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The Analytics of Segmented Labor Markets

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The Analytics of Segmented Labor Markets

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Abstract

This paper provides an analytical overview of models of segmented urban labor markets in developing countries. It begins by reviewing the characteristics of the labor market in these countries, including institutions and regulations that may lead to segmentation. The wage and employment effects of imperfect labor mobility between the formal and informal sectors are then illustrated with a simple graphical analysis. Formal models of urban wage formation are discussed next, and a two-sector shirking model with segmented urban labor markets is presented. The model is used to analyze the impact of an increase in the minimum wage on unskilled unemployment.

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1 Introduction

A pervasive feature of urban labor markets in developing countries is segmentation, that is, a situation where observationally identical workers (or workers with apparent similar productive abilities) receive different wages depending on their sector of employment. Workers in one segment of the market may be prevented from having access to jobs in another segment where similar qualifications are required, even if wages are fully flexible. As a result, equilibrium of the labor market is often characterized by job rationing in one segment of the market, despite the fact that workers able and willing to take these jobs at the going wage are unemployed (or underemployed) in another segment. In such conditions, the distinction between voluntary and involuntary unemployment (a much debated issue in the past by economists in industrial countries) lacks meaning.

There is an extensive literature in development economics focusing on labor market segmentation, with early observers (most notably Mazumdar (1983)) emphasizing restrictions on occupational mobility induced by institutional barriers. However, much of this literature is descriptive in nature, and only recently have macroeconomists begun to systematically incorporate various sources of segmentation into formal models, both theoretical and applied. This paper contributes to this agenda by providing an analytical overview of models of segmented labor markets in developing countries. Section II reviews some of the salient characteristics of the labor market in these countries, including institutions and regulations (such as minimum wages and firing costs) that may lead to segmentation.¹ Section III argues that the Harris-Todaro model, initially developed to explain rural-urban migration, is a useful framework for analyzing the employment and wage implications of imperfect labor mobility between the formal and informal sectors in urban areas. A partial equilibrium analysis of the impact of a demand shock in the formal economy is used to illustrate the predictions of the model, compared to the benchmark case of perfect mobility and full wage flexibility in both sectors. Section IV discusses a variety of formal models of wage formation in the urban sector, including those based on efficiency wages, trade union behavior, bilateral bargaining, job search, and adverse selection. Throughout the discussion, the emphasis is on the determination of skilled wages,

¹I do not address in this paper what determines labor market regulations themselves, in particular the role of political economy considerations. See Saint-Paul (2002) for a discussion of some of the issues involved, albeit in a different context.

although some of these models could be equally relevant to understanding wage formation for the unskilled. Section V presents a two-sector model with segmented labor markets that emphasizes shirking behavior and the role of unemployment as a “discipline device,” as emphasized early on by Shapiro and Stiglitz (1984). The model is used to examine the impact of an increase in the minimum wage on open unemployment. Section V offers concluding remarks and identifies some perspectives for future research on the economics of segmented labor markets.

2 Overview of Labor Markets

In order to set the stage for the rest of the analysis, this section provides an overview of the economic, institutional, and regulatory features of labor markets in developing countries. This review is not exhaustive; rather, it focuses on those characteristics that are most relevant for understanding the sources of labor market segmentation in these countries. The discussion begins by describing some of the most salient structural characteristics of the labor market in a developing-country setting and the composition of employment. Attention then turns to labor market institutions and regulations, in particular minimum wage laws, hiring and firing regulations, nonwage labor costs and unemployment benefit schemes, indexation practices, and wage bargaining mechanisms. Recent evidence on unemployment is also discussed. A key aspect of the analysis is the attention paid to the influence of government regulations regarding pay and other employment conditions—such as regulations related to job security and nonwage labor costs—on different segments of the labor market.

2.1 Basic Structure

Labor markets in developing countries differ in important ways from those in industrial countries. Key structural differences are the importance of the agricultural sector in economic activity (which tends to impart a marked seasonal pattern to employment), the importance of self-employment, and irregular work activities. These differences imply that standard labor market concepts used in the industrial world (such as employment and unemployment) do not necessarily have the same meaning and must be interpreted with care.

Development economists typically distinguish three sectors in the labor

market in developing countries (see Rosenzweig (1988)). The first is the rural sector, which is often characterized by a large share of self-employed persons and unpaid family workers. The second is the informal urban sector, which emerged largely as a result of accelerated rural-urban migration and the labor surplus that it generated in the cities. This sector is characterized by self-employed individuals with limited skill levels (such as small traders, street vendors, taxi drivers, tailors, carpenters, and bricklayers) or small privately-owned enterprises with limited access to credit markets and producing mainly services and other nontradables. Activities in this sector rely mostly on the provision of labor services by owners and their families, but occasionally also on paid labor without formal employment contracts. Job insecurity is pervasive, underemployment (as a result of low labor productivity) is high, wages are highly flexible, and workers get very few benefits from their employers. Legal minimum wage laws do not apply or are not enforced, and labor unions play a very limited role. Wages are typically much lower than those offered in the formal sector, often below legislated minimum wage levels. In Turkey, for instance, according to calculations made by Tansel (2000, pp. 15-16) on the basis of household survey data, male workers in the formal sector earn on average 35 percent more than their counterparts in the informal sector; for women, the differential is about 80 percent. Similar figures are suggested by Tunali (2003). However, surveys conducted in several other countries also suggest that earnings of some categories of self-employed workers in the informal sector compare favorably with wage earners in the formal sector, often being significantly higher than the minimum wage (see below).

The third segment of the labor market is the formal urban sector, consisting of medium and large enterprises (including state-owned firms) producing both tradable and nontradable goods, and using workers with a wide range of skills. Firms tend to hire workers (at least the more qualified ones) on the basis of formal contracts. Workers and employers are subject to various labor market regulations; employers, in particular, must provide a variety of benefits (such as pension, health insurance, and relative job security) to their workers.² Labor unions and productivity considerations often play an important role in the determination of wages, and legal minimum wage laws exist—albeit enforced with varying intensity across professional occupations and across countries.

²In some countries, the formal sector is not entirely confined to urban areas; wage earners bound by explicit contracts may also be employed in agriculture.

Since the concept of the informal sector first appeared in the literature (apparently in a report on Kenya prepared by the International Labor Organization in the early 1970s), a variety of criteria have been employed in the development literature to measure it. These criteria include establishment size, type of employment (notably the ratio of self-employed workers to the labor force as a whole), technological or capital level of firms, income level and legal status (or the degree of coverage under existing labor regulations). In practice, some of these criteria have tended to overlap. Nowadays, the notion of informality is being used to refer to conditions under which transactions are carried out, that is, to the fact that the activities being encompassed are unregulated.³

The relative size of the informal sector varies across countries as a result of the costs of formality, which can be divided into costs of accessing the formal sector (such as those incurred to register a small firm) and costs of remaining in the formal sector, such as taxes, compliance with labor regulations—nonwage benefits, social security, and firing compensation—and bureaucratic requirements (see Braun and Loayza (1994), Loayza (1994), Dessy and Pallage (2003), and Ihrig and Moe (2004)). A further distinction between an “easy-entry” informal sector, and an “upper-tier” informal sector was proposed by Fields (1990) to account for the heterogeneity of informal activities. Earnings in some of the upper-tier activities (which involve small-scale enterprises with a higher degree of capital intensity and a greater use of educated labor) can be significantly higher than in the lower-tier sector and may compare very favorably with some occupations in the formal sector.⁴ Earnings and employment may also be more pro-cyclical. Workers may, however, face barriers to entry in the upper-tier segment of the informal sector, as a result, for instance, of financial capital requirements.

³See Charmes (1990), Schneider and Enste (2000), and Blunch et al. (2001) for a discussion of changes over time in the definition of the informal sector. The role of labor market legislation in the distinction between formal and informal labor markets was emphasized in early contributions by Mazumdar (1983) and Kannappan (1985).

⁴See for instance Yamada (1996) for the case of Peru. Blunch et al. (2001) also proposed a disaggregation of the informal sector between non-wage employment (which comprises the self-employed and those working in family businesses) and wage employment (which includes both regular and casual workers).

2.2 Composition of Employment

In a large number of developing countries, agriculture still employs a large share of the labor force in rural areas, whereas the “modern” (or urban) sector—despite a sharp expansion in some cases—continues to provide limited employment opportunities. The share of informal sector employment in total urban employment is sizable in many developing countries—particularly in Latin America, the Middle East, sub-Saharan Africa, and some parts of Asia—and may vary from anywhere between 30 and 70 percent (see International Labor Organization (2005)). Most estimates are derived from labor force surveys and, less frequently, general censuses of population. The definition of the informal sector used in arriving at these estimates is generally based on firm size; firms employing five or fewer workers are often classified as informal. Workers in certain occupational categories—typically, self-employed workers (excluding professionals or those with higher levels of education) and unpaid family workers—are also generally classified as informal.⁵ Indeed, a large proportion of employment in nonagricultural sectors is found in micro enterprises and small firms. As a result, formal sector firms account for only a small fraction of all enterprises in manufacturing, and formal sector employment is often limited to the public sector. Even in upper middle-income developing countries, the informal sector continues to account for a sizable part of total urban employment.

Because of the importance of the rural and urban informal sectors, the proportion of wage earners in total employment in developing countries tends to be much lower than in the industrial world, although large variations exist across countries and regions. Formal wage employment tends to be particularly low in sub-Saharan Africa. In many developing countries, public sector employment accounts for a large share of wage employment and the formal sector workforce.

2.3 Public Sector Pay and Employment

The public sector (including both employment in parastatal enterprises and regular government services) is often the dominant employer of educated

⁵For instance, PREALC (the International Labor Organization’s regional program for employment for Latin America) has adopted the following definition: “The informal labor market consists of those persons who develop activities for self-employment, those who work in small firms and those who provide low-productivity personal services.”

labor. At the same time, the distribution of public sector employment across different levels of government (central and local) and public enterprises varies substantially across countries and regions. In part, this is related to the degree of centralization of power and the degree of government involvement in “strategic” industries. Employment in the public sector tends to increase not only in response to growing demand for public services (such as education and health) but also partly in response to adverse conditions in private labor markets—sometimes giving governments the role of “employer of last resort.” This counter-cyclical role, however, may lead to fiscal instability, because recessions also hamper the ability of the government to raise resources.

Public sector employment may provide a variety of benefits that help attract workers: relative job security and sometimes less than complete enforcement of performance standards, nonwage entitlements (such as subsidized or free housing), enhanced social status, and opportunities for moonlighting and rent-earning offered by some government positions (see Gelb, Knight, and Sabot (1991)). However, a high level of government employment may be the result of the need to provide (partial) insurance against undiversifiable external risk faced by the domestic economy, rather than the need to generate and redistribute rents. There is indeed some evidence suggesting that countries that are greatly exposed to external risk have also higher levels of public employment (see Rodrik (2000)). “Overemployment” in government however, often translates into low public sector wages and salaries; to the extent that these wages and salaries are low in comparison with private sector salaries, attracting and retaining qualified workers may prove difficult.

In principle, relatively high public sector wages can be justified in the presence of adverse selection and moral hazard problems. They may help attract more qualified or more productive workers, thereby mitigating some of the potentially adverse effects associated with public sector employment (such as the incentive to engage in rent-seeking activities) noted earlier. At the same time, however, the combination of attractive public sector jobs and government hiring policies may be an important source of “wait” unemployment, particularly among the skilled. Public sector employment may also be inefficient and unproductive, and the cost in terms of foregone income may be high.

Government wage and employment decisions are often determined more by political considerations than conventional economic considerations (see Nelson (1994)). When faced with budgetary pressures, it is easier politically for governments to cut investment outlays or maintenance expenditure than

to fire public sector workers. An unstable political climate may lead to increases in employment or higher wages to attract followers (prior to elections, in participatory democracies) or to retain them (by rewarding key followers). Because the government's primary constituency is often the urban labor force (of which it employs a large share), it tends to legislate in its favor—say, by raising the minimum wage at a faster rate than food prices or the overall cost-of-living index.

Government pay and employment policies affect private labor markets through a variety of channels. Public sector employment may have a limited effect on market wages when labor is hired at wages below market rates (possibly in exchange for job security). At the same time, however, wage increases in the public sector may exert a “leadership effect” on wage setting in the private sector. In countries like Morocco and Turkey for instance, this signaling role seems to be quite pronounced; wage increases in the regulated manufacturing sector appear to be highly correlated with wage movements in the public sector (see Agénor and El Aynaoui (2003) and Tunali (2003)).

In practice, data on public-private pay differentials are often difficult to interpret, for a variety of reasons (see Stevenson (1992)). In addition to base pay, compensation packages often include bonuses and nonwage compensation (such as subsidized or free housing, insurance, and other benefits, as noted earlier), which are normally not captured by the wage data. Because of the difficulties involved in controlling for differences in education and the composition of skills, most studies do not weight wages by skill categories—making comparisons of average wages difficult to interpret. In some countries, there are also important differences between the compensation packages of government employees and those of workers in state enterprises or local government.

2.4 Labor Market Institutions and Regulations

Allocation of the work force and wage formation depend critically on labor market institutions and government regulations. As indicated earlier, trade union activity and minimum wage laws may represent important sources of labor market segmentation. These and other institutional features of the labor market—such as wage indexation and labor tenure laws—have been blamed for pushing labor costs above market-determined levels, for contributing to large differentials between wages and the marginal product of labor (particularly in urban areas), and for limiting the ability of firms to adjust production

patterns to changes in relative prices, factor supply, and aggregate demand conditions.

In what follows the main features of labor market institutions and regulations in developing countries are briefly described. I begin by examining minimum wage laws, and then consider hiring and firing regulations, nonwage labor costs and unemployment benefits, indexation practices, and bargaining structures. The next sections will analyze in the context of formal models the implications of several of these features for the functioning of the labor market and the degree of segmentation.

2.4.1 Minimum Wage Laws

The effects of minimum wages on the labor market depend on both the degree to which the legislation is enforced and the frequency at which they are adjusted (the latter often at the government's discretion). In most developing countries, enforcement of minimum wage laws is typically lax, often more so in public sector enterprises (compared to private enterprises), as a result of "soft" budget constraints or implicit government guarantees. In an inflationary environment, the real minimum wage can fall to very low levels if it is adjusted only infrequently. In such conditions, the minimum wage may not operate as a binding constraint. In the presence of lax enforcement, excessively high minimum wages (relative to the marginal product of labor) provides incentives to evade the law and operate partly illegally, or to shift activities entirely to the informal economy—in a manner very similar to a tightening of job security provisions, as discussed later. They may also lead firms to rely more on casual labor, with possibly adverse effects on productivity.

The lack of effectiveness of minimum wage policies can be inferred from data on real minimum wages (compared to average wages) and the actual proportion of workers earning the minimum wage or above. In many countries, a substantial number of workers (even in large-scale enterprises) still earn less than the minimum wage, and minimum wages can be up to less than half the average wage. One reason for this in some cases is that high unemployment has led governments to allow employers some flexibility in hiring workers on a temporary and apprenticeship basis at wages below the minimum rate. Nevertheless, there is some evidence suggesting that the role of minimum wages can be significant. In several countries, private firms in the regulated sector pay wages near or above the minimum, suggesting that

the minimum wage may play the role of a “wage floor” in the formal sector labor market. There is also evidence suggesting that wages of unskilled workers in the formal sector tend to shift concomitantly with changes in the minimum wage. Thus, although minimum wages are not binding in a strict sense, changes in minimum wages may still have a significant causal effect on average wages.

Declines in real minimum wages may be large enough to erode over time the distortions created by excessively high nominal wage levels in the first place. However, despite an erosion in its real value, the minimum wage measured in proportion to the average unskilled labor wage—a more relevant indicator of the effect of minimum wages on the labor market—may not change to a significant degree. Bell (1997), for instance, estimated the impact of minimum wages on the demand for skilled and unskilled labor in the formal manufacturing sector in Mexico and Colombia. At the end of the 1980s, the minimum wage stood at just 31 percent of the average unskilled manufacturing wage in Mexico, and roughly 53 percent of the average unskilled wage in Colombia. Bell found substantial adverse employment effects of minimum wages in Colombia, with significantly larger effects on unskilled employment. She attributed the lack of evidence on negative employment effects in the case of Mexico to the relationship between the legally imposed minimum wage and the distribution of average unskilled wages across firms. She found that the minimum wage is very far to the left in the Mexico distribution and much closer to the mean in the Colombia distribution. Thus, minimum wages appeared ineffective in the formal manufacturing sector in Mexico and effective in Colombia.⁶

Other evidence on the impact of minimum wages on unemployment is also mixed. Lustig and McLeod (1997) examined (using cross-section regression techniques) the effect of changes in statutory minimum wages on unemployment in a group of 22 developing countries, controlling at the same time for various other variables—such as per capita income growth, inflation, changes in the terms of trade, and the share of the labor force in agriculture.⁷ They found that high minimum wages tend to be associated with high unemploy-

⁶Of course, it is also possible that in Mexico changes in the minimum wage affected other sectors.

⁷The sample includes 5 Asian (India, Indonesia, the Philippines, Sri Lanka, and Thailand), 13 Latin American (Argentina, Bolivia, Brazil, Colombia, Costa Rica, Guatemala, Honduras, Mexico, Panama, Paraguay, Peru, Uruguay, and Venezuela), and 4 African (Ghana, Mauritius, Morocco, and Tunisia) countries.

ment: a 10 percent increase in real minimum wages raises unemployment by 0.5 to 1 percentage point. They attribute this effect to the negative impact of the wage increase on the demand for unskilled labor. In one of the few studies (in addition to Bell (1997)) that uses micro-level data to examine the impact of minimum wages on employment in developing countries, Alatas and Cameron (2003) examined the experience of the Philippines during the period 1990-96. They found some evidence of a negative employment effect of higher minimum wages for small domestic firms, but no effect for large firms, either domestic or foreign. One reason for this outcome may be that small firms tend to be more labor intensive and therefore tend to adjust faster to changes in labor costs.

2.4.2 Hiring and Firing Regulations

Legislation on hiring, firing and regulation of working time is aimed at providing protection to workers engaged in a contractual employment relationship. Although the exact nature of regulations varies considerably across countries, many developing nations provide extensive employment protection to workers in the formal sector, such as restrictions on firms' ability to lay off workers without "proper" justification or reason (the definition of "proper" sometimes being very narrow and subject to false claims), the requirement of long notification periods prior to dismissal, generous severance arrangements that must be borne by firms, and administrative procedures that delay or prevent layoffs and plant closures. In some countries, employers must pay several months' wages as a minimum severance pay to workers dismissed with "just cause" (major misconduct). In the absence of "just cause", the severance payment often rises (by a multiple of the daily or monthly wage) for each year on the job. In others, if a worker quits voluntarily or is dismissed with "just cause", the employer must pay compensation equivalent to a fraction of the worker's monthly salary per year of service. If dismissal is deemed "without just cause," there can be an additional severance payment of several months' salary if the employee has less than a certain number of years of service, or one month's salary per year of service (up to a maximum) if the employee has more than the minimum number of years of service.⁸

⁸See Cox Edwards (1997) and Heckman and Pagés (2000) for data on redundancy payments (measured in terms of days' salary for each year worked) that employers are required to make in Latin America, and Betcherman and Ogawa (2001) for some broader evidence.

Empirical studies of the impact of job security regulations on employment in developing countries are scarce. Restrictions on layoffs in the formal sector often make firing redundant (or unproductive) workers difficult. Although in practice enforcement is not uniform across sectors and skill categories, regulating the workplace with severe restrictions on firing and generous severance pay may have a perverse effect on hiring: more stringent job security provisions may reduce hiring rates (by increasing the fear of incurring expensive dismissal costs in the future) and raise the duration of unemployment. Job protection may therefore reduce both job destruction and creation, as argued by Bertola (1990). By implication, the net impact of firing costs on unemployment is (in theory at least) ambiguous. For instance, Hopenhayn and Rogerson (1993) examined the consequences of job protection in a general equilibrium framework in which firms are subject to idiosyncratic productivity shocks, and a continuum of identical consumers choose their labor supply and consumption. In their model, a rise in firing costs (which are redistributed to consumers in the form of lump-sum transfers) corresponds to a distortion that decreases the returns of labor, leading to a fall in labor supply and eventually to a drop in employment. The model predicts that more stringent employment protection has an ambiguous impact on the level of overall employment, because it reduces both job creation and destruction.

Recent evidence on the impact of job security provisions on employment in developing countries is rather mixed.⁹ In Latin America for instance, job turnover rates (that is, the sum of job creation and destruction rates) appear to be quite high in the manufacturing sector, ranging from 15 to 30 percent depending on the country (Inter-American Development Bank (2003, p. 48)). Put differently, up to about one in every three jobs is created or destroyed in any given year. However, at the same time, changes in the net employment rate (the difference between job creation and destruction rates) tend to be significantly smaller than total job turnover.¹⁰ This evidence is thus partly consistent with the theoretical predictions highlighted earlier.

⁹Addison and Teixeira (2001) survey the literature on the effects of job security provisions on employment and unemployment rates in industrial countries and found it to be largely inconclusive. In their own research on severance pay (see Addison and Teixeira (2003)), they found some evidence supporting the view that severance pay tends to increase overall unemployment, but much weaker support for other possible effects on long-term unemployment, the employment-population ratio, or the labor force participation rate.

¹⁰High turnover rates appear to characterize only workers with low human capital and low wages.

Nevertheless, Heckman and Pagés (2000) estimated that, in Latin America, a 10-percentage point increase in social security contributions reduces the overall employment-to-population rate by 1.7 percentage points.

The evidence also suggests that, in some countries, high firing costs for permanent employees increased firms' incentives to hire workers on temporary contracts. In India for instance, legislation was passed in the mid-1970s making it illegal for a firm with more than 100 employees to lay off workers without the authorization of the state governor. Regulations such as these encouraged the use of casual labor and subcontracting (see Besley and Burgess (2004)). In Zimbabwe, job security regulations had an equally adverse effect on the demand for labor in the manufacturing sector (Fallon and Lucas (1993)). Montenegro and Pagés (2003) also found that in Chile job security provisions are non neutral across age and skill groups. They argued that these provisions reduced youth and unskilled employment rates in total employment. Kugler (2004) studied the impact on open unemployment of the Colombian labor market reform of 1990, which reduced severance payments, widened the definition of "just cause" for dismissals, extended the use of temporary contracts, and eased advance notice requirements for mass layoffs. The reform, thus, lowered substantially firing costs for firms in the formal sector, although it had little effect on informal sector firms (which did not comply with the legislation in the first place). Using household survey data, and informal sector firms as a "control" group, she estimated that the reform contributed to 10 percent of the subsequent reduction in unemployment.

Botero et al. (2004) found that Latin America and the Caribbean is the region with the highest job security index in the world. The index that they compiled is a normalized sum of the following four dimensions of protection: *a*) whether employment at will is allowed and whether termination for economic reasons is considered a fair cause for dismissal; *b*) procedures that an employer must follow and approvals it must seek prior to individual or collective dismissals; *c*) advance notice and severance payments; and *d*) whether job security is explicitly recognized in a country's constitution. Heckman and Pagés (2000) provide an alternative measure of job security that takes into account the monetary transfer that by law a firm has to pay to a worker on dismissal. Their measure includes advance notice, severance pay, and mandatory contributions to individual savings accounts. In line with Botero et al. (2004), they found that the average cost of job security in Latin America is significantly higher (by a factor of three) than in developed countries. Both

studies also find that the degree of job security is inversely related to income levels, which is itself related to the presence of a state-run unemployment insurance system. Thus, in poorer countries where a public unemployment insurance scheme does not exist, mandatory job security provisions appear to be used to provide a form of partial insurance against adverse conditions in the job market.

Other studies, however, did not prove conclusive. In a study on Brazil, for instance, Paes de Barros and Corseuil (2001) found no evidence of a statistically significant effect of job security provisions on employment. Downes et al. (2003) found that labor market regulations in English-speaking Caribbean countries had only a limited impact on employment creation; output growth was the key factor. Thus, whether or not reducing firing costs would help to reduce unemployment by enhancing labor market flexibility (through increased worker turnover into and out of the pool of the unemployed), as advocated by some, is an open question.

2.4.3 Nonwage Labor Costs and Unemployment Benefits

Nonwage labor costs include social security contributions and nonwage benefits, such as housing, health care, pensions, subsidized transportation and meals, and family allowances. Their importance varies substantially across countries and there is little systematic evidence on their effect on labor market outcomes in developing countries. In one of the few studies available, Heckman and Pagés (2000) found that, in Latin America, part of the cost of non-wage benefits (namely, social security contributions, and mandatory benefits such as paid vacation, maternity leave, health benefits, pensions, and work insurance) is passed on to workers in the form of lower wages.

Unemployment benefit schemes exist in only a small number of developing countries.¹¹ Financing of these schemes is usually shared between employers and employees.¹² The relative contribution of employers is often in the form of a flat payroll tax and is usually substantially higher than employees' contributions. Although net replacement rates (benefits after taxes as a percentage of previous net earnings) are often the same between industrial and developing countries, there are several important differences in the design of

¹¹As noted earlier, the absence of an unemployment benefit scheme is often viewed as a key reason why severance pay upon dismissal can be quite generous.

¹²See Inter-American Development Bank (2003, Chapter 8) for a review of current features of unemployment benefit systems in Latin America and the Caribbean.

these schemes. In particular, the potential duration of benefits is generally shorter in schemes implemented in developing countries, waiting periods are more likely, and government workers are rarely covered.

It has been argued that unemployment insurance may act as a disincentive to search for (or accept) employment, and that they may encourage individuals to enter the labor force for the sole purpose of collecting unemployment benefits. By raising incentives to extend job search (or equivalently by reducing the intensity of job search effort), an overly generous unemployment insurance may therefore increase both the level and duration of unemployment. In addition, unemployment insurance schemes, to the extent that they benefit low-skilled workers more, may serve as an income insurance substitute for human capital acquisition (see Dellas (1997)). By reducing incentives to accumulate human capital, they may lead to an increased supply of low-skilled workers and to higher unemployment among them. Moreover, by reducing precautionary savings, an adverse and possibly permanent growth effect may also result.

However, unemployment insurance may also have positive effects by encouraging long-term labor force participation and favoring regular, as opposed to marginal or casual, employment (Atkinson and Micklewright (1991)). There is consequently an “optimal” level of unemployment insurance, as argued by Hopenhayn and Nicolini (1997) and Acemoglu and Shimer (1999), which balances positive and negative effects.¹³ Because of limited data on variables such as the duration of unemployment benefits in developing countries, it has proved difficult to test alternative views on these issues. The elasticity of unemployment with respect to replacement rates may be relatively low; but whether high unemployment benefits tend to increase open unemployment remains an open issue.

2.4.4 Indexation Practices

The traditional economic rationale for indexation of wages to prices is that a high degree of real wage rigidity helps to insulate output and employment

¹³In contrast to Hopenhayn and Nicolini (1997) and Acemoglu and Shimer (1999), Young (2004) found that unemployment insurance may have unambiguously negative output and welfare effects. The key reason in his model (which treats both interest rates and capital accumulation as endogenous, unlike the previous studies) is that by affecting labor supply, unemployment insurance also affects the marginal productivity of capital and the precautionary demand for savings.

from monetary (aggregate demand) shocks, although not from real (supply) shocks.¹⁴ However, a high degree of wage indexing in specific production sectors (such as the nontradables sector) may also distort the signaling effect of policy-induced changes in relative prices (such as a nominal devaluation) and may hamper the reallocation of resources. In addition, wage contracts indexed on *past* inflation have been blamed for creating sticky inflationary expectations and causing inflation persistence and, by reducing the welfare losses caused by price instability, for weakening the will of governments to fight inflation (Simonsen (1983)). However, as discussed by Agénor (1996, 1998), *forward-looking* wage contracts, based on (expected) *future* inflation, may speed up disinflation instead of hampering it.

Indexation clauses usually aim at allowing for the adjustment of wages not only for inflation but also productivity changes. In practice, indexation procedures differ among countries and over time in three main respects: the interval between wage adjustments; the degree of indexation to past or future inflation; and the nature of adjustments for productivity changes. In some countries, the law permits productivity adjustments to be negotiated freely between workers and employers; in others, adjustments are specified by the government. In some high-inflation countries in the 1980s, the frequency of wage adjustments tended to increase with the rate of inflation; the frequency itself was viewed as one of the structural elements in the inflationary process.¹⁵ Indeed, in chronic-inflation countries, inflationary shocks tended to increase the frequency of adjustment in nominal wages, as workers attempted to prevent an erosion in their real wages—thereby leading to a shortening of wage contracts and/or periods over which adjustments to past inflation are specified. In some cases, the degree of indexation to inflation was a function of the wage level, with overindexation at certain levels and underindexation at others.

In practice, real wage rigidity induced by indexation in some sectors often coexists with full wage flexibility in others. The consequence is thus labor market segmentation—in a manner consistent with the “stylized” description

¹⁴Carmichael, Fahrer, and Hawkins (1985) provided a detailed discussion of wage indexation rules in an open-economy context; see also van Gompel (1994). Most of the analytical literature focuses on the role of *ex ante* indexation. In practice, wage indexation is often *ex post*, with current wages adjusting to past changes in prices. Fischer (1988) examined the role of *ex post* wage indexation in the conduct of disinflation programs. See Agénor (1996) for a further discussion.

¹⁵See Dornbusch, Sturzenegger, and Wolf (1990), and Parkin (1991).

of the labor market provided earlier, if differences in wage formation occur along the lines of the formal-informal sector dichotomy. In recent years, many developing countries have enacted legislation aimed at either curbing wage indexation or at changing the mechanisms through which wages are indexed. Some countries (particularly in Latin America) have prohibited all types of indexation, including wage and pension indexation. This measure has helped to reduce inflation both directly and indirectly (by lowering pressure on public finances) and increase the degree of wage flexibility.

2.4.5 Bargaining Structures and Trade Unions

Wage bargaining mechanisms vary considerably across developing countries. In some cases, collective bargaining is fairly centralized and involves substantial government intervention at both the sectoral and national levels. Such intervention has thus a direct effect on the structure of wages in the formal sector and may be a key source of segmentation.

Another source of labor market segmentation is related to the presence of trade unions, which play an essential role in collective bargaining mechanisms in many developing countries. A common strategy of unions—in Latin America in particular, but also in other regions—has been to seek ties with the state and political parties to obtain legislated protections (for instance, regarding employment conditions) and redistributive policies (such as severance payments, or high minimum wages). Rent-seeking behavior by overly politicized trade unions implies that bargaining systems may be subject to heavy government involvement (see O’Connell (1999) for Latin America). Another implication is that the degree of unionization is not a good indicator for assessing the potential influence of trade unions in the bargaining process and wage formation.¹⁶ At the same time, if trade union movements are not very centralized, organizing collective labor action becomes more difficult (see Nelson (1994)).

Much recent research has aimed at understanding the implications of a low degree of centralization on wage formation. Studies by Calmfors (1993), Moene, Wallenstein, and Hoel (1993), and Flanagan (1999) have argued that the relationship between the degree of centralization in wage bargaining—defined as the extent to which unions and employers cooperate in wage

¹⁶A low degree of unionization is often viewed as an indication that trade unions may be more relevant in affecting working conditions and enforcing labor regulations than in influencing wage negotiations.

negotiations—and wage pressures may actually have an inverted U-shape, rather than being monotonic. Wage push is limited when bargaining is highly centralized (conducted at the union level) and highly decentralized—when it takes place at the level of individual firms. The highest degree of influence on wage formation would thus tend to occur in countries where centralization is in the intermediate range, that is, at the industry level.

Various types of externalities can explain why centralized bargaining is likely to produce lower aggregate real wages and higher employment. The basic idea is that a high degree of cooperation between unions and employers implies that the effects on others of a wage increase in one part of the economy is internalized, thereby lowering the marginal benefit of an increase in wages. In particular, if unions are averse to inflation, they will tend to moderate their wage demands in order to induce the central bank to stick to a low inflation target.

Decentralized bargaining systems, for their part, produce real wage moderation because of the restraint imposed by competitive forces—although moderation may occur at the cost of increased wage dispersion. Indeed, Pencavel (1997) argued that decentralized bargaining tempers the union’s ability to impose across-the-board increases in wages, thereby keeping labor compensation more in line with productivity of workers in a competitive market.

Thus, decentralizing collective bargaining may increase labor market flexibility (and reduce the degree of segmentation) by more closely linking contract provisions to the conditions of the firm. Similarly, increasing collective autonomy may increase flexibility if it facilitates direct negotiations and helps the parties to internalize the costs and benefits of their negotiations. With intermediate centralization, neither internalization effects nor competitive forces are sufficiently strong to restrain unions’ incentives to demand higher wages.

However, a higher degree of centralization may not always reduce wage pressures. Cukierman and Lippi (1999), in particular, argued that an increase in the degree of centralization of wage bargaining (as measured by a fall in the number of trade unions in the economy) triggers two opposite effects on real wages. On the one hand, the reduction in the number of unions tends to reduce the degree of effective competition among unions; this competition effect tends to raise real wages. On the other, the fall in the number of unions strengthens the moderating influence of inflationary fears on the real wage demands of each union. This strategic effect tends to lower wages. The net

effect is thus ambiguous.¹⁷

In practice, it is not always easy to classify wage bargaining systems into completely centralized or decentralized systems. In addition, as noted earlier, the degree of unionization is a highly imperfect measure of the influence of trade unions on wage formation and the labor market. Trade unions in certain “strategic” sectors or industries may exert considerable influence on wage formation and working conditions at the national level, even if overall union membership is a low proportion of the work force. Indeed, although union density is low in some countries, collective bargaining agreements may be extended to the nonunionized workers within individual firms.

Empirical evidence suggests that there is great diversity in the impact of unions on real wages in developing countries. Nelson (1994) argued that in Latin America unions have caused wages to rise above the opportunity cost of labor through a combination of union pressure, minimum wage legislation, and wage policies in the public sector. Other studies have attempted to estimate directly the bargaining strength of organized labor, as reflected in the union-nonunion wage differential. Park (1991), for instance, estimated that blue-collar workers in the unionized manufacturing sector in Korea are paid on average only 4 percent more than their counterparts in the nonunionized sector. By contrast, Panagides and Patrinos (1994) estimated the union-nonunion wage differential in Mexico to be about 10.4 percent, which would suggest significant bargaining strength.

However, a significant premium is not necessarily a direct reflection of the ability of unions to impose rent sharing on firms through their bargaining power (rents that workers could not obtain on their own). If union workers are more productive than their nonunion counterparts (as a result of reduced shirking prompted by greater job security, for instance), the productivity differential between the two categories of labor may be large enough to offset the union-nonunion wage differential. Unions may also extract rents that are distributed to members through higher wages by either reducing turnover and negotiation costs. As noted by Booth and Chatterji (1998), for instance, unions can also have an indirect effect on the wage premium if they promote training. Blunch and Verner (2004) found evidence indeed of a union premium related to training in Ghana. In general, however, given the paucity

¹⁷As noted by Groth and Johansson (2004), the degree of centralization in wage bargaining may also affect contract negotiation costs, which may in turn lead to temporary wage rigidity. However, this argument explains nominal, not real, wage rigidity.

of reliable panel data sets in developing countries, it is difficult to test rigorously these different effects—particularly the view that union workers may be more productive than nonunion workers.

2.5 Unemployment

Published data on unemployment in developing countries are not very reliable and often incomplete. They usually include unemployed workers looking for jobs in the formal sector, but not underemployed workers in the informal and rural sectors (what is known as “disguised” unemployment), thereby understating the effective excess supply of labor. They also do not account for the fact that job seekers may be employed part of the time in the informal sector. Very few countries provide information on the duration of unemployment. Nevertheless, available data suggest that open unemployment is often concentrated in urban areas and is mostly associated with wage employment, and that underemployment is far more pervasive than open unemployment. In some countries, open and disguised unemployment combined amount to as much as 70 percent in proportion of the labor force.

In recent years several regions have experienced a sharp increase in open unemployment, most particularly the Middle East and North Africa (MENA), and Latin America. In MENA the population nearly quadrupled during the second half of the past century. At the same time, as noted by the World Bank (2004), although output grew at healthy rates during the 1970s, it slowed down (particularly in the oil-exporting countries) during the 1980s and the 1990s. Employment growth therefore failed to keep pace with the expansion of the labor force, and the region recorded some of the highest unemployment rates among developing regions. In Latin America, during the 1990s, unemployment rates increased in most countries. In some countries, as noted by Saavedra (2003) and Duryea, Jaramillo, and Pagés-Serra (2003), higher unemployment was caused by falling employment rates. In others, the increase in unemployment resulted from a substantial rise in participation rates that were not fully absorbed by increases in employment. Duryea and Székely (2001) also emphasized changes in labor supply (which began in the 1960s and will persist well into the next decades for some countries) as a factor underlying the increase in unemployment, particularly among the young, in Latin America. At the same time, improvements in educational attainments in the region have been slow (at about one year per decade during

the past 30 years), which translated into an increase in wage inequality.¹⁸

The composition of unemployment by skill categories varies considerably across countries. In many cases the openly unemployed tend to be skilled workers. Hirata and Humphrey (1991) found that skilled workers in Brazil, upon losing their job, are more likely than other labor categories to remain in open unemployment, rather than working in the informal sector. This is also the case in several other Latin American countries (see Inter-American Development Bank (2003)). Similarly, Banerjee and Bucci (1995) found that the open unemployment rate in India is higher among the educated. Hollister and Goldstein (1994), Said (2001), and the World Bank (2004) provide evidence of high levels of skilled unemployment in MENA; in several countries of the region, a large majority of those in open unemployment have secondary or postsecondary degrees.

Given that the informal sector is characterized by free entry, skilled workers who choose to remain unemployed are, in a sense, “quasi-voluntarily” unemployed. This may be because their reservation wage (that is, the wage that makes workers indifferent between taking a job or remaining unemployed) is higher than the going wage in the informal sector. Alternatively, it may be because job search in the formal sector is more efficient while unemployed, or because the higher family income of the educated allows them to remain openly unemployed while searching for a job. Unskilled workers, by contrast, often cannot afford to remain unemployed for long and are often “forced” to enter the informal sector. Unskilled unemployment may nevertheless emerge if (as in the modified Harris-Todaro framework discussed later) workers who expect to be hired at the higher formal sector wage are willing and able to wait for the good jobs. The shirking model discussed in Section V will integrate both “quasi-voluntary” or “luxury” unemployment of skilled workers and “wait” unemployment of unskilled workers.

A common observation in developing countries is that the correlation between the rate of output growth and the open unemployment rate tends to be unstable and weak (unlike what Okun’s law would predict). In the long term, open unemployment may show a rising trend despite strong output and employment growth, as industrialization combined with migration from rural to urban sectors frequently means that previously underemployed work-

¹⁸They recommended a reduction in hiring and firing costs for young workers as an essential step to facilitate their insertion in the labor market. In light of the foregoing discussion, however, the likely impact of this measure is open to question.

ers are registered as openly unemployed while they are looking for modern sector jobs. In the short term, the absence of a stable output-unemployment relationship may be the result of spillover effects across different segments of the labor market and shifts in production activities, which are not properly accounted for in published employment and output data. Following a recession for instance, the loss of jobs in the formal or modern sector may lead to a sharp increase in self employment. Thus, employment in the informal sector tends to evolve counter-cyclically.¹⁹ The partial equilibrium setup of the next section and the model developed in Section IV capture these interactions between the formal and informal sectors. They help to illustrate how the adverse output and employment effects of macroeconomic shocks can be mitigated by a shift to informal production activities.

3 Urban labor Mobility and the Harris-Todaro Framework

An early model of labor market segmentation in developing countries is the migration model of Harris and Todaro (1970). The main objective of the model was to explain the persistence of rural-to-urban migration, despite the existence of widespread urban unemployment in developing countries. The starting point of the analysis is that migrants from rural areas are attracted to the urban formal sector by the *expectation* of higher wages, even if they are unlikely to find jobs in the formal sector immediately. A key element of the model is thus the equality of expected (rather than actual) wages as the basic equilibrium condition across the different segments of the labor market.

Specifically, Harris and Todaro assumed that rural workers, in deciding to migrate, compare (in present value terms) wages in agriculture, w_A , to the expected urban wage, w_U^e , which is calculated by multiplying the prevailing wage, w_U —assumed fixed as a result of the existence of, say, a minimum wage law or trade union activity, as discussed earlier—by the urban employment ratio, which measures the probability of being hired. In equilibrium, the Harris-Todaro hypothesis yields

$$w_A = w_U^a = \left(\frac{L_U}{L_U + N_U} \right) w_U, \quad (1)$$

¹⁹Blunch et al. (2001, p. 10) noted that there is much evidence supporting the counter-cyclical role of the informal sector.

where L_U is urban employment and N_U the number of unemployed workers in urban areas.

The Harris-Todaro model was extended in a variety of directions over the years; these extensions have been reviewed in a number of contributions.²⁰ Given the focus here on segmentation in urban labor markets, the key issue is whether an equation similar to (1) can be used to explain movements of labor between the formal and informal sectors in *urban* areas, as opposed to rural-to-urban migration. I have argued elsewhere that this is indeed a reasonable assumption (see Agénor (1996, 2005)), given the typical informational inefficiencies that prevail in labor markets in developing countries. These markets are indeed characterized by the absence (or poor functioning) of institutions capable of processing and providing in a timely manner relevant information on job opportunities to potential applicants—particularly those with low levels of qualifications. As a result, low-skilled workers employed in the informal sector are unable to engage in on-the-job search; looking for a job in the formal sector for that category of workers often requires, literally speaking, waiting for employment offers at factory gates. Evidence of queuing by informal sector workers for formal sector jobs as hypothesized here has been provided by several authors. Gong, van Soest, and Villagomez (2004), for instance, found evidence of significant entry barriers into the formal sector for workers with low levels of education in Mexico.²¹

I will discuss later, in the context of a formal model with two categories of labor, how the assumption of imperfect labor mobility between the formal and informal sectors may lead to unskilled unemployment. For the moment, the implications of this assumption for the response of urban wages and employment to shocks can be illustrated with a simple, partial equilibrium graphical analysis with homogeneous labor, adapted from Agénor and Montiel (1999, Chapter 2). Consider a small open economy producing formal and informal goods using only labor, the supply of which is given. Prices of

²⁰See Djajic (1985), Rozensweig (1988), Fields (1989, 2005), Bhattacharya (1993), Ghatak, Levine, and Price (1996), Lucas (1997), and Fields (2005). Stark (1991) provides a more critical view. Fields (2005) for instance analyzed the welfare effect of various types of labor market reforms in a basic version of the Harris-Todaro framework. His results, however, should be viewed with some caution, given that general equilibrium effects are not fully accounted for.

²¹There is also evidence, however, of a relatively high degree of mobility between the informal and formal sectors; see, for instance, Funkhouser (1997) for El Salvador and Inter-American Development Bank (2003) for some Latin American countries.

both goods are also taken as given. The determination of wages and employment under four different assumptions regarding labor market adjustment is shown in Figure 1.1. In all four panels the horizontal axis measures total labor available to the economy, $O_F O_I$. The vertical axis on both sides measures the wage rate, which is either uniform across sectors or sector specific. The demand for labor in the formal (informal) sector is represented by the downward-sloping curve L_F^d (L_I^d).

Consider first panel A, which is based on the assumption that wages are perfectly flexible and labor perfectly mobile across sectors. Segmentation of any kind is therefore absent. The initial equilibrium position of the labor market obtains at point E , where the economy-wide wage rate is equal to w^* , labor employed in the formal sector is $O_F L_F^*$, and labor used in the informal sector is $L_F^* O_I$.

In panels B, C, and D the wage rate in the formal sector is fixed at w_F^c (above the economy-wide, market-clearing wage) whereas wages in the informal sector remain flexible.²² The panels differ in the underlying assumptions regarding the degree of intersectoral labor mobility. In panel B, labor can move freely across sectors, as in panel A. Perfect labor mobility, together with wage flexibility in the informal sector, prevents the emergence of unemployment. The initial equilibrium obtains at point A in the formal sector, corresponding to an employment level of $O_F L_F^c$, and at point E_I in the informal sector, with a wage rate equal to w_I and employment equal to $L_F^c O_I$. In panel C, labor is completely immobile within the time frame of the analysis. The labor force in the formal sector is equal to $O_F \bar{L}_F$, whereas the supply of labor in the informal sector is measured by $\bar{L}_F O_I$. Because sectoral labor supply is completely inelastic and wages cannot adjust in the formal sector, unemployment will typically emerge there. The situation depicted in panel C indicates that employment in the formal sector is equal to $O_F L_F^c$ and unemployment to $L_F^c \bar{L}_F$. Finally, panel D is an adaptation of the Harris-Todaro labor allocation mechanism (1), which assumes that equilibrium obtains when the wage rate in the informal sector is equal to the expected wage in the formal sector. The downward-sloping locus QQ is a rectangular hyperbola along which this equality holds (see Corden and Findlay (1975)). As indicated above, the expected wage in the formal sector is defined as the product of the actual wage in that sector times the probability

²²The source of wage rigidity in the formal sector is left unspecified at this stage. It is discussed more formally in the next section.

of being hired, which is measured by the employment ratio: $w_F(L_F^d/O_F L_F^c)$. The equilibrium condition of the Harris-Todaro model implies, therefore, that $w_I(O_F L_F^c) = w_F L_F^d$. Because L_F^d is normally a decreasing function of w_F , the preceding condition defines the rectangular hyperbola QQ . The requirement that the wage rate be equal to the marginal product of labor for $w_F = w_F^c$ is met only at points A and E_I on the QQ curve. The intersection of the L_I^d curve with QQ determines the wage rate and the employment level in the informal sector, whereas the intersection of the L_F^d curve with the horizontal line drawn at w_F^c determines employment in the formal sector. The initial equilibrium is therefore also characterized by sectoral unemployment, which is equal to $L_F^c L_I$.

Suppose that, as a result of an exogenous shock, the demand for labor in the formal sector falls, shifting the curve L_F^d to the left while leaving the demand curve for labor in the informal sector unchanged. With constant relative prices, if wages are perfectly flexible and labor perfectly mobile across sectors, adjustment of the labor market entails a fall in the overall wage rate in the economy and a reallocation of labor across sectors, leading the economy to a new equilibrium (point E' in panel A) with full employment.

Consider now what happens in the presence of a sector-specific wage rigidity. If labor is perfectly mobile across sectors, the demand shock leads only to a reallocation of the labor force toward the informal sector and a fall in wages in that sector (panel B). However, if workers cannot move across sectors, the adverse labor demand shock leads to an increase in unemployment in the formal sector, with no effect on wages and employment in the informal sector (panel C). With a labor allocation mechanism of the Harris-Todaro type, the demand shock reduces employment in the formal sector, as in the preceding case (panel D). However, the effect on the unemployment rate is now ambiguous. This is due to the fact that QQ shifts to the left following the shift in L_F^d ; the fall in employment reduces the likelihood of being hired and, therefore, the expected wage in the formal sector. This implies that more workers would elect to seek employment in the informal sector, bidding wages there down. Employment therefore increases in the informal sector, whereas wages fall. However, despite the reallocation of labor across sectors, in equilibrium unemployment may well increase in the formal sector.

The foregoing discussion provides a good illustration of the importance of accounting for labor market segmentation (as well as the degree of labor mobility) for understanding the response of wages and employment to shocks. However, while the hypothesis of a high degree of wage flexibility in

the informal sector conforms well with the evidence alluded to earlier, wage rigidity in the formal sector was simply postulated. I now examine various approaches that have been proposed to explain rigidity in that sector.

4 Wage Formation in the Urban Formal Sector

In explaining wage rigidity in the urban private formal sector, I will consider an economy with a heterogeneous labor force, consisting of skilled and unskilled workers, and will focus on the determinants of skilled wages only. One reason for doing so is that wages of the unskilled are often set in relation to a minimum wage (as discussed earlier); such wages are generally set by government fiat—although in practice trade unions can exert significant influence on the timing and magnitude of wage increases. A second reason is that some of the underlying explanations for departure from market-clearing that I will examine below relate to observability of effort, which is likely to be more difficult for skilled workers. Indeed, for workers engaged in non-manual activities, firms may be able to monitor directly the level of effort only at a substantial cost. In addition, bargaining (either through a trade union or on a bilateral basis) may be more relevant for skilled workers, compared to low-skilled workers engaged in more routine work.²³

In general, rigidity of skilled wages can result from a variety of factors. In what follows I consider five alternative approaches and examine their implications for the degree of rigidity of skilled wages in the urban formal sector. These approaches dwell on efficiency wages (motivated by shirking or turnover costs), trade union behavior, bilateral bargaining between firms and workers, job search, and adverse selection.²⁴

4.1 Efficiency Wages

The basic idea of efficiency wages is that firms set wages so as to minimize labor costs per efficiency unit, rather than direct labor costs per worker

²³Some of these arguments should not be pushed too far, however. Labor unions may also play an important role as bargaining agents for unskilled workers, either directly, or (as noted earlier) indirectly, as collective agreements are extended to nonunionized workers.

²⁴I do not consider insider-outsider models (see Lindbeck and Snower (2001)), for which there has been more limited research in developing countries.

(see Stiglitz (1982)). The difference is crucial if, for instance, the level of effort expended by skilled workers depends positively on the wage paid in the current sector of employment, relative to the wage paid in other production sectors.²⁵ The outcome of the firms' wage-setting decisions would then take the form of a markup of wages over the opportunity cost of effort, which is such that the efficiency wage exceeds the market-clearing wage. Other models of efficiency wages lead to a similar prediction: wages in equilibrium end up being higher than the competitive wage because firms try to motivate their employees by offering them a premium over the market average. But because the premium may result in a wage that is too high compared with the market-clearing wage, involuntary unemployment may prevail in equilibrium.

Despite this common prediction of efficiency wage models, the specific mechanism through which efficiency considerations are introduced does have a bearing on the outcomes of policy shocks and the effect of structural parameters. In what follows I examine two types of efficiency-wage formulations; the first dwells on the link between effort (or productivity) and wages, and the second on quits and turnovers. In both cases I consider several alternative specifications and illustrate the different predictions of these models.²⁶

4.1.1 The Wage-Productivity Link

As a benchmark case, I will focus first on exogenous effort. Consider an economy producing one traded good (whose price is fixed on world markets) using only skilled labor, S . The economy consists of a large (arbitrary) number of identical firms. The production function is Cobb-Douglas:

$$Y = (eS)^\alpha, \tag{2}$$

where Y is output, $\alpha \in (0, 1)$, and $e \in (0, 1)$ is the level of effort, taken as given for the moment. eS is thus the effective supply of skilled labor. If the labor market is competitive, the skilled wage, w_S , is given by

$$w_S = \partial Y / \partial S = \alpha e^\alpha S^{\alpha-1}, \tag{3}$$

²⁵The fact that a higher wage raises productivity suggests that the term proposed by Phelps (1994), "incentive wages", is a more accurate description of the role of wages in these models than the standard heading "efficiency wages."

²⁶I will consider in detail in the next section another form of efficiency wage model, based on shirking behavior, along the lines of Shapiro and Stiglitz (1984).

from which the demand function for skilled labor can be written as

$$S = \left(\frac{w_S}{\alpha e^\alpha}\right)^{-1/(1-\alpha)}. \quad (4)$$

A higher level of effort (for a given wage) therefore raises the demand for skilled labor. If the supply of skilled labor is constant at L_S , the equilibrium wage is given by

$$w_S = \alpha e^\alpha / L_S^{1-\alpha},$$

which implies that higher productivity raises the skilled wage.

Suppose now that there are two types of imperfectly substitutable workers, skilled and unskilled, in quantities U and S . Both are combined with a CES function in production:

$$Y = [U^\rho + (eS)^\rho]^{1/\rho}, \quad (5)$$

where $\rho \leq 1$. The elasticity of substitution is $\sigma = 1/(1 - \rho)$. Skilled and unskilled labor are gross substitutes if $\sigma > 1$ (that is, $\rho > 0$), and gross complements when $\sigma < 1$ (or $\rho < 0$).²⁷

Let $x = S/U$. If the labor market is competitive, skilled and unskilled wages (w_U and w_S , respectively) are given by

$$w_U = \partial Y / \partial U = [1 + e^\rho x^\rho]^{(1-\rho)/\rho}, \quad (6)$$

$$w_S = \partial Y / \partial S = e^\rho [x^{-\rho} + e^\rho]^{(1-\rho)/\rho}, \quad (7)$$

which imply that $\partial w_U / \partial x > 0$ and $\partial w_S / \partial x < 0$. Equivalently, combining these two equations yields the wage ratio as

$$\omega = \frac{w_S}{w_U} = e^\rho x^{-(1-\rho)} = e^{(\sigma-1)/\sigma} x^{-1/\sigma}, \quad (8)$$

which is greater than unity as long as $e > x^{1/(\sigma-1)}$. Equation (8) implies that $\partial \ln \omega / [\partial \ln x] = -\sigma^{-1} < 0$, so that the wage ratio falls as the relative

²⁷If $\sigma \rightarrow \infty$, skilled and unskilled labor are perfect substitutes. If $\sigma \rightarrow 0$ (or $\rho \rightarrow -\infty$), the production function takes the Leontief form, and output can be produced only by using skilled and unskilled labor in fixed proportions. If $\sigma \rightarrow 1$ (or $\rho \rightarrow 0$), the production function tends to the Cobb-Douglas case.

supply of skilled labor increases.²⁸ Most importantly for the purpose at hand, equation (8) also implies that

$$\frac{\partial \ln \omega}{\partial \ln e} = (\sigma - 1)/\sigma,$$

so that if $\sigma > 1$ (that is, $\rho \in (0, 1)$ and labor categories are gross substitutes) then an increase in skilled labor's effort increases the wage ratio. Conversely, when $\sigma < 1$, and labor categories are gross complements, a rise in the effort level of skilled labor reduces the wage gap. Improved effort, in a sense, creates an excess supply of skilled labor, driving down the return to that category of labor.²⁹ Note also that if the unskilled wage is set at a binding minimum, the behavior of ω will reflect only the behavior of w_S ; as can be seen in (7), an increase in e then always increases the wage ratio.

I now endogenize the level of effort, e , under the assumption that wages affect the productivity of skilled workers. Following Agénor and Aizenman (1999), a simple form of the effort function e can be specified as

$$e = 1 - (1 - e_m)\left(\frac{\Omega}{w_S}\right)^\theta, \quad e_m \in (0, 1), \quad (9)$$

where Ω denotes workers' reservation wage or an alternative wage, e_m a minimal level of effort, and $\theta \geq 0$. This equation indicates that an increase in the skilled wage relative to the reservation wage raises the level of effort, so that $e_{w_S} > 0$. Effort is also concave in w_S , so that $\partial^2 e / \partial w_S^2 < 0$. If effort is independent of relative wages ($\theta = 0$), or if w_S is continuously equal to the reservation wage, then $e = e_m$.³⁰

The micro foundations of this function can be derived as follows (see Agénor and Aizenman (1999, pp. 280-81)). Suppose that consumption and effort decisions are separable and that the decision to provide effort depends only on the wage earned, w_S , and the disutility of effort. All workers share the same instantaneous utility function $V(w_S, e)$, which, after appropriate normalization, is defined as

$$V(w_S, e) = \ln w_S^\delta (1 - e)^{1-\delta}, \quad (10)$$

²⁸The average wage, given by $(w_S S + w_U U)/(S + U)$, is also increasing in x as long as the wage gap is positive, that is, $\omega > 1$.

²⁹Bernal and Cárdenas (2003) found an average value of σ of 0.9 for Colombia during the period 1976-96. However, a number of other studies suggest that $\sigma > 1$. See, for instance, Hamermesh (1993).

³⁰An alternative, common specification is $e = [(w_S - \Omega)/\Omega]^\theta$, where $\theta > 0$.

where $\delta \in (0, 1)$.³¹ Let π denote the probability (per unit time) that the worker is caught shirking, in which case he is fired and must seek employment in another sector, where efficiency considerations are absent and the going wage is Ω . The level of effort provided is either e (when employed and not shirking) or e_m (when shirking while employed, or when working elsewhere). The optimal level of effort is determined so that the expected utility derived from working is at least equal to the expected utility of shirking:

$$V(w_S, e) \geq \pi[\ln \Omega^\delta (1 - e_m)^{1-\delta}] + (1 - \pi) \ln[w_S^\delta (1 - e_m)^{1-\delta}]. \quad (11)$$

The left-hand side in this expression measures the expected utility derived by a worker who is not shirking and provides a level of effort equal to e , whereas the right-hand side measures the expected utility of a shirking worker as a weighted average of the wage earned if caught shirking and fired (with probability π) but working at the alternative wage Ω , and if not caught (with probability $1 - \pi$), with a level of effort equal to e_m in both cases.

In equilibrium, workers are indifferent between shirking and not shirking; condition (11) therefore holds with equality. Thus,

$$w_S^\delta (1 - e)^{1-\delta} = [\Omega^\pi w_S^{1-\pi}]^\delta (1 - e_m)^{1-\delta},$$

or equivalently,

$$\left(\frac{1 - e}{1 - e_m}\right)^{1-\delta} = \left(\frac{\Omega}{w_S}\right)^{\pi\delta}.$$

Solving this equation for the level of effort yields (9), with

$$\theta \equiv \frac{\pi\delta}{1 - \delta},$$

which implies that an increase in the probability of getting caught shirking (a rise in π) raises the level of effort at any given level of the wage ratio. An increase in the alternative wage Ω (which measures the opportunity cost of effort) lowers productivity.

Suppose that the production function is given by (2). Profits can thus be written as $(eS)^\alpha - w_S S$. Maximization with respect to both S and w_S yields the first-order conditions

$$\frac{\partial(eS)^\alpha}{\partial S} - w_S = 0, \quad \frac{\partial(eS)^\alpha}{\partial w_S} - S = 0,$$

³¹The quantity $1 - e$ can be viewed as measuring leisure, although the supply of hours is assumed fixed.

or equivalently,

$$w_S = \alpha S^{\alpha-1} e^\alpha, \quad S = \alpha e^{\alpha-1} S^\alpha e', \quad (12)$$

where $e' = de/dw_S$.³² Combining these equations gives $w_S = e/e'$, or equivalently

$$\eta_{e/w_S} \equiv w_S e' / e = 1. \quad (13)$$

Thus, in equilibrium, the effort-wage elasticity, η_{e/w_S} , is equal to unity. This result is known as the Solow condition.

Using (9), expressions (12) can be rewritten as

$$w_S = \alpha S^{\alpha-1} [1 - (1 - e_m) (\frac{\Omega}{w_S})^\theta]^\alpha, \quad (14)$$

$$S = \alpha e^{\alpha-1} S^\alpha \theta (1 - e_m) w_S^{-1} (\frac{\Omega}{w_S})^\theta. \quad (15)$$

These equations can be combined to give

$$w_S = \kappa \Omega, \quad (16)$$

where $\kappa \equiv [(1 + \theta)(1 - e_m)]^{1/\theta} > 1$. Thus, the efficiency wage is proportional to, and higher than, the opportunity cost Ω . Figure 1.2 illustrates the determination of the efficiency wage. The concavity of the relationship between e and w_S guarantees a unique solution. When $w_S/\Omega = 1$, the level of effort is e_m . At the optimal wage, given in (16), the equilibrium level of effort is constant at $e^* = 1 - (1 - e_m)\kappa^{-\theta} > 0$ (see point E). Given the Cobb-Douglas form of the production function, the optimal values of w_S and e do not depend on the technology parameters but only on the worker's preferences and the detection technology, as summarized by δ and π .

The Solow condition given earlier (equation (13)) has been criticized as implying too high an elasticity of labor supply. As shown by Schmidt-Sorensen (1990), however, accounting for fixed employment costs is sufficient to obtain an elasticity lower than unity. Suppose indeed that there are fixed employment costs per worker, χ , resulting for instance from mandated employer-provided insurance, or from a tax levied on the number of employees to support an unemployment benefit scheme. Profits are now given by $(eS)^\alpha - (w_S + \chi)S$. The first-order conditions become

$$w_S + \chi = \alpha S^{\alpha-1} e^\alpha, \quad S = \alpha e^{\alpha-1} S^\alpha e',$$

³²The second-order conditions imply that the second derivative of the effort function, e'' , must be negative. This is ensured with the present specification (which implies that e is concave with respect to w_S).

so that

$$\eta_{e/w_S} = \frac{1}{1 + \chi/w_S} < 1.$$

This condition shows that the (equilibrium) effort-wage elasticity, η_{e/w_S} is now lower than unity (with the standard case corresponding to $\chi = 0$). It can also be shown that $dw_S/d\chi > 0$ and $dS/d\chi < 0$, so that an increase in fixed employment costs results in a rise in the wage and a reduction in employment. By reducing employment, the firm can counteract an increase in total labor costs stemming from higher employment costs. As a result, output falls; to counteract this effect, the firm increases the wage in order to raise the level of effort, which tends to increase output. The net effect on output is, nevertheless, negative ($dY/d\chi < 0$). Thus, the positive effect on output from higher wages via increased work effort is outweighed by the adverse effect operating through the reduction in labor demand.

An alternative approach is to assume, as in Esfahani and Salehi-Esfahani (1989), that firms face a recurrent cost c (measured in effort units) to organize and manage each worker. The production function therefore takes the form

$$Y = [(e - c)S]^\alpha.$$

Maximizing profits with respect to w_S and S yields now

$$w_S = \alpha S^{\alpha-1} (e - c)^\alpha, \quad S = \alpha [(e - c)]^{\alpha-1} S^\alpha e',$$

which can be combined to give

$$\eta_{e/w_S} = (e - c)/e < 1.$$

Thus, higher recurrent costs lower the elasticity of effort. The Solow condition holds only if $c = 0$.

Several extensions to the specification of the effort function have been considered. For instance, instead of considering the gross wage in (10), the after-tax wage, $(1 - \tau)w_S$, could be introduced, where $\tau \in (0, 1)$ is the tax rate. Taxation would therefore drive a wedge between the consumption wage (which affects workers' behavior) and the product wage (which is what producers are concerned about), in addition to differences in price deflators, as discussed later. Pisauro (1991) for instance, in his derivation of an effort function based on expected utility maximization, accounts explicitly for taxes on labor. In his analysis, the representative worker's utility function is

additively separable in effort and consumption, linear in effort, and concave in income. These restrictions lead to an effort function that depends on the unemployment rate and is not homogeneous of degree zero in the wage ratio. The unemployment rate, in a sense, acts as a “worker discipline” device, in a manner similar to its role in the model of Shapiro and Stiglitz (1984) discussed below: the higher the unemployment rate, the stronger are the incentives to put forth more effort, as the fear of being unemployed increases or, more generally, the outside options of the worker become worse.³³ This effect may increase with the level of unemployment, in which case effort can be specified as a convex function of unemployment. By introducing unemployment in the effort function, a feedback effect is also introduced in the behavior of wages: an increase in unemployment would tend to lower wages. Thus, in contrast to the Phillips curve, efficiency wage models explain a relationship between the *level* of real wages and unemployment, as opposed to a relationship between the *growth rate* of wages and unemployment.

4.1.2 Quits, Turnover Costs, and Wages

An alternative model of efficiency wages emphasizes the impact of quits and turnover costs on wages. To illustrate the model’s implications, suppose that effort is now constant and normalized to unity. The production function is thus given by

$$Y = S^\alpha. \quad (17)$$

In addition to normal labor costs, firms incur a total cost of cqS in hiring and training new skilled workers, where $q \in (0, 1)$ is the quit rate, and $c > 0$ the cost incurred in recruiting and training each worker. Suppose that the quit rate takes the form

$$q = \frac{1}{1 + \delta w_S/\Omega}, \quad \delta > 0, \quad (18)$$

where Ω is an alternative (or reservation) wage. This specification implies that $q_\omega < 0$ and $q_{\omega\omega} > 0$, where $\omega = w_S/\Omega$ is the wage ratio.

As shown by Agénor and Aizenman (1996), specification (18) can be derived from fairly general conditions. Suppose that the net compensation

³³Brecher (1992) also developed an efficiency wage model in which effort is positively related to unemployment.

of worker h when employed in sectors i and j are given by, respectively, the following equations:

$$V_i^h = b + \ln w_S + \varepsilon_i^h, \quad (19)$$

$$V_j^h = \ln \Omega + \varepsilon_j^h, \quad (20)$$

where ε^h is a personal taste (or idiosyncratic) variable, and b measures the non-pecuniary benefits of working in sector i , such as proximity to family and friends, or physical location of activities.

Suppose that worker h is currently employed in sector i . The worker decides to quit when the net compensation in sector j is likely to be higher than the current one, that is:

$$V_j^h > V_i^h. \quad (21)$$

Using equations (20) and (19), equation (21) implies

$$\varepsilon_i^h < -b + \varepsilon_j^h - \ln \omega. \quad (22)$$

Under the assumption that ε^h follows a standard Weibull (or extreme value) distribution across agents, Agénor and Aizenman (1996) showed that the probability that an individual drawn randomly from the population of employed workers in the formal sector will opt to quit yields equation (18), with $\delta = \exp(b)$.³⁴

Profits are given by $S^\alpha - w_S S - cqS$. Maximization with respect to w_S and S (for Ω given) yields the first-order conditions

$$-cq_{w_S} = 1, \quad (23)$$

$$\alpha S^{\alpha-1} - w_S - cq = 0. \quad (24)$$

From (18), $q_{w_S} = -\delta q^2 / \Omega = -\delta / \Omega (1 + \delta \omega)^2$. Substituting this result in (23) yields

$$\frac{c\delta}{\Omega} = \left(1 + \frac{\delta w_S}{\Omega}\right)^2, \quad (25)$$

that is

$$w_S = \sqrt{c\delta^{-1}\Omega} - \delta^{-1}\Omega, \quad (26)$$

³⁴The density function of the standard Weibull distribution is $f(x) = \gamma x^{\gamma-1} \exp(-x^\gamma)$, with $x \geq 0$ and $\gamma > 0$ is the shape parameter. The cumulative distribution function is $1 - \exp(-x^\gamma)$. The exponential distribution corresponds to $\gamma = 1$.

which indicates that an increase in the unit cost of hiring and training, c , raises the efficiency wage, whereas an increase in the alternative wage has in general an ambiguous effect. To understand the latter result, note that equation (23) can be written in the form $1 = -cq_\omega/\Omega$, given that $q_{w_S} = q_\omega/\Omega$. This equation can be interpreted as equating the marginal cost of a unit of labor (which is unity) to the marginal benefit of that unit, which results from a reduction in labor turnover costs.³⁵ It also indicates that an increase in the alternative wage has an ambiguous effect on the marginal benefit. On the one hand, it drives the quit rate up, thereby raising the marginal benefit resulting from an increase in the efficiency wage. On the other, it reduces the marginal benefit associated with a rise in the efficiency wage because a unit increase in that wage represents now a smaller percentage improvement in the relative wage (this is captured by $1/\Omega$). For low values of the alternative wage the first effect dominates, whereas for large values of Ω the second effect dominates. If the net nonpecuniary benefit associated with employment, given by δ , is sufficiently high (a condition that implies that the elasticity of the quit rate with respect to relative wages is also high), the net effect will be positive.³⁶ From (26), the elasticity of the efficiency wage with respect to the alternative wage would then be less than unity.

Combining (23) with $q_{w_S} = -\delta q^2/\Omega$ yields $cq = \Omega\delta^{-1}/q$, that is, using (18) to substitute for q on the right-hand side, $cq = w_S + \delta^{-1}\Omega$. Unit labor costs, defined as $\Phi = w_S + cq$, can therefore be written as, using (26),

$$\Phi = 2w_S + \delta^{-1}\Omega = 2\sqrt{c\delta^{-1}\Omega} - \delta^{-1}\Omega.$$

As can be inferred from (26), for an internal solution to obtain (that is, for the skilled wage to be positive) the restriction $\Omega < c\delta$ must be imposed. By implication, therefore, $\Phi > 0$.

The behavior of wages, unit labor costs and the quit rate are shown in Figure 1.3. Equation (26) implies that w_S is concave in Ω . For $\Omega = c\delta$, $w_S = 0$ and $\Phi = c$. For the restriction given earlier ($\Omega < c\delta$) to hold, the economy must operate along the upward-sloping portion of the wage curve shown in the upper panel of the Figure. As indicated in the lower panel, this assumption is equivalent to restricting the quit rate to be less than one

³⁵Given that $q_\omega = \Omega q_{w_S} = -\delta q^2$, (24) implies that the marginal benefit curve is $c\delta q^2/\Omega$. Using (18) shows that this curve is a decreasing function of w_S , for Ω given.

³⁶Formally, the condition for an increase in Ω on w_S to be positive is that $\delta\omega > 1$, or (see equation (18)) that the quit rate be less than one half, as assumed below.

half. The main implication of this specification, in contrast to (16), is that the skilled wage is not a constant markup over the alternative wage.

The foregoing derivation of a wage-setting equation based on turnover costs was based on a static optimization problem. Campbell and Orszag (1998) provided an alternative derivation, based on a dynamic optimization problem. Suppose that the production function is again given by (17). Suppose also that now the objective of each firm is to maximize discounted profits at time $t_0 = 0$:

$$V_0 = \int_0^\infty [S^\alpha - w_S(1 + \tau)S - (1 - \theta)T(H)S]e^{-\beta t} dt, \quad (27)$$

where S and w_S are as defined before, H is the hiring rate, and $T(H)$ represents training costs, measured in terms of time existing skilled workers need to devote to training new employees. $\beta > 0$ denotes the discount rate, $\tau \in (0, 1)$ is a payroll tax paid by employers, and θ a training subsidy. Maximization is subject to a dynamic constraint on employment adjustment,

$$\dot{S}/S = H - q(w_S, w_A, L_A), \quad (28)$$

where $q(\cdot)$ is the quit rate, which depends now on the firm's specific wage, w_S , the economy-wide average wage, w_A , and the economy-wide average level of employment, L_A . Whereas an increase in the firm's specific wage, as before, lowers the propensity to quit ($q_{w_S} < 0$), higher economy-wide averages for wages and employment tend now to increase quits ($q_{w_A} > 0$, $q_{L_A} > 0$). The economy-wide average wage plays therefore the role of the "alternative" wage defined earlier, whereas the economy-wide average employment level (relative to an exogenous supply of labor) may be viewed as measuring the probability of finding a job elsewhere—in a manner similar to the Harris-Todaro mechanism discussed in the previous section.

Each individual firm treats economy-wide averages as given in solving its maximization problem, but in equilibrium, wages and employment levels are the same across firms.

Suppose that the quit rate has the following constant elasticity form:

$$q(w_S, w_A, L_A) = q_0 \left(\frac{w_S N}{w_A L_A} \right)^{-\eta} = q_0 \left[\frac{w_S}{(1 - u)w_A} \right]^{-\eta}, \quad (29)$$

where $q_0, \eta > 0$, N is the total labor force, and u the unemployment rate. The quantity $(1 - u)w_A$ can be interpreted as the *expected* wage available

outside the firm, with $1 - u$ measuring the probability of finding a job (equal to one minus the unemployment rate, u).

Suppose also that the training cost function is quadratic, that is

$$T(H) = \frac{A}{2}H^2, \quad (30)$$

where $A > 0$.

From (27), (28), (29), and (30), the current-value Hamiltonian for the firm is

$$\Lambda = S^\alpha - w_S(1 + \tau)S - (1 - \theta)\left(\frac{A}{2}H^2\right)S + \lambda\left[H - q_0\left[\frac{w_S}{(1 - u)w_A}\right]^{-\eta}\right]S, \quad (31)$$

where λ is the shadow price associated with constraint (28). The first-order conditions for maximization are given by

$$A(1 - \theta)H = \lambda, \quad (32)$$

$$1 + \tau = \lambda q_0 \eta w_S^{-\eta-1} [(1 - u)w_A]^\eta, \quad (33)$$

$$-\frac{\partial \Lambda}{\partial S} = \dot{\lambda} - \beta \lambda. \quad (34)$$

In equilibrium, $w_S = w_A$. Equation (33) therefore yields

$$w_S = \frac{q_0}{1 + \tau} \eta (1 - u)^\eta \lambda. \quad (35)$$

Substituting (32) into (35) and imposing the steady-state condition $H = q$ yields

$$w_S = \kappa \left(\frac{1 - \theta}{1 + \tau}\right) (1 - u)^{2\eta},$$

where $\kappa \equiv q_0^2 A \eta$. Thus, a rise in the unemployment rate u , an increase in the subsidy rate θ , or a reduction in the payroll tax rate τ , lower the equilibrium skilled wage.³⁷ In a sense, the effect of unemployment on the skilled wage comes about because the alternative wage (Ω in the previous model) is endogenized and specified as an expected value, equal to $(1 - u)w_A$.

³⁷Moreover, the elasticity with respect to unemployment is 2η , which is independent of τ and θ and thus of public policies. However, this result is not general; the model can readily be extended to restore a role for labor market policies.

An alternative dynamic approach to wage determination in the job turnover model is that of Amano (1983), which also emphasizes the impact of employment adjustment costs in hiring and firing decisions. Suppose again that the production function takes the form (17), and that adjustment of the number of skilled workers entails costs to the firm, which can be training costs (as before) or simply “settling in” costs (as in Stiglitz (1974)).

Let H denote now the flow of newly-employed workers (or of discharged and quitting workers, when $H < 0$), and $x = H/S$. Costs associated with $H > 0$ consist of training expenses and foregone output in the form of lower productivity, whereas those arising when $H < 0$ are compensation to workers who leave the firm voluntarily or involuntarily (in which case they correspond indeed to firing costs).

Adjustment costs for the new flow of workers, C , are defined as

$$C = C(x), \quad C(0) = 0, \quad C' \begin{matrix} \geq \\ < \end{matrix} 0 \leftrightarrow x \begin{matrix} \geq \\ < \end{matrix} 0, \quad C'' > 0.$$

Total adjustment costs are therefore $C(x)S$. The assumption $C'' > 0$ reflects scale effects in the sense that firms with larger S find it cheaper to adjust their labor force, for a given number of workers.

The new flow of workers consists of net changes in employment and quits:

$$H = \dot{S} + q\left(\frac{w_S}{\Omega}, v\right)S, \quad \frac{\partial q}{\partial(w_S/\Omega)} < 0, \quad \frac{\partial q}{\partial v} > 0, \quad (36)$$

where q is the quit rate, w_S the (real) wage paid by the firm, Ω the average wage expected by workers, over all firms in the sector, and v the skilled employment rate in the urban formal sector, with $v \in (0, 1)$. The quit rate depends negatively on the firm’s relative wage position and positively on the employment rate, which captures labor market tightness. When the employment rate is high, job opportunities are also assumed to improve.

Assume further that the expected alternative wage Ω is an increasing function of the actual wage w_S in the sector under consideration and that the elasticity of Ω with respect to w_S is less than unity. Then Ω can be suppressed in (36), so that

$$H = \dot{S} + q(w_S, v)S. \quad (37)$$

Assume, as before, that $q_{w_S} < 0$, $q_{w_S w_S} > 0$, and that now $q_v > 0$, $q_{w_S v} = 0$. Given the definition of x , (37) can also be written as

$$\dot{S} = [x - q(w_S, v)]S. \quad (38)$$

The firm's profits are now $S^\alpha - w_S S - C(x)S$. With $\beta > 0$ denoting again the discount rate, the firm's problem is thus

$$\max_{w_S, x} \int_0^\infty [S^\alpha - w_S S - C(x)S] e^{-\beta t} dt,$$

subject to (38), which determines the dynamics of the state variable S . The firm treats the skilled employment rate, v , as a parameter. The current-value Hamiltonian can be written as

$$\Lambda = S^\alpha - w_S S - C(x)S + \lambda[x - q(w_S, v)]S,$$

where λ is the imputed price of an additional unit of labor employed. Necessary conditions are³⁸

$$1 + \lambda q_{w_S}(w_S, v) = 0, \quad (39)$$

$$\lambda - C'(x) = 0, \quad (40)$$

$$\dot{\lambda} = [\beta + q(w_S, v) - x]\lambda + w_S + C(x) - \alpha S^{\alpha-1}, \quad (41)$$

together with the transversality condition

$$\lim_{t \rightarrow \infty} \lambda S \exp(-\beta t) = 0.$$

Eliminating λ from (39) and (40) yields

$$1 + C'(x)q_{w_S}(w_S, v) = 0,$$

which, given that $q_{w_S v} = 0$, can be solved for x to give

$$x = x(w_S), \quad x' \equiv \frac{-q_{w_S w_S} C'}{q_{w_S} C''} > 0. \quad (42)$$

Substituting this result in (38) yields

$$\dot{S} = [x(w_S) - q(w_S, v)]S. \quad (43)$$

Equation (39) implies that $\lambda = -1/q_{w_S}$, which can be differentiated with respect to time to give

$$\dot{\lambda} = \left(\frac{q_{w_S w_S}}{q_{w_S}^2} \right) \dot{w}_S. \quad (44)$$

³⁸Sufficiency is ensured by the assumptions that $\partial^2 Y / \partial S^2 < 0$ and $q_{w_S w_S} > 0$.

Substituting (40) for λ , as well as (41) and (42) in (44), therefore yields

$$\dot{w}_S = \frac{q_{w_S}}{q_{w_S w_S}} \left\{ -\beta - q(w_S, v) + x(w_S) + q_{w_S} [w_S + C[x(w_S)] - \alpha S^{\alpha-1}] \right\}. \quad (45)$$

Equations (43) and (45) define a dynamic system in w_S and S , which can be written as

$$\begin{bmatrix} \dot{w}_S \\ \dot{S} \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & 0 \end{bmatrix} \begin{bmatrix} w_S - \tilde{w}_S \\ S - \tilde{S} \end{bmatrix},$$

where

$$a_{11} = \frac{q_{w_S}}{q_{w_S w_S}} \left\{ x' - q_{w_S} + q_{w_S w_S} [\tilde{w}_S + C[x(\tilde{w}_S)] - \alpha \tilde{S}^{\alpha-1}] + q_{w_S} (1 + C' x') \right\},$$

$$a_{12} = \frac{\alpha(1-\alpha)\tilde{S}^{\alpha-2}q_{w_S}^2}{q_{w_S w_S}} > 0, \quad a_{21} = \tilde{S}(x' - q_{w_S}) > 0.$$

Given that $1 + C' q_{w_S} = 0$, the expression for a_{11} is actually

$$a_{11} = q_{w_S} [\tilde{w}_S + C[x(\tilde{w}_S)] - \alpha \tilde{S}^{\alpha-1}],$$

which is positive given that $\tilde{w}_S + C[x(\tilde{w}_S)] - \alpha \tilde{S}^{\alpha-1} < 0$ in the neighborhood of the steady state.

The steady-state solution of this system is obtained by setting $\dot{w}_S = \dot{S} = 0$, so that

$$-\beta - q(\tilde{w}_S, v) + x(\tilde{w}_S) + q_{w_S}(\tilde{w}_S, v)[\tilde{w}_S + C[x(\tilde{w}_S)]] = \alpha \tilde{S}^{\alpha-1},$$

$$x(\tilde{w}_S) = q(\tilde{w}_S, v).$$

Substituting the second equation in the first and re-arranging yields

$$\tilde{S} = \left\{ \frac{q_{w_S}(\tilde{w}_S, v)[\tilde{w}_S + C[x(\tilde{w}_S)]] - \beta}{\alpha} \right\}^{-1/(1-\alpha)}.$$

The phase diagram of this system is shown in Figure 1.4 Curve WW (respectively LL) corresponds to values of wages and employment for which $\dot{w}_S = 0$ (respectively $\dot{S} = 0$) are constant over time. Curve LL is horizontal, whereas WW is downward sloping, with a slope given by

$$\left. \frac{dw_S}{dS} \right|_{\dot{w}_S=0} = - \frac{\alpha(1-\alpha)\tilde{S}^{\alpha-2}q_{w_S}}{q_{w_S w_S} \{ \tilde{w}_S + C[x(\tilde{w}_S)] - \alpha S^{\alpha-1} \}} < 0.$$

The initial equilibrium is at point E . Local stability, as implied by the Routh-Hurwitz conditions, requires that $\text{tr}A < 0$ and $\det A > 0$, to ensure the existence of two negative roots.

Figure 1.4 can be used to illustrate the impact of various shocks on skilled wages and employment. Consider, for instance, an increase in the economy-wide employment rate, v . It can readily be shown that

$$\left. \frac{dw_S}{dv} \right|_{\dot{s}=0} = \frac{q_v}{x_{w_S} - q_{w_S}} > 0, \quad \left. \frac{dw_S}{dv} \right|_{\dot{w}_S=0} = \frac{q_v}{q_{w_S} w_S (w + C - \alpha \tilde{S}^{\alpha-1})} < 0,$$

which imply that LL shifts upward (to $L'L'$) whereas WW shifts downward (to $W'W'$). The new equilibrium point is E' , which shows that in the long run wages are higher and employment lower. Thus, firms respond to an increase in the economy-wide employment rate by raising wages, to reduce incentives to quit. Equivalently, an increase in the unemployment rate (a drop in v), reduces the skilled wage, just as in the Campbell-Orszag model discussed earlier.

Efficiency wage models with a wage-productivity link and turnover costs can be combined into “hybrid” specifications, to highlight their complementarity (see, for instance, Marti (1997)). In such specifications, it has been shown that the elasticity of effort with respect to wages is a function of recruiting and training costs, which depend on quit behavior. Beyond that, however, hybrid models do not add much to the main result regarding the impact of unemployment on wage formation—which is that, regardless of the source of efficiency considerations, these models generate a relationship between real wages and the *level* of unemployment. Moreover, because unemployment is only one of the determinants of real wages, they may also lead to a significant degree of wage rigidity.

There is significant evidence supporting the view that efficiency wage considerations matter in explaining wage formation in the urban formal sector in developing countries. For instance, Schaffner (1998) and Velenchik (1997), in studies on Peru and Zimbabwe, respectively, found that larger establishments in manufacturing, where the level of effort may be more difficult to observe, pay higher wages, even after controlling for other (individual and firm) characteristics. Other relevant evidence is provided by Hoddinot (1996) for Côte d’Ivoire, with more general reviews for sub-Saharan Africa discussed by Bigsten and Horton (1998) and Dabalén (2000).

Finally, it should be noted that, in the above analysis, wages in the effort and quit functions were measured in terms of the same numéraire; there is

no relative price effect, as one would expect in multi-sector models. This distinction is actually critical for understanding the transmission of policy and exogenous shocks in an open-economy general equilibrium setting, as shown by Agénor (2004*b*, 2005).

4.2 Trade Unions

As discussed earlier, trade unions play a pervasive role in wage formation in many developing countries. Calvo (1978) developed one of the first models of urban wage determination based on bargaining between formal sector firms and a utility-maximizing trade union.³⁹

Suppose that production is as in (5), with effort normalized to unity:

$$Y = (U^\rho + S^\rho)^{1/\rho}, \quad (46)$$

With profits given by $Y - w_U U - w_S S$, and letting again $\sigma = 1/(1 - \rho)$, the demand for skilled labor is

$$S^d = Y w_S^{-\sigma}. \quad (47)$$

The simplest way of capturing union behavior is based on the “monopoly union” framework, which is derived as follows (see, for instance, Agénor (1999), Devarajan, Ghanem, and Thierfelder (1997), and Thierfelder and Shiells (1997)). Let w_S^T and S^T denote the union’s wage and employment targets, respectively. A centralized labor union sets w_S with the objective of maximizing a utility function that depends on deviations of both employment and the real wage from their target levels, subject to the firm’s labor demand schedule. Specifically, suppose that the union’s utility function is given by

$$V = (w_S - w_S^T)^\nu (S - S^T)^{1-\nu}, \quad \nu \in (0, 1), \quad (48)$$

where the parameter ν reflects the relative importance that the union attaches to wage deviations from target, as opposed to employment deviations.⁴⁰ The union’s problem is thus to maximize (48) with respect to w_S ,

³⁹Calvo’s model was subsequently reexamined by Quibria (1988), who showed that the properties of the model depend crucially on the specification of the objective function of the trade union.

⁴⁰If skilled workers can work in a sector other than the one where the union operates, an alternative assumption would be to assume, as in Agénor and Santaella (1998, Appendix A), that it is the wage differential, rather than deviations from the target wage, that appears in the union’s utility function.

subject to (47). The first-order condition is given by

$$\nu \left\{ \frac{S^d - S^T}{w_S - w_S^T} \right\}^{1-\nu} - (1 - \nu) \left\{ \frac{S^d - S^T}{w_S - w_S^T} \right\}^{-\nu} \sigma \left(\frac{S^d}{w_S} \right) = 0,$$

or equivalently

$$\nu \left\{ \frac{S^d - S^T}{w_S - w_S^T} \right\} - \frac{(1 - \nu)\sigma S^d}{w_S} = 0.$$

Solving this condition yields

$$\frac{w_S - w_S^T}{w_S} = \frac{\nu}{(1 - \nu)\sigma} \left(\frac{S^d - S^T}{S^d} \right),$$

which indicates that percentage deviations of the optimal wage from its target value are linearly related to percentage differences of employment from its target level.

The union's target wage, w_S^T , can be assumed to be related positively to wages elsewhere (for instance, in the public sector, w_{SG}) and negatively to the skilled unemployment rate, z_S , and the real firing cost per skilled worker, f_S .⁴¹ In developing countries, as noted earlier, wage-setting in the public sector can play a signaling or "leadership" role for wage setters in the rest of the economy. When unemployment is high, the probability of finding a job (at any given wage) is low. Consequently, the higher the unemployment rate, the greater the incentive for the union to moderate its wage demands in order to induce firms to increase employment. As also noted earlier, firing costs do prevent excessive job losses in bad times (thereby preventing the loss of firm-specific human capital if downturns are temporary) but they also discourage new hires—namely because reversing mismatches is costly if workers prove to be inadequate matches with their job requirements. It is therefore natural to assume that the union internalizes the disincentive effect of severance payments on labor demand. As a result, the higher the firing cost, the greater the incentive for the union to reduce its wage demands, in order to encourage firms to hire.

⁴¹The target wage could also be specified as increasing in the income tax rate, implying that the union would demand higher wages to compensate for a decrease in after-tax income.

Normalizing the target level of employment to zero ($S^T = 0$), the above expression can thus be rewritten as

$$w_S = \frac{z_S^{-\phi_1} f_S^{-\phi_2} w_{SG}^{\phi_3}}{1 - \nu / (1 - \nu)\sigma}, \quad (49)$$

where the ϕ_i coefficients are all positive. This equation implies, in particular, that a higher level of unemployment lowers the *level* of the skilled wage, as predicted by the various efficiency wage theories reviewed earlier.⁴²

As an alternative to the “monopoly union” framework, it could be assumed that firms and the union bargain over wages (through a generalized Nash bargaining process), with either firms determining employment (the so-called “right to manage” approach) or firms and the union bargaining over *both* wages and employment (see McDonald and Solow (1985)). In the former case, the firm and the union would determine ω_S by maximizing the product of each party’s gains from reaching a bargain, weighted by their respective bargaining strengths, and once wages are set, employment would be determined by the firm. As shown for instance by Creedy and McDonald (1991), for wage determination, it does not make much difference whether bargaining is over wages only, or over wages and employment. However, in the case of bargaining over both wages and employment, the equilibrium outcome is typically such that firms are not in general on their labor demand schedule (see for instance Booth (1995)).

4.3 Bilateral Bargaining

In the real world, individual wage bargaining is common among higher-paid (skilled) workers. Another approach to wage determination is thus to assume direct bilateral bargaining, in each period, between producers and workers over compensation. If a bargain is reached, each worker receives w_S , whereas the producer receives $m_S - w_S$, where m_S is the marginal product of the worker, given by, from (46):

$$m_S = \frac{\partial Y}{\partial S} = \left(\frac{Y}{S}\right)^{1-\rho}. \quad (50)$$

The worker’s bargaining surplus is $\omega_S - \Omega$, where Ω represents an alternative wage, an unemployment benefit (if one exists), or the value of a

⁴²Note that, in general, the optimal wage would also be an increasing function of union density. Here, it is implicitly assumed that all skilled workers are members of the union.

non-market activity. The firm's bargaining surplus is normally $m_S - w_S$, but this expression must be modified in the presence of firing costs (see Coe and Snower (1997)). Suppose that, in case of disagreement in the bargaining process, the worker engages in industrial action that is costly to the firm (but not to himself). The greater the cost of industrial action is, the lower will be the producer's fallback position and thus the higher will be the wage that the worker can achieve—up to a limit, beyond which the firm has an incentive to fire him. Suppose that producers face a firing cost of f_S per worker, and assume for simplicity that all workers become eligible for severance payments immediately upon hiring.⁴³ If the cost of the industrial action to the firm exceeds the firing cost f_S , the worker will be replaced by another one. Consequently, the worker will set the level of industrial action so that its cost to the firm is exactly f_S , making the firm indifferent between retaining him and replacing him. Thus, the firm's bargaining surplus is $m_S - (w_S + f_S)$.

The Nash bargaining problem can be formulated as

$$\max_{w_S} N = (w_S - \Omega)^\nu [m_S - (w_S + f_S)]^{1-\nu}, \quad \nu \in (0, 1),$$

where ν measures now the bargaining strength of the worker relative to the firm. The first-order condition is given by

$$\frac{d \ln N}{dw_S} = \frac{\nu}{w_S - \Omega} - \frac{1 - \nu}{m_S - (w_S + f_S)} = 0,$$

from which the equilibrium wage can be derived as

$$w_S = \nu(m_S - f_S) + (1 - \nu)\Omega.$$

Suppose that $\Omega = 0$, and that the bargaining strength of a skilled worker, ν , varies inversely with the rate of unemployment, u , with an elasticity ϕ . The wage-setting equation can thus be written as

$$w_S = u^{-\phi}(m_S - f_S), \tag{51}$$

which implies again that the *level* of wages and the rate of unemployment are inversely related, as in some efficiency wage models and the trade union formulation described previously. In addition, an increase in the firing cost now reduces the skilled wage.

⁴³In practice, as noted earlier, redundancy payments are only made to workers with some minimum period of continuous service with the firm.

In the above framework, all firms in the economy behave identically, whereas all workers have the same bargaining strength. This is a useful analytical abstraction when studying the general equilibrium implications of homogeneous behavior among workers and firms, but it may not be a realistic description of an actual economy. For instance, the ability to bargain over the wage may vary considerably across sectors (or across jobs in any given sector). Thus, wage determination may follow different patterns in different sectors, thereby complicating significantly the task of identifying the causes of labor market segmentation.

4.4 Job Search

In the formal sector in developing countries, just as in industrial countries, a large number of workers move between activity, unemployment, and inactivity at any given point in time. These movements occur regardless of whether the economy is in a boom or a recession. For instance, the Inter-American Development Bank (2003, Chapter 2) found that in Brazil and Mexico, for each job created or destroyed every year, three workers change jobs or employment status. The evidence also suggests that those who change jobs have generally higher skills. This is consistent with the evidence, alluded to earlier, suggesting that the poorest workers (generally among the unskilled) cannot afford long periods of job search (and therefore enter or leave the informal economy quite rapidly), whereas richer workers (often among the skilled) are better able to undergo a period of open unemployment and wait for a proper match.⁴⁴ Understanding the determinants of workers' search decisions is thus important to explain wage formation, open unemployment, labor mobility, and therefore labor market segmentation in the formal sector.

Models of job search make explicit the role of frictions in the decision to look for employment and accept a job offer, such as the existence of unemployment insurance or hiring subsidies.⁴⁵ One branch of the literature, which is particularly relevant here, focuses on the effects of market frictions on the determination of wages, under the assumption that wage offers are set and posted by employers, and workers search for the best offer among them.

⁴⁴Workers in rural areas typically have more limited opportunities to engage in job search than those in urban areas.

⁴⁵For recent reviews of the equilibrium job search literature (whose focus has been mostly on industrial countries), see Mortensen and Pissarides (1999) and Rogerson, Shimer, and Wright (2004).

Search frictions, in this context, relate essentially to the fact that workers must allocate some time to gather information about wage offers. A key feature of this literature is that it helps to explain, in an equilibrium setting, differences in wages paid across employers that are not associated with observed differences in productivity among workers. One reason for this is the existence of differential costs of search among workers.

The ability of this class of job search models to explain wage dispersion across observably identical workers provides therefore an explanation for (urban, formal) labor market segmentation in developing countries. However, models along these lines have seldom been applied in the context of these countries.⁴⁶ As a result, the relevance for these countries of the policy implications discussed by Mortensen and Pissarides (1999) for instance is difficult to ascertain. This is an important area of investigation for improving our understanding of the dynamics of labor markets in developing countries. In that regard, job search models in which only firms incur a cost to match workers with their opened vacancies (with workers passively waiting for a match, comparing their prospective income with the opportunity cost of being unemployed) are unlikely to be useful. As in King and Welling (1995) for instance, a more judicious specification would be to assume that workers bear a direct cost when they decide to actively search for a job. This assumption would be more appropriate for developing countries, where the lack of adequate institutions in the labor market may create severe informational frictions. Indeed, as noted earlier, centralized employment agencies do not exist or do not perform very well in these countries. Search costs may therefore be prohibitive for some categories of workers—thereby contributing to persistence in unemployment.

4.5 Adverse Selection Models

Adverse selection models of the labor market dwell on the fact that workers differ in terms of their abilities and that information about these abilities is private. Key contributions to this approach are those of Weiss (1980, 1991), whose work was subsequently expanded in several directions (see, for instance, Cahuc and Zylberberg (2004)).

⁴⁶Davidson, Martin and Matusz (1999) for instance developed a model with search-generated unemployment, but it dwells on the matching approach, as opposed to the approach based on wage offers. See Mortensen and Pissarides (1999) for an attempt to integrate the two approaches.

There are relatively few studies focusing on adverse selection as a source of labor market segmentation and unemployment in developing countries. But the assumption that workers are generally better informed than alternative potential employers about their true abilities has important implications for a number of labor market issues of great importance for these countries. For instance, Bencivenga and Smith (1997) showed how an adverse selection problem in the formal economy can give rise to open urban unemployment in equilibrium and wage dispersion. Thus, adverse selection may provide an alternative explanation of labor market segmentation in the urban formal sector. Furthermore, as shown by Weiss (1991), adverse selection may also provide a rationale for efficiency wages. A higher than market-clearing wage induces workers to self select and, in a sense, “reveal” their true characteristics. In addition, if current employers are better informed about the abilities of their workers than alternative employers, they may concentrate their effort on preventing rapid turnover of their better workers.⁴⁷ Because this may induce fewer quits among better workers, unemployment (or more generally the stream of individuals changing jobs) may consist disproportionately of the less capable ones. Without lower wages, firms may be unwilling to hire, and unemployment may display strong persistence. Moreover, workers who do change jobs may send adverse signals about their abilities, thereby lowering their future bargaining power and wages. In turn, this perceived loss of future income may represent a major impediment to mobility. Thus, these models may not only explain high unemployment rates among the unskilled, but also low quit rates among the skilled.

5 A Shirking Model with Segmented Labor Markets

This section presents a two-sector, partial equilibrium model of a closed economy with segmented urban labor markets. It distinguishes between the formal and informal sectors and accounts for two categories of labor, skilled and unskilled. Unskilled wages in the formal sector are assumed set by government fiat, whereas informal sector wages are flexible. In addition, the model also assumes imperfect mobility of the unskilled labor force between

⁴⁷As argued by Kugler and Saint-Paul (2000), this tendency may be exacerbated by the existence of high hiring and firing costs.

the formal and informal sectors, in line with the Harris-Todaro mechanism described earlier.

Following Shapiro and Stiglitz (1984), firms set skilled wages in order to avoid shirking. Models of segmented labor markets in which wages are determined along these lines have been developed by a variety of authors, including Bulow and Summers (1986), Jones (1987), and Fukushima (1998).⁴⁸ Jones (1987) showed that a large enough differential between the primary- and secondary-sector wages removes the need for (involuntary) unemployment as a discipline device—a key feature of the Shapiro-Stiglitz contribution. Fukushima (1998) also developed a two-sector version of the Shapiro-Stiglitz model (with efficiency wage-setting in both sectors), and studied the impact of active labor market policies on employment and wages. However, all of these papers consider only the case of homogeneous labor. Here, as in Agénor and Aizenman (1997), I consider explicitly two categories of workers and highlight differences in wage formation between them.

The basic setup, in which only skilled workers may face unemployment, is presented first. It is then extended to account for unskilled unemployment by introducing a Harris-Todaro migration mechanism, which generates wait unemployment as a result of workers' decisions to queue for jobs in the formal sector. To illustrate the functioning of the model, the effects of an increase in the minimum wage are examined.

5.1 The Economy

Consider an economy producing two nonstorable goods. Both goods are tradables; their domestic prices are given on world markets and normalized to unity. The first good is produced in the formal sector, using skilled and unskilled labor. Unskilled workers earn a legally-binding minimum wage, whereas skilled workers' wage (together with the employment level of both categories of labor) are determined by firms' optimization decisions. The second good is produced in the informal sector using only unskilled labor. In the informal sector, wages adjust instantaneously to clear the labor market.

There are no physical or institutional impediments to mobility across sectors for either category of workers. As a result, skilled workers who are unable to find employment in the formal sector may work (as unskilled labor)

⁴⁸In addition, Strand (2003) proposed a synthesis of the Shapiro-Stiglitz model with an individual wage bargaining framework.

in the informal economy if they so decide. Both categories of workers have infinite lives, and discount future earnings at a constant rate. Capital markets do not exist, so neither group may lend or borrow.

Endowments of skilled and unskilled workers—and thus the economy’s total labor force—are assumed fixed throughout. The number of firms operating in each production sector is also assumed fixed, and is normalized to unity.

5.1.1 Production

The representative firm in the informal sector produces output, Y_I , using labor in quantity L . Supervision and monitoring of workers’ activities are costless, so that employed workers always provide the constant level of effort (normalized to unity, for simplicity) required by their employers (possibly themselves). The production technology is characterized by diminishing returns:

$$Y_I = Y_I(L), \quad Y_I' > 0, \quad Y_I'' < 0. \quad (52)$$

The firm takes wages as given and hires labor up to the point where the cost of the marginal unit of labor just offsets its product. The demand for labor in the informal sector is therefore given by

$$L^d = L^d(w_I), \quad L^{d'} = Y_I''^{-1} < 0, \quad (53)$$

where w_I denotes the market-clearing informal wage.

Production in the formal sector, Y_F , is a function of both skilled and unskilled labor, U and S :

$$Y_F = Y_F(S, U), \quad (54)$$

The production function exhibits positive but decreasing marginal productivity to each labor category. Using a quadratic approximation and dropping constant terms yields

$$Y_F = b_1S + b_2U - b_{11}S^2/2 - b_{22}U^2/2 + b_{12}S \cdot U,$$

where all coefficients are positive. Thus, labor inputs are assumed to be Edgeworth complements, that is, $b_{12} > 0$.⁴⁹

The minimum wage for unskilled labor in the formal sector is set by the government at the level w_m , and firms comply fully with the legislation. In equilibrium, the minimum wage is assumed to be strictly greater than the informal sector market-clearing wage ($w_m > w_I$). This assumption ensures that unskilled workers will look for job opportunities in the formal sector first, thereby avoiding corner solutions.⁵⁰

From the first-order conditions for profit maximization, and normalizing constant terms to zero, the demand functions for unskilled and skilled labor in the formal sector are, respectively,

$$U^d = -(b_{11}w_m + b_{12}w_S)/\Delta, \quad (55)$$

$$S^d = -(b_{22}w_S + b_{12}w_m)/\Delta, \quad (56)$$

where w_S denotes the skilled wage and

$$\Delta = b_{22}b_{11} - b_{12}^2,$$

which is positive as a result of the second-order conditions for profit maximization. Equations (55) and (56) indicate that increases in either wage reduces the demand for both categories of labor.

5.1.2 Effort and Utility

Both categories of workers are risk neutral and dislike effort. The instantaneous utility function is taken to be additively separable and linear in w and e :

$$u(w, e) = w - e,$$

⁴⁹Evidence on the degree of substitutability between skilled and unskilled labor in developing countries was briefly discussed earlier. It suggests that skilled and unskilled workers in the modern sector tend to be Hicks-Allen substitutes, that is, that the output-constant cross elasticities of demand for each category of labor are positive. This, of course, does not preclude the possibility that these two groups of workers be gross complements at the same time.

⁵⁰More generally, it could be assumed that employment in the formal sector provides also a nonpecuniary benefit, such as enhanced social status. As a result of this assumption, in equilibrium the informal sector wage could be either higher or lower than the legal minimum wage—but the wage differential would still need to be less than the nonpecuniary benefit.

where w is the wage earned in the sector of employment and e the level of effort. The effort level provided by unskilled workers in the formal sector and those employed in the informal sector is the same, e_U , and corresponds to the level of effort required by employers. Skilled workers, however, have the possibility to shirk because firms in the formal sector cannot monitor perfectly their on-the-job effort. They supply either the level of effort required from them ($e = e_S$) or zero effort when shirking ($e = 0$). Effort is thus dichotomous.⁵¹ Firms, in equilibrium, set the wage of skilled workers so as to deter them from shirking and induce them to provide the required level of effort, e_S .

5.1.3 Effort Monitoring and the Skilled Wage

The monitoring technology is such that there exists a constant probability (per unit time), v , that a skilled worker engaged in shirking is caught. If detected, the worker is fired and faces two options: remain unemployed in the formal sector, or seek employment in the informal economy.⁵² In general, the choice between these two options depends on a variety of factors, both noneconomic (such as the perceived loss of social status) and economic—for instance, whether informal sector employment has an adverse signaling effect, or whether it is easier to seek a job in the formal sector while being unemployed instead of working in the informal sector. Here the choice is assumed to depend solely on whether the worker's reservation wage is higher or lower than the going wage in the informal sector, adjusted for the disutility of effort.

Let τ denote the exogenous turnover rate per unit of time for skilled workers. Following Shapiro and Stiglitz (1984), arbitrage equations can be used to derive the wage of skilled workers. Let $V_{F_s}^S$ denote the expected lifetime utility of a skilled worker currently employed in the formal sector who chooses to shirk, and let $V_{F_n}^S$ be the expected utility stream if the employed worker is not shirking. The steady-state arbitrage equations are

$$\beta V_{F_s}^S = w_S + (\tau + v)(V_n^S - V_{F_s}^S), \quad (57)$$

⁵¹The assumption that shirking involves a zero level of effort is made for simplicity only.

⁵²In principle, a skilled worker who attaches a nonpecuniary benefit to formal sector employment may also be willing to accept an unskilled position in that sector. This case can be excluded by assuming that an employer whose aim is to minimize frictions among its employees would refrain from hiring skilled workers to fulfill unskilled tasks, while at the same time other skilled workers occupy positions consistent with their qualifications.

$$\beta V_{Fn}^S = w_S - e_S + \tau(V_n^S - V_{Fn}^S), \quad (58)$$

where $\beta > 0$ is the rate at which future earnings are discounted and V_n^S is the expected lifetime utility of a skilled worker who is not employed in the formal sector.

To see how these expressions are derived, consider for instance (58). Following Shapiro and Stiglitz (1984), the expected utility stream derived within an infinitesimally small time interval $(t, t + dt)$ can be defined as

$$V_{Fn}^S = (w_S - e_S)dt + \exp(-\beta dt)[(1 - \tau dt)V_{Fn}^S + \tau dt V_n^S],$$

because τdt measures the probability of a skilled worker leaving the job during the interval $(t, t + dt)$. Approximating the discount factor by $\exp(-\beta dt) \simeq 1 - \beta dt$ and solving for V_{Fn}^S yields

$$V_{Fn}^S = \frac{dt}{1 - (1 - \beta dt)}(w_S - e_S) + \frac{(1 - \beta dt)dt}{1 - (1 - \beta dt)}\tau(V_n^S - V_{Fn}^S).$$

Taking limits as $dt \rightarrow 0$ yields therefore equation (58). Equation (57) can be derived in a similar manner.

Equations (57) and (58) can be interpreted as indicating that the interest rate times the asset value equals the flow benefits (dividends) plus the expected capital gain (or loss). For instance, if a skilled worker shirks, he or she obtains the wage w_S without providing any effort but faces a probability $\tau + v$ of losing his or her job, thus incurring a loss in utility equal to $(V_{Fs}^S - V_n^S)$.

To elicit the appropriate level of effort requires that $V_{Fn}^S \geq V_{Fs}^S$, so that, using equations (57) and (58):

$$w_S \geq \beta V_n^S + \frac{\Lambda e_S}{v}, \quad \Lambda \equiv v + \beta + \tau. \quad (59)$$

Equation (59) is the no-shirking condition (NSC) originally derived by Shapiro and Stiglitz (1984). In equilibrium this condition holds as an equality, and a rational worker will be indifferent between working and not working.

5.2 Equilibrium with Skilled Unemployment

The equilibrium solution of the model requires solving for the informal sector wage and calculating V_n^S , the expected lifetime utility of a skilled worker not

employed in the formal sector, to determine w_S . As indicated before, whether a skilled worker who is not hired in the formal sector takes up employment in the informal economy or enters the unemployment pool depends on whether utility while employed in the informal sector, $w_I - e_U$, is greater or lower than Ω , the reservation wage—which can be viewed here as the imputed value (in wage units) of leisure.

In the spirit of Shapiro and Stiglitz (1984), suppose that skilled workers perceive the transition probabilities into a formal sector job out of informal employment or unemployment as identical and equal to the exogenous hiring rate (or employment probability), a . The steady-state arbitrage equations for a skilled worker who is not employed in the formal sector are therefore equal to

$$\beta V_n^S = \Omega + a(V_F^S - V_n^S), \quad w_I - e_U \leq \Omega, \quad (60)$$

$$\beta V_n^S = w_I - e_U + a(V_F^S - V_n^S), \quad w_I - e_U > \Omega, \quad (61)$$

where it is assumed that, in equilibrium, the no-shirking condition (59) holds with equality so that

$$V_{Fn}^S = V_{Fs}^S = V_F^S.$$

The quantity $a(V_F^S - V_n^S)$ in equations (60) and (61) is equal to the net expected utility gain of being employed in the formal sector, times the probability (per unit time) of being hired in that sector.

Solving equations (58), (60) and (61) simultaneously yields the expected discounted utility of a skilled worker not employed in the formal sector:

$$\beta V_n^S = \frac{\Omega(\beta + \tau)}{\Gamma} + \frac{a}{\Gamma}(w_S - e_S), \quad w_I - e_U \leq \Omega, \quad (62)$$

$$\beta V_n^S = w_I - e_U + \frac{a}{\Gamma}[(w_S - e_S) - (w_I - e_U)], \quad w_I - e_U > \Omega, \quad (63)$$

where $\Gamma = a + \beta + \tau$.

Substituting these results in (59) yields

$$w_S = \Gamma^{-1}[\Omega(\beta + \tau) + a(w_S - e_S)] + \frac{\Lambda e_S}{v}, \quad w_I - e_U \leq \Omega, \quad (64)$$

$$w_S = w_I - e_U + \frac{a}{\Gamma}[(w_S - e_S) - (w_I - e_U)] + \frac{\Lambda e_S}{v}, \quad w_I - e_U > \Omega. \quad (65)$$

In a steady-state equilibrium, flows of skilled workers in and out of employment in the formal sector must be equal. Because all skilled workers who

are not currently employed in the formal sector can be hired by firms in that sector, it must be that

$$\tau S^d = a(N_S - S^d), \quad (66)$$

where N_S denotes the total number of skilled workers available.

Substituting equation (66) for a in equations (64) and (65) yields the steady-state NSC:

$$w_S = \Omega + \frac{e_S}{v} \left\{ \Lambda + \frac{\tau S^d}{N_S - S^d} \right\}, \quad w_I - e_U \leq \Omega, \quad (67)$$

$$w_S - e_S = w_I - e_U + \frac{e_S}{v} \left\{ \Lambda + \frac{\tau S^d}{N_S - S^d} \right\}, \quad w_I - e_U > \Omega. \quad (68)$$

Equations (67) and (68) indicate that to deter skilled workers from shirking, firms must pay a going wage sufficiently high relative to the opportunity cost of effort. The difference between equations (67) and (68) is that in the first case an increase in the informal sector wage—which is such that the condition $w_I - e_U \leq \Omega$ continues to hold—has no effect on the efficiency wage, whereas in the second case it raises the efficiency wage in the exact same proportion. The wage differential between skilled and unskilled workers (adjusted for the disutility of effort) for $w_I - e_U > \Omega$, and the wage level itself for $w_I - e_U \leq \Omega$, depend positively on the required level of effort in the formal sector, the turnover rate, and the discount rate (because future losses incurred if caught shirking are valued less), and negatively on the probability v of being caught shirking.

The market-clearing wage in the informal sector depends on whether skilled workers seek employment in the informal economy or not, that is, on whether $w_I - e_U \leq \Omega$. If skilled workers choose to remain unemployed, the equilibrium wage is determined by

$$N_U - U^d = L^d, \quad w_I - e_U \leq \Omega, \quad (69)$$

where $N_U = N - N_S$ denotes the total number of unskilled workers, and N the overall size of the labor force. By contrast, if skilled workers decide to take up employment in the informal sector, the equilibrium condition of the informal sector labor market is

$$N - (S^d + U^d) = L^d, \quad w_I - e_U > \Omega. \quad (70)$$

Equations (69) and (70) can be solved for w_I as a function of the efficiency wage and the minimum wage, as shown below.

Thus, depending on whether $w_I - e_U \lesseqgtr \Omega$, two equilibria may emerge in the above framework. In both cases, wages and actual employment are determined at the intersection of a wage-setting curve and an employment schedule.

Consider first the case where the informal sector wage—net of the disutility of effort—exceeds the reservation wage ($w_I - e_U > \Omega$), so that skilled workers subject to job rationing opt to take unskilled positions in the informal sector. The equilibrium is consequently characterized by full employment, and is depicted in Figure 1.5. In panel A, the demand curves for both skilled and unskilled workers in the formal sector are inversely related to the efficiency wage. Panel B gives the supply constraint imposed by the given size of the labor force. Using the 45-degree line shown in that quadrant, the demand for unskilled labor in the formal sector can be reported from panel A to panel C. The overall labor supply constraint determines, given the level of employment of skilled workers, the residual supply of labor in both sectors, $N - S^d$. This quantity is also equal to total demand for unskilled workers, the demand curve of which is shown in panel C as $L^d + U^d$. By subtracting vertically from the total demand curve the level of employment of unskilled workers in the formal sector, the demand curve for unskilled labor in the informal sector and the market-clearing wage are obtained. The equilibrium wage for unskilled workers is determined at point C , with total employment in the informal sector measured by the distance CC' . The NSC condition, which is shown in panel D as a positive and concave relation between w_S and w_I , is derived by substituting the demand function for skilled workers, equation (56), in equation (68). Given the informal sector wage (determined at point C), the efficiency wage is determined through the NSC curve at point D .⁵³ Finally, given the NSC, the demand for skilled labor is determined at point A . Because the efficiency wage exceeds the market-clearing wage for skilled labor (which is obtained at point A'), the horizontal distance between A and A' gives the supply of skilled labor in the informal sector.

In the second case, where the informal sector wage (adjusted for the disutility of effort) is too low relative to the reservation wage ($w_I - e_U \leq \Omega$),

⁵³Note that when skilled workers elect to seek employment in the informal sector the no-shirking efficiency wage will depend, through w_I , on the level of employment of both categories of workers in the formal economy. Note also that from equation (68), the informal sector wage is always lower than the efficiency wage.

rationed workers prefer to remain unemployed rather than work in the informal sector. The luxury unemployment equilibrium is illustrated in Figure 1.6, which is constructed essentially in the same manner as Figure 1.5. The NSC, however, is now horizontal—because w_S does not depend on w_I —as shown in panel D of the diagram. The demand for skilled workers is again determined at point A , but skilled unemployment prevails, at the rate $(N_S - S^d)/N_S$.⁵⁴

Thus, in this basic framework, unemployment affects only skilled workers, and can be deemed quasi-voluntary. It is involuntary in the sense that employment opportunities requiring highly qualified workers are demand constrained, and all skilled workers (given the required level of effort) would prefer to earn the efficiency wage. It is also voluntary, however, in the sense that skilled workers could find employment in the informal sector but opt not to work there—because their reservation wage (or, equivalently, the opportunity cost of effort) is too high relative to the going wage.

5.3 Labor Mobility and Unskilled Unemployment

The assumption of wage flexibility and the absence of barriers to entry in the informal sector in the basic framework developed above implies that unemployment of unskilled workers cannot emerge in equilibrium. A worker who is unable to find employment in the formal economy can always be hired in the informal sector at the going wage. These features of the model, as discussed by Agénor (1996), and as noted the first part of this chapter, are well supported by the evidence. In many developing countries, open unemployment tends to affect mostly skilled workers, because unskilled workers (in the absence of unemployment benefits) often cannot afford to remain unemployed for long. Nevertheless, even if it does not exist on a massive scale, open unskilled unemployment can also be observed in a number of developing countries, as documented earlier.

Accordingly, the basic framework is now extended to account for the possibility of unskilled unemployment. The analysis essentially applies the Harris-Todaro mechanism to labor movements within the urban sector, as proposed earlier. This extension allows the model to provide an explanation for wait unemployment, that is, a situation where (high) wage expectations

⁵⁴Because there is no unemployment benefit scheme in the present framework, unemployed workers are implicitly assumed to either turn to a subsistence activity (home production) or to rely on other members of their household for their survival.

by informal sector workers induce them to remain unemployed and queue up for job opportunities in the formal sector.

Suppose that, as before, on-the-job search is excluded and that employers in the formal sector can hire only out of the pool of unemployed workers. Unskilled workers may opt not to take a job in the informal sector and instead remain unemployed if the perceived benefit of doing so is higher than the opportunity cost of waiting. To determine these benefits and costs, suppose that unskilled workers' reservation wage, denoted Ω_U , is lower than the legal minimum wage adjusted for the disutility of effort, so that $w_I - e_U > \Omega_U$. Thus, unskilled workers are always willing to work in the formal sector, if given the opportunity to do so.⁵⁵

Let π denote the perceived employment probability (that is, the perceived hiring rate) for unskilled workers in the formal sector. In analogy with equations (60) and (61), the arbitrage equation for an unskilled worker who decides to remain unemployed is given by

$$\beta V_H = \pi(V_F^U - V_H), \quad (71)$$

where V_F^U measures the discounted utility stream derived by an unskilled worker employed in the formal sector, and V_H the discounted utility stream derived by an unskilled worker who is unemployed. V_F^U is obtained from the arbitrage condition

$$\beta V_F^U = w_m - e_U + \tau_U(V_H - V_F^U), \quad (72)$$

where τ_U denotes the turnover rate for unskilled workers in the formal sector.

Solving equations (71) and (72) implies

$$\beta V_H = \frac{\pi(w_m - e_U)}{\Phi}, \quad \Phi \equiv \tau_U + \beta + \pi. \quad (73)$$

Unskilled workers opt to wait for employment in the formal sector as long as the net expected utility stream of queueing is positive. In equilibrium,

⁵⁵With an informal sector wage (adjusted for the disutility of effort) lower than the reservation wage ($w_I - e_U \leq \Omega_U$), all unskilled workers who are unable to find a job in the formal economy would opt to remain unemployed. This situation would yield an unemployment equilibrium similar to the one described in the previous section. I therefore exclude it and focus instead on the case where $w_I - e_U > \Omega_U$. As shown later, however, this condition is not sufficient to prevent the emergence of wait unemployment of unskilled workers.

the expected utility stream associated with queueing (that is, being openly unemployed), V_H , must be equal to the discounted utility stream associated with employment in the informal sector, V_I . Because employers in the formal sector hire only out of the pool of unemployed workers, the turnover rate in the informal sector is zero in equilibrium. As a result, $V_I = (w_I - e_U)/\beta$. Using equation (73), the migration equilibrium condition, $V_H = V_I$, can be solved to yield

$$w_I = e_U + \beta V_H = \left(\frac{\tau_U + \beta}{\Phi}\right)e_U + \frac{\pi}{\Phi}w_m,$$

which can be rewritten as

$$w_I = e_U + \frac{\pi}{\tau_U + \beta + \pi}(w_m - e_U). \quad (74)$$

Equation (74) shows that in equilibrium, for a given turnover rate, an increase in the minimum wage leads to a less-than-proportional increase in wages in the informal sector.

In a stationary equilibrium, flows of unskilled workers in and out of employment in the formal sector must be equal. Thus, because formal sector firms hire only unemployed workers, an equilibrium condition similar to equation (66) holds:

$$\tau_U U^d = \pi(N_U - U^d - L^d), \quad (75)$$

where $N_U - U^d - L^d$ denotes the total number of unskilled workers openly unemployed in the formal sector.

This condition can be solved for π to give

$$\pi = \frac{\tau_U U^d}{N_U - U^d - L^d}. \quad (76)$$

The effect of w_S on w_I is given by

$$\frac{dw_I}{dw_S} = \frac{(w_m - e_U)(\tau_U + \beta)}{(\tau_U + \beta + \pi)^2} \left(\frac{d\pi}{dw_S}\right).$$

By definition, from (76), (53), and (55), $\pi = \pi(w_S, w_I; w_m)$. Thus, $d\pi/dw_S = (\partial\pi/\partial w_S) + (\partial\pi/\partial w_I)(dw_I/dw_S)$. Substituting this result in the previous equation yields

$$\frac{dw_I}{dw_S} = \frac{\Gamma(\partial\pi/\partial w_S)}{1 - \Gamma(\partial\pi/\partial w_I)}, \quad \Gamma \equiv \frac{(w_m - e_U)(\tau_U + \beta)}{(\tau_U + \beta + \pi)^2}.$$

Using (76), as well as (53) and (55), it can be shown that

$$\text{sg}\left(\frac{\partial\pi}{\partial w_I}\right) = \text{sg}(L^d) < 0, \quad \text{sg}\left(\frac{\partial\pi}{\partial w_S}\right) = \text{sg}\left(\frac{\partial U^d}{\partial w_S}\right) = -b_{12} < 0,$$

Thus, the equilibrium wage in the informal sector is given by

$$w_I = G(w_S; w_m), \quad G_{w_S} < 0.$$

Equation (??) shows that the skilled wage in the formal sector and wages in the informal economy are negatively related.

Given the assumed flexibility of wages in the informal sector, firms in that sector must be on their labor demand curve. Combining equations (53) and (??) yields the equilibrium level of employment in the informal sector:

$$L^d = L^d(w_S; w_m), \quad L^d_{w_S} < 0. \quad (77)$$

Aggregate unskilled unemployment is thus given by⁵⁶

$$N_U - U^d(w_S; w_m) - L^d(w_S; w_m). \quad (78)$$

The case of generalized unemployment is illustrated in Figure 1.7, using a similar construction process as the one used before. It assumes that $w_I - e_U \leq \Omega$, so that, as discussed in the previous section, skilled workers who are unable to find a job in the formal sector choose to remain unemployed. The NSC curve in panel D is thus horizontal, as in Figure 1.6. The relation between the efficiency wage and the informal sector wage, obtained by inverting (??), is denoted ILC in panel D. The equilibrium wage in the informal sector is thus determined at the intersection of the NSC and ILC curves, at point D in that panel. Employment in the informal economy is determined at the intersection between the equilibrium wage, and the labor demand curve in the informal sector (point C). Given the total demand for unskilled labor (in the formal and informal sectors), unskilled unemployment, $N_U - (U^d + L^d)$, is given by the distance $C'C''$ in panel C.

⁵⁶When skilled workers opt to seek employment in the informal sector, equation (78) holds only if it is assumed that unskilled workers are hired first. This assumption is needed to equate the demand for labor in the informal sector with actual employment of unskilled workers in that sector. In practice, of course, it is not necessarily appropriate.

5.4 Increase in the Minimum Wage

As discussed in the first part of this chapter, the impact of changes in minimum wages on employment (as well as relative wages) in developing countries remains controversial. In what follows the effects of an increase in the minimum wage on wage dispersion and employment allocation are examined. This is done first under the assumption that in the initial position of the economy skilled workers who are unable to find a job in the formal sector choose to work in the informal sector—an outcome that requires, as shown earlier, $w_I - e_U > \Omega$.

The appendix shows that an increase in the minimum wage lowers the informal sector wage, because it reduces the demand for unskilled workers in the formal sector and raises labor supply in the informal economy. The efficiency wage also falls, thereby dampening the direct effect of the increase in the minimum wage on the demand for unskilled labor in the formal sector. The net effect on the demand for skilled labor is ambiguous; the direct effect is to reduce the demand for that category of labor, but the indirect effect (associated with the reduction in the efficiency wage) is to increase it. The demand for labor in the informal economy tends to increase, offsetting job losses in the formal sector.⁵⁷ Wage dispersion in the formal sector (that is, the skilled wage–minimum wage differential) tends to fall. However, because $w_m > w_I$ in the initial equilibrium, the differential between wages earned by unskilled workers in the formal and informal sectors rises. In addition, because both the skilled workers' wage and the informal sector wage fall, the net effect on the differential between these two wages is ambiguous.

An important implication of the above analysis is that it is possible for the informal sector wage to fall so much that the inequality $w_I - e_U > \Omega$ is reversed. In that case, skilled workers who were initially employed in the *informal sector* will opt to quit and choose instead to remain openly unemployed. As can be inferred from the results presented in the appendix, the lower the elasticity of labor demand in the informal sector, the larger will be the reduction in the market-clearing wage, and thus the more likely it is that skilled unemployment will emerge.

Suppose now that in the initial equilibrium position skilled workers who

⁵⁷Graphically, as can be inferred from Figure 1.5, the labor demand curves for both skilled and unskilled workers shift to the left in panel A. The labor demand curves in panel C also shift to the right. The *NSC* curve in panel D—which depends on the minimum wage as a result of the labor demand curve—shifts downward.

are unable to find a job in the formal sector choose to remain unemployed (that is, $w_I - e_U \leq \Omega$). Similar conclusions to those obtained in the preceding case can be derived (see the appendix): the increase in the legal minimum wage shifts unskilled employment toward the informal sector and has an ambiguous effect on skilled employment. Again, the skilled wage-minimum wage differential falls, but wage disparity between unskilled workers in the formal and informal sectors rises.

Consider now the extended framework in which unemployment of unskilled workers may emerge in equilibrium and suppose that $w_I - e_U > \Omega$ initially. From equations (??), (77), and (68), written as $w_S = w_S(w_m)$ with $w'_S < 0$, it can readily be established that

$$dw_I/dw_m \leq 0, \quad dL^d/dw_m \leq 0, \quad (79)$$

which shows that an increase in the minimum wage has, in general, an ambiguous effect on the equilibrium levels of employment and wages in the informal sector. On the one hand, the increase in the minimum wage raises the supply of labor in the informal sector, thus exerting downward pressure on wages there and stimulating the demand for labor. On the other, the minimum wage hike (at a given employment rate in the formal sector) leads more workers to queue up for employment in the formal economy. That is, for a given turnover rate in the formal sector, the increase in the minimum wage raises the expected utility stream associated with waiting for a job in the formal economy. But because the higher legislated wage also lowers labor demand in the formal sector, the employment probability (the hiring rate) falls.

Whether the indirect wage effect is large enough to compensate for the direct effect cannot be determined a priori. If the elasticity of unskilled labor demand in the formal sector with respect to a change in the minimum wage is less than unity in absolute value (that is, if $\eta \equiv |w_m h'_U / h_U| < 1$, where the function h_U is defined in the appendix, equation (A6)), the wage effect will dominate and the overall impact of an increase in the minimum wage on employment in the informal sector will be negative. By contrast, if the elasticity η is sufficiently large, employment in the informal sector will increase.

From these results, it can be inferred that an increase in the minimum wage has also an ambiguous effect on unskilled unemployment. If the elasticity of the demand for unskilled labor in the formal sector with respect

to a change in the minimum wage is sufficiently low, unemployment will unambiguously increase.

Alternatively, consider the case where the initial situation is characterized by generalized unemployment (that is, $w_I - e_U \leq \Omega$), so that the skilled workers' wage is independent of w_I . As shown in the appendix, for the formal sector, the results are

$$\frac{dw_S}{dw_m} < 0, \quad \frac{dS^d}{dw_m} < 0, \quad \frac{dU^d}{dw_m} < 0, \quad (80)$$

together with

$$\frac{d(w_S - w_m)}{dw_m} < 0, \quad \frac{d(S^d + U^d)}{dw_m} < 0. \quad (81)$$

Thus, an increase in the minimum wage lowers skilled wages and labor demand, as well as unskilled employment in the formal sector. Wage dispersion in the formal sector (given that $w_S > w_m$ initially) therefore unambiguously falls. Also, aggregate employment in the formal sector $S^d + U^d$ falls, as the increase in skilled employment is not large enough to offset the reduction in unskilled employment. As also shown in the Appendix, the effect of an increase in the minimum wage on employment and wages in the informal sector remains ambiguous; if the minimum wage (adjusted for the disutility of effort) is initially very low, the effect is likely to be positive.

To conclude, it should be noted that there are other (longer-run) effects of minimum wages that are not captured in the above setting. To the extent that these effects are favorable and significant, they could overturn some of the results derived above. For instance, high minimum wages may have positive nutritional effects on workers in poor countries—as emphasized in the efficiency wage models of Bliss and Stern (1978) and Dasgupta and Ray (1986), for instance—and result in strong increases in productivity in the formal sector. High minimum wages may help to raise productivity also by enticing workers in the formal sector to work harder, as in De Fraja (1999), and to change jobs less frequently.⁵⁸ Furthermore, in a longer-run perspective, they may enhance growth prospects and increase welfare if the positive externality associated with human capital accumulation and the incentive to acquire skills has a sufficiently large impact on overall productivity, as noted

⁵⁸A long literature, going back at least to the mid-1940s, has argued that (reasonably) high minimum wages may have a direct *positive* effect on employment in the presence of monopsony factors. See Boal and Ransom (1997) for a discussion.

by Agell and Lommerud (1997), Cahuc and Michel (1996), and Cubitt and Heap (1999).

6 Concluding Remarks

Labor market segmentation, which can be defined as a situation where observationally identical workers receive different wages depending on their sector of employment, is a pervasive feature of developing economies. The purpose of this chapter has been to provide an analytical overview of models aimed at explaining this phenomenon. The first part reviewed some of the salient characteristics of the labor market in developing countries, including institutions and regulations that may lead, directly or indirectly, to segmentation—such as minimum wages, hiring and firing regulations, nonwage labor costs and unemployment benefits, wage indexation provisions, and bargaining structures.

The second part argued that the Harris-Todaro model of rural-urban migration is also a useful device to examine labor mobility between the formal and informal sectors in urban areas. The implications of this assumption were illustrated by examining the wage and employment effects of an adverse labor demand shock in the formal sector. The third part discussed alternative models of wage formation in the urban sector and examined their implications for labor market segmentation. These models include those focusing on efficiency wages, trade union behavior, bilateral bargaining, search behavior, and adverse selection. Efficiency wage theories, in particular, postulate that real wage cuts lower productivity because they may reduce incentives to provide effort, as well as increase incentives to shirk or quit. Thus, efficiency wage theories help explain why firms in the urban formal sector may pay some workers (particularly among the skilled) more than the market-clearing wage. They also predict noncompetitive wage differentials across segments of the labor market, even in the absence of institutional impediments to wage flexibility. If, for instance, efficiency wage considerations apply differentially across sectors (owing to, say, differences in specific training costs), then intersectoral wage gaps that cannot be eliminated by market forces will emerge. Finally, they help explain a relationship between the level of wages and unemployment, in contrast to the relationship between the growth rate of wages and unemployment postulated implied by the Phillips curve.

The fourth part presented a two-sector model with segmented labor mar-

kets and shirking behavior by the skilled, dwelling on the work of Shapiro and Stiglitz (1984). Using a Harris-Todaro migration mechanism, the model explains the emergence of both skilled and unskilled unemployment. The impact of an increase in the minimum wage on open unemployment was examined in this setting. The analysis highlighted the importance of accounting for interactions in the process of wage formation across different segments of the labor market and the role of imperfect labor mobility in assessing the employment and wage effects of minimum wage regulations. In particular, once imperfect mobility of unskilled labor between the formal and informal sectors is accounted for, the effect of an increase in the minimum wage on earnings and employment in the informal sector become ambiguous.

Two important areas for future research on wage formation and labor market segmentation in developing countries are the role of informational frictions in the search process and the determinants of reservation wages. Regarding the latter, little empirical work exists (even in industrial countries), despite the importance of this concept for various theories of the labor market and more generally for modeling labor supply decisions. For instance, under the assumption of a stationary reservation wage, optimal search theory predicts a positive correlation between the duration of unemployment and the reservation wage; that is, workers with higher reservation wages would tend to have longer unemployment spells (see Mortensen and Pissarides (1999)). In one of the few studies available, Prasad (2003) used longitudinal micro data to examine the determination of the reservation wage of unemployed workers in Germany. He found that the availability of unemployment benefits raises the reservation wage and has a strong disincentive effect on the decision of the unemployed to seek employment. By contrast, Hogan (2004), in a study of the United Kingdom, found that previous wages (which may impart inertia in perceived standards of living) have a significant but relatively small effect on reservation wages. He also found no significant effect of unemployment benefits, and a small impact of the local unemployment rate. Studies along these lines are important to examine the determinants of job search in developing countries. As noted earlier, many workers (especially the poorest) cannot afford long periods of job search in these countries, and therefore are forced to accept the first job opportunity that comes their way, even if waiting would have meant finding a better alternative and earning a higher wage.

Appendix

The Impact of a Change in the Minimum Wage

This Appendix begins by establishing the sign of dw_I/dw_m under alternative assumptions about $w_I - e_U$ and perfect and imperfect mobility of the unskilled labor force in the model with shirking.

Consider first the case of perfect mobility, and suppose that initially $w_I - e_U > \Omega$. From equation (70), we have

$$dU^d + dS^d + dL^d = 0. \quad (\text{A1})$$

From equation (53), $dL^d = L^d dw_I$, whereas from equations (55) and (56):

$$dU^d = -\Delta^{-1}(b_{11}dw_m + b_{12}dw_S), \quad (\text{A2})$$

$$dS^d = -\Delta^{-1}(b_{22}dw_S + b_{12}dw_m), \quad (\text{A3})$$

where Δ , as defined in the text, is positive. Substituting the above results in (A1) yields

$$-\Delta^{-1}[(b_{11} + b_{12})dw_m + (b_{22} + b_{12})dw_S] + L^d dw_I = 0. \quad (\text{A4})$$

From equation (68), we have⁵⁹

$$dw_S = dw_I + \gamma dS^d, \quad \gamma \equiv \frac{e_S \tau N_S}{v(N_S - \tilde{S}^d)^2} > 0,$$

or, using equation (A3),

$$dw_S = dw_I - \gamma \Delta^{-1}(b_{22}dw_S + b_{12}dw_m). \quad (\text{A5})$$

Equations (A4) and (A5) can be written as

$$\begin{bmatrix} L^d & -\Delta^{-1}(b_{22} + b_{12}) \\ 1 & -\gamma \Delta^{-1}b_{22} - 1 \end{bmatrix} \begin{bmatrix} dw_I \\ dw_S \end{bmatrix} = \begin{bmatrix} \Delta^{-1}(b_{11} + b_{12}) \\ \gamma \Delta^{-1}b_{12} \end{bmatrix} dw_m,$$

from which it can be shown that

$$dw_I/dw_m < 0, \quad dw_S/dw_m < 0.$$

⁵⁹In evaluating γ as well as ϕ and the C coefficients later, labor demand functions are valued at initial steady-state levels, which are denoted by ‘ $\hat{\cdot}$ ’.

Substituting these results in (53), (A2), and (A3), yields

$$dL^d/dw_m > 0, \quad dU^d/dw_m < 0, \quad dS^d/dw_m = -(dU^d + dL^d)/dw_m \leq 0.$$

Suppose now that initially $w_I - e_U \leq \Omega$. From equation (67), the efficiency wage w_S is thus independent of w_I . Using the implicit function theorem, it can be shown that the minimum wage lowers again the efficiency wage; thus, $w_S = w_S(w_m)$, with $w'_S < 0$. Substituting this result in equation (55) yields

$$U^d = -\Delta^{-1}[b_{11}w_m + b_{12}w_S(w_m)] \equiv h_U(w_m). \quad (\text{A6})$$

I assume in what follows that $h'_U < 0$, so that the net effect of an increase in the minimum wage on the demand for unskilled workers in the formal sector is negative.

Solving equation (69) using (53) and (A6) yields

$$w_I = \frac{N_U - h_U(w_m)}{L^d} \equiv w_I(w_m), \quad w'_I < 0,$$

which shows that an increase in the minimum wage lowers the market-clearing wage in the informal sector. Thus, the results obtained are similar to those derived with $w_I - e_U > \Omega$.

Consider now the model with the Harris-Todaro migration mechanism and suppose that initially $w_I - e_U \leq \Omega$. From equations (56) and (67),

$$w_S = \Omega + \frac{e_S}{v} \left\{ \Lambda + \frac{\tau S^d}{N_S - S^d} \right\},$$

which implies that

$$dw_S = -\phi(b_{22}dw_S + b_{12}dw_m),$$

where $\phi \equiv e_S \tau N_S / v(N_S - \tilde{S}^d)^2 \Delta > 0$. Thus

$$\frac{dw_S}{dw_m} = -\frac{\phi b_{12}}{1 + \phi b_{22}} < 0. \quad (\text{A7})$$

Using equation (55) yields

$$\frac{dU^d}{dw_m} = -\Delta^{-1}[b_{11} + b_{12}\left(\frac{dw_S}{dw_m}\right)],$$

that is, using equation (A7), and given that $\Delta = b_{22}b_{11} - b_{12}^2$,

$$\frac{dU^d}{dw_m} = -\frac{(\phi + \Delta^{-1}b_{11})}{1 + \phi b_{22}} < 0. \quad (\text{A8})$$

Equation (A7) also implies that

$$\frac{d(w_S - w_m)}{dw_m} = -\frac{[1 + \phi(b_{22} + b_{12})]}{1 + \phi b_{22}} < 0.$$

Equation (56) or (??) yields

$$\frac{dS^d}{dw_m} = -\Delta^{-1}[b_{22}\left(\frac{dw_S}{dw_m}\right) + b_{12}],$$

that is, using equation (A7):

$$\frac{dS^d}{dw_m} = -\frac{\Delta^{-1}b_{12}}{1 + \phi b_{22}} < 0. \quad (\text{A9})$$

Combining equations (A8) and (A9) yields

$$\frac{d(S^d + U^d)}{dw_m} = -\frac{\Delta^{-1}(b_{12} + b_{11}) + \phi}{1 + \phi b_{22}} < 0.$$

To calculate dw_I/dw_m , begin by differentiating (74) with respect to w_m . This yields

$$\frac{dw_I}{dw_m} = \frac{\pi}{\tau_U + \beta + \pi} + \Gamma \frac{d\pi}{dw_m}, \quad (\text{A10})$$

where $\Gamma \equiv (w_m - e_U)(\tau_U + \beta)/(\tau_U + \beta + \pi)^2$, as defined previously.

From equation (76), it can also be shown that

$$\frac{d\pi}{dw_m} = -C_1 \frac{dw_I}{dw_m} + C_2 \frac{dw_S}{dw_m} - C_3, \quad (\text{A11})$$

where

$$C_1 = -\frac{\pi L^d}{(N_U - \tilde{U}^d - \tilde{L}^d)} > 0, \quad C_2 = -\frac{b_{12}(N_U - \tilde{L}^d)\pi}{\Delta \tilde{U}^d(N_U - \tilde{U}^d - \tilde{L}^d)} > 0,$$

$$C_3 = -\frac{b_{11}(N_U - \tilde{L}^d)\pi}{\Delta \tilde{U}^d(N_U - \tilde{U}^d - \tilde{L}^d)} > 0.$$

Equations (A10) and (A11) imply

$$\frac{dw_I}{dw_m} = (1 + \Gamma C_1)^{-1} \left\{ \frac{\pi}{\tau_U + \beta + \pi} + \Gamma C_2 \frac{dw_S}{dw_m} - \Gamma C_3 \right\},$$

from which it can be shown that, in the general case, dw_I/dw_m (and thus dL^d/dw_m) is ambiguous. For $w_m - e_U \simeq 0$ initially, then $\Gamma \simeq 0$ and $dw_I/dw_m > 0$.

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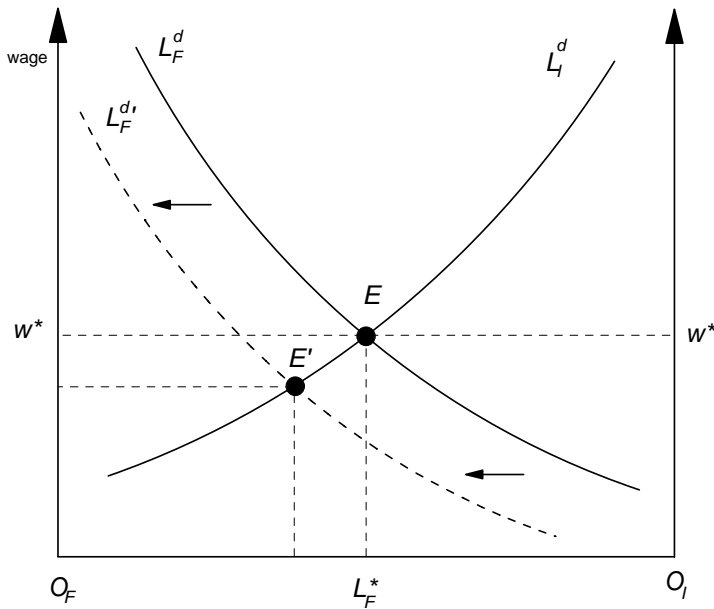
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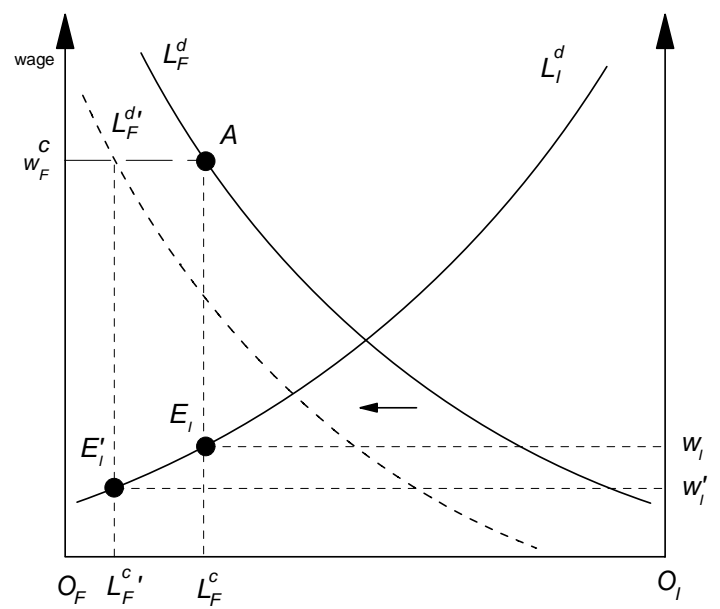
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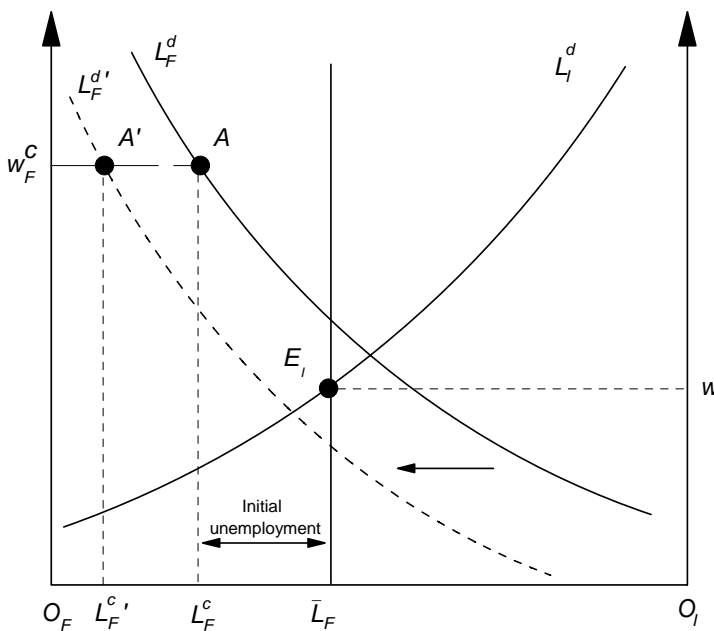
Figure 1.1
Labor Mobility, Sectoral Wage Rigidity, and Adjustment



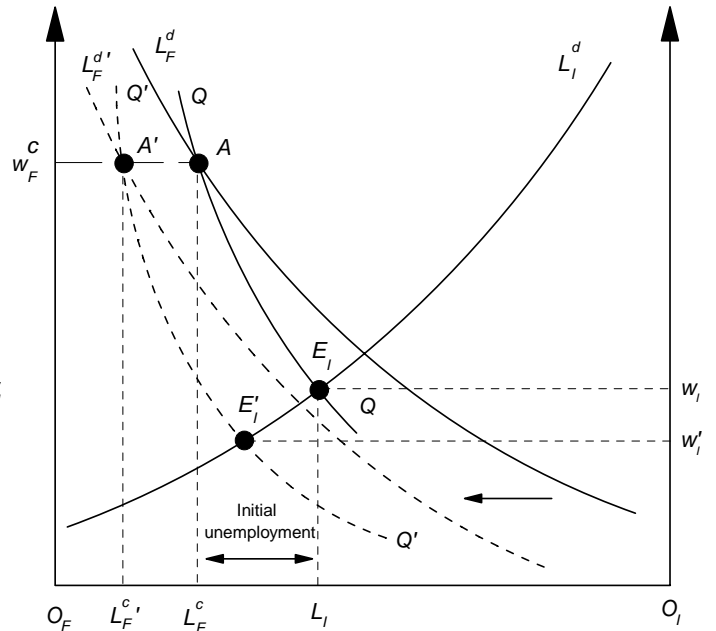
Panel A. Flexible wages and perfect labor mobility



Panel B. Sectoral wage rigidity and perfect labor mobility



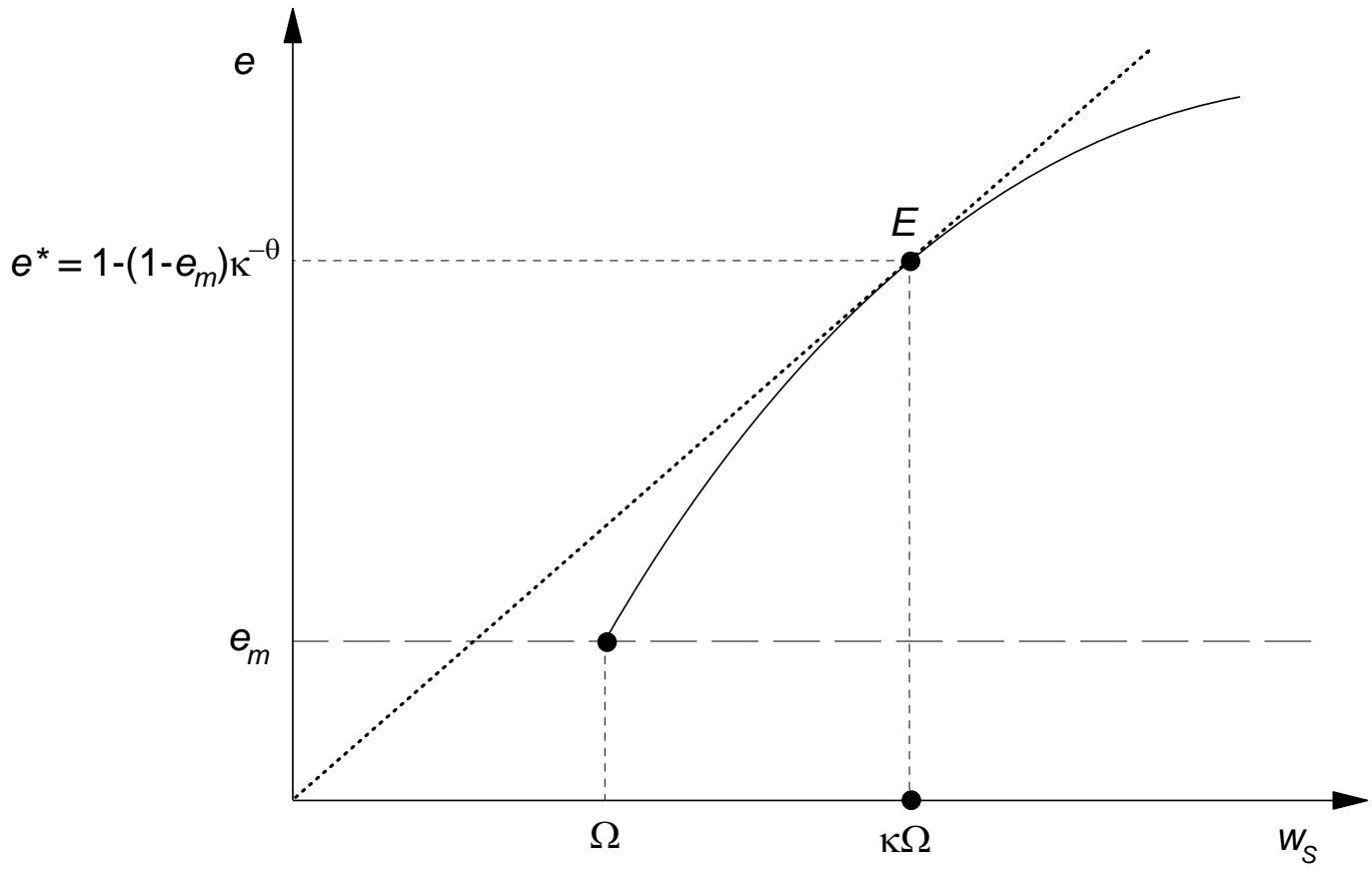
Panel C. Sectoral wage rigidity and no labor mobility



Panel D. Harris-Todaro migration process

Source: Adapted from Agénor and Montiel (1999, p. 73).

Figure 1.2
Productivity and the Efficiency Wage



Source: Adapted from Agénor and Santaella (1998, p. 272).

Figure 1.3
Wages, Unit Labor Costs and the Quit Rate

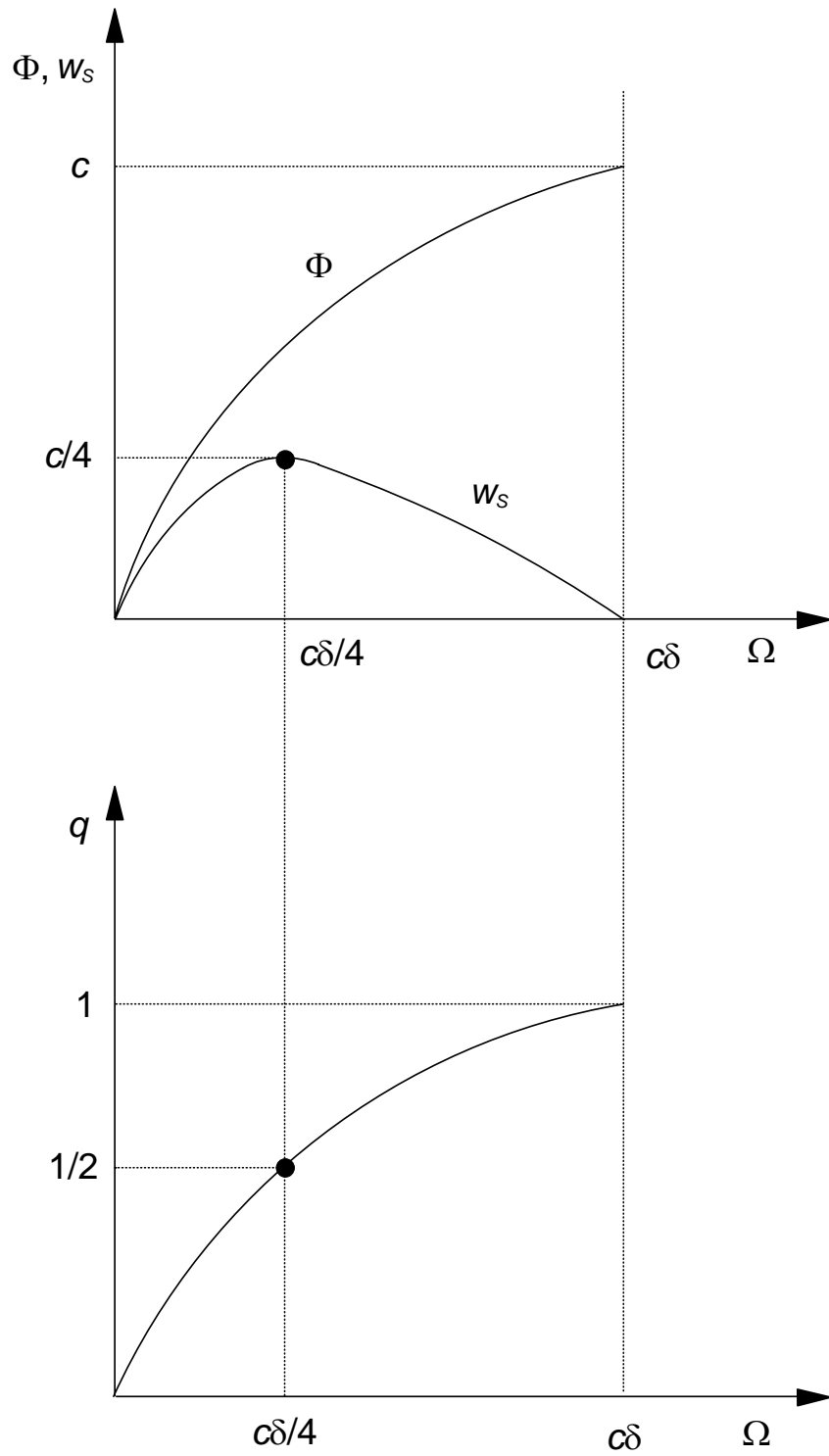
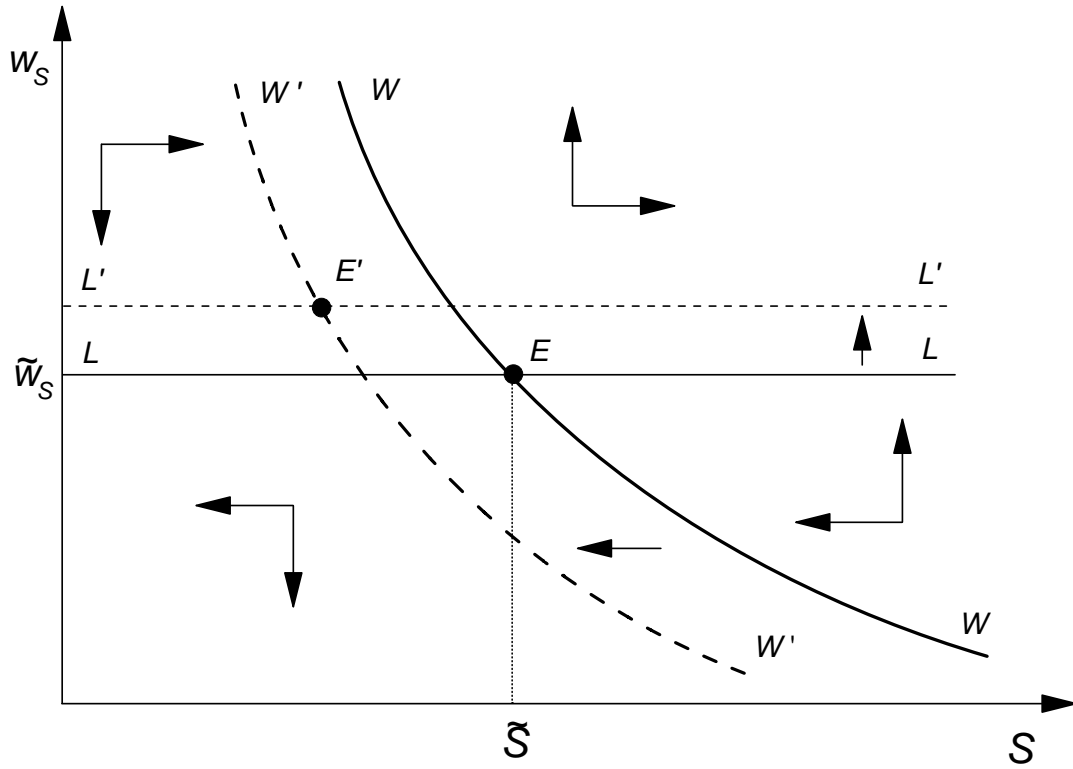


Figure 1.4
Dynamics of Wages and Employment in the Urban Sector



Source: Adapted from Amano (1983, p. 314).

Figure 1.5
Equilibrium with Full Employment

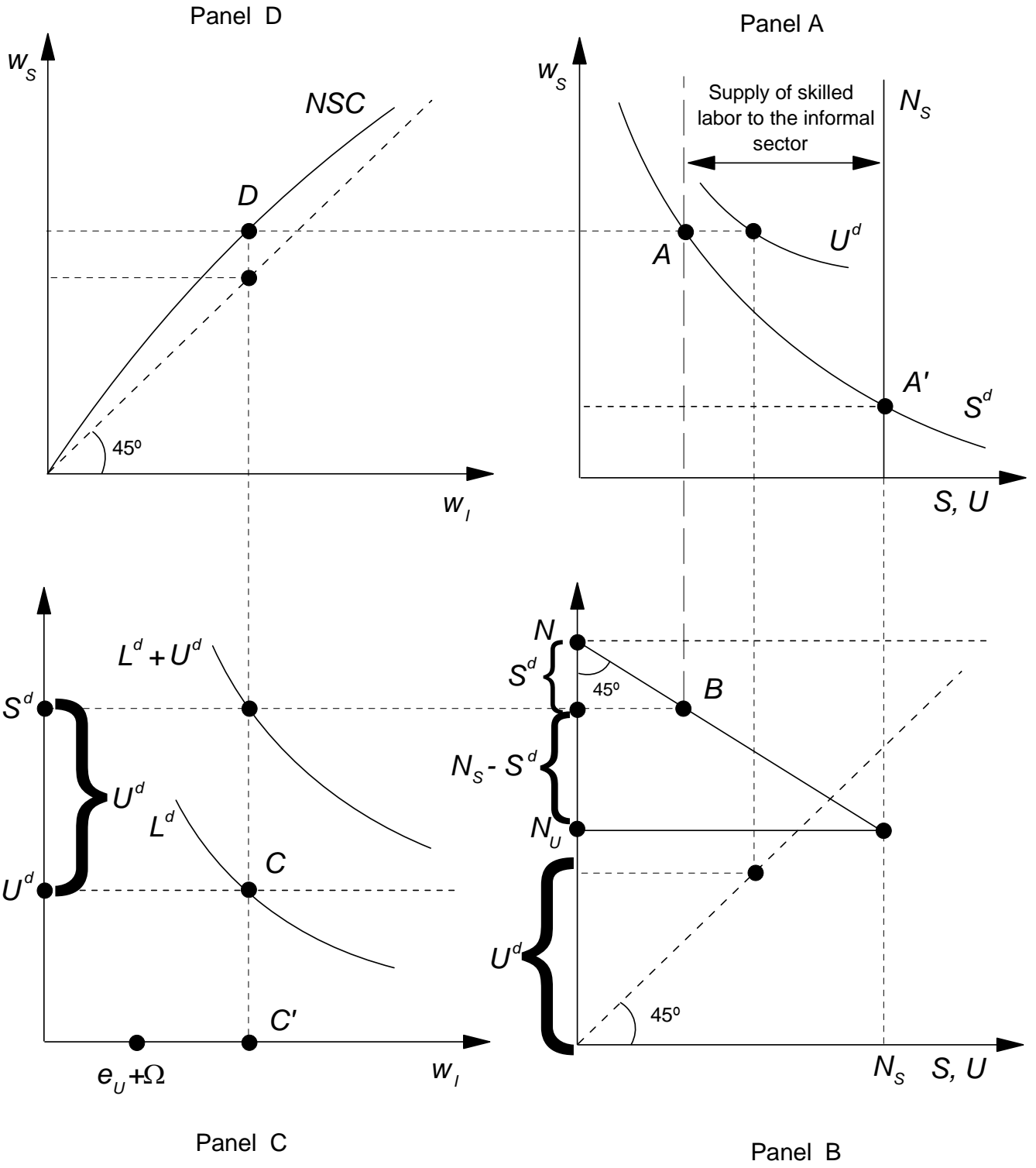


Figure 1.6
Equilibrium with Skilled Unemployment

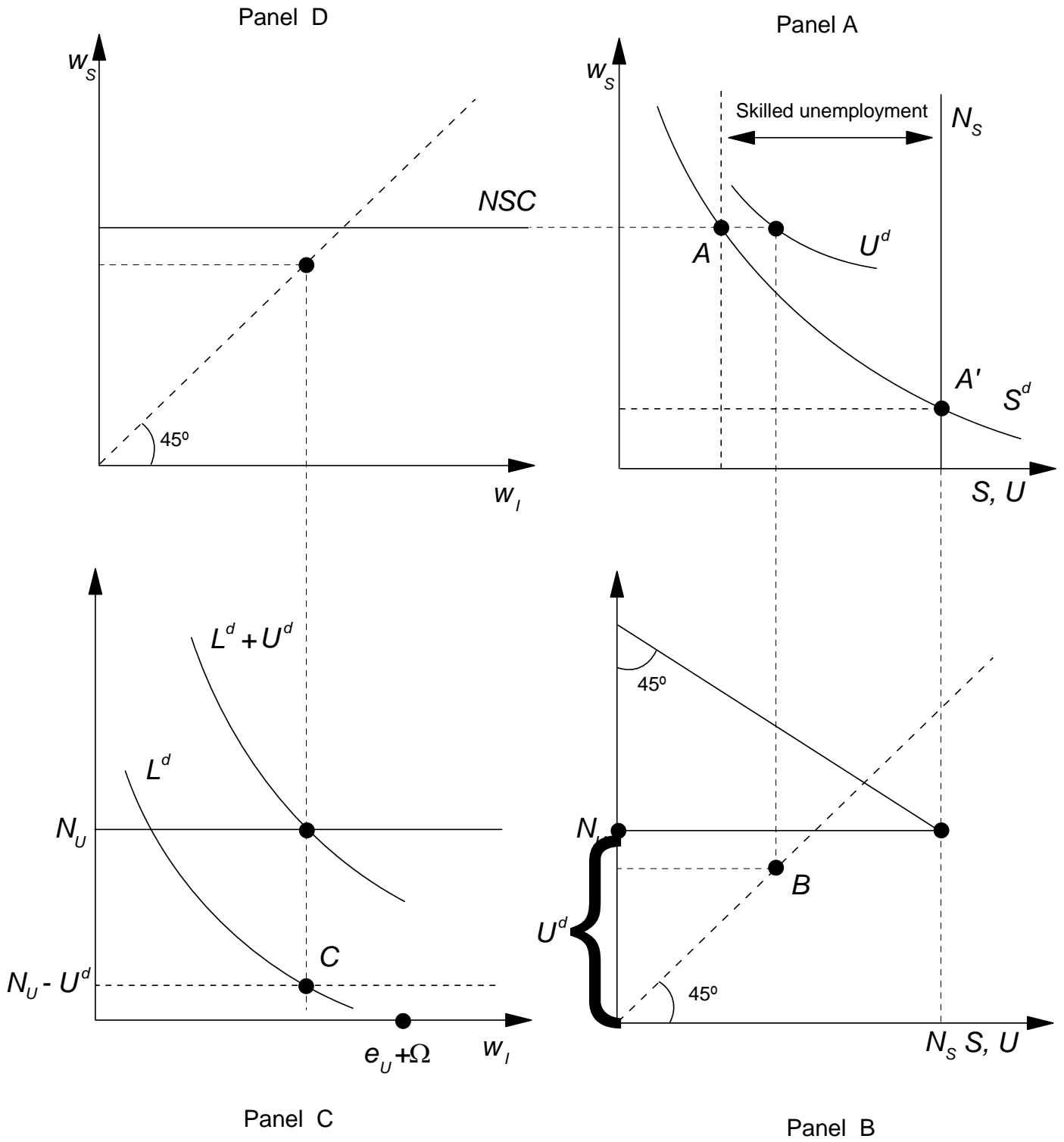


Figure 1.7
Equilibrium with Generalized Unemployment

