Starting the year 2005-06, the survey was conducted on a quarterly basis. Sampled households were divided up into four distinct, nationally representative samples, each enumerated in a given quarter. Moreover, since the year 2005-06, the survey has been regularly conducted every year. Prior to that, LFS was not carried out every year.

LFS gathers individual level cross-section data on key indicators of the labor market. It is representative at the national, provincial and rural/ urban level. The survey covers all urban and rural areas of Pakistan excluding Federally Administered Tribal Areas (FATA), military restricted areas, and protected areas of KPK province. The population of excluded areas constitutes about 3% of the total population. In terms of sampling, each city/ town is divided into a number of enumeration blocks where each block contains 200-250 households. These enumeration blocks and villages are the primary sampling units (PSUs). Within these sample PSUs, households are the secondary sampling units (SSUs). 12 households are selected from each urban sample PSU and 16 from each rural sample PSU with equal probability using systematic sampling. The total sample for the year is evenly distributed for enumeration on a quarterly basis to offset the effects of seasonal variation.[1]

[1]For details see http://www.pbs.gov.pk/content/methodology.

A.0.2 Testing for Confounding Effects of Simultaneous Law Changes

The Employees' Old Age Benefits Act (EOBA) was amended through the Finance Act of July 2008. The Finance Act also made amendments to the Provincial Employees Social Security Ordinance (PESSO), a provincial level law that provides for health, maternity and disability benefits for workers irrespective of skill, contract, or mode of payment. These benefits were provided to all workers earning wages at or below Rs 200 per day or Rs 5000 per month before July 2008. In July 2008, the maximum wage thresholds for the applicability of PESSO were doubled; all workers earning wages at or below Rs 400 per day or Rs 10,000 per month became eligible for social security benefits under PESSO. Below I examine the potential confounding effects of simultaneous amendments made to the Provincial Employees Social Security Ordinance for my empirical estimates.

If the applicability of PESSO is also contingent on employing 5 or more workers, firms in the two treatment groups are likely to witness an increase in employment costs over and above the increase in employment costs due changes in EOBA, in case their employees claim any of the aforementioned benefits. This is because changes in PESSO increase the range of wages over which social security contributions are payable, potentially increasing the number of workers eligible for social security benefits at any point in time.

According to the text of the ordinance, the applicability of PESSO is not based on a specific firm size threshold in any of the four provinces. Each province has its own governing body and it is at the discretion of the governing body to notify a certain firm to register with the Provincial Employees' Social Security Institution. There is however, some suggestive evidence from the literature stating that PESSO applies to 10 or more employee firms in the provinces of Punjab, Sind and Kyber Pakhtunkhwa, and to firms with 5 or more employees in the province of Baluchistan (see (Mahmood and Nasir, 2008)).[2]

If firms with 5 or more employees in Baluchistan are covered by PESSO, treated firms with 5 to 8 employees might witness an increase in employment costs over and above the increase due to changes in EOBA. In order to disentangle the two effects, I perform the difference-in-difference analysis excluding the

[2]For details of the respective social security institutions see www.pessi.gop.pk for Punjab, www.sessi.gov.pk for Sind, www.khyberpakhtunkhwa.gov.pk/Departments/ESSI for KPK and www.balochistan.gov.pk for baluchistan. The US social security administration (www.ssa.gov/policy/docs/progdesc/ssptw/2008-2009/asia/pakistan) states that sickness and maternity benefits under PESSO are available to all firms with 5 or more employees, irrespective of the province. If this is true, I cannot disentangle the effects of the two laws.

province of Baluchistan.[3] The results are similar to the ones obtained earlier.I find close to full tax shifting to wages with negligible employment effects.

Given that PESSO applies to all firms with 9 or more employees across the four provinces, it is not possible to separately identify the effects of an increase in employment cost due to changes in PESSO from an increase in employment costs due to EOB law for the second treatment.

[3]The results are available on request.

APPENDIX B

CHAPTER 2 APPENDIX

B.1 Sample Attrition in PSES Data

Pakistan Socio-Economic Survey (PSES) is a longitudinal survey conducted during the years 1998-99 and 2000-01. As the second round was conducted close to the 9/11 attacks, approximately 22% of the households from the first round were not followed-up in the second round. The households that moved within the same primary sampling units (PSUs) were tracked and re-interviewed in the second round. However, no attempt was made to follow the households if they moved out of their original PSUs. About one-fifth of the total attriting sub-sample (21.6%) was dropped or excluded from the second round due to two main reasons; civil unrest particularly in Baluchistan and KPK province following the post-September 11, 2001 US operation in Afghanistan, and the deterioration of law and order situation in the province of Sind. Arif and Bilquees (2006) provide a comprehensive analysis of sample attrition, type of attrition and the examine the possibility of systematic differences between attritors and non-attritors in the PSES sample. They state that attrition due to entire household mobility was more common in urban areas. Overall, attritors and non-attritors broadly differed along five characteristics, household size (smaller in the attriting sample), age of the household head (younger household heads in the attriting sample), employment status of the household heads (those employed are less likely to exit), ownership of dwelling units (less persistent in the attriting sample) and geographical location (greater attrition in urban areas and in the provinces of KPK, Balochistan and Sind as compared to the province of Punjab).

B.2 Details of the Social Security Rules and Important Amendments

B.2.1 Applicability

At the time of inception, the Employees' Old Age Benefits Act was applicable to all non-agricultural private sector establishments employing 10 or more workers. In July 2006, the firm-size threshold required for the

applicability of the law was increased from firms employing 10 or more workers to firms employing 20 or more workers, for all firms established on or after July 1, 2006. The amendment reduced the overall contributions and put a strain on the institution's financial resources. Realizing the need for higher funds, and to extend social security coverage to informal sector workers, the law was extended to all firms employing 5 or more workers on July 1, 2008. Moreover, the carpet industry and the banking industry were brought under the purview of the law. In July 2010, the government also allowed self-employed individuals to register with EOBI.

B.2.2 Contributions

At the time of inception of the Act, employers were mandated to make social security contributions at the rate of 5% of the federal minimum wage per month, for all workers under their employment. Starting July 2001, employees' contribution was instituted into the system. Initially, the employees' contribution was fixed at 20 ($0.255)rupees per month, which was increased to 1% of the federal minimum wage per month per employee on July 1, 2005. At the same time, employer contribution was increased from 5% to 6% of the federal minimum wage. The latter change was reversed in July 2008, and employers' contribution was reduced from 6% to 5% of the federal minimum wage. A summary of the amendments to the contribution rate is presented in the Table 2.2. In the estimation of the model, I use data for the year 2007-08. Therefore, I consider workers in firms with 10 or more employees as part of the covered sector, and estimate the model with a payroll tax rate of 7% (6% by the employer and 1% by the employee).

An important feature of the EOBI system is the flexibility in contribution payments it provides to workers, in case they work part-time. According to the law, the contribution is collected as a fixed percentage of the monthly minimum wage, whereby a month is considered as 26 days of employment. However, if a worker works for less than 26 days in a month, the base wage at which contributions are payable is adjusted to take account of the actual number of days worked. Thus, contribution payments for workers earning wages below the minimum wage are calculated as a percentage of their actual wages, while contributions for workers earning wages at or above the minimum wage are calculated at the the minimum wage.

B.2.3 Benefits

Old-Age Pension

The most important determinant of pension eligibility in the EOBI system is the number of years of covered sector experience that an individual accumulates before the age of retirement. Conditional on 15 years of covered employment, individuals receive old-age pension equal to the maximum of the minimum pension guarantee or the individual's accrued pension benefit. Accrued pension benefits are equal to 2% of the average wage drawn in the last year of insurable employment or the average minimum wage, whichever is lower, times the number of years of insurable employment. Insurable employment is defined as the number of years of covered sector employment for which social security contributions have been paid by the employee.

Old-Age Grant

Employees that do not fulfill the eligibility requirement for old-age pension are entitled to receive an old-age grant conditional on 3 to 14 years of insurable employment. Old-age grant is equal to the average wage drawn in the last year of insurable employment or the minimum wage, whichever is lower, times the number of years of insurable employment. It is a lump-sum paid at the time of retirement. The minimum pension benefit also applies to the calculation of the old-age grant.

Survivor's Pension

Upon the death of an insured employee, his dependents (spouse, children or parents, in order of precedence) are eligible to receive pension if the deceased had completed 3 years of covered sector employment. Survivors' pension was fixed at 50% of the rate of old-age pension before July 2002. Thereafter, it was increased to 100% of old-age pension. In case of married employees, the spouse is the primary survivor. Spousal pension continues despite remarriage of the spouse. In case of a deceased spouse, all male children under the age of 18 years and female unmarried children of the deceased worker are eligible to receive pension. Pension stops for male children after they reach 18 years of age and for female children when they get married. In case of single employees, or employees with a deceased spouse and no children, parents of the deceased are eligible to receive survivor's pension. The minimum rates of old-age pension and the reduction in pension in case of early retirement also apply to survivor's pension. In July 2011, the government also extended survivor's

pension to the survivors of all deceased employees who retired with an old age grant. The current version of the model only focuses on individuals, and therefore does not include survivor's pension.

Invalidity Pension

All workers that attain a permanent disability (invalidity) during covered employment are eligible to receive invalidity pension before retirement. All the invalidity pension claims are converted to old-age pension once the employee reaches the retirement age. Invalidity pension is paid to workers for whom (a) contributions were payable for at least 15 years, (b) contributions were paid for not less than 5 years since they entered covered employment and for not less than 3 years during the period of 5 years preceding the month that they sustained the disability. Both (a) and (b) are applicable if the individual was not of retirement age when he became permanently disabled. Due to the lack of information on the health status of individuals in the sample, I do not include invalidity pension in the model.

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