

Labor Market Reforms, Growth, and Unemployment in Labor-Exporting MENA Countries

Pierre-Richard Agénor, Mustapha K. Nabli,
Tarik Yousef, and Henning T. Jensen*
The World Bank
Washington DC, 20433

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Abstract

This paper studies the impact of labor market policies on growth and unemployment in labor-exporting MENA countries. The analysis is based on a framework that captures many of the main features of the labor market in these countries. We conduct a variety of policy experiments, including a reduction in payroll taxation, cuts in public sector wages and employment, an increase in employment subsidies, a reduction in trade unions' bargaining power, and a composite reform program. A number of specific policy lessons are drawn from our simulations. Our broad message is that in order to foster growth and job creation in the region, labor market reforms must not be viewed in isolation but rather as a component of a comprehensive program of structural reforms aimed at exploiting policy complementarities.

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1 Introduction

The population of the Middle East and North Africa (MENA) region nearly quadrupled during the second half of the past century. However, although employment growth was relatively strong in the 1970s, it failed to keep pace with the expansion of the labor force during the 1980s and 1990s. As a result, the MENA region recorded some of the highest unemployment rates among developing regions during the 1990s. Recent estimates by the International Labor Organization (2003) indicate that unemployment rates range from about 3 percent in Bahrain to close to 29 percent in Algeria. In 2001, the number of unemployed in the region—mostly the young (or first-time job seekers) and women—was estimated to be over 22 million, or 17.6 percent of the labor force.¹ Based on current trends, prospects are rather bleak; The recent *Arab Human Development Report* published by the United Nations (2002) estimates that population in MENA is likely to continue to grow faster than in any other region between 2000 and 2015 (with a rate of growth of the labor force of about 3 percent) and that unemployment could exceed 25 million by the year 2010.

Low growth (or, in some cases, growth that was not sufficiently labor intensive) was in many ways a “proximate” cause of the rise in unemployment in many MENA countries. Increasing output growth rates (through sustained structural and institutional reforms) is thus essential to reduce unemployment. At the same time, however, there have been various other factors at play. The region’s joblessness is also due in part to insufficiently developed human resources. Despite relatively high expenditures on education—and some impressive gains, measured in terms of the average number of years of education, in countries like Algeria, Egypt, Jordan, and Tunisia, during the period 1975 to 2000—illiteracy rates remain high (especially among women), the quality of education remains poor, and there is a significant mismatch between the skills being created and the needs of modern market economies.² Labor market policies have also introduced severe distortions in the way the

¹In Egypt, for instance, the unemployment rate for women (22.6 percent) is four times higher than that of men, and in Jordan it is almost double. The youth unemployment rate is almost 39 percent in Algeria and exceeds 73 percent in Syria (International Labor Office (2003)).

²See for instance Pissarides (1993) and Pritchett (1999). In countries where wage levels fell in real terms during the 1990s, educated and experienced workers were affected the most, leading to a degradation of skills.

labor market operates. In many countries, government legislation on minimum wages and hiring and firing requirements, government influence on collective bargaining agreements, and employment guarantees in the public sector, have hindered an efficient functioning of the labor market (by encouraging, for instance, “conservative” hiring practices by the private sector, and wait unemployment) and resulted in misallocation of resources and distorted price signals. In normal times, the impact of some of these labor market regulations may well be mitigated by the existence of large informal sectors; however, in periods of significant structural changes, they may hamper the ability of firms to adjust to market incentives in a new environment—thereby becoming binding constraints on growth in output and employment. In such conditions, labor market reforms may be close complements to other reforms aimed at stimulating growth and promoting job creation.

Accordingly, the purpose of this paper is to offer a quantitative analysis of the impact of labor market reforms on growth, real wages, and unemployment in labor-exporting (LE-) MENA countries.³ We begin in Section II with a brief overview of the main features of the labor market in five LE-MENA countries, namely, Algeria, Egypt, Jordan, Morocco, and Tunisia.⁴ Section III presents a quantitative framework that captures many of these features (such as a large informal urban sector, active trade unions, public sector employment, and international labor flows), as well as other important structural characteristics of these countries, such as an unfunded pension system.⁵ Section IV discusses the calibration procedure and parameter values. Section V presents simulation experiments focusing on four types of individual policy shocks: a reduction in payroll taxation on unskilled labor, reductions in public sector wages and workforce, higher employment subsidies to the private sector, and a reduction in the bargaining power of trade

³We focus in this study on LE-MENA countries only because labor market characteristics (as well as other structural economic features) in labor-importing countries of the region differ significantly from those highlighted below. We intend to develop in a companion paper a macroeconomic model that is more appropriate for these countries.

⁴Yemen is also an important labor-exporting country in MENA, but due to the lack of reliable information on the labor market in that country we chose to exclude it from our review.

⁵In principle, a rigorous analysis of pension systems and pension reform would require the use of intergenerational models, such as the OLG-CGE models discussed by Farmer and Wendner (1999). For recent studies of pension reforms along these lines, see Cavalletti and Lubke (2002) and Fehr, Hans, and Erling Ateigum (2002). Our analysis should be viewed as an approximation only.

unions. We also consider a “composite” reform package, involving a cut in payroll taxes and public sector employment, as well as a reduction in unions’ bargaining strength. The extent to which high payroll taxes have tended to discourage the demand for (unskilled) labor has been an important policy issue in MENA countries in general. Our framework allows us to consider the implications of both neutral and non-neutral changes in these taxes, and the various channels through which they affect job creation and unemployment. The concluding section summarizes the main results and draws together the main policy lessons of the analysis. It emphasizes the need for an overall package of reforms, involving not only labor market policies but also other structural measures, to foster growth and employment in LE-MENA countries.

2 Some Basic Facts

The functioning of the labor market in MENA countries in general, and labor-exporting countries in particular, has been reviewed in a number of recent contributions.⁶ In this section we briefly review some of the salient features of this market (as summarized in Figure 1), in order to motivate the specification of the model developed in the next section.

Fundamentally, the labor market in LE-MENA countries can be characterized as consisting of three segments: the rural sector (which continues to employ a sizable proportion of the labor force in many countries); the informal urban sector (characterized mostly by self-employment and a limited proportion of hired labor, a high degree of wage flexibility, low employment security, and no enforcement of labor regulations); and the formal urban sector, where workers are hired on the basis of explicit contracts and the degree of compliance with labor regulations (particularly in the public sector) is relatively high.⁷ The informal sector accounts for a large fraction of

⁶For a more detailed discussion of the features of the labor market in MENA countries, see Hollister and Goldstein (1994), Shaban, Assaad and Al-Qudsi (1-), Said (-), and Pissarides (1993). See Agénor (1996, 2000) for a more general discussion of the features of labor markets in developing countries.

⁷Labor market segmentation refers to a situation where observationally identical workers (that is, workers with similar qualifications) receive different wages depending on their sector of employment. It is a pervasive feature of LE-MENA countries. Segmentation may be induced by various factors: government intervention in the form of minimum wages; trade unions, which may prevent wages from being equalized across sectors by imposing

non-agricultural employment. Because the public sector accounts also for a sizable share of formal employment in many of these countries, the informal sector's share of private sector employment is even higher. In Egypt, for instance, the informal sector has been estimated at over 48 percent of the total employment, and about 65 to 70 percent of private sector employment. In most of LE-MENA countries, the public sector is indeed the dominant employer in the formal urban sector, particularly of educated labor. In fact, public sector employment, when measured as a percentage of nonagricultural employment, is the highest among all developing regions. Governments are often considered as "employers of last resort", especially for those people with higher education levels. In Egypt, for instance, a special job security regulation put in place in the 1960s provided, until the early 1990s, a guarantee of public sector employment for secondary and post-secondary graduates. In countries like Algeria, Jordan, and Tunisia, government employment has played a countercyclical role in recent years, rising significantly during periods of weak economic activity.

Although open unemployment has increased in recent years, underemployment remains far more pervasive.⁸ Open and disguised unemployment (which affects disproportionately the young and women) amount to anywhere between 25 and 60 percent of the labor force in some countries. A large majority of the openly unemployed have secondary or post-secondary degrees; but open unemployment is also becoming more widespread among unskilled workers as well. Part of this unemployment is "queueing" or "wait" unemployment, resulting (as noted earlier in the case of Egypt) from the explicit or implicit guarantees of employment in the public sector provided by some governments in the region. Except in Egypt, unemployment benefit schemes do not exist.

Labor market regulations (namely, minimum wage legislation, and restrictions on hiring and firing) are widespread in the region. In all LE-MENA countries (except Jordan) there is a minimum wage regulation. These wages are set for both public and private sectors. A minimum wage law exists in Morocco but is not highly effective in the private sector—in part because

a premium for their members; and efficiency wages, resulting from nutritional factors, turnover costs or productivity considerations (see Agénor (1996)). The first two sources of segmentation are incorporated in the model presented in the next section.

⁸Published measures of unemployment mostly include unemployed workers looking for jobs in the formal sector, but not underemployed workers in the informal and rural sectors, that is, disguised unemployment.

the high unemployment rate has led the authorities to allow employers some flexibility in hiring workers on a temporary and apprenticeship basis at wages below the minimum rate.⁹ In Tunisia, only 11 percent of the labor force is subject to the minimum wage. In Egypt and Tunisia, compliance with minimum wages is mostly limited to the public sector. Restrictions on layoffs in the formal sector (and often generous severance payments) make firing redundant workers difficult in most LE-MENA countries. They therefore restrict the incentives for firms to hire to begin with, and therefore tend to have an adverse effect on job creation. In practice, however, the enforcement of the law is weak; compliance with existing regulations is limited to the formal sector. Thus, although labor market regulations may be pervasive on paper, their impact is mitigated by the existence of large informal sectors.

Wage determination often departs from market-clearing mechanisms as a result of legal restrictions, the existence of labor unions, and wage-setting behavior by firms. Wages in agriculture and the urban informal sectors tend to be highly and substantially flexible. But while some sectors have flexible wages, others show rigid systems that are subject to institutional constraints. In most countries, civil service pay remains a point of reference for public enterprises and many large firms in the formal private sector. This “leadership effect” of public wage settlements is a source of downward rigidity in wage formation in the private sector. Among non-wage labor costs, social security contributions (which are typically shared between employers and employees) are particularly significant—in some cases amounting to 20-30 percent of the total wage bill.

Unionization rates are relatively low (except in Egypt), and union membership tends to be primarily in the public sector. With the exception of Jordan, where collective bargaining is practically non-existent, labor unions in Algeria, Egypt, Morocco, and Tunisia play a significant role in collective bargaining (see for instance Assad and Commander (1994) for Egypt). The trade union movement is usually highly centralized, except in Morocco; its influence on wage formation is often through the political process (by lobbying to secure increases in minimum wages, for instance) rather than through industrial action, such as strikes and other forms of work disruptions. Finally, *international migration flows* are an important source of foreign exchange

⁹Said (199-) found no close correlation between minimum wages and wages of unskilled labor in Morocco; and during the 1980s, real wages for these workers fell faster than the real legal minimum wage.

and income for all of these countries. These flows play a significant role in the adjustment of the domestic labor market, in ways that we discuss more specifically below.

3 A Formal Framework

We now describe a quantitative framework to analyze the impact of labor market reforms in LE-MENA countries.¹⁰ The model captures many of the structural features of the labor market highlighted in the foregoing discussion. In this section, we briefly summarize the main features of the model (focusing on the production structure, the labor market, and the pension system), with a complete list of equations provided in Appendix A, and variable definitions in Appendix B.

3.1 Production

The composition of output and the structure of the labor market are summarized in Figure 2. The basic distinction on the production side is that between rural and urban sectors. The rural sector (or agriculture) produces only one good, which is sold both on domestic markets and abroad. Urban production includes both formal and informal components; in addition, the formal urban economy is separated between production of a private good and a public good. Land available for production in agriculture is in fixed supply. Gross output in the rural sector, as well as in all other sectors, is given by the sum of value added and intermediate consumption (equation (A1)). Value added is assumed to be produced with a Cobb-Douglas function of a composite factor defined as a function that depends on the number of unskilled rural workers employed in agriculture and the economy-wide stock of public physical capital (equation (A2)). The presence of public physical capital in the production function of the agricultural good is based on the view that a greater availability of public physical capital in the economy (roads, power plants, and the like) improves the productivity of private firms and

¹⁰The model is based on the Integrated Macroeconomic Model for Poverty Analysis (IMMPA) framework developed by Agénor (2003), Agénor, Izquierdo and Fofack (2003), and Agénor, Fernandes, Haddad, and van der Mensbrugghe (2003), modified to account for international labor migration (as in Agénor and El Aynaoui (2003)) and a social security system.

other production units in agriculture, because it facilitates not only trade and domestic commerce but also the production process itself. For simplicity, in what follows we normalize the area of land allocated to production to unity. Agricultural production exhibits decreasing returns to scale in the remaining (composite) input. Allocation of agricultural output to domestic consumption and exports occurs according to a production possibility frontier (equation (A3)).

Value added is given as a function of the number of unskilled workers employed in the informal economy with decreasing returns to scale (equation (A4)). Gross production of public goods and services (or public good, for short) is given by the sum of value added and intermediate consumption (equation (??)). Value added in the public sector is generated by combining skilled and unskilled labor using a CES function (equation (A5)). Employment levels of both categories of workers are treated as exogenous.

Private formal production uses as inputs both skilled and unskilled labor, as well as physical capital. Skilled labor and private physical capital have a higher degree of complementarity (lower degree of substitution) than physical capital and unskilled workers. In order to account explicitly for these differences in the degree of substitutability among inputs, we adopt a nested production structure. At the lowest level, skilled labor and private capital are combined to form the composite input with a low elasticity of substitution between them (equation (A8)). At the second level, this composite input is used together with unskilled labor to form the other composite input (equation (A7)). The elasticity of substitution between the first composite input and unskilled workers is higher than between skilled employment and private capital. The final layer combines the second composite input and the stock of government capital as production inputs (equation (A6)). The urban formal sector allocates its output to exports or the domestic market according to a production possibility frontier (equation (A9)).

3.2 The Labor Market

Unskilled workers in the economy may be employed either in the rural economy, U_R , or in the urban economy, U_U , whereas skilled workers are employed only in the urban economy. We also assume that skilled workers are not employed in the informal economy either—perhaps as a result of signaling considerations, as discussed later.

Agriculture and Internal Migration The demand for labor in the agricultural sector consistent with profit maximization, U_A^d , can be derived as

$$U_A^d = \left(V_A^{1+\frac{\rho_{XA}}{1-\eta_{XA}}} \frac{1-\eta_{XA}}{w_A} \cdot \frac{\beta_{XA}}{\alpha_{XA}^{\rho_{XA}}} \right)^{\frac{1}{1+\rho_{XA}}}, \quad \text{where } w_A = \frac{W_A}{PV_A}, \quad (1)$$

where V_A is value-added in the agricultural sector, W_A denotes the nominal wage, and PV_A the net output price in the agricultural sector.

Nominal wages in agriculture adjust to clear the labor market. Let U_R^s denote labor supply in agriculture; the equilibrium condition is thus given by

$$U_R^s = U_A^d(V_A, \frac{W_A}{PV_A}). \quad (2)$$

The size of the labor force in the rural sector, U_R , is predetermined at any given point in time. Over time, U_R grows at the exogenous population growth rate, g_R , net of worker migration to urban areas, MIG :

$$U_R = U_{R,-1}(1 + g_R) - MIG. \quad (3)$$

The incentives to migrate are taken to depend negatively on the ratio of the average expected *consumption* wage in rural areas to that prevailing in urban areas. Unskilled workers in the urban economy may be employed either in the formal sector, in which case they are paid a minimum wage, W_M , or they can enter the informal economy and receive the market-determined wage in that sector, W_I . When rural workers make the decision to migrate to urban areas, they are uncertain as to which type of job they will be able to get, and therefore weigh wages in each sector by the probability of finding a job in that sector. These probabilities are approximated by prevailing employment ratios. Finally, potential migrants also consider what their expected purchasing power in rural and urban areas will be, depending on whether they stay in the rural sector and consume the “typical” basket of goods of rural households, or migrate and consume the “typical” urban basket of goods.

The expected, unskilled urban real wage, Ew_U , is thus a weighted average of the minimum wage in the formal sector and the going wage in the informal sector, deflated by the urban consumption price index, P_{URB} :

$$Ew_U = \frac{\theta_U W_{M,-1} + (1 - \theta_U) W_{I,-1}}{P_{URB,-1}}, \quad (4)$$

where θ_U is the probability of finding a job in the urban formal sector, measured by the proportion of unskilled workers in the private formal sector, relative to the total number of unskilled urban workers looking for a job in the urban formal sector (net of government employment), in the previous period:

$$\theta_U = \frac{U_{P,-1}}{U_{F,-1}^s - U_{G,-1}}. \quad (5)$$

A similar reasoning is used to calculate the expected rural consumption real wage, Ew_A . Here the employment probability is equal to unity, because workers can always find a job at the going wage. Assuming a one-period lag, we thus have

$$Ew_A = \frac{W_{A,-1}}{P_{R,-1}},$$

where P_R is the rural consumption price index.

The migration function can therefore be specified as

$$MIG = U_{R,-1} \lambda_m \left[\sigma_M \ln \left(\frac{Ew_U}{Ew_A} \right) \right] + (1 - \lambda_m) \frac{U_{R,-1}}{U_{R,-2}} MIG_{-1}, \quad (6)$$

where $0 < \lambda_m < 1$ measures the speed of adjustment and $\sigma_M > 0$ measures the elasticity of migration flows with respect to expected wages. This specification assumes that costs associated with migration or other frictions may delay the migration process, introducing persistence in migration flows.

The Urban Sector The public sector employs an exogenous number of unskilled workers, U_G , at the nominal wage rate W_{UG} , whereas the demand for unskilled labor by the formal private sector is determined by firms' profit maximization subject to the given minimum wage, W_M . Both wages are assumed to be fully indexed on the urban formal price index, P_F :

$$W_{UG} = \omega_{UG} P_F, \quad W_M = \omega_M P_F, \quad (7)$$

where ω_M and ω_{UG} measure real wages in constant terms.

Labor demand by the formal private sector is determined by firms' profit maximization. We assume also that firms pay a payroll tax, at the rate $0 < ptax_U < 1$ for unskilled workers, that is proportional to the wage bill, $W_M U_P$, and they receive a nominal employment subsidy on unskilled labor

of $ES_U \leq W_M$ per worker. Unskilled labor demand by the private sector is thus given by

$$U_P^d = T_1 \left(\frac{PT_1}{(1 + ptax_U)W_M - ES_U} \frac{\beta_{XP1}}{\alpha_{XP1}^{\rho_{XP1}}} \right)^{\sigma_{XP1}}. \quad (8)$$

We assume that, as a result of relocation and congestion costs, mobility of the unskilled labor force between the formal and the informal sectors is imperfect. Migration flows are determined by expected income opportunities. Specifically, the supply of unskilled workers in the formal sector (including public sector workers), U_F^s , is assumed to change gradually over time as a function of the expected wage differential across sectors, measured in real terms. Wage and employment prospects are formed on the basis of prevailing conditions in the labor market. Because there is no job turnover in the public sector, the expected nominal wage in the formal economy is equal to the minimum wage weighted by the probability of being hired in the Private sector. Assuming that hiring in that sector is random, this probability can be approximated by the ratio of currently employed workers to those seeking employment at the previous period, $U_{P,-1}^d / (U_{F,-1}^s - U_{G,-1})$. The expected nominal wage in the informal economy, W_I , is simply the going wage, because there are no barriers to entry in that sector. Assuming a one-period lag, the supply of unskilled workers in the formal sector thus evolves over time according to

$$\frac{U_F^s}{U_{F,-1}^s} = \left\{ \frac{U_{P,-1}^d}{U_{F,-1}^s - U_{G,-1}} \left(\frac{W_{M,-1}}{W_{I,-1}} \right) \right\}^{\beta_F}, \quad \beta_F > 0, \quad (9)$$

where β_F is an elasticity. The rate of unskilled unemployment in the formal sector, $UNEMP_U$, is thus given by

$$UNEMP_U = 1 - \frac{(U_G + U_P^d)}{U_F^s}. \quad (10)$$

From (A4), the demand for labor in the informal sector can be derived as

$$U_I^d = \beta_{XI}(V_I/w_I), \quad (11)$$

where V_I is the value added in the informal sector and w_I is the product wage given by $w_I = W_I/PV_I$, with PV_I denoting the price of value added in the informal sector.

The supply of labor in the informal economy, U_I^s , is obtained by subtracting from the urban unskilled labor force, U_U , the quantity $U_F^s + U_G$:

$$U_I^s = U_U - U_F^s. \quad (12)$$

The informal labor market clears continuously, so that $U_I^d = U_I^s$. From equations (11) and (12), the equilibrium nominal wage is thus given by

$$W_I = \beta_{XI} \left(\frac{PV_I V_I}{U_I^s} \right). \quad (13)$$

The urban unskilled labor supply, U_U , grows as a result of “natural” urban population growth and migration of unskilled labor from the rural economy, as discussed earlier. Moreover, some urban unskilled workers, SKL , do acquire skills and leave the unskilled labor force to increase the supply of skilled labor in the economy. We make the additional assumption that individuals are born unskilled, and therefore natural urban population growth (not resulting from migration or skills acquisition factors) is represented by urban unskilled population growth only, at the exogenous (gross) rate g_U . Finally, there are international migrations, the flow of which is measured by $IMIG$, and retirement from the formal sector labor force, measured by $\delta_{NP}^U(U_{P,-1}^d + U_G)$, which are defined below. Thus, the size of the urban unskilled labor supply evolves according to

$$U_U = U_{U,-1}(1 + g_U) + MIG - SKL - IMIG - \delta_{NP}^U(U_{P,-1}^d + U_{G,-1}). \quad (14)$$

The employment levels of both skilled and unskilled workers in the public sector are taken as exogenous. Given that some workers retire in every period, we have

$$U_G = (1 + g_{UG} - \delta_{NP}^U)U_{G,-1},$$

where $g_{UG} > 0$ is the exogenous growth rate of the unskilled labor force in the public sector.

The nominal wage that skilled workers earn, W_{SG} , is also indexed on the urban formal consumption price index:

$$W_{SG} = \omega_{SG} P_F, \quad (15)$$

where ω_{SG} is an exogenous real wage level.

To determine wages and employment for skilled labor, we use the “right to manage” approach, in which firms bargain over wages with a (representative)

trade union, and set unilaterally the level of employment. In addition, we assume that private urban firms pay a payroll tax on for skilled labor, at the rate $0 < ptax_S < 1$, which is proportional to the wage bill, $W_S S_P$, and they receive a nominal employment subsidy on unskilled labor of $ES_S \leq W_S$ per worker. From (A8), the demand for skilled labor is given by

$$S_P^d = T_2 \kappa_S \left(\frac{PT_2}{(1 + ptax_S)W_S - ES_S} \cdot \frac{\beta_{XP2}}{\alpha_{XP2}^{\rho_{XP2}}} \right)^{\sigma_{XP2}}, \quad (16)$$

Following Booth (1995, pp. 124-26) and Layard, Nickell, and Jackman (1991, pp. 100-3), the nominal wage for skilled labor in the private sector, W_S , is determined as follows. Assume that all private sector firms are unionized, or equivalently that all workers belong to a single (representative) union. Let Ω_S denote the union reservation wage. Let $PROF_P$ denote firms' profits, as defined in equation (A65). Under the Nash bargaining approach, the bargain is the one that maximizes

$$N_S = [S_P^d (W_S - \Omega_S)]^\nu PROF_P, \quad (17)$$

where ν is a measure of the trade union's bargaining power. The bargained wage must therefore satisfy the first-order condition

$$\frac{\partial \ln N_S}{\partial W_S} = \frac{\nu \partial S_P^d}{S_P^d \partial W_S} + \frac{\nu}{W_S - \Omega_S} - \frac{S_P^d}{PROF_P} = 0,$$

because $\partial PROF_P / \partial W_S = -S_P^d$ by the envelope theorem (because each firm will choose employment *ex post* such that W_S is equal to the marginal value product of skilled labor), and with S_P^d given by equation (16). This yields

$$\frac{\nu W_S}{W_S - \Omega_S} = \nu \varepsilon_{S_P^d / W_S} + \frac{W_S S_P^d}{PROF_P}, \quad (18)$$

where $\varepsilon_{S_P^d / W_S} = -(\partial S_P^d / \partial W_S)(W_S / S_P^d)$ is the wage elasticity of the demand for skilled labor. The term on the left-hand side of this expression measures the proportional marginal benefit to the bargain from the proportional increase in the skilled wage. The benefit associated with a wage increase incurs only to the union, so it is weighted by the union's bargaining power, ν . The first term on the right-hand side is the union's proportional marginal (the percentage reduction in employment due to the proportional increase in the wage) weighted by the union's bargaining power. The second term on the

right-hand side represents the firm's proportional marginal cost. Thus, condition (18) indicates therefore that the bargained wage is set such that the proportional marginal benefits to both parties from a unit increase in wages is exactly equal to the proportional marginal cost to each party, weighted by each party's bargaining strength.

We also assume that the union's reservation wage, Ω_S , is assumed to be related positively to skilled wages in the public sector, W_{SG} , and negatively to the skilled unemployment rate, $UNEMP_S$. Wage-setting in the public sector is assumed to play a signaling role to 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 and boost employment. The above expression can thus be rewritten as

$$\frac{W_S}{W_S - \Omega_0 UNEMP_S^{-\phi_1} W_{SG}^{\phi_2}} - \varepsilon_{S_P^d/W_S} - \frac{W_S S_P^d}{\nu PROF_P} = 0,$$

where $\Omega_0 > 0$, and $UNEMP_S$ is defined below. It can be established (using the implicit function theorem) that lower unemployment, higher public sector wages, or an increase in the bargaining strength of the union, raise the level of wages in the private sector.

Given that firms set wages and are on their labor demand curve, open skilled unemployment may emerge. The rate of skilled unemployment, denoted $UNEMP_S$, is given by the ratio of skilled workers who are not employed either by the private or the public sector, divided by the total (urban) population of skilled workers:

$$UNEMP_S = \frac{S - S_G^T - S_P^d}{S}, \quad (19)$$

where S_G^T is the *total* number of skilled workers in the public sector, engaged in both the production of public services, S_G , and education, S_G^E (see below):

$$S_G^T = S_G + S_G^E, \quad (20)$$

which grows over time according to

$$S_G^T = (1 + g_{SG} - \delta_{NP}^S) S_{G,-1}^T, \quad (21)$$

where $g_{SG} > 0$ is the exogenous growth rate of the skilled labor force in the public sector.

We assume that skilled workers who are unable to find a job in the formal economy opt to remain open unemployed, instead of entering the informal economy (in contrast to unskilled workers), perhaps because of adverse signaling effects.

The evolution of the skilled labor force depends on the rate at which unskilled workers acquire skills:

$$S = (1 - \delta_S)S_{-1} + SKL - \delta_{NP}^S(S_{P,-1}^d + S_{G,-1}^T), \quad (22)$$

where $0 < \delta_S < 1$ is the rate of “depreciation” or “de-skilling” of the skilled labor force.

Skills Acquisition The acquisition of skills by unskilled workers takes place through an education system operated by the public sector. Specifically, the flow of unskilled workers who become skilled, SKL , is taken to be a CES function of the “effective” number of teachers in the public sector, S_G^E , and the government stock of capital in education, K_E :

$$SKL = [\beta_E(\varphi S_G^E)^{-\rho_E} + (1 - \beta_E)K_E^{-\rho_E}]^{-\frac{1}{\rho_E}}, \quad (23)$$

where φ measures the productivity of public workers engaged in providing education. φ is assumed to depend on the relative wage of skilled workers in the public sector, W_{SG} , relative to the expected wage for that same category of labor in the private sector, which (in the absence of unemployment benefits) is given by one minus the unemployment rate, $1 - UNEMP_S$, times the going wage, W_S . Using the effort function derived by Agénor and Aizenman (1999) yields:

$$\varphi = 1 - \varphi_m \left[\frac{(1 - UNEMP_{S,-1})W_{S,-1}}{W_{SG,-1}} \right]^{\delta_E}, \quad \delta_E > 0, \quad (24)$$

and where $0 < \varphi_m < 1$ denotes the “minimum” level of effort.¹¹

¹¹Note that we do not explain endogenously the allocation of unskilled workers’ time between production and learning—an important trade-off from the individual’s point of view. Allocating more time to learning reduces the individual’s current labor income, but enhances his (or her) human capital, thereby increasing its earnings in the future. To the extent that public capital in education enters as an input to the human capital production function, as in (23), it would also affect private decisions to accumulate human capital. See for instance Glomm and Ravikumar (1998) for a formal model of the labor-learning choice, which emphasizes, however, *flow* spending on education.

International Labor Migration As noted earlier, international migrations are an important feature of the labor market in LE-MENA countries. We assume here that migration involves only unskilled workers, and that potential migrants are in the urban sector (as captured in (14)). Moreover, international migration flows are taken to be determined by two factors: the prevailing unskilled unemployment rate in the formal urban sector, and the expected urban real wage for unskilled labor, Ew_U , given by (4), relative to the expected foreign wage measured in terms of the urban formal price index, Ew_{FOR} , defined as

$$Ew_{FOR} = \frac{ER \cdot W_{FOR,-1}}{P_{F,-1}},$$

with W_{FOR} denoting the foreign wage measured in foreign-currency terms, assumed exogenous. Adopting a specification similar to (6), the migration function is specified as

$$IMIG = U_{U,-1} \lambda_{im} \left[\sigma_{IM} \ln \left(\frac{Ew_{FOR}}{Ew_U} \right) \right] + (1 - \lambda_{im}) \frac{U_{U,-1}}{U_{U,-2}} IMIG_{-1}, \quad (25)$$

where $0 < \lambda_{im} < 1$ measures the speed of adjustment, and $\sigma_{IM} > 0$ the partial elasticity of migration flows with respect to expected wages. Again, costs associated with migration (such as relocation costs) are assumed to introduce some degree of persistence. Remittances associated with international migration flows of unskilled labor are assumed to benefit unskilled households in the urban formal and informal sectors.¹²

3.3 The Pay-as-you-go Pension System

We assume that there is a pay-as-you-go pension system, whose current outlays to pensioners (retired workers in the urban formal sector, both public and private), given by $PENSIONS$, are financed by payroll taxes on workers in the private formal sector and transfers from the government, $TRSOC$:

$$PENSIONS = ptax_U U_P^d + ptax_S S_P^d + TRSOC. \quad (26)$$

Total pension outlays are given by the product of an average benefit, $BENEF$, which is fully indexed (with a one-period lag) on the relevant price index for the urban formal sector, P_F :

¹²See Glystos (2002, 2003) for a discussion of the macroeconomic effects of foreign remittances in several MENA countries, including Egypt, Jordan, Morocco, and Tunisia.

$$BENEF = BENEF_{-1}(1 + \Delta \ln P_{F,-1}). \quad (27)$$

The number of pensioners at the current period, $NUMPEN$, consists of last period's "stock" (adjusted for a fixed mortality rate), plus a flow of skilled and unskilled workers retiring in each period, $NEWPEN$:

$$NUMPEN = (1 - \delta_N)NUMPEN_{-1} + NEWPEN,$$

where δ_N is the proportion of pensioners who die in each period. The number of new pensioners is defined as

$$NEWPEN = \delta_{NP}^U(U_{P,-1}^d + U_{G,-1}) + \delta_{NP}^S(S_{P,-1}^d + S_{G,-1}^T).$$

This equation indicates that at the beginning of each period a fixed fraction δ_{NP}^U (respectively δ_{NP}^S) of unskilled (respectively skilled) workers retires from the formal sector labor force.

Thus, total pension outlays are given by

$$PENSIONS = BENEF \cdot NUMPEN. \quad (28)$$

If we assume that the pension fund cannot borrow directly from the public, and that its accounts must be balanced, government transfers are determined from (26), given (28):

$$TRSOC = PENSIONS - ptax_U U_P^d - ptax_S S_P^d, \quad (29)$$

Alternatively, if government transfers are considered fixed, the budget constraint can be used to determine the pension benefit, $BENEF$, after dropping (27):

$$BENEF = \frac{ptax_U U_P^d + ptax_S S_P^d + TRSOC}{NUMPEN}.$$

3.4 Other Model Features

Components of *supply* and *demand* are described by equations (A38) to (A49). Both the informal and public sector goods are nontraded. Total supply in each sector is thus equal to gross production (equations (A40) and (A41)). Agricultural and private formal urban goods, by contrast, compete with imported goods. The supply of the composite good for each of these

sectors consists of a combination of imports and domestically produced goods (equations (A39) and (A42)).

For the agricultural and informal sectors, aggregate demand consists of intermediate consumption and demand for final consumption (by both the government and the private sector), whereas aggregate demand for the public and private goods consists not only of intermediate consumption and final consumption but also of investment demand (equations (A43), (A44), (A45), and (A46)). Total demand for intermediate consumption of any good is the sum of the share of this good in the consumption of other sectors (equation (A38)). Government expenditure on any good (except informal good) is equal to the share of this good in total real government expenditure (equation (A48)). Final consumption for each production sector is the summation across all categories of households of nominal consumption of this sector's good deflated by the demand price of this good (equation (A47)). Total private investment by private urban firms consists of purchases of both public and urban formal private goods and services (equation (A49)).

Regarding *external trade*, private firms in the urban formal sector allocate their output to exports or the domestic market according to a production possibility frontier (equation (A9)). Allocation of agricultural output to domestic consumption and exports occurs according to a production possibility frontier (equation (A3)). Efficiency conditions require that firms equate this relative price to the opportunity cost in production (equations (A50)). Imports compete with domestic goods in the agricultural sector as well as in the private formal sector. The demand for imported vs. domestic agricultural and private urban goods will be a function of relative domestic and import prices, and the elasticity of substitution between these goods (equations (A51)).

Prices are defined in equations (A52) to (A63). The net or value added price of output is given by the gross price net of indirect taxes, less the cost of intermediate inputs (equation (A52)). The world prices of imported and exported goods are taken to be exogenously given. The domestic currency price of these goods is obtained by adjusting the world price by the exchange rate, with import prices also adjusted by the tariff rate (equations (A53) and (A54)). Because the transformation function between exports and domestic sales of the agricultural and urban private good is linear homogeneous, the domestic sales prices are derived from the sum of export and domestic expenditure on agricultural and private goods divided by the quantity produced of these goods (equation (A55)). For the informal and public sectors,

the composite price is equal to the domestic market price, which is in turn equal to the output price (equation (A57)). For the agricultural sector and private urban production, the substitution function between imports and domestic goods is also linearly homogeneous, and the composite market price is determined accordingly by the expenditure identity (equation (A56)). The nested production function of private formal urban goods is also linearly homogeneous; prices of the composite inputs are derived in similar fashion (equations (A61) and (A62)). The price of capital is constructed as using the investment expenditure identity, which involves public good and private-formal urban good (equation (A63)). Finally, the consumption price indices for the rural sector, urban unskilled and skilled workers are given as the sum of relative weights of different goods in consumption times their composite good price (equations (A58), (A59), and (A60)).

Profits and income are defined in (A64) to (A71). Firms' profits in the informal and agricultural sectors are defined as revenue minus total labor costs (equation (A64)). Profits of private-urban sector firms account for salaries paid to both skilled and unskilled workers (equation (A65)). Firms' income in the agricultural and the informal sector is equal to their profits (equation (A66)). But firms' income in the formal urban economy is equal to their profits minus corporate taxes and interest payments on foreign loans (equation (A67)). Household income is based on the return to labor (salaries), distributed profits, and transfers. Households are defined according to both labor categories and their sector of location. There are four categories of households: rural, urban informal, urban formal, and capitalists. The rural household comprises all workers employed in agriculture. The urban informal household consists of workers in the informal sector. The urban formal household consists of those employed in the formal sector (skilled and unskilled). There is a capitalist-rentier household, whose income comes from firms' earnings in the formal private sector. We further assume that households in agricultural sector and in the informal urban economy own the firms in which they are employed—an assumption that captures the fact that firms in these sectors tend indeed to be small, family-owned enterprises. Income of the agricultural sector households is equal to the sum of transfers from the government and production revenue (equation (A68)). Income of the informal sector households also includes the fraction of foreign-currency value of the flow of remittances from (unskilled) workers employed abroad (equation (A69)). Income of the urban formal household depends on government transfers and salaries, foreign remittances, and pension payments (equation

(A70)). Firms provide no source of income, because these groups do not own the production units in which they are employed. Firms in the private urban sector retain a portion of their after-tax earnings for investment financing purposes and transfer the remainder to capitalist households. Thus, capitalist-rentier households' income is the sum of transfer payments and retained income (equation (A71)).

Consumption, savings, and investment are described in equations (A72) to (A75). Each category of household saves a constant fraction of its disposable income, which is equal to total income minus income tax payment (equation (A72)). The portion of disposable income that is not saved is allocated to consumption (equation (A73)). The accumulation of capital over time depends on the flow level of investment and the depreciation rate of capital from the previous period (equation (A75)). The aggregate identity between savings and investment implies that total investment must be equal to total savings, equal to firms' after-tax retained earnings, total after-tax household savings, government savings, and foreign borrowing by firms and the government (equation (A74)). In the simulations, this equation is solved residually either for the level of private investment (in which case the model is "savings driven") or for the savings rate of capitalists-rentiers (in which case the model is "investment driven.")

The *government* side is described in equations (A76) to (A81). Government expenditures consist of government consumption, which only has demand-side effects, and public investment, which has both demand- and supply-side effects. Public investment consists of investment in infrastructure, education, and health. We define investment in infrastructure as the expenditure affecting the accumulation of public infrastructure capital, which includes public assets such as roads, power plants and railroads. Investment in education affects the stock of public education capital, which consists of assets such as school buildings and other infrastructure affecting skills acquisition, but does not represent human capital. In a similar fashion, investment in health adds to the stock of public assets such as hospitals and other government infrastructure affecting health. All value added in the production of public goods is distributed as wages. Thus, the current fiscal deficit is equal to tax revenue minus transfer payments, pensions transfers from the government, total current expenditure on goods and services, wage expenditure, and interest payments on foreign public loans (equation (A76)). Net government saving is equal to minus the *overall* government budget deficit and is obtained by adding public investment expenditure to the current fis-

cal deficit (equation (A77)). Total tax revenues consist of revenue generated by import tariffs, sales taxes, income taxes (on both households and firms in the urban private sector), and payroll taxes (equation (A78)). Government investment is the sum of investment in infrastructure, investment in health, and investment in education, which are all considered exogenous policy variables (equation (A79)). Government investment increases the stock of public capital in either infrastructure, education or health. The stock of public capital in education includes items such as school buildings, whereas the stock of health capital includes hospitals and the like. Infrastructure capital includes all other stocks of public property, such as roads, railroads, and power plants. Accumulation of each type of capital is equal to the sum of the capital stock from previous period and deflated investment in the current period minus depreciated capital stock from the previous period (equation (A80)). Because we assume that only the private urban good is used for capital accumulation, we deflate nominal investment by the demand price for private goods. Infrastructure and health capital affect the production process in the private sector as they both combine to produce the stock of government capital (equation (A81)).

Finally, the balance of payments is defined in equations (A87) to (A89). The external constraint implies that any current account surplus (or deficit) must be compensated by a net flow of foreign capital, given by the sum of changes in foreign loans made to the government and to private firms (equation (A87)). The flow of remittances is equal to the foreign wage measured in foreign-currency terms times the stock of domestic workers abroad (equation (A88)). The stock of domestic workers abroad is the sum of new immigrants and the stock of domestic workers abroad from the previous period, minus attrition (equation (A89)).

4 Calibration and Parameter Values

This section presents a brief overview of the characteristics of the data underlying the model's social accounting matrix (SAM) and discusses the parameter values.

4.1 The Social Accounting Matrix

The basic data set consists of a SAM and a set of initial levels and lagged variables. The SAM encompasses 27 accounts including production and retail sectors (4 accounts), labor production factors and profits (3 accounts), enterprises (1 account), households (5 accounts), government current expenditures and taxes (9 accounts), government investment expenditures (3 accounts), private investment expenditures (1 account), and the rest of the world (1 account). The actual SAM data are presented in Table 1.

The characteristics of the SAM data are summarized in the following. On the output side, agricultural and informal sectors are very small accounting for respectively 3 and 11 percent of total output. In contrast, private urban formal production account for almost 75 percent of total output. On the demand side, private current expenditures account for 68 percent of GDP, while government current expenditures account for 15 percent of GDP. At the same time, total investment expenditures represent 25 percent of GDP, implying that our “prototype” labor-exporting MENA country is running a trade deficit equivalent to 8 percent of GDP.

Looking at the balance of payments, total net remittances to households and net factor income to enterprises amounts to 2 percent of GDP. The ensuing current account deficit, amounting to 6 percent of GDP, is financed equally by private and public foreign borrowing. The trade balance are dominated by non-agricultural imports and exports - agricultural exports account for only 14 percent of total export earnings, while non-agricultural imports account for 95 percent of total import expenditures. The level of trade openness, measured by the ratio of the sum of imports and exports to GDP, amounts to a moderate 44 percent.

Looking at the government budget, indirect taxes in the form of production and retail level taxes account for 62 percent of total government revenues excluding inter-government transfers. Enterprise tax revenues, amounting to 18 percent of total government income, represents the largest revenue item among direct tax items, while combined factor and household taxes account for only 12 percent of revenues. Foreign borrowing accounts for the remaining 8 percent of government revenues. On the expenditure side, domestic and foreign transfers account for respectively 8 and 9 percent of the budget, while consumption and savings for investment purposes amount to respectively 40 and 42 percent of the budget. Overall, the government relies heavily on indirect taxes for revenue collection, while maintaining almost equal proportions

between consumption and saving for investment purposes.

4.2 Behavioral Parameters

Consider now the behavioral parameters of the model. In the agricultural sector production of value added, the Cobb-Douglas (share) parameter equals 0.8, whereas the CES substitution elasticity between rural agricultural labor and public capital equals $2/3$. Public capital is aggregated from infrastructure and health capital using a substitution elasticity of $1/2$. The informal sector only has one factor of production, unskilled labor, and the Cobb-Douglas (share) parameter equals 0.8. In contrast, the private formal sector has a three-level nested production structure, with a bottom level substitution elasticity of $2/3$ between private capital and skilled labor, a middle level substitution elasticity of $7/6$ between the bottom level composite factor and unskilled labor, and at top level substitution elasticity of $5/6$ between the middle level composite factor and public capital. Finally, public sector value added is derived using CES aggregation of skilled and unskilled labor with a substitution elasticity of $5/6$.

Turning to the factor market and the wage bargaining equation for private sector skilled wages, elasticities with respect to skilled labor unemployment and public sector wages are respectively -2.0 and 2.0, whereas the wage elasticity of private skilled labor demand is -1.0, and the union bargaining power parameter is 0.7. Rural-urban and international migration elasticities with respect to relative expected wages are respectively 0.4 and 0.6, whereas persistence parameters for rural-urban and international migration are respectively 0.1 and 0.3. The formal-informal sector migration elasticity with respect to relative expected wages is 0.4. the elasticity of substitution between public employed teachers and education capital in the skills-upgrading CES production function is $1/3$, whereas the elasticity of teachers effort with respect to relative wages is 0.8.

The Armington elasticities for rural agricultural and urban formal sector goods imports are respectively $2/3$ and 1.5. Similarly, the CET transformation elasticities for rural agricultural and urban formal sector goods exports are respectively $2/3$ and 1.5. Finally, household minimum consumption levels amount to 10 percent of initial consumption levels.

5 Simulation Experiments

In what follows we use the framework described above to analyze five types of labor market reforms: a reduction in payroll taxes on unskilled labor, assuming both neutral and non-neutral changes on the budget; reductions in public sector employment and wages; an active labor market policy taking the form of employment subsidies to unskilled workers in the urban formal private sector; and a reduction in trade unions' bargaining strength. We also consider a composite reform package, which consists of a cut in payroll taxes and public sector employment, as well as a reduction in unions' bargaining power. In all of these experiments we use a savings-driven closure rule, and solve residually for private investment demand, using the aggregate savings-investment balance (equation (A74)). This allows us to study the “crowding in” and “crowding out” effects of labor market policies, through their impact on the government budget balance.

5.1 Reduction in Payroll Taxes on Unskilled Labor

The effects of a permanent, 5 percentage-point reduction in the payroll tax rate on unskilled labor are illustrated in Figure 3. In analyzing the impact of this policy measure on growth and employment, a key aspect involves evaluating its implications for the fiscal situation. For instance, assuming that the policy change must be neutral with respect to the budget deficit, what are the alternative options for offsetting the effect of a reduction in payroll taxation? To illustrate this type of interactions between labor market reforms and fiscal policy, we examine three alternative “closure” rules on the fiscal side. In the first, there is no offsetting change in revenue, and the government borrows domestically to balance its budget—implying therefore full crowding out of private investment, as implied by the aggregate savings-investment balance (equation (A74)). In the second, the policy is budget-neutral, and the government raises sales taxes on the private, formal sector good to offset additional expenditures on transfers to the pension system; there is therefore no scope for crowding out. In the third, the policy is also budget-neutral, and the government offsets the initial reduction in payroll taxes by an increase in income taxes on capitalists and rentiers; again, therefore, there are no crowding out of private capital formation.¹³ In all cases, we assume that the

¹³Of course, other offsetting changes, such as increases in direct tax rates on a particular household group, or an increase in indirect taxes on urban goods, could also be considered.

accounts of the pension system are balanced through government transfers, as indicated in (29).

A number of results are common to all three payroll tax experiments. Reduced labor costs leads to increased employment of unskilled labor, as well as substitution away from skilled labor (and physical capital) in the private formal sector. A decrease in skilled labor wages—resulting from the rise in skilled unemployment, itself due to the reduction in the demand for skilled labor—partly offsets the initial tax-induced 5 percent increase in the differential between skilled and unskilled labor costs. The net increase in the labor cost differential amounts to around 3.8 percent in the longer term, implying a strong substitution away from skilled labor toward unskilled labor even in the long run.

The increase in unskilled employment is drawn partly from the pool of unemployed workers and partly from increasing migration from the informal sector. Increasing formal sector migration occurs against the backdrop of strongly increasing informal sector wages. This results from the fact that the minimum wage increases over time (as a result of full indexation on urban consumption prices) and the demand for unskilled unemployment in the formal sector rises as well; as a result, the expected domestic urban wage increases strongly (beyond the second period). The ensuing increase in the expected formal-informal sector wage differential leads to higher migration flows to the formal economy. Employment in the informal sector also increases in the short run but tapers off in the medium to long term. The initial combination of reduced overseas and formal sector migration flows in period 2 increases informal sector employment by 0.3-0.4 percent. However, although reduced migration overseas, due to increased domestic urban wages, continues to add workers to the informal sector labor force, the subsequent reversal of formal sector migration coupled with migration outflows to the rural sector, leads to a gradual reversal of the initial increase in employment. The mirror image of reduced informal sector employment is a gradual increase in rural employment. Accordingly, the cumulative effect of medium-term outward migration to rural areas due to increasing agricultural wages leads to a relatively strong expansion of labor supply in the rural sector.

At the aggregate level, the reduction in payroll taxes leads to a strong initial increase followed by a gradual decline in nominal GDP. In contrast, real GDP increases over time, indicating that the declining growth path for nominal GDP is a purely nominal phenomenon. The adjustment process involves a real exchange rate depreciation, which gradually raises exports

and lowers imports in the long term. The increasing trade surplus is used to finance the drop in net factor service income due to declining overseas migration.

While the growth paths of GDP and trade aggregates are relatively similar across payroll tax experiments, the growth paths of private consumption and investment are relatively sensitive—as could be expected—to whether or not there are offsetting changes in taxes. The growth paths of private consumption and investment are diverging strongly in the experiment with a non-neutral budget closure. The ensuing budget deficit is financed through domestic borrowing, leading to crowding out of private investment and higher disposable household income, which translates into increased private consumption.

The strong crowding-out effect disappears when sales or income taxes are raised to pay for increased transfers to the pension system. However, differences persist. Sales taxes on formal sector goods raise the price of investment goods and intermediate inputs, which depresses profits, savings, and private capital accumulation (everything else equal). In contrast, an increase in the income tax rate for capitalists reduces household disposable income and private consumption, but allows for increased investment in the long term. Thus, the scenario where reduced payroll tax revenues and increased transfers to the pension system are offset by increased household income taxes results in the highest long-term GDP growth rates.¹⁴ Growth in the formal sector due to increased private capital accumulation is responsible for higher long-term aggregate growth in the latter scenario.

The impact on the government budget is also related to the government budget closure. Government transfers to the pension system will, in each case, increase by around 0.2 percent of GDP in the long run, due to the decline in own-financing through reduced payroll taxes. Without the introduction of alternative financing sources, this leads to a domestic borrowing requirement of 0.3 percent of GDP in the long term. In contrast, domestic borrowing is completely avoided in the long term, if budget-neutral specifications with variable sales and/or income taxes are applied. Looking at the pension system, total pension payments increases the most when increased

¹⁴Note that the model does not capture the disincentive effects of higher direct tax rates on labor supply (or participation rates). To the extent that these effects are large, the impact of higher output growth rates on unemployment would be ambiguous. The reason is that a reduction in labor supply (which would tend to lower unemployment) could be offset by large substitution effects toward physical capital.

government transfers are financed by increased sales taxes on formal sector goods. The number of pensioners rises (due to the expansion of formal sector employment) by around 0.5 percent in the long run, regardless of the budget closure. However, while the average benefit rate decreases by 0.4 percent when increased government transfers are *a*) financed by increased income taxes, or *b*) not financed by tax increases, it only decreases by 0.1 percent when increased formal sector sales taxes increases formal sector goods prices.

5.2 Cut in Public Sector Wages

We now examine the effects of wage reductions for both unskilled public workers and skilled public employees (excluding teachers). Results of a permanent, 5 percent reduction in the wage rate for each labor category are summarized in Figures 4 and 5.

The reduction in public sector wages leads, in both cases, to a reduction in the public sector borrowing requirement and to crowding-in of private investment. Combined with increased employment of (skilled) labor in the case of reduced skilled wages, the increased rate of capital accumulation drives the expansion of formal sector output and the overall rate of economic growth. A reduction in unskilled wages in the public sector, by contrast, has little impact on growth in the long term. The main channel through which public sector wage reductions is transmitted is a reduction in aggregate demand, induced by lower government consumption expenditures, and an increase in domestic savings (and thus private investment). The initial demand effect leads to increased private sector employment of unskilled labor and a reduction in the unemployment rate. In turn, the reduction in unemployment (which raises the probability of finding a job in the private formal economy) leads to strong migration into the formal sector. These increased employment and formal sector migration levels are, however, immediately reversed. The combination of declining demand for formal sector goods and increasing accumulation of capital lowers the demand for unskilled labor over time. Moreover, increasing informal sector wages and formal sector unemployment leads to outward migration from the formal sector. In the long term, employment levels are unchanged in every sector, and the higher level of production (in the formal sector) is entirely driven by increased private capital accumulation. Migration flows reverse themselves and unemployment rates remain unchanged at baserun levels. Looking at the pension system, overall pensions, including transfers from the government, remain unchanged. Accordingly, both the

number of pensioners and the level of pension benefits are unchanged in the long term.

In contrast, a cut in skilled wages in the public sector has a relatively strong long-term impact on growth because of the leadership effect on private skilled wages. Reduced public sector wages spills over into lower private skilled wages and higher employment of that category of labor in the private sector. Combined with the cumulative effect of increased private investment, this leads to higher growth rates in the formal sector. At the same time, growth in the rural and urban informal sectors is driven by declining migration into the urban (formal) sector. The outward migration is driven by substitution of skilled for unskilled labor in private formal sector production, which leads to a declining formal-informal sector wage differential. In addition, an increase in the expected urban wage, due to increasing informal wages and a gradually declining unskilled unemployment rate, leads to a decline in international migration flows. The combination of declining international and formal sector migration leads to increasing labor supply in the urban informal sector, and, because of increasing rural wages, to further out-migration and higher labor supply in the rural sector.

Interestingly enough, a cut in public sector skilled wages leads to a long-term reduction in both skilled and unskilled formal sector unemployment rates. The reduction in unemployment among skilled workers results from increased formal sector employment. In contrast, the reduction in unemployment among unskilled workers follows mainly from outward migration to the informal sector.

Looking at the current account, reduced international migration (resulting from the increase in the expected urban wage) leads to a decline in net factor income. This decline is counterbalanced by an improvement in the trade balance, which comes about as a result of a small depreciation of the real exchange rate.

The pension system sees some minor changes in the long term, including a small increase in the number of retirees and a small decrease in the average pension benefit rate. The number of pensioners increases due to increased formal sector employment levels, while pension benefits decline because the strong supply response in the formal sector reduces formal sector prices. The overall effect is to leave overall pension payments, including government transfers to the pension system, unchanged in the long run. The main impact on the government budget is therefore to reduce the budget deficit through reduced consumption.

5.3 Public Sector Layoffs

The experiments of this section include public sector layoffs of both unskilled workers and skilled public employees (excluding teachers). Results of a permanent, 5 percent reduction in the number of workers in each labor category are summarized in Figures 6 and 7.

Reducing the size of public sector employment has the twin effects of increasing private capital accumulation and raising levels of employment in the private sector. Crowding-in of private investment is achieved because non-budget neutral layoffs turn into a smaller domestic government borrowing requirement. Increased private capital accumulation has a positive supply-side effect on formal sector output. Nevertheless, the strong impact on relative demand for formal sector goods (as a result of higher private investment and lower private consumption), means that private formal sector employment levels also increases for both categories of workers.

Aggregate growth effects are absent in the case of unskilled labor layoffs. Real GDP declines in the short term, and only returns to baserun levels in the longer run. Nevertheless, there is positive growth over time in every production sector other than public services, including the rural and urban informal sectors. Accordingly, while the aggregate growth impact is neutral in the long term due to lower value added in the public sector, the growth path has a distinct upward trend. Positive formal sector growth is particularly evident throughout the simulation period. Short-term growth is due to increased employment of unskilled labor in the private sector, whereas long-term growth is mainly driven by higher private capital accumulation. In fact, employment of unskilled labor in the private sector falls over time and returns to close to baserun levels in the long term. At the same time, growth in the rural agricultural and urban informal sectors are driven primarily by increased labor supplies, due to the cumulative impact of outward migration from the urban (formal) sector. Outward migration is particularly strong because declining employment prospects lowers the expected urban wage.

The unskilled unemployment rate increases sharply in the short term, because the rise in private sector employment is insufficient to absorb laid-off workers in the public sector. In the longer run, unskilled unemployment declines toward its baserun level, due to the cumulative effect of migration outflows into the urban informal and rural sectors. Accordingly, formal sector employment of unskilled labor is reduced to baserun levels, whereas the

supply of unskilled labor in the formal sector declines by more than 1 percent in the long term. International migration flows increase in the short term but move in the opposite direction in the longer term due to higher domestic wages and lower unemployment levels. The dynamics of international migration leave net factor service income and the current account balance, including the trade balance, unchanged in the long term.

In contrast to the unskilled labor experiment, layoffs of skilled public employees have markedly positive growth effects. Real GDP increases in both the short and the long term. Again, output growth occurs in every non-public sector, but in contrast to the previous experiment of unskilled labor layoffs, more balanced and stronger growth is recorded among the rural and urban informal and formal sectors. Strong formal sector growth is driven by increased employment of (skilled) labor in the short term. Thus, the short-term impact of skilled labor layoffs follows the pattern of unskilled layoffs. However, the long-term growth effect is driven by a combination of increased employment levels and private capital accumulation. Thus, the initial increase in the level of (skilled) labor employment persists in the long term, in contrast with the unskilled labor layoffs.

Growth in the rural and urban informal sectors is again driven by declining urban migration flows, resulting from layoffs of unskilled labor in the private sector. Sharply declining skilled labor wages (resulting from reduced union wage demands, due to increased unemployment among skilled workers) leads to increased substitution of skilled for unskilled labor in the private formal sector. The accompanying narrowing in wage differentials leads to declining urban (formal) migration and increasing rural and urban informal labor supplies. Although a decline in the unskilled unemployment rate, and the associated increase in the expected urban formal sector wage, partly reverses the strong initial outward migration from the formal sector, increasing informal sector wages are such that formal sector migration flows are lower in the long-term.

In line with the previous experiment of unskilled layoffs in the public sector, skilled layoffs lead to higher unemployment among skilled workers and reduced unemployment among unskilled workers. Moreover, unskilled unemployment is reduced further in the longer run as migration flows reduce the supply of unskilled labor in the formal sector. This long-term reduction is, however, markedly smaller than in the case of unskilled layoffs. The increase in informal and formal urban wages combined with the declining open unemployment rate means that international migration flows decline as

well in the long run. The cumulative effect on the domestic workforce abroad leads to a reduction in net factor income over time. This is made up for by a small improvement in the trade balance, which comes about through a small real exchange rate depreciation.

The main impact of public sector layoffs on the government budget is to reduce current consumption and reduce the domestic government borrowing requirement. In contrast, transfers to the pension system remain relatively unchanged. Overall, pension payments decline by around 0.2 percent in the long run. In the case of unskilled layoffs, the decline in pension payments are due solely to declining numbers of retirees. Layoffs of unskilled workers result in the largest reduction in employment, and therefore result in the largest reduction in pensioners. In contrast, layoffs of skilled workers results partly from declining numbers of retirees and partly from a declining average benefit rate. A stronger supply effect of skilled labor layoffs leads to declining formal sector prices and, accordingly, to an increasing pension benefit rate.

5.4 Subsidies to Private Employment

We now turn to an analysis of the impact of subsidies to the employment of unskilled labor in the private sector under various government budget closures, including *a*) a non-neutral budget closure; *b*) a budget-neutral increase in sales taxes on private formal sector goods, and *c*) a budget-neutral increase in income taxes on capitalists and rentiers. In each case, the increase in employment subsidy amounts to 5 percent of the base year private formal unskilled wage level. The simulation results are summarized in Figure 8.

The employment subsidy for unskilled labor increases the differential between skilled and unskilled labor costs, in a manner similar to the 5 percent reduction in payroll taxes considered earlier. The only difference between the two sets of results comes from the fact that the payroll tax rate applies to the unskilled wage rate whereas the employment subsidy does not. The unskilled wage rate is fixed in real terms, but variations in consumer prices in the formal sector leads to some variation in its nominal value. However, these wage changes have minimal impact on the results, which are therefore almost identical to the results of the payroll tax experiments.

In particular, the reduction in unskilled labor costs leads to a strong increase in formal sector employment and a decline in open unskilled unemployment. The increase in unskilled employment is the main engine for formal sector growth. Initial migration flows also fuel increases in labor supply in

the informal sector. However, subsequent outward migration from urban to rural areas leads to an increase in rural labor supply, whereas the initial increase in labor supply in the informal sector tapers off. In the long term, aggregate growth is driven equally by rural and urban formal sector growth, when a non neutral government budget closure is used. An increase in the domestic government borrowing requirement leads to crowding-out of private investment, reduced capital accumulation, and depressed formal sector growth. In contrast, urban formal sector growth is markedly stronger than rural agricultural growth when employment subsidies are financed by higher income tax revenues. The domestic government borrowing requirement is eliminated and crowding-out of investment is reversed, leading to slightly increased capital accumulation in the long term. Unemployment among skilled workers increases slightly, regardless of the government budget closure. In contrast, strongly increasing labor demand in the private sector reduces the unskilled unemployment rate, in spite of a sharp long-term increase in labor supply. Net factor income declines due to the cumulative effect of reduced international migration, but the current account remains unchanged due to a compensating improvement of the trade balance. Finally, pensions payments increases marginally, due to relatively strong increase in the number of retirees (due to increasing formal sector employment), and a smaller decline in the pension benefit rate (due to declining formal sector prices).¹⁵

5.5 Reduction in Unions' Bargaining Strength

Finally, we turn our attention to a reduction in labor union bargaining strength. To do so we reduce the bargaining strength parameter, the coefficient ν in equation (17), from its initial level of 0.7 to a value of 0.6. The results are shown in Figure 9.

The main impact of the reduction in union bargaining power is to lower the wages, and increase the employment, of skilled labor in the private sector. The income expansion leads to a strong increase in final demand. The expansion of private investment is particularly large. Increasing demand, combined with a lower wage bill, increases firms' profits in the private formal sector. In turn, this increases private savings and investment. The combination of higher skilled employment, and capital accumulation in the private

¹⁵A limitation of our analysis is that we do not account for the fact that employment subsidies may have unintended consequences, such as subsidized workers replacing unsubsidized ones, or employers firing subsidized workers once the subsidy period ends.

sector, and increased unskilled employment in urban informal and rural sectors, leads to a rise in output, which persists in the long term. This growth scenario is therefore broad-based in the sense that it stems from both rural and urban formal sector growth, and to a lesser extent from urban informal sector growth.

The sharp drop in skilled wages leads to strong substitution away from unskilled labor in the urban formal sector. Although the initially large initial decline in private formal unskilled employment is partly reversed over time, it remains below its baseline value in the long term, as a result of the permanent nature of the reduction in the wage differential. Growth in the formal sector is thus driven essentially by increased employment of skilled labor and private capital accumulation. The strong initial substitution away from unskilled labor also leads to high unemployment for that category of labor and a drop in expected urban wages. This leads to an marked initial decline in formal sector migration flows, and an equally large initial increase in labor supply in the informal sector. However, the strong migration response also reduces unemployment to below baseline levels. This increases the expected urban wage and, subsequently, leads to a reversal in the direction of formal sector migration flows. In the longer run, migration flows tend to increase labor supply in the urban informal sector at a constant rate and labor supply in the rural sector at an increasing rate. This leads to relatively fast long-term growth in the rural sector and slower but robust growth in the urban informal sector.

After an initial adjustment period, formal sector unemployment rates drop well below baseline levels and stay there in the long term. The reduction in skilled unemployment follows from increased employment of skilled labor in the private sector. In contrast, the long-term reduction in unskilled unemployment follows from a reduction in the formal sector supply of unskilled labor, resulting itself from reduced migration flows.

Looking at the wage differentials governing migration flows, it follows that a long-term decline in overseas migration flows is supported by a long-term drop in the international wage differential. This contrasts with the long-term decline in migration between rural and urban areas, where a high degree of persistence implies weak migration flows, despite of long-term increases in the wage differential. The implication is that urban migration is set to rebound beyond our 10 year time horizon.

Looking at the current account, the decline in international migration leads to a reduction in net factor income. This reduction is counterbalanced

in the long term by an improvement in the trade balance. The government budget is characterized by long-term declines in overall income- and expenditure-to-GDP ratios, and by a long-term decline in the domestic borrowing requirement which allows for crowding-in of private investment. The pension system transfers item on the government budget does not change significantly. Looking at the overall pension system, pension payments increases only slightly in the long run. An increase in the number of retirees is evened out by a drop in the pension benefit rate. The increase in the number of retirees follows from increased private sector (skilled) employment, whereas the reduction in the pension benefit rate follows from declining formal sector prices associated with the strong formal sector supply response.

5.6 A Composite Reform Program

Finally, we consider a composite, “realistic” package of policies, which combines reductions in payroll taxes on unskilled labor, a reduction in unions’ bargaining strength, and a cut in unskilled employment in the public sector. Based on actual data, and a sense of what is feasible by policymakers in the region, we assume that the payroll tax on unskilled labor is reduced by 5 percentage points, the number of unskilled workers in the public sector is reduced by 5 percent, and that the bargaining strength of trade unions is reduced from an initial level of 0.7 to a “neutral” value of 0.5. We consider the three alternative budget closure rules specified above, but to save space we do not report the results graphically.

Given that the transmission channels of each of the individual components of the composite program have been described extensively in previous sections, we restrict our attention here to the impact and long-run effects of the program on growth and unemployment. Simulation results with a non-neutral public deficit closure do not show evidence of large nonlinear effects. Specifically, the impact and long-term effects on the growth rate of aggregate real value added amount to 0.2 and 0.9 percent, respectively. This is approximately equal to the sum of the growth rates derived from the individual simulations described earlier. Similarly, the impact and long-term effects on private formal sector employment are very close to linear, amounting to -0.1 and 4.0 percent respectively for unskilled labor, and 3.2 and 3.1 percent respectively for skilled labor. Unskilled employment increases slightly by 0.2 percent when income taxes are used to keep the public deficit unchanged. Overall, although the simultaneous implementation of the individual compo-

nents of the above specified policy reform package does bring some benefits (suggesting therefore that complementarity between labor market policies is desirable from an economic point of view, independently of other, political economy considerations) the impact of a “realistic” package of labor market reforms on growth and employment does not appear to be large. This has important implications for the design of adjustment programs in a region where the challenge is not only to reduce an existing high level of unemployment, but also to create sufficient jobs to absorb new entrants in the labor force.

6 Summary and Policy Lessons

The purpose of this paper has been to analyze the impact of labor market reforms on growth, real and relative wages, and the composition of employment and unemployment in LE-MENA countries. We first provided a brief overview of the main features of the labor market in some of these countries. We then presented a simulation model, based on the IMMPA framework developed by Agénor (2003), Agénor, Izquierdo and Fofack (2003), and Agénor, Fernandes, Haddad and van der Mensbrugghe (2003), which captures many of these features (such as a large informal urban sector, a significant role of public sector employment and “leadership effects” of public sector wages, powerful trade unions, and international migration of labor), as well as other important structural characteristics of these countries (such as a pay-as-you-go pension system). After discussing the calibration procedure and our choices of parameter values, we presented and discussed a series of simulation experiments. We focused on a reduction in payroll taxation on unskilled labor, reductions in public sector wages and workforce, an increase in employment subsidies to the private sector, changes in the bargaining strength of trade unions, and a composite reform package involving several of these policies. In the case of payroll taxation, employment subsidies and the composite package, we considered both neutral and non-neutral changes. Specifically, we considered three alternative fiscal “closure” rules. In the first, we assumed no offsetting change in revenue, and the government borrows domestically to balance its budget—implying full crowding out of private investment, which is determined through the aggregate savings-investment balance. In the second, the policy is budget-neutral, and the government raises sales taxes on the private, formal sector good to offset additional expenditures on transfers

to the pension system; there is therefore no scope for crowding out. In the third, the policy is also budget neutral, and the government offsets the initial reduction in payroll taxes by an increase in income taxes on capitalists and rentiers; again, therefore, there are no crowding out of private capital formation.

There are a number of policy lessons that emerge from our results. For instance, we found that, regardless of how a cut in payroll taxes on unskilled labor is financed (either by borrowing from the private sector, or by implementing revenue-neutral changes in sales or income taxation), reduced labor costs leads to increased employment of unskilled labor, as well as substitution away from skilled labor (and physical capital) in the private formal sector. A decrease in skilled labor wages—resulting from the rise in skilled unemployment, itself due to the reduction in the demand for skilled labor—partly offsets the initial tax-induced increase in the differential between skilled and unskilled labor costs. The net increase in the labor cost differential is still very significant in the longer term, implying a strong substitution away from skilled labor toward unskilled labor even in the long run. At the same time, our results showed that the overall rate of output growth varies significantly across experiments—essentially because the behavior of private investment depends very much (as could be expected) on whether or not there are offsetting changes in taxes. When the increase in the budget deficit resulting from a cut in the payroll tax is financed through domestic borrowing, private investment is crowded out; the lower rate of capital accumulation has an adverse effect on growth and thus on the demand for both categories of labor. Thus, the indirect or “level” effect on the demand for unskilled labor may mitigate significantly the substitution effect triggered by the change in relative labor costs. The results associated with a reduction in trade unions’ bargaining power in wage negotiations also indicate large long-term gains in overall employment associated with general equilibrium effects.

The main policy lessons of our simulation experiments can be summarized as follows. First, in assessing the impact of labor market reforms on growth and unemployment, it is important to account not only for the direct, partial equilibrium effects of these policies, but also for their indirect, general equilibrium effects, resulting from changes in the government budget, the impact on income and aggregate demand. The government can crowd out the private sector if it accumulates large budget deficits that cannot be financed by borrowing abroad. The government must therefore resort to domestic borrowing by inducing a sufficiently large increase in net private

savings; the high interest rates that may be needed to do so may reduce private investment.¹⁶

For instance, it has argued that a policy of subsidizing employment in the private sector would help to reduce unemployment in MENA countries. A simple, partial equilibrium analysis of this policy is indeed unambiguous: by lowering the relative cost of unskilled labor, a subsidy leads to an increase in the demand for that category of labor, which may be particularly significant if wages are fixed (as a result, say, of a binding minimum wage). As long as the increase in labor demand does not prompt greater participation in the labor force (that is, if unskilled labor supply is fairly inelastic), unskilled unemployment is thus likely to fall. However, a partial equilibrium view can be misleading, in at least two respects. First, the increase in subsidies must be financed, and this can occur in a variety of ways. If the government keeps overall spending constant, and therefore reduces another component of expenditure, the net effect on the budget would be zero. But general equilibrium effects could still be significant; suppose for instance that the government reduces investment spending on infrastructure; to the extent that public capital generates a positive externality for private production and investment, the subsidy may end up in the longer term affecting adversely the demand for labor. Alternatively, suppose that spending remains constant, and the government chooses to either let its fiscal deficit increase and borrow from the rest of the economy, or to raise taxes to keep the budget deficit constant. The increase in borrowing can have a large crowding-out effect on private investment, if private savings do not adjust quickly; this fall in investment may, over time, restrain the expansion of the demand for all categories of labor—including unskilled labor. Thus, the longer-run effect of the policy on employment may be either nil or negative. Similarly, an increase in, say, taxes on capital may restrain private capital formation and have an adverse effect on employment in the medium and the long run. More specifically, our general equilibrium analysis indicates that the overall impact of a change in payroll taxes on the demand for unskilled labor may be compounded, or mitigated, depending on how the government chooses to adjust its tax and spending instruments to maintain a balanced budget. In the presence of large crowding out effects on private investment (and possibly savings), the direct gains (in terms of higher employment) associated with

¹⁶Of course, the government could also resort to inflationary financing of its deficit. The resulting increase in inflation would also deter private investment.

a reduction in payroll taxes may be highly mitigated. Similarly, whether employment subsidies end up reducing open unemployment in the formal sector may depend on the extent to which a higher perceived probability of finding a job in that sector affects workers' decision to remain in the informal sector.

Second, our simulation results indicate that a “piecemeal” approach to labor market reforms is unlikely to bring substantial benefits in terms of growth and employment; a comprehensive approach is needed to allow policymakers to exploit complementarities between individual policies. The idea that labor market reform programs must be sufficiently broad (in the sense of covering a wide range of complementary policies) and deep (of substantial magnitude) to have much of an effect was emphasized in a related context by Coe and Snower (1997) and Orszag and Snower (1998). At the same time, however, although a “realistic” package of policies (which combines reductions in payroll taxes on unskilled labor, a reduction in unions' bargaining strength, and a cut in unskilled employment in the public sector) may have a significant impact on the composition of employment in LE-MENA countries, fostering a sustained increase in growth rates and job creation in these countries may require a more comprehensive program of structural reforms— involving, in particular, financial sector reforms, privatization, and measures aimed to increase private sector participation.

Appendix A
List of Equations¹⁷

PRODUCTION

$$X_j = V_j + X_j \sum_i a_{ij} \quad (\text{A1})$$

$$V_A = \left[\alpha_{XA} \left\{ \beta_{XA} U_A^{-\rho_{XA}} + (1 - \beta_{XA}) K_G^{-\rho_{XA}} \right\}^{-\frac{1}{\rho_{XA}}} \right]^{1-\eta_{XA}} \quad (\text{A2})$$

$$X_A = \alpha_{TA} \{ \beta_{TA} E_A^{\rho_{TA}} + (1 - \beta_{TA}) D_A^{\rho_{TA}} \}^{\frac{1}{\rho_{TA}}} \quad (\text{A3})$$

$$V_I = \alpha_{XI} U_I^{\beta_{XI}} \quad (\text{A4})$$

$$V_G = \left[\alpha_{XG} \left\{ \beta_{XG} U_G^{-\rho_{XG}} + (1 - \beta_{XG}) S_G^{-\rho_{XG}} \right\}^{-\frac{1}{\rho_{XG}}} \right]^{1-\eta_{XG}} \quad (\text{A5})$$

$$V_P = \alpha_{XP} \left\{ \beta_{XP} T_1^{-\rho_{XP}} + (1 - \beta_{XP}) K_G^{-\rho_{XP}} \right\}^{-\frac{1}{\rho_{XP}}} \quad (\text{A6})$$

$$T_1 = \alpha_{XP1} \{ \beta_{XP1} T_2^{-\rho_{XP1}} + (1 - \beta_{XP1}) U_P^{-\rho_{XP1}} \}^{-\frac{1}{\rho_{XP1}}} \quad (\text{A7})$$

$$T_2 = \alpha_{XP2} \{ \beta_{XP2} S_P^{-\rho_{XP2}} + (1 - \beta_{XP2}) K_P^{-\rho_{XP2}} \}^{-\frac{1}{\rho_{XP2}}} \quad (\text{A8})$$

$$X_P = \alpha_{TP} \{ \beta_{TP} E_P^{\rho_{TP}} + (1 - \beta_{TP}) D_P^{\rho_{TP}} \}^{\frac{1}{\rho_{TP}}} \quad (\text{A9})$$

EMPLOYMENT

$$U_R = U_{R,-1}(1 + g_R) - MIG \quad (\text{A10})$$

$$U_A^d = \left(V_A^{1+\frac{\rho_{XA}}{1-\eta_{XA}}} (1 - \eta_{XA}) \left(\frac{PV_A}{W_A} \right) \frac{\beta_{XA}}{\alpha_{XA}^{\rho_{XA}}} \right)^{\frac{1}{1+\rho_{XA}}} \quad (\text{A11})$$

$$U_R^s = U_A^d \left(V_A, \frac{W_A}{PV_A} \right). \quad (\text{A12})$$

¹⁷Unless otherwise indicated, the indexes i and j , with $i, j = A, I, P, G$ refer to production sectors and $h = A, I, F, KR$ to households.

$$U_P^d = T_1 \left(\frac{PT_1}{(1 + ptax_U)W_M - ES_U \alpha_{XP1}^{\rho_{XP1}}} \right)^{\sigma_{XP1}} \quad (A13)$$

$$\frac{U_F^s}{U_{F,-1}^s} = \left\{ \frac{U_{P,-1}^d}{U_{F,-1}^s - U_{G,-1}} \left(\frac{W_{M,-1}}{W_{I,-1}} \right) \right\}^{\beta_F} \quad (A14)$$

$$U_U = U_{U,-1}(1 + g_U) + MIG - SKL - IMIG - \delta_{NP}^U (U_{P,-1}^d + U_{G,-1}) \quad (A15)$$

$$U_G = (1 + g_{UG} - \delta_{NP}^U) U_{G,-1} \quad (A16)$$

$$U_I^s = U_U - U_F^s \quad (A17)$$

$$U_I^d = \beta_{XI} (V_I / w_I) \quad (A18)$$

$$S_P^d = T_2 \kappa_S \left(\frac{PT_2}{(1 + ptax_S)W_S - ES_S \alpha_{XP2}^{\rho_{XP2}}} \right)^{\sigma_{XP2}} \quad (A19)$$

$$UNEMP_S = 1 - \frac{(S_G^T + S_P^d)}{S} \quad (A20)$$

$$UNEMP_U = 1 - \frac{(U_G + U_P^d)}{U_F^s} \quad (A21)$$

$$W_M = w_M P_F \quad (A22)$$

$$W_I = \beta_{XI} \left(\frac{P V_I V_I}{U_I^s} \right) \quad (A23)$$

$$W_{UG} = \omega_{UG} P_F \quad (A24)$$

$$\frac{W_S}{W_S - \Omega_0 UNEMP_S^{-\phi_1} W_{SG}^{\phi_2}} - \varepsilon_{S_P^d / W_S} - \frac{W_S S_P^d}{\nu PROF_P} = 0 \quad (A25)$$

$$W_{SG} = \omega_{SG} P_F \quad (A26)$$

$$MIG = U_{R,-1} \lambda_m \left[\sigma_M \ln \left(\frac{E w_U}{E w_A} \right) \right] + (1 - \lambda_m) \frac{U_{R,-1}}{U_{R,-2}} MIG_{-1} \quad (A27)$$

$$E w_U = \frac{\theta_U W_{M,-1} + (1 - \theta_U) W_{I,-1}}{P_{URB,-1}} \quad (A28)$$

$$\theta_U = \frac{U_{P,-1}}{U_{F,-1}^s - U_{G,-1}} \quad (A29)$$

$$Ew_A = \frac{W_{A,-1}}{P_{R,-1}} \quad (\text{A30})$$

$$IMIG = U_{U,-1} \lambda_{im} \sigma_{IM} \ln \left(\frac{Ew_F}{Ew_U} \right) + (1 - \lambda_{im}) \frac{U_{U,-1}}{U_{U,-2}} IMIG_{-1} \quad (\text{A31})$$

$$Ew_{FOR} = \frac{ER \cdot W_{FOR,-1}}{P_{URB,-1}} \quad (\text{A32})$$

$$SKL = [\beta_E (\varphi S_G^E)^{-\rho_E} + (1 - \beta_E) K_E^{-\rho_E}]^{-\frac{1}{\rho_E}} \quad (\text{A33})$$

$$\varphi = 1 - \varphi_m \left[\frac{(1 - UNEMP_{S,-1}) W_{S,-1}}{W_{SG,-1}} \right]^{\delta_E} \quad (\text{A34})$$

$$S_G^T = S_G + S_G^E \quad (\text{A35})$$

$$S_G^T = (1 + g_{SG} - \delta_{NP}^S) S_{G,-1}^T \quad (\text{A36})$$

$$S = (1 - \delta_S) S_{-1} + SKL - \delta_{NP}^S (S_{P,-1}^d + S_{G,-1}^T) \quad (\text{A37})$$

SUPPLY AND DEMAND

$$INT_j = \sum_i a_{ji} X_i \quad (\text{A38})$$

$$Q_A^s = \alpha_{QA} \{ \beta_{QA} M_A^{-\rho_{QA}} + (1 - \beta_{QA}) D_A^{-\rho_{QA}} \}^{-\frac{1}{\rho_{QA}}} \quad (\text{A39})$$

$$Q_I^s = X_I \quad (\text{A40})$$

$$Q_G^s = X_G \quad (\text{A41})$$

$$Q_P^s = \alpha_{QP} \{ \beta_{QP} M_P^{-\rho_{QP}} + (1 - \beta_{QP}) D_P^{-\rho_{QP}} \}^{-\frac{1}{\rho_{QP}}} \quad (\text{A42})$$

$$Q_A^d = C_A + G_A + INT_A \quad (\text{A43})$$

$$Q_I^d = C_I + INT_I \quad (\text{A44})$$

$$Q_G^d = C_G + G_G + Z_P^G + INT_G \quad (\text{A45})$$

$$Q_P^d = C_P + G_P + (Z_P^P + Z_G) + INT_P \quad (\text{A46})$$

$$C_i = \sum_h C_{ih} = \sum_h x_{ih} + \frac{\sum_h c_{ih} (CON_h - \sum_i PQ_i x_{ih})}{PQ_i} \quad (\text{A47})$$

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$$G_j = gg_j \frac{NG}{PQ_j}, \quad \sum gg_j = 1, \text{ for } j = A, G, P \quad (\text{A48})$$

$$Z_P^j = zz_j \frac{PK \cdot Z_P}{PQ_i}, \quad \sum zz_j = 1, \text{ for } j = G, P \quad (\text{A49})$$

TRADE

$$E_i = D_i \left(\frac{PE_i}{PD_i} \cdot \frac{1 - \beta_{Ti}}{\beta_{Ti}} \right)^{\sigma_{Ti}}, \text{ for } i = A, P \quad (\text{A50})$$

$$M_i = D_i \left(\frac{PD_i}{PM_i} \cdot \frac{\beta_{Qi}}{1 - \beta_{Qi}} \right)^{\sigma_{Qi}}, \text{ for } i = A, P \quad (\text{A51})$$

PRICES

$$PV_i = V_i^{-1} \left\{ PX_i(1 - \text{indtax}_i) - \sum_j a_{ji} PQ_j \right\} X_i \quad (\text{A52})$$

$$PE_i = wpe_i ER, \text{ for } i = A, P \quad (\text{A53})$$

$$PM_i = wpm_i(1 + tm_i) ER, \text{ for } i = A, P \quad (\text{A54})$$

$$PX_i = \frac{PD_i D_i + PE_i E_i}{X_i}, \text{ for } i = A, P \quad (\text{A55})$$

$$PQ_i = \frac{PD_i D_i + PM_i M_i}{Q_i}, \text{ for } i = A, P \quad (\text{A56})$$

$$PQ_i = PX_i = PD_i, \text{ for } i = I, G \quad (\text{A57})$$

$$P_R = \sum_i wr_i PQ_i, \text{ with } \sum_i wr_i = 1 \quad (\text{A58})$$

$$P_F = \sum_i wf_i PQ_i, \text{ with } \sum_i wf_i = 1 \quad (\text{A59})$$

$$P_{URB} = \sum_i wu_i PQ_i, \text{ with } \sum_i wu_i = 1 \quad (\text{A60})$$

$$PT_1 = \frac{T_2 PT_2 + [(1 + \text{ptax}_U) W_M - ES_U] U_P}{T_1} \quad (\text{A61})$$

$$PT_2 = \frac{PROF_P + [(1 + \text{ptax}_S) W_S - ES_S] S_P}{T_2} \quad (\text{A62})$$

$$PK = \frac{\sum_i PQ_i Z_i}{Z} = \frac{PQ_G Z_P^G + PQ_P Z_P^P}{Z} \quad (\text{A63})$$

INCOME

$$PROF_i = PV_i V_i - W_i U_i, \text{ for } i = A, I \quad (\text{A64})$$

$$PROF_P = PV_P V_P - [(1 + ptax_U)W_M - ES_U]U_P - [(1 + ptax_S)W_S - ES_S]S_P \quad (\text{A65})$$

$$YF_i = PROF_i, \text{ for } i = A, I \quad (\text{A66})$$

$$YF_P = (1 - entax)PROF_P - IF \cdot ER \cdot FL_{P,-1} \quad (\text{A67})$$

$$YH_A = \gamma_A TRH + PV_A V_A \quad (\text{A68})$$

$$YH_I = \gamma_I TRH + PV_I V_I + (1 - \tau_F)ER \cdot REMIT \quad (\text{A69})$$

$$YH_F = PENSIONS + \gamma_F TRH + (W_M U_P + W_{UG} U_G) + (W_S S_P + W_{SG} S_G) + \tau_F ER \cdot REMIT \quad (\text{A70})$$

$$YH_{KR} = \gamma_{KR} TRH + (1 - re)YF_P \quad (\text{A71})$$

CONSUMPTION, SAVINGS, AND INVESTMENT

$$SAV_h = sr_h(1 - inctax_h)YH_h \quad (\text{A72})$$

$$CON_h = (1 - inctax_h)YH_h - SAV_h \quad (\text{A73})$$

$$PK \cdot Z_P + PQ_P Z_G = re \cdot YF_P + \sum_h SAV_h - CDEF + ER(\Delta FL_P + \Delta FL_G) \quad (\text{A74})$$

$$K_P = (1 - \delta_P)K_{P,-1} + Z_{P,-1} \quad (\text{A75})$$

GOVERNMENT

$$-CDEF = TXREV - TRH - TRSOC - W_{SG} S_G^E - ES_U U_P^d - ES_S S_P^d - NG - IF_G ER \cdot FL_{G,-1} \quad (\text{A76})$$

$$-ODEF = -CDEF - PQ_P Z_G \quad (\text{A77})$$

$$\begin{aligned}
TXREV &= \sum_{i=A,P} wpm_i tm_i M_i ER + ptax_U W_M U_P^d + ptax_S W_S S_P^d \quad (A78) \\
&+ \sum_i indtax_i P X_i X_i + entax \cdot PROF_P + inctax_R Y H_R \\
&+ inctax_A Y H_A + inctax_F Y H_F
\end{aligned}$$

$$PQ_P Z_G = I_{INF} + I_E + I_H \quad (A79)$$

$$K_i = K_{i,-1}(1 - \delta_i) + \frac{I_{i,-1}}{PQ_{P,-1}}, \text{ where } i = INF, H, E \quad (A80)$$

$$K_G = \alpha_G \{ \beta_G K_{INF}^{-\rho_G} + (1 - \beta_G) K_H^{-\rho_G} \}^{-\frac{1}{\rho_G}} \quad (A81)$$

PENSION SYSTEM

$$TRSOC = PENSIONS - ptax_U U_P^d - ptax_S S_P^d \quad (A82)$$

$$BENEF = BENEF_{-1}(1 + \Delta \ln P_{F,-1}) \quad (A83)$$

$$NUMPEN = (1 - \delta_N) NUMPEN_{-1} + NEWPEN \quad (A84)$$

$$NEWPEN = \delta_{NP}^U (U_{P,-1}^d + U_{G,-1}) + \delta_{NP}^S (S_{P,-1}^d + S_{G,-1}^T) \quad (A85)$$

$$PENSIONS = BENEF \cdot NUMPEN \quad (A86)$$

BALANCE OF PAYMENTS

$$\begin{aligned}
0 &= \sum_{i=A,P} (wpe_i E_i - wpm_i M_i) + REMIT - IF \cdot FL_{P,-1} \quad (A87) \\
&- IF_G FL_{G,-1} + \Delta FL_G + \Delta FL_P
\end{aligned}$$

$$REMIT = W_{FOR} FORL_{-1} \quad (A88)$$

$$FORL = (1 - \delta_{IMIG}) FORL_{-1} + IMIG \quad (A89)$$

Appendix B

Variable Names and Definitions¹⁸

Endogenous Variables

<i>BENEF</i>	Average pension benefit
<i>C_i</i>	Consumption of good <i>i</i> by the urban and rural private sector
<i>C_{ih}</i>	Consumption of good <i>i</i> by household <i>h</i>
<i>CON_h</i>	Total nominal consumption by household <i>h</i>
<i>CDEF</i>	Current public budget deficit
<i>D_i</i>	Domestic demand for good <i>i</i> = <i>A, P</i>
<i>E_i</i>	Export of traded goods for <i>i</i> = <i>A, P</i>
<i>ES_S</i>	Nominal employment subsidy on skilled labor in the private sector
<i>ES_U</i>	Nominal employment subsidy on unskilled labor in the private sector
<i>Ew_U</i>	expected urban unskilled wage
<i>Ew_A</i>	expected agricultural wage
<i>FORL</i>	Stock of domestic workers abroad
<i>G_i</i>	Government spending on good <i>i</i> = <i>A, G, P</i>
<i>IMIG</i>	International migration
<i>INT_i</i>	Intermediate good demand for good <i>i</i>
<i>K_E</i>	Public capital in education
<i>K_G</i>	Total Public capital
<i>K_H</i>	Public Capital in health
<i>K_{INF}</i>	Public capital in infrastructure
<i>K_P</i>	Private capital
<i>M_i</i>	Imports of good <i>i</i> = <i>A, P</i>
<i>MIG</i>	Migration to urban area
<i>NEWPEN</i>	Flow of skilled and unskilled workers retiring in each period
<i>NUMPEN</i>	Number of pensioners
<i>ODEF</i>	Overall budget deficit
<i>P_F</i>	Formal urban price index
<i>P_R</i>	Rural price index
<i>P_S</i>	Price index for skilled labor
<i>P_{URB}</i>	Urban price index

¹⁸Unless otherwise indicated, the index *i* = *A, I, P, G* refers to production sectors and *h* = *A, I, F, KR* to households.

PD_i	Domestic price of domestic sales of good $i = A, P$
PE_i	Price of exported good $i = A, P$
$PENSIONS$	Total amount of pension paid for the urban formal pensioner
PK	Price of capital
PM_i	Price of imported good $i = A, P$
PQ_i	Composite good price of good i
$PROF_i$	Profits by firms in sector $i = A, I, P$
PT_1	Price of composite input T_1
PT_2	Price of composite input T_2
PV_i	Value added price of good i
PX_i	Sales price of good i
Q_i^s, Q_i^d	Composite supply and demand of good i
$REMIT$	Foreign-currency value of the flow of remittances from abroad
S	Skilled workers
S_P^d	Demand for skilled workers in private urban formal sector
SAV_h	Saving by household h .
sr_h	Saving rate for household h
SKL	New skilled workers
S_P	Skilled labor employed in private urban formal
T_1	Composite input from T_2 and unskilled labor
T_2	Composite input from capital and skilled labor
TRH	Transfers to households
$TRSOC$	Net government pension transfer
$TXREV$	Tax revenues
U_i	Unskilled labor employed in sector $i = A, I, P$
U_R	Unskilled workers in rural sector
U_R^s	Unskilled labor supply in the rural sector
U_U	Unskilled workers in urban sector
U_i^d	Demand for labor in sector $i = A, I, P$
U_F^S	Unskilled labor supply in the urban formal sector
U_I^S	Unskilled labor supply in the informal sector
$UNEMP_S$	Skilled unemployment rate
$UNEMP_U$	Unskilled unemployment rate in the formal sector
V_i	Value added in sector i

W_i	Nominal wage for labor employed in sector $i = A, I$
w_i	Real wage rate for unskilled labor employed in sector $i = A, I$
W_M	Minimum wage (unskilled labor in urban formal private sector)
w_M	Real minimum wage (unskilled labor in urban formal private sector)
W_S	Nominal wage rate for skilled worker in the private urban formal sector
w_S	Real wage rate for skilled worker in the private urban formal sector
W_{SG}	Nominal wage rate for skilled labor in the government sector
w_{SG}	Skilled wages in the public sector measured in terms of the relevant price index
W_{UG}	Nominal wage rate for unskilled labor in the government sector
w_{UG}	Unskilled wages in the public sector measured in terms of the relevant price index
x_{ih}	Subsistence level of consumption of good i by household h
X_i	Production of good i
YF_i	Income by firms in sector $i = A, I, P$
YH_h	Household income for household h
Z	Total investment demand
Z_i	Investment demand for good $i = P, G$
Z_P^i	Investment demand for good $i = P, G$ by formal private sector

Exogenous Variables

Name	Definition
in text	
$entax$	Corporate income tax
ER	Nominal exchange rate
EW_{FOR}	Expected real foreign wage (in terms of domestic prices)
FL_i	Foreign loans to sector $i = G, P$
G_C	Government consumption
g_R	Population growth in rural economy
g_{SG}	Growth rate of the skilled labor force in the public sector
g_{UG}	Growth rate of the unskilled labor force in the public sector
g_U	Population growth in urban economy
I_E	Investment in education
IF	Foreign interest rate
IF_G	Interest rate on government foreign loans
I_H	Investment in health
I_{INF}	Investment in infrastructure
$inctax_h$	Income tax rate for h
$indtax_i$	Rate of indirect taxation of output in sector i
NG	Total government current expenditure on goods and services
$ptax_S$	Payroll tax for skilled labor in private urban sector
$ptax_U$	Payroll tax for unskilled labor in private urban sector
S_G	Skilled workers in public sector
S_G^E	Skilled labor in the public sector engaged in the production of education
S_G^T	Total number of skilled workers in the public sector
tm_i	Import tariff for good $i = A, P$
U_G	Unskilled workers in public sector
W_{FOR}	Nominal foreign wage
wpe_i	World price of export for $i = A, P$
wpm_i	World price of import for $i = A, P$

Parameters

Name	Definition
in text	
a_{ij}	Input-output coefficient
α_G	Shift parameter in the public capital equation
α_{Qi}	Shift parameter in the total supply function of good $i = A, P$
α_{Ti}	Shift parameter in transformation function between exported and domestic production of good $i = A, P$
α_{Xi}	Shift parameter in production of good $i = A, I, P$
α_{XP1}	Shift parameter in composite input of unskilled and skilled/capital composite input
α_{XP2}	Shift parameter in composite input of skilled workers and private capital
β_E	Parameter determining the weight of skilled labor in production of education
β_F	Speed of adjustment for the supply of unskilled labor in the formal private sector
β_G	Share parameter in the public capital equation
β_{QA}	Shift parameter in agricultural composite good
β_{QP}	Shift parameter in urban composite good
β_{Ti}	Shift parameter between exported and domestic production of good $i = A, P$
β_{Xi}	Shift parameter in production of good $i = A, I, P$
β_{XP1}	Share parameter between unskilled and skilled/capital composite input
β_{XP2}	Share parameter between skilled workers and private capital
cc_{ih}	Shares of household h in consumption of good i
δ_E	Depreciation of education capital
δ_H	Depreciation of health capital
δ_{INF}	Depreciation of infrastructure
δ_{IMIG}	Rate of "attrition" of the stock of migrants
δ_{NP}^S	Rate of skilled retirement in the urban formal private and public sectors
δ_{NP}^U	Rate of unskilled retirement in the urban formal private and public sectors
δ_P	Private capital's depreciation rate
δ_S	Rate of "depreciation" or "de-skilling" of the skilled labor

$\varepsilon_{S_P^d/W_S}$	Wage elasticity of the demand for skilled labor
φ	Productivity of public workers engaged in providing education
φ_m	Minimum level of effort
η_{XA}	Coefficient of returns to scale in the agricultural value added function
γ_h	Share of transfers allocated to household h
gg_i	Share of government expenditure on good $i = A, G, P$
κ_S	Shift parameter for skilled private sector employment
λ_{im}	Speed of adjustment in the international migration equation
λ_m	Partial adjustment rate on migration
ϕ_j	Parameters determining the nominal wage rate for the skilled labor for $j = 1, 2$
re	Percentage of profits retained
ρ_E	Substitution parameter between skilled labor in production of education and educational capital stock
ρ_G	Substitution parameter in the public capital equation
ρ_{Qi}	Substitution parameter in total supply of good $i = A, P$
ρ_{Ti}	Substitution parameter between exported and domestic production of good $i = A, P$
ρ_{Xi}	Substitution parameter in production of good $i = A, P$
ρ_{XP1}	Substitution parameter between unskilled and skilled/capital composite input
ρ_{XP2}	Substitution parameter between skilled workers and private capital
σ_{IM}	Elasticity of international migration flows with respect to expected wages
σ_M	Elasticity of migration flows with respect to expected wages
σ_{QA}	Elasticity of agricultural composite good
σ_{QP}	Elasticity of private urban composite good
σ_S	Elasticity of saving rate to deposit rate
σ_{Ti}	Elasticity of transformation between exported and domestic production of good $i = A, P$
σ_{XP1}	Elasticity of substitution between unskilled workers and composite input of skilled workers and private capital
σ_{XP2}	Elasticity of substitution between skilled workers and private capital
τ_F	Fraction of the remittances that are allocated to households in the formal sector

θ_U	Share of urban unskilled workers employed in formal sector
v	Measure of the trade union's bargaining power
wf_i	Initial share of good i in consumption of formal sector goods
wr_i	Relative weight of good i in rural consumption
wu_i	Initial share of good i in urban unskilled workers' consumption
zz_i	Share of investment expenditure on good $i = G, P$

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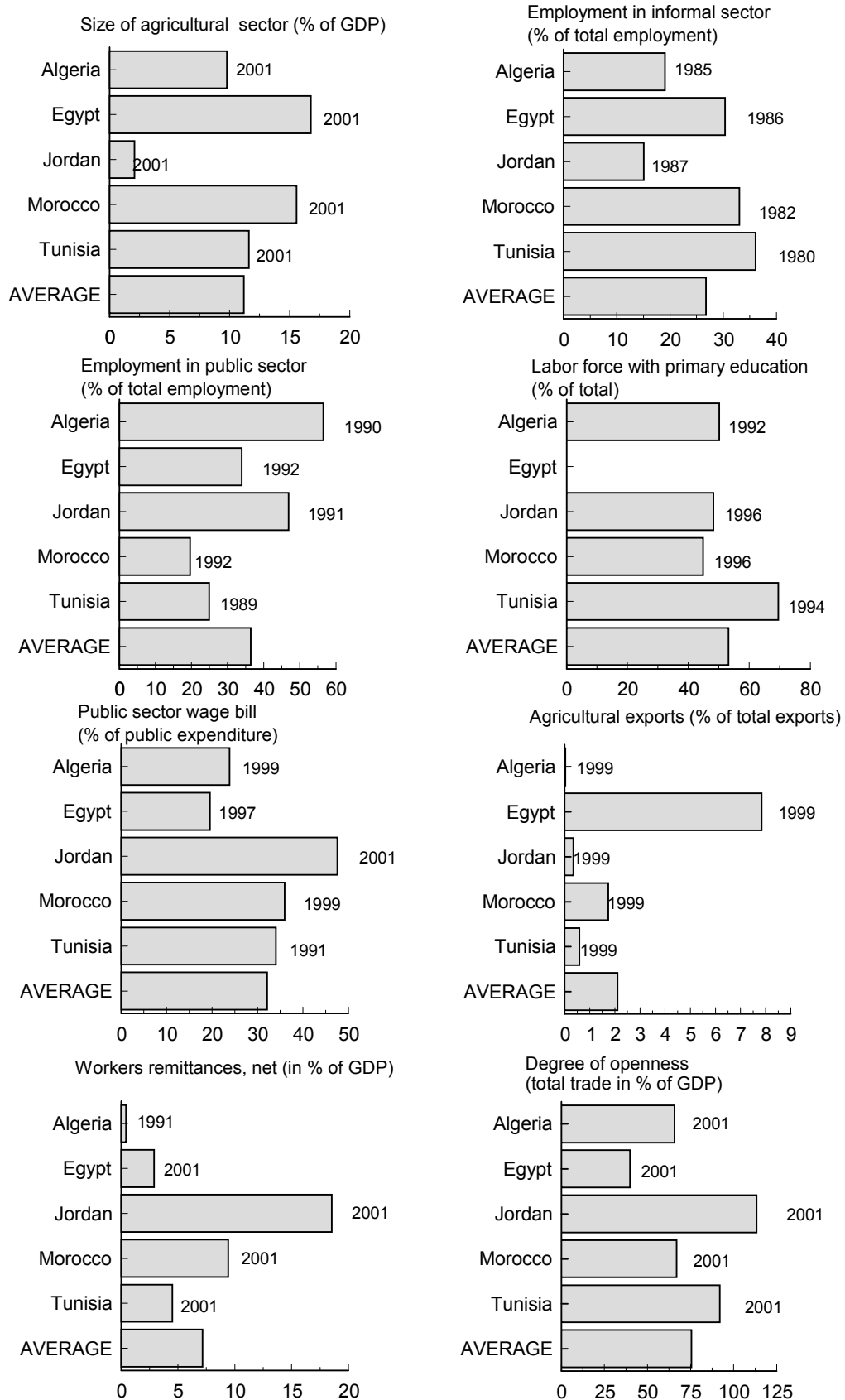
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Figure 1
 Labor-Exporting MENA Countries: Economic and Labor Market Indicators



Note: Years are given next to bars.

Figure 2
A Stylized View of the Labor Market in Labor-Exporting MENA Countries

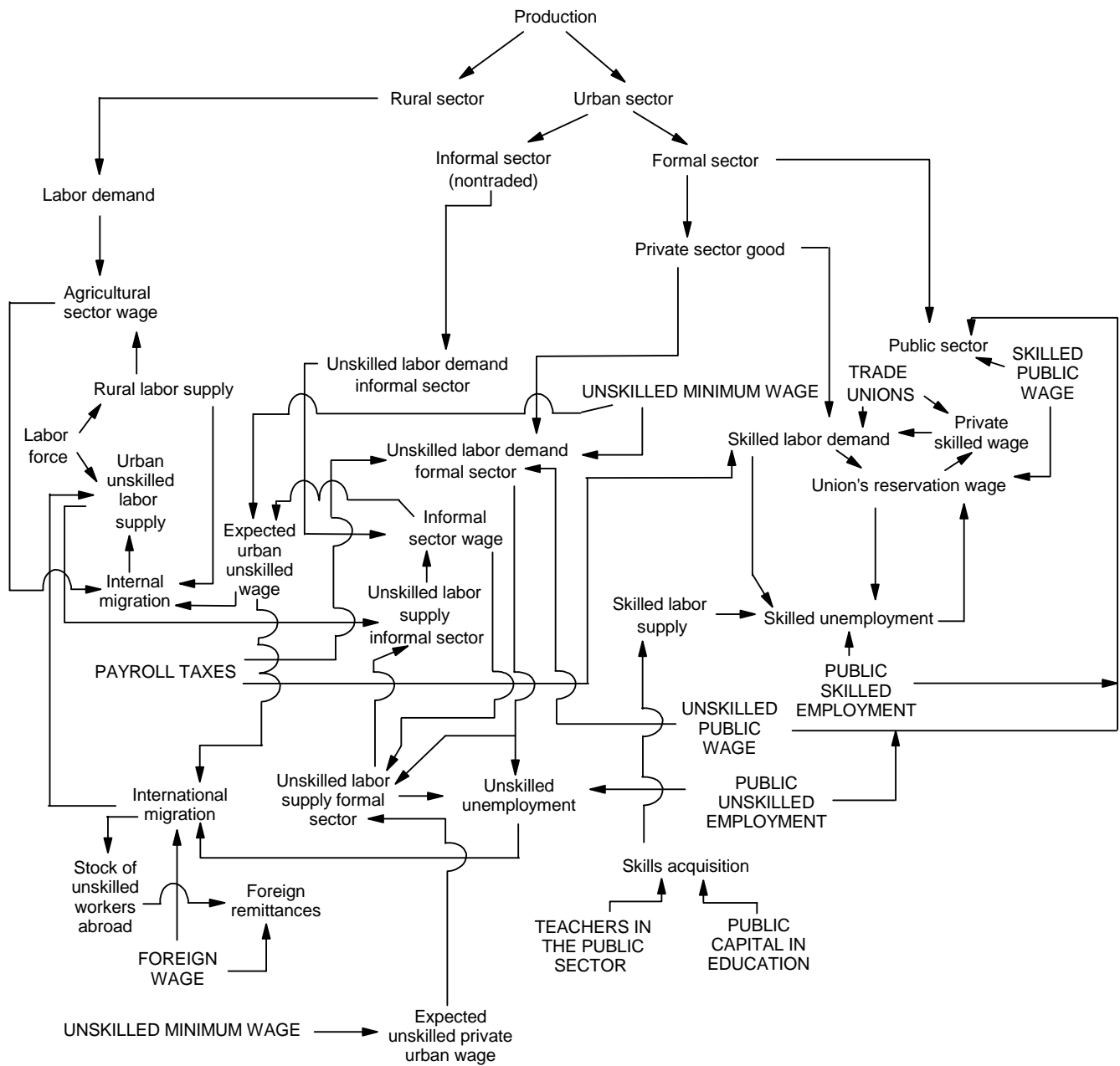
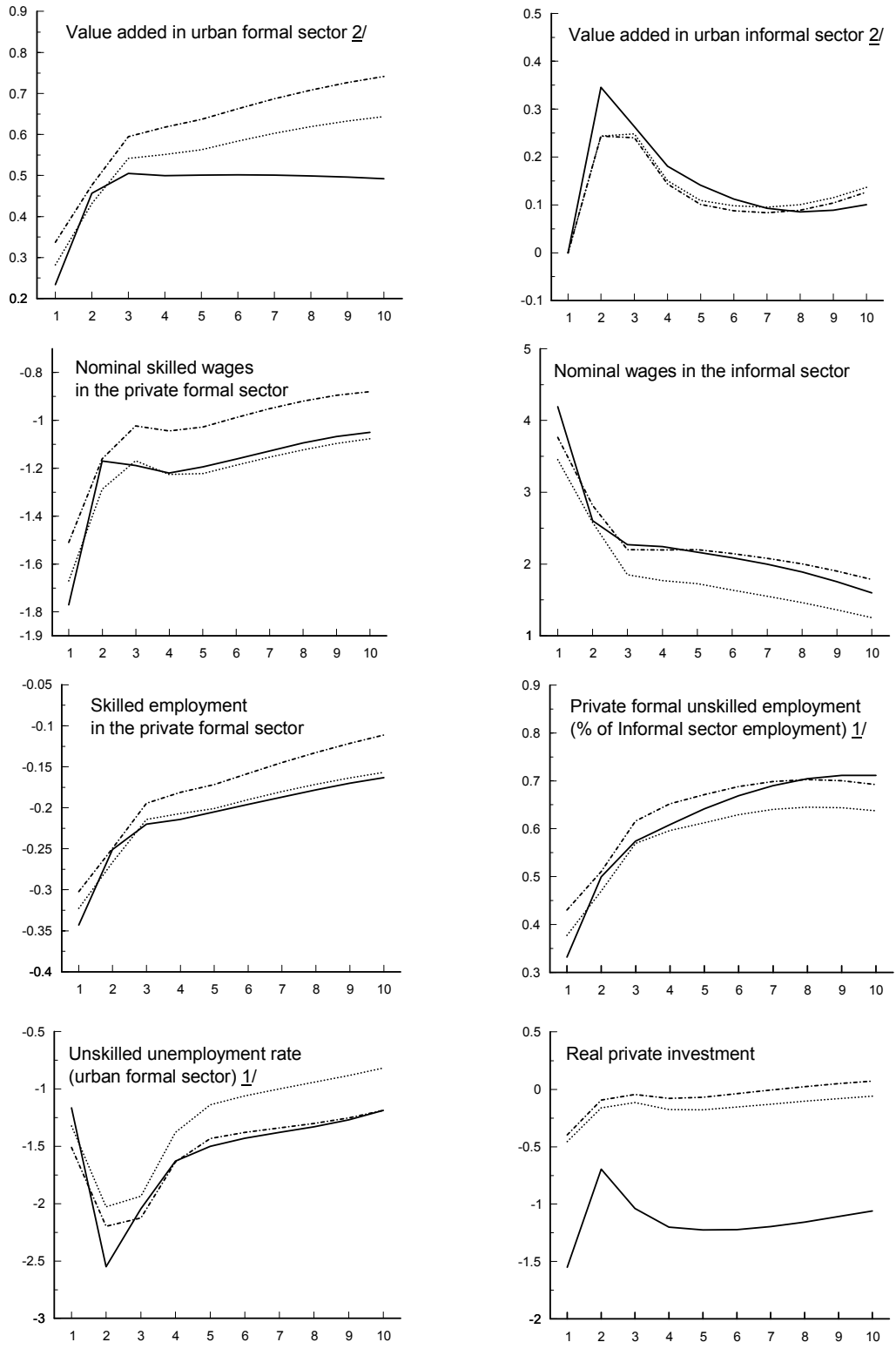


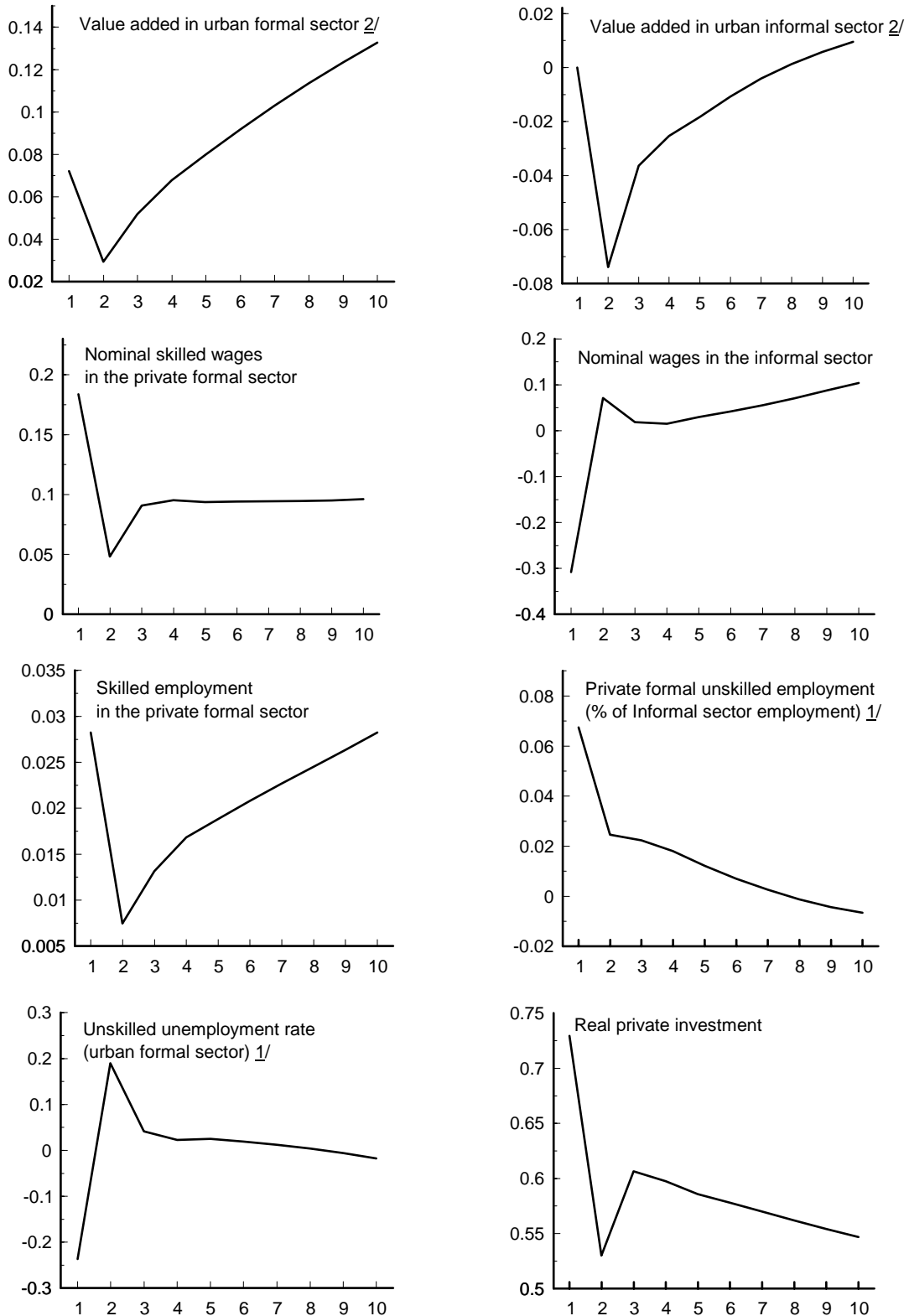
Figure 3
Simulation Results
5 Percentage Reduction in Unskilled Labor Payroll Tax Rate
 (Percentage deviations from baseline, unless otherwise indicated)

———— Non revenue neutral ······· Revenue neutral sales tax - - - - - Revenue neutral income tax



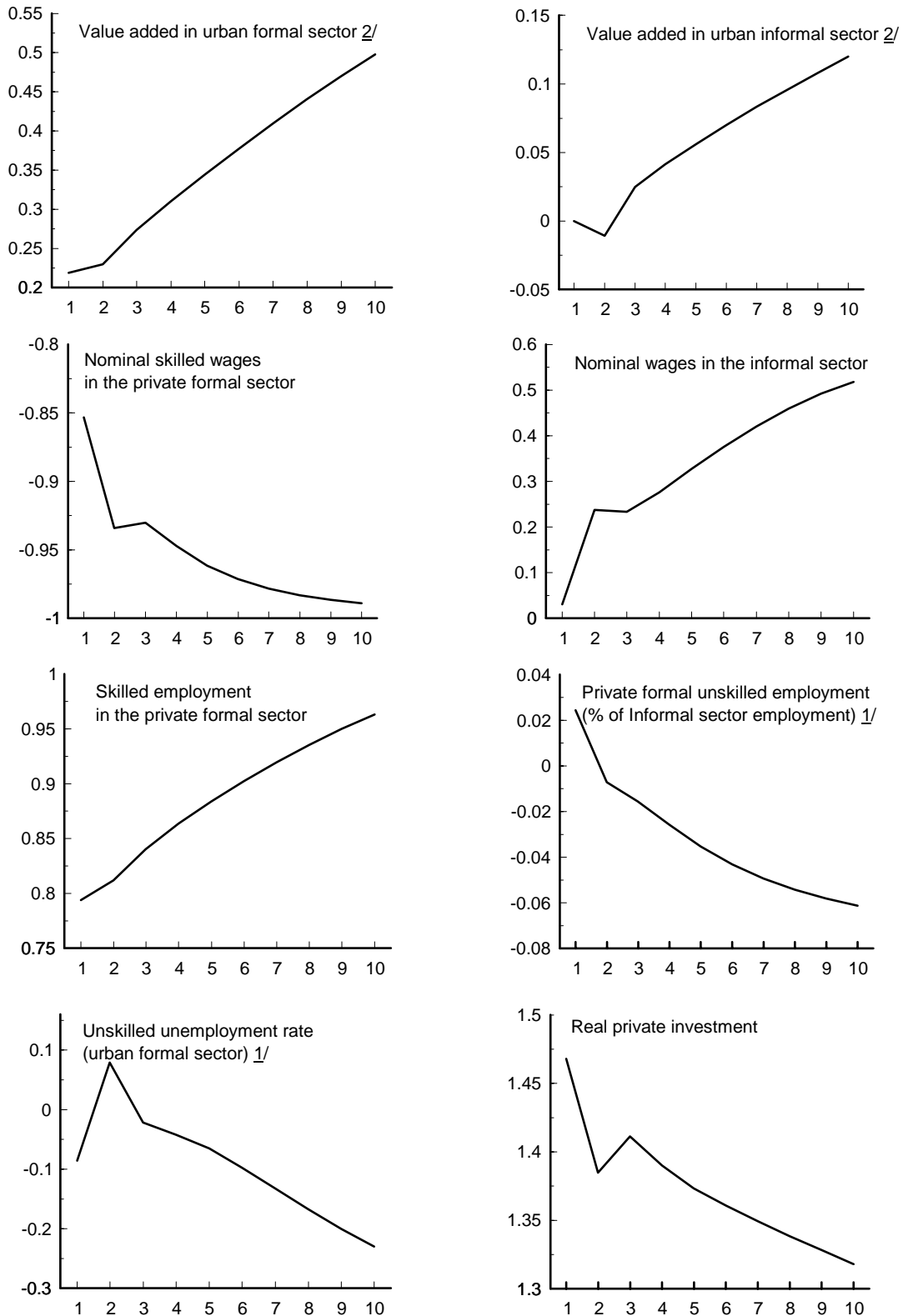
1/ Absolute deviations from base line.
2/ Real terms.

Figure 4
Simulation Results
5 Percentage Points Reduction in Public Sector Unskilled Labor Wage
 (Percentage deviations from baseline, unless otherwise indicated)



1/ Absolute deviations from base line.
2/ Real terms.

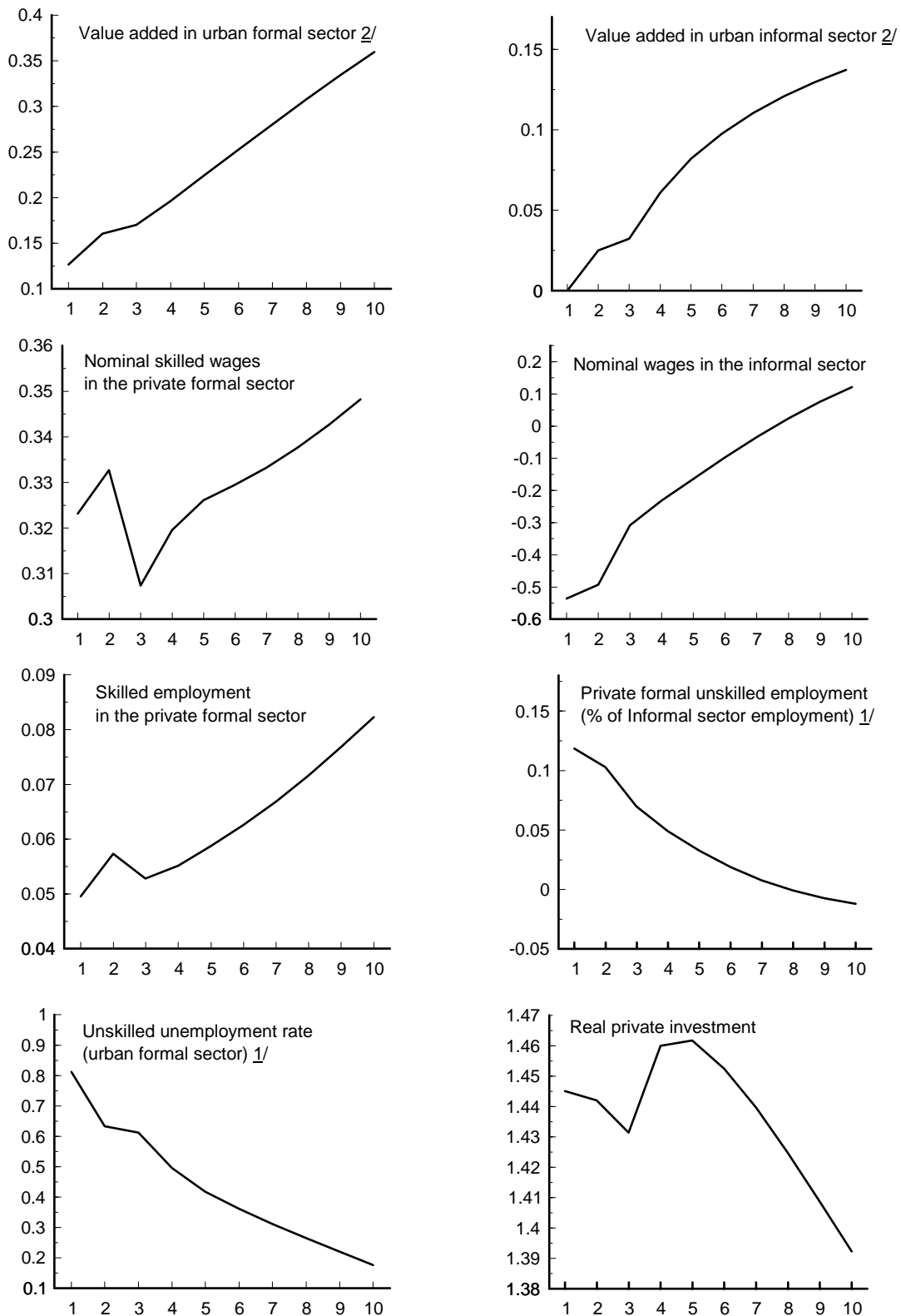
Figure 5
Simulation Results
5 Percentage Points Reduction in Public Sector Skilled Labor Wage
 (Percentage deviations from baseline, unless otherwise indicated)



1/ Absolute deviations from base line.

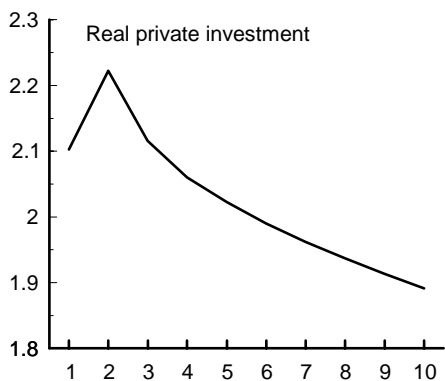
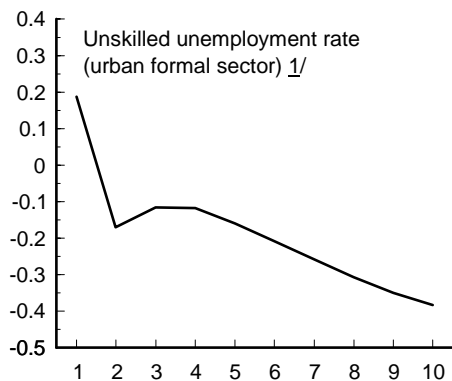
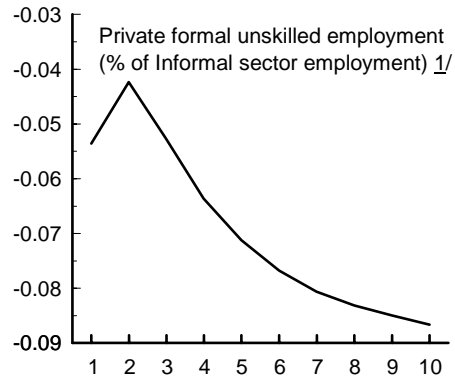
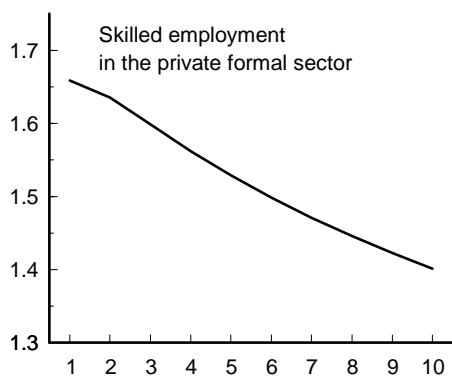
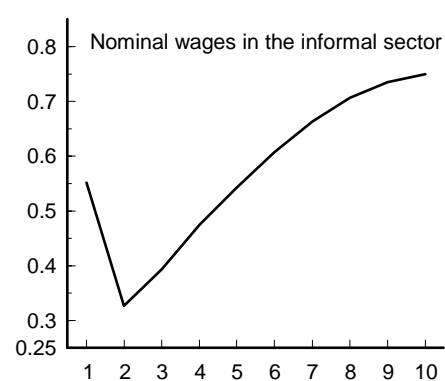
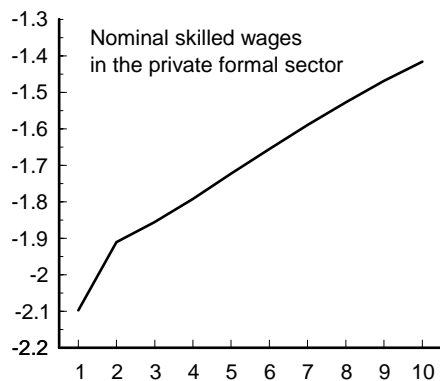
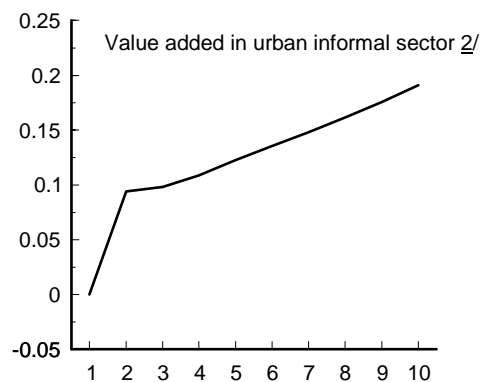
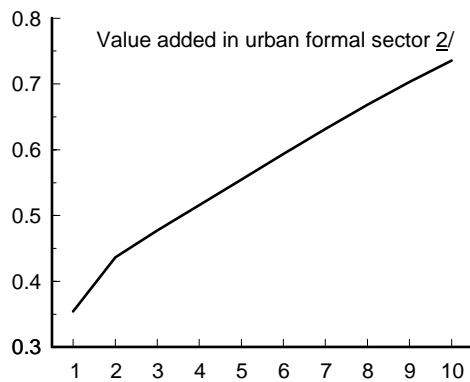
2/ Real terms.

Figure 6
Simulation Results
5 Percentage Points Reduction in Public Sector Unskilled Labor Employment
 (Percentage deviations from baseline, unless otherwise indicated)



1/ Absolute deviations from base line.
2/ Real terms.

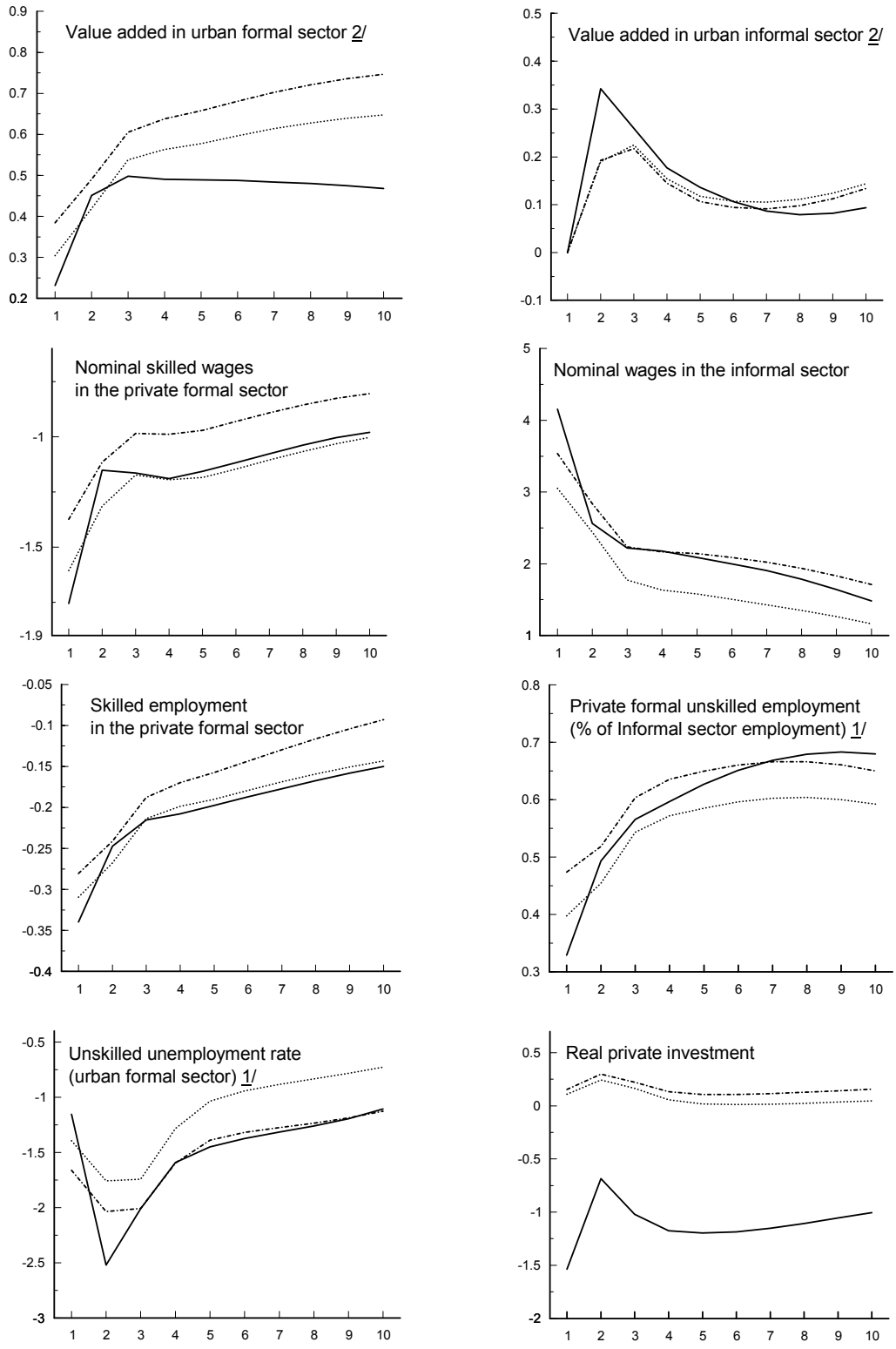
Figure 7
Simulation Results
5 Percentage Points Reduction in Public Sector Skilled Labor Employment
 (Percentage deviations from baseline, unless otherwise indicated)



1/ Absolute deviations from base line.
 2/ Real terms.

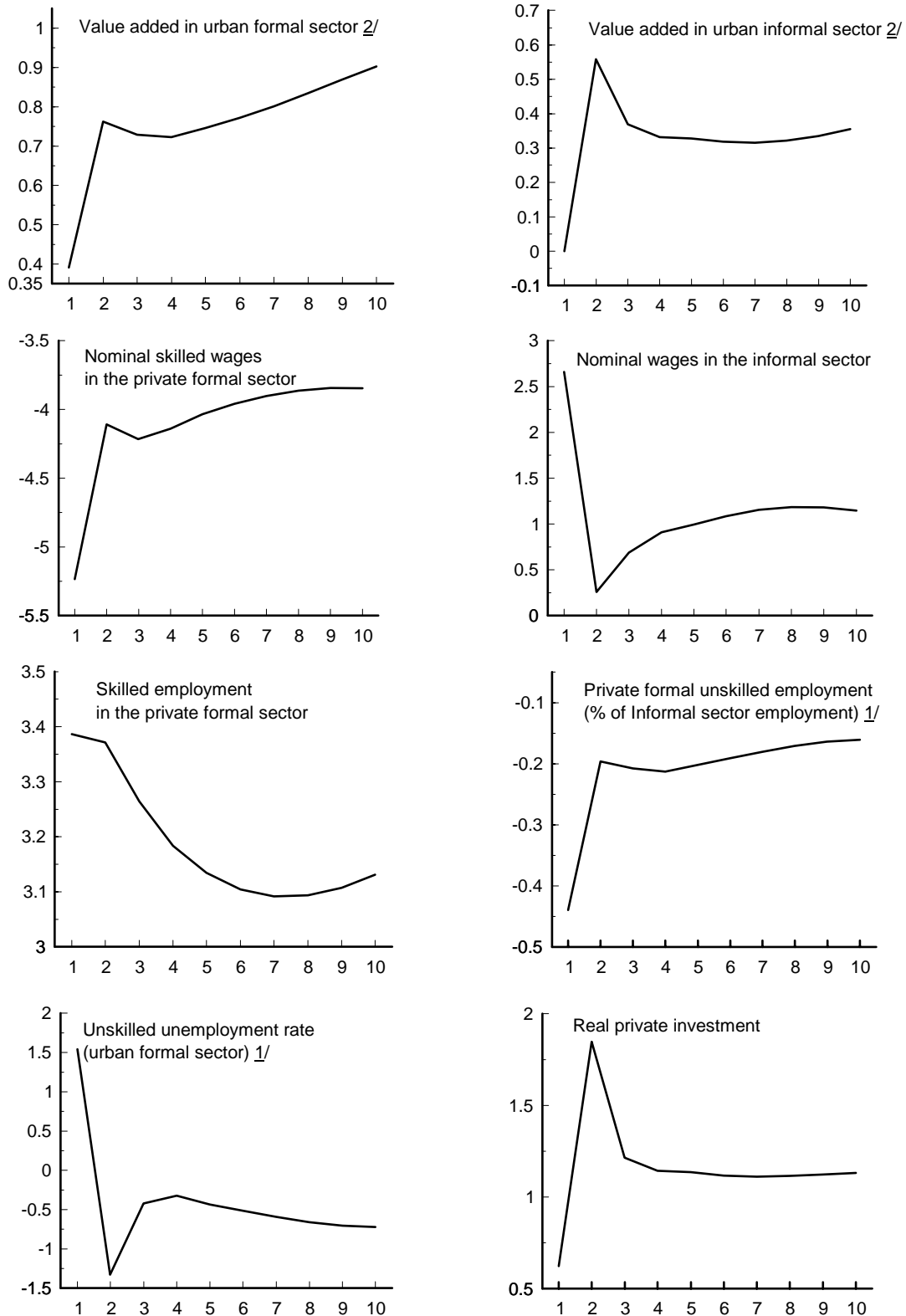
Figure 8 Simulation Results 5 Percentage Points Increase in Unskilled Labor Employment Subsidy (Percentage deviations from baseline, unless otherwise indicated)

————— Non revenue neutral
······ Revenue neutral sales tax
······ Revenue neutral income tax



1/ Absolute deviations from base line.
2/ Real terms.

Figure 9
Simulation Results
Reduction in Labor Union's Bargaining Strength
 (Percentage deviations from baseline, unless otherwise indicated)



1/ Absolute deviations from base line.

2/ Real terms.