Unemployment-Poverty Trade-offs

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Abstract

This paper examines the potential trade-offs that may arise between poverty alleviation and unemployment reduction. The first part discusses various analytical arguments that may provide a rationale for their existence. I then use three alternative methodologies to assess empirically their relevance: a VAR framework (which is applied to Brazil and Chile), cross-country regressions, and simulations with a structural macro model built for poverty and labor market analysis. Impulse response functions to output and wage shocks indicate no short-run trade-off between unemployment and poverty. By contrast, regression results, which control for a variety of determinants of poverty rates across countries, suggest that such a trade-off may indeed exist. Simulations with the structural model show that labor market reforms may induce both short- and long-run trade-offs between the *composition* of unemployment and the incidence of poverty among various household groups.

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1 Introduction

Reducing unemployment and alleviating poverty are key policy goals in many developing countries, yet progress has remained elusive on both fronts. Although the measurement of poverty and the use of international poverty lines for cross-country comparisons have generated much controversy in recent years (see Deaton (2001, 2003) and Ravallion (2003), there is some agreement that poverty has remained high in many parts of the world, and even increased in some countries. Figure 1 displays the behavior of the headcount ratio (which measures the incidence of poverty, that is, the proportion of individuals or households earning less than a given level of income) in various regions of the developing world, using international poverty lines of $1.08 and $2.16 a day. The data show that, between 1990 and 1999, although poverty rates fell significantly in East Asia and the Pacific, they increased in Europe and Central Asia, and the Middle East and North Africa. In Latin America and the Caribbean, South Asia, and sub-Saharan Africa, very little progress was recorded. In addition, according to the United Nations *Human Development Report 2003*, during the 1990s poverty rates (measured by the proportion of a country's people living below $1.08 a day) increased in 37 out of 67 countries for which data were available.[1] As illustrated by the projections for 2015 shown also in Figure 1, prospects for sub-Saharan Africa remain bleak based on current trends.

Unemployment has also become a greater source of concern, in part because those who have been particularly hard hit include women and the young, whose jobs are highly vulnerable to adverse economic shocks. In its *Global Employment Trends 2003* report, the International Labor Organization (ILO) estimated that the number of unemployed workers worldwide grew by 20 million between the beginning of 2001 and the end of 2002, to reach a record level of 180 million. As shown in Figure 2, only in transition economies did unemployment rates fall in recent years. But they remain well above 10 per cent in several countries (and even close to 20% in Poland, the Slovak Republic, the former Yugoslavia and Bulgaria), despite

[1] 54 countries also recorded an average growth rate of below zero for the last decade, and 21 countries experienced a drop in the human development index—a more conprehensive index of welfare calculated by the United Nations, which includes life expectancy and literacy. 12 countries registered a decline in primary school enrollment rates, and 14 countries recorded an increase in child mortality.

strong economic growth in recent years.[2]In Latin America, many countries (including those with sustained growth) have experienced major increases in unemployment. The unemployment rate doubled to more than 10 percent in Argentina, Brazil and Chile during the 1990s. In the Middle East and North Africa (MENA), a region where the population nearly quadrupled during the second half of the past century, employment growth has 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 (see Figure 2). According to the ILO, unemployment rates range from less than 3 percent for the United Arab Emirates to close to 30 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.[3] Based on current trends, prospects remain bleak; The *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.

Unemployment reduction and poverty alleviation are often viewed as complementary policy goals, and thus as involving no trade-offs. There a number of good reasons to believe, however, that this is not always the case. The experience of the recent years shows that in many cases vulnerable groups (young people, older workers, women, and the unskilled) benefited little from improvement in aggregate macroeconomic conditions, and often ended up in poorly paid jobs. Indeed, in Latin America, the share of the "working poor" (that is, workers who earn less than the $1.08 a day international poverty line) in total employment rose significantly in most countries. In sub-Saharan Africa and in South Asia, although measured unemployment remained relatively low, the share of the working poor in total employment reached almost 40 percent on average in both regions, and even 50 percent in India (see Fig-

[2]Unemployment was inexistent at the beginning of the 1990s in Central and Eastern Europe, but it jumped to about 15% of the labor force in the early phases of the transition to a market economy.

[3]In 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 (see International Labor Office (2003)). Note that the World Bank (2003) reports a regional unemployment rate at 14.9 percent for 2000-01 and 15.7 million unemployed.

ure 3). In the MENA region the proportion of working poor is also high, as for instance in Morocco and Syria. A potential trade-off between unemployment reduction and poverty alleviation is thus readily apparent: to the extent that the higher growth rates of output and job creation that are needed to absorb the increase in the supply of labor and reduce unemployment require a significant drop in real wages, the deterioration in living standards may lead to higher poverty.

Various other sources of potential trade-offs may arise between reducing poverty and lowering unemployment, in both the short and the long term. The purpose of this paper is to provide a systematic assessment of the factors that may entail an arbitrage between two key policy goals. Section II presents a broad analytical discussion of the reasons why identifying and understanding the causes of unemployment-poverty trade-offs are important, particularly in the context of the design of growth-enhancing policies and adjustment programs. It reviews the conditions under which such trade-offs may arise, focusing in particular on the role of several types of labor market reforms, namely, a cut in payroll taxes on unskilled labor, a reduction in the minimum wage, and a reduction in firing costs. Section III proposes two econometric techniques for assessing empirically the importance of unemployment-poverty trade-offs. The first is based on a vector autoregression (VAR) model linking the cyclical components of output, real wages, unemployment, and poverty. The second involves cross-country regressions of the determinants of poverty rates, with the unemployment rate as an explanatory variable. Section IV proposes a third approach, based on a simulation model that integrates a structural macro component and a household survey to assess the impact of policy shocks on unemployment and poverty. The analysis focuses on labor market reforms as a source of shocks and studies their impact on the composition of both unemployment (skilled and unskilled) and poverty (with a distinction between various categories of urban households). Many economists regard labor market rigidities as being a major obstacle to an expansion of employment in the formal economy and a reduction of urban poverty, which tends to be concentrated in the informal sector.[4] At the same time, the possible existence of trade-offs between unemployment and poverty reduction has received scant attention in the analytical literature focusing on these reforms. The framework presented in this paper

[4]See for instance Saavedra (2003) for a review of the experience of Latin America with labor market reform during the 1990s.

is particularly useful because it allows a description of the transitional dynamics associated with this type of reforms. It therefore allows one to assess whether they entail the existence of not only a short-term trade-off between unemployment and poverty reduction, but also whether this trade-off tends to persist over time. The last part of the paper offers some concluding remarks and discusses some future research perspectives.

2 Analytical Issues

As noted earlier, an obvious reason for an inverse correlation (or the lack thereof) between poverty and unemployment is based on the possibility that reducing unemployment requires a fall in real wages; this lowers real income and therefore leads to an increase in poverty. The trade-off may be particularly steep if the expansion in employment (induced by lower real wages and output growth) is skewed toward low-paying jobs, implying that the end result is an increase in the number of "working poor", despite the fall in unemployment. The increase in the number of working poor documented earlier appears consistent with this interpretation, although the concomitant increase in unemployment in some cases (due either to the fact that real wages did not fall sufficiently or that labor supply expanded too rapidly) suggests the absence of a trade-off induced by movements in real wages.

The important point that this example leads to, however, is that unemployment and poverty are jointly endogenous; and if unemployment and poverty are indeed simultaneously determined, the correlation between them will be driven by factors that are likely to vary from sample to sample, depending on the sources of shocks that prove to be dominant. Adverse wage shocks may be an important source of negative correlation between unemployment and poverty over time (and across countries or regions), as noted above. But other sources of shocks to labor demand may also matter. In general, if the economy's production function is not separable in (all) inputs, the demand for labor will depend not only on the cost of labor but also on all the variables other than labor affecting output (that is, inputs such as physical capital, raw materials, and the productivity of factors). Productivity shocks, in particular, may also affect the unemployment-poverty correlation, either positively or negatively. A positive productivity shock, for instance, may raise labor demand and put upward pressure on wages, thereby lowering both unemployment and poverty. But if wages cannot adjust, as a result for

instance of a binding minimum wage, an increase in the number of "working poor" may be an alternative outcome.

Moreover, the underlying source of these shocks (whether to wages or productivity) may be policy-induced, rather than purely random disturbances. Put differently, changes in real wages and productivity may themselves be endogenous and may need to be analyzed jointly with poverty and unemployment. Indeed, there are various mechanisms through which labor market reforms (viewed as policy decisions) may entail a trade-off between unemployment and poverty through their impact on wages and labor demand. Labor market regulations, particularly job security provisions, have been shown to have a major impact on both the level and distribution of employment in many developing countries, particularly in Latin America (see Heckman and Pagés (2003) and Saavedra (2003). An increase in employment subsidies, for instance, may have a direct, beneficial impact on unskilled employment; at the same time, if it is financed by an increase in the sales tax on goods sold domestically, it may increase poverty, because of the impact that the tax hike may have on the cost of living. Thus, although the subsidy may lower the nominal (and product) wage of the unskilled, their real (consumption) wage may fall. Depending on the exact nature of the tax that is used to offset the impact of the increase in spending on the budget (whether it is indeed an increase in the sales tax, or on the contrary a rise in income tax on individuals or firms), as well as the composition of household spending, the impact may be particularly large for the poorest households in urban areas. It is possible for poverty to increase in the informal sector (because workers in that sector bear the brunt of the increase in consumer prices, for instance), while at the same time unskilled unemployment falls in the formal economy. A reduction in the payroll tax on unskilled workers (a policy that has been often advocated to reduce unemployment) may have similar results. If the reduction in the payroll tax is financed by a mixture of higher taxes on domestic goods and corporate income, and the reduction in the net rate of return on physical capital accumulation lowers investment by firms, the net effect on employment may be mitigated, because the demand for labor may not increase over time as much as it would otherwise (as a result of gross complementarity between capital and labor). Unemployment may thus fall to a limited extent, whereas poverty among the most vulnerable urban groups can increase significantly—again, because higher taxes on domestic goods affect the price index faced by those households.

Even labor market reforms that do not have a direct impact on the gov-

ernment budget may entail a trade-off between unemployment and poverty, as a result of their indirect, general equilibrium effects. A cut in the minimum wage, for instance, may indeed increase the demand for unskilled labor in the urban formal sector; but to the extent that the elasticity of labor demand in the formal economy is not high, average income of unskilled households in that sector (taking into account those workers who remain unemployed) may fall below the poverty line. And to the extent that the cut in the minimum wage reduces the expected wage (because the employment ratio does not rise sufficiently to offset the reduction in that wage) and therefore the incentive to queue for employment in the formal economy, the supply of labor may increase in the informal sector, thereby putting downward pressure on wages there. Urban poverty rates may therefore increase. This transmission process of a cut in the minimum wage is studied more formally in the context of the structural model described later. The model is also useful to , are illustrate other examples of general equilibrium effects, operating for instance through private investment and changes in the capital stock.

In a growth context, a negative correlation between unemployment and poverty may also emerge from an ambiguous relationship between growth and unemployment, depending on the source of the underlying shock. The reasons for this ambiguity are well illustrated in a simplified version of the model developed by Bean and Pissarides (1993), which considers a two-period economy with overlapping generations and a constant population. Suppose that production in each individual firm in this economy, Y_t, exhibits constant returns to scale in the firm's capital, K_t, and diminishing returns to labor:

$$Y_t = K_t n_t^{\alpha}, \tag{1}$$

where $0 < \alpha < 1$ and $n_t = \bar{K}_t N_t / K_t$, where N_t is the firm's employment level and $\bar{K}_t$ the economy-wide stock of capital (which is treated as given by individual firms). Capital depreciates fully in a single period. Thus, in Romer-like fashion, technology exhibits positive externalities.

Potential workers and employers have to search for each other, with the number of successful matches increasing in both the number of unemployed and the number of job vacancies. This matching process takes place at the start of the period, and individuals who fail to find a job then have no chance to re-enter the labor market later. Given the generational structure, this implies that all matches last exactly one period, and the matching technology for aggregate employment, $\bar{N}_t$, may thus be written as

$$\bar{N}_t = m(\bar{V}_t, L_t), \tag{2}$$

where $\bar{V}_t$ is the aggregate number of job openings at the start of period t, and L_t the number of young households. The matching function is concave, homogeneous of degree one, and increasing in both arguments.[5] These properties can be summarized as

$$m_i > 0, \;\; m_{ii} < 0, \;\; m(0, L_t) = m(\bar{V}_t, 0) = 0,$$
$$\lim_{\bar{V}_t \to \infty} m(\bar{V}_t, L_t) = L_t, \;\; \lim_{L_t \to \infty} m(\bar{V}_t, L_t) = \bar{V}_t.$$

Because the population is constant, one can set $L_t = 1$ and suppress it in what follows, so that $m(\bar{V}_t, 1) = m(\bar{V}_t)$. $\bar{N}_t$ (respectively $1 - \bar{N}_t$) can thus be interpreted as the employment (respectively unemployment) rate.

Hires by an individual firm, N_t, are proportional to the number of vacancies it has relative to the aggregate, that is

$$N_t = (\frac{V_t}{\bar{V}_t}) m(\bar{V}_t). \tag{3}$$

Households are endowed with one unit of labor, which is supplied inelastically in the first period of life. For simplicity, their propensity to save when young is assumed constant and equal to $0 < \gamma < 1$. In the second period of their lives, households become entrepreneurs and invest directly. A firm's profits, Π_t, are given by

$$\Pi_t = K_t n_t^{\alpha} - w_t N_t - q_t V_t, \tag{4}$$

where w_t is the wage rate and q_t is the hiring cost per job opening, which is assumed to be proportional to the economy-wide capital stock, $\bar{K}_t$:[6]

$$q_t = \chi \bar{K}_t. \tag{5}$$

[5] Concavity is assumed in order to capture a congestion externality in the labor market. The higher the number of vacancies opened by firms, the shorter the search effort of unemployed workers; and the more unemployment workers on-search in the labor market, the faster the match available for each firm.

[6] In this setting only firms incur a cost to match workers with their opened vacancies; workers passively wait for a match, comparing their prospective income with the opportunity cost of being unemployed. An alternative approach, following King and Welling (1995), would be to assume that workers bear a direct cost when they decide to actively search for a job. This assumption would be more appropriate for developing economies, where the lack of adequate institutions in the labor market may create informational frictions.

The wage is determined after a match has occurred, as the outcome of a Nash bargain between the firm and the individual worker. Workers can only work at one firm; and if both parties fail to reach agreement, neither has the opportunity to look for an alternative match elsewhere.[7] The firm's utility is linear in the marginal profit from employing an additional worker, that is, using (1), $\alpha \bar{K}_t n_t^{\alpha-1} - w_t$. Thus, using the wage rate as a measure of the worker's surplus, and assuming that the unemployed receive no benefit and have no alternative source of income, the wage must satisfy

$$w_t = \text{Arg}\max w_t^{\nu}[\alpha \bar{K}_t n_t^{\alpha-1} - w_t]^{1-\nu},$$

where $0 < \nu < 1$ measures the worker's bargaining strength. This equation yields the first-order condition

$$\nu w_t^{-1}[\alpha \bar{K}_t n_t^{\alpha-1} - w_t] - 1 = 0,$$

from which the equilibrium wage can be derived as:

$$w_t = \alpha\beta n_t^{\alpha-1} \bar{K}_t, \qquad \beta \equiv \nu/(1+\nu). \tag{6}$$

Substituting (6) in (4), and eliminating V_t using (2) and (3), together with (5), yields

$$\Pi_t = K_t \left\{ n_t^{\alpha} - [\alpha\beta n_t^{\alpha-1} + \chi \frac{m^{-1}(\bar{N}_t)}{\bar{N}_t}] n_t \right\} = K_t \left\{ (1-\alpha\beta) n_t^{\alpha} - \chi \frac{m^{-1}(\bar{N}_t)}{\bar{N}_t} n_t \right\}.$$

The firm's optimal choice of n_t thus satisfies

$$\frac{d\Pi_t}{dn_t} = \alpha(1-\alpha\beta) n_t^{\alpha-1} - \chi \frac{m^{-1}(\bar{N}_t)}{\bar{N}_t} = 0.$$

With a large number of identical firms, and in general equilibrium, $K_t = \bar{K}_t$, $N_t = \bar{N}_t$, and $n_t = N_t$. The above expression thus becomes

$$\alpha N_t^{\alpha-1} = \frac{\chi}{1-\alpha\beta} \frac{m^{-1}(N_t)}{N_t}, \tag{7}$$

[7] This assumption can be relaxed (by assuming instead that it is costly for each agent to change an alternative match) without affecting qualitatively the main results of the model.

which equates the marginal product of labor, $\alpha N_t^{\alpha-1}$, to an expression that captures both the marginal cost of matching capital and labor, and the strategic use of employment by the firm to affect the outcome of the wage bargain (higher employment lowers the marginal product and thus also the wage).

Finally, the evolution of the capital stock is determined by the savings of the young, that is, given the assumption of a full depreciation of capital, $K_{t+1} = \gamma w_t N_t$. Using (6) with $K_t = \bar{K}_t$ and $n_t = N_t$ yields

$$\frac{K_{t+1}}{K_t} = \gamma\alpha\beta N_t^{\alpha}. \tag{8}$$

The rate of growth of output (or, equivalently here, output per capita) along a balanced growth path with a constant employment rate is $K_{t+1}/K_t - 1$, which is obtained from (8). Thus, equations (7) and (8) determine the economy's equilibrium in terms of the employment rate and the rate of growth of output.

This framework can be used to analyze the impact of various changes in the parameters along balanced growth paths.[8] A reduction in hiring costs, χ, raises employment, the rate of capital formation, and growth. An increase in the propensity to consume (a reduction in γ) lowers the rate of growth but has no effect on employment. The first experiment predicts a negative empirical (cross sectional) relationship between growth and unemployment—and thus a positive relationship between the latter variable and poverty—if differences in growth rates are primarily due to differences in hiring costs across countries. By contrast, if cross-country differences result from differences in saving rates, no systematic relationship should be observed.[9]

An increase in the relative bargaining strength of workers, β, has two opposite effects. On the one hand, from (7), it tends to reduce employment and the growth rate, under reasonable conditions.[10] On the other, it tends

[8] In general, exercises of this type are complicated because changes in parameters will generally affect the rate of return and thus the propensity to save. However, these changes are ruled out here because of the assumption of Cobb-Douglas preferences.

[9] In the above model, an exogenous reduction in the savings rate has the conventional Classical effect of lowering investment and reducing the growth rate. Bean and Pissarides (1993) developed a two-sector extension (based on imperfect competition in the consumption goods sector), which implies (in the Keynesian tradition) that an increase in the propensity to consume raises both investment and growth.

[10] This is most easily shown if the matching technology is CES, that is, $\bar{N}_t = (\bar{V}_t^{-\rho} + L_t^{-\rho})^{-1/\rho}$, with $\rho > 0$. The resulting equation (7) may yield multiple solutions, but using the implicit function theorem one can show that an increase in β does reduce employment.

to increase the growth rate, with no effect on employment. Thus, the effect on growth is ambiguous. Intuitively, these two effects can be explained as follows. On the one hand, the increase in bargaining strength shifts income from entrepreneurs (who consume all their income here) to workers, which raises savings and fosters growth. On the other, provided that the "strategic effect" is not too strong, unemployment rises, thereby reducing workers' income and the available pool of savings, and dampening growth. The overall impact on growth (and thus poverty) depends on which effect dominates.

There are several other models in the recent growth literature that may lead to a negative correlation between unemployment and poverty, as a result of a nonlinear relation between unemployment and growth. These models include Aghion and Howitt (1994), Cahuc and Michel (1996), van Schaik and de Groot (1995), and Aricó (2003). In the Aghion-Howitt framework, for instance, an increase in the growth rate of productivity raises the present discounted value of the profits from creating a new job opening, on the one hand, leading firms to open more vacancies, and thus reducing unemployment. This is what they call a capitalization effect. On the other, when productivity growth occurs through the "creative destruction" of low productivity jobs and their replacement by new high productivity ones elsewhere in the economy, then the inflow rate into unemployment will also be increased. This is what they term the reallocation effect, which affects workers in the opposite direction to the capitalization effect. Aghion and Howitt showed that the reallocation effect dominates at low growth rates, whereas the capitalization effect dominates at high ones, leading to a hump-shaped relationship between growth and unemployment.[11] The main point, however, is similar to the one made earlier, which is that trade-offs between unemployment and poverty reduction may emerge as a result of policy or structural shocks.

It is also important to stress that, in practice, labor is heterogeneous and households differ in terms of their sources of income. This implies that when looking at unemployment, it is important to consider its composition; similarly, it is important to examine changes in poverty rates not only at the aggregate level but also at the level of various household groups. A policy-induced shock may entail a trade-off solely between unemployment of one category of workers (say, unskilled workers) and one particular group of households (say, households in the urban informal sector), as noted earlier. In

[11] However, their analysis is based on a causal effect from growth to unemployment, instead of growth and unemployment being determined jointly as endogenous variables.

such conditions, of course, the nature of the social welfare function becomes crucial in choosing a given policy path. The simulation framework presented below will help to illustrate "partial" trade-offs of this nature.

3 Econometric Techniques

In this section I use two alternative econometric techniques to assess empirically the importance of potential trade-offs between unemployment and poverty. The first focuses on short-run dynamics, and is based on a vector autoregression (VAR) model involving a small set of stationary variables, which includes unemployment and poverty. The second involves cross-country regressions of poverty rates on a variety of structural and macroeconomic variables, with unemployment being one of them.

3.1 A VAR Framework

A first approach to determining whether unemployment and poverty move in opposite directions in response to shocks in the short term is to specify a VAR consisting of the detrended components of output, the open unemployment rate, real wages, and the poverty rate. These variables are chosen on the premise that in the short term an output shock, for instance, is transmitted to poverty primarily through two channels: either a change in unemployment or a change in real wages.[12] In general, of course, the impact of a shock on poverty will depend on what group is hit the most by the rise in unemployment or the fall in real wages. If movements in these two variables affect primarily prime age working males with low education, poverty may increase significantly. Thus, it may be important to include in the VAR a measure of unemployment that reflects well labor market conditions faced by unskilled and/or young workers (as a proxy for "vulnerable" groups), and a real wage index that is representative of wages earned by the poor—say, an index of unskilled workers' wage, or informal sector wages.

[12] As noted by Agénor (2002), output shocks may be accompanied also by changes in intra-family allocation of income or government transfers. It is also possible that changes in open unemployment are not highly correlated with output fluctuations, because adjustment to changes in labor demand takes the form of large movements in the labor force between the formal and informal sectors; in such conditions, the open unemployment rate should be replaced by a measure of the size of the informal sector.

The procedure suggested above was applied to Brazil and Chile, using in both cases annual data. For Brazil, the estimation period is 1981-2002, whereas for Chile it is 1981-2001. Brazil is a particularly interesting case, because it is one of the few countries for which several recent studies have focused on assessing the impact of macroeconomic variables on poverty.[13]

In both cases, the trend component of each variable is estimated by using a modified version of the "ideal" band pass filter of Baxter and King (1999), as proposed by Christiano and Fitzgerald (2003). The Baxter-King filter is a linear transformation of the data, which leaves intact the components within a specified band of frequencies and eliminates all other components. However, its application requires a large amount of data. Christiano and Fitzgerald (2003) proposed the following approximation. Let y_t be the data series that would result from applying the ideal band pass filter to the raw data, x_t. y_t is approximated by $\widehat{y}_t$, which is a filter of x_t. The filter weights are chosen to minimize the mean square error:

$$E\left[(y_t - \widehat{y}_t)^2 | x\right].$$

$\widehat{y}_t$ can be computed as

$$\widehat{y}_t = B_0 x_t + B_1 x_{t+1} + ... + B_{T-1-t} x_{T-1} + \widetilde{B}_{T-t} x_T + B_1 x_{t-1}$$
$$+ ... + B_{t-2} x_2 + B_{t-1} x_1, \qquad \text{for } t = 1, 2, 4, ..., T,$$

where

$$B_j = \frac{\sin(jb) - \sin(ja)}{\pi j}, \; j \geq 1,$$
$$B_0 = \frac{b-a}{\pi}, \qquad a = \frac{2\pi}{p_u}, \; b = \frac{2\pi}{p_l},$$

and $\widetilde{B}_{T-t}$ and $\widetilde{B}_{t-1}$ are linear functions of the B_j's:

$$\widetilde{B}_{T-t} = -\frac{1}{2} B_0 - \sum_{j=1}^{T-t-1} B_j,$$

and $\widetilde{B}_{t-1}$ solves

$$0 = B_0 + B_1 + ... + B_{T-1-t} + \widetilde{B}_{T-t} + ... + B_{t-2} + \widetilde{B}_{t-1},$$

[13] Paes de Barros et al. (2000), for instance, in a study based on micro-simulation techniques, found that unemployment has a major impact on the behavior of poverty rates.

with $p_u = 24$ and $p_l = 2$ in the present case.

Consider first the case of Brazil. The variables included in the VAR are the (log of the) output gap, and the cyclical components of the (log of the) aggregate unemployment rate, the real minimum wage , and the poverty gap, defined as the average shortfall of the income of the poor with respect to the national poverty line, multiplied by the headcount index (as defined earlier).[14,15] The real minimum wage, which plays a key role in the distribution of wages in Brazil (as noted for instance by Neri and Thomas (2000)), is a good proxy for the unskilled real wage; evidence for Brazil indicates that these two series are indeed highly correlated.

Augmented Dickey-Fuller (ADF) stationary tests indicated that all the variables, as defined here, are stationary.[16] A "standard" VAR approach (that is, one that ignores cointegrating relationships between the variables in level form) can therefore be used.[17] Figure 4 shows the evolution of the cyclical components of all the variables included in the VAR. The data illustrate fairly well the pro-cyclical behavior of the real minimum wage and the counter-cyclical behavior of unemployment and poverty.

Variables in the VAR are ordered as follows: output gap-real minimum

[14]Suppose that a poverty line y^* has been defined; the headcount index can be defined as

$$P_H = n/N,$$

where n is the number of households below the poverty line, and N is the total number of households. The poverty gap is defined as

$$P_G = \frac{1}{ny^*} \sum_{i \in L} (y^* - y_i),$$

where $y^* - y_i$ measures, for individual i in poverty, the gap between income y_i and the poverty line, L is the set of all poor, and n is the total number of poor.

[15]More precise definitions of these variables are provided in Appendix A.

[16]The ADF test statistic were respectively -3.418 for the cyclical component of the poverty rate (significant at a 5 percent significance level, using MacKinnon's critical values for rejection of the null hypothesis), -2.978 for the detrended component of unemployment (significant at 10 percent), -3.889 for the cyclical component of the real minimum wage (significant at 1 percent), and -4.975 for the detrended component of output.

[17]Alternatively, all variables in the VAR could be measured in levels, despite being nonstationary. As shown by Sims, Stock and Watson (1990), least-squares estimates are consistent for the levels specification (whether cointegration exists or not), whereas a differenced specification is inconsistent if some variables are cointegrated. But in the absence of cointegration, the estimated standard errors of the levels specification are not consistent, so conventional inference could potentially be misleading.

wage-unemployment rate-poverty rate. The fact that the output gap and the unemployment rate are placed before the poverty rate in the VAR captures the assumption that shocks to poverty have no contemporaneous impact on these variables. Any contemporaneous correlation between a disturbance to the poverty rate and the output gap, for instance, is thus taken to reflect causation from output to poverty, and not the other way around.[18] To choose the optimal lag length, the Akaike criterion is used. Given the relatively small size of the sample, only models with one and two lags were compared. The test led to the selection of one lag as the "optimal" choice.

The impulse response functions of the poverty gap and unemployment associated with a one standard deviation shock to the innovation in all the variables included in the model are shown in Figure 5. The solid lines in the figures represent the impulse responses themselves, whereas the dotted lines are the associated 95 percent upper and lower confidence bands.[19] An innovation in output lowers unemployment (as expected) but has no statistically significant effect on poverty. An innovation in real wages has, again, no effect on poverty and a perverse effect on unemployment in the first period. An innovation in the unemployment rate raises of course unemployment with no effect on poverty, whereas an innovation in the poverty gap has a positive and significant effect on both variables.

Consider now the case of Chile. The variables included in the VAR are the (log of the) output gap, and the cyclical components of the (log of the) urban unemployment rate, the real wage for unskilled labor, and the headcount poverty index for the Santiago Metropolitan area.[20] ADF tests also indicated that all these variables are stationary.[21] Figure 6 displays the cyclical components of all the variables. Although real unskilled wages display fairly limited fluctuations over time, they do show some degree of pro-cyclicality.

[18] Alternative orderings were also considered, with either the poverty rate or the unemployment rate always appearing last in the sequence. The results discussed below remained virtually unchanged.

[19] The confidence intervals were generated with the procedure based on analytical derivatives incorporated in Eviews.

[20] More precise definitions of these variables are provided in Appendix A as well. The VAR model was also estimated with a measure of extreme poverty, and with an index of average wages in the urban sector. In both cases, the impulse response functions obtained were very similar to those reported here.

[21] The ADF test statistic were -4.479, -3.461, -3.022, and -3.064 for the detrended components of, respectively, the poverty rate, the unemployment rate, the real unskilled wage, and real GDP. All these statistics are significant at least at 5 percent.

Both unemployment and poverty are counter-cyclical; in addition, however, unemployment seems to fluctuate a lot more than poverty and during the 1990s the two variables appear to be negatively correlated—an observation that would be consistent with the possibility of a trade-off. Using the same ordering as before, and selecting uniformly one lag (based on the Akaike criterion), the impulse response functions of the poverty gap and unemployment were calculated. The results, illustrated in Figure 7, indicate that a positive innovation in output lowers unemployment and raises unskilled wages (again, as expected) but has no discernible effect on poverty. An innovation in real wages has no statistically significant effect on the variables of the system. Unemployment shocks have no significant impact on poverty, and conversely poverty shocks do not affect unemployment.

Overall, therefore, the results for Brazil and Chile do not indicate any short-term trade-off between poverty reduction and unemployment. However, this result may be due to a variety of factors, including limitations in the data. For instance, the aggregate unemployment rate was used in both cases, instead of the unskilled unemployment rate; the latter would be more appropriate given the correlation between education and poverty levels. More advanced approaches might also provide different results. One line of investigation would be to develop *structural* VAR or vector error-correction models, which would allow one to disentangle the importance of, say, real wage shocks, as opposed to, say, productivity shocks, in the behavior of poverty and unemployment in the short and the longer term.

3.2 Cross-Country Regressions

As noted earlier, if both unemployment and poverty are viewed as jointly endogenous, a key issue then becomes to identify the ultimate source of the differences in unemployment, growth and poverty, either over time (at the level of an individual country) or across countries. Figure 8 displays data for a group of 31 developing countries on two standard measures of poverty (the headcount index and the poverty gap, both defined earlier) and the open unemployment rate. The number of countries corresponds to all those for which matching data were obtained between the World Bank and the ILO databases on these variables. Each data point is an average of all available observations for each country. The figure does suggest indeed a negative correlation (and thus a potential trade-off) between poverty and unemployment across countries. Moreover, a simple cross-section regression of poverty on

unemployment (also shown in the figure) suggests that the relationship between these variables is convex; beyond a certain poverty threshold (about 40 percent for the headcount index) the correlation turns positive. However, given the small number of data points in that range, it is difficult to draw much from this increasing portion of the curve—despite the statistical significance of the quadratic term in unemployment in the regression.

A simple explanation for the negative correlation between unemployment and poverty shown in the figure is that it is simply a reflection of the fact that poor countries often have a larger informal sector; thus, *open* (or officially-measured) unemployment tends to be small. At the same time, the urban poor tend to be highly concentrated in the informal sector. Thus, the greater the size of the informal sector, the lower the open unemployment rate (or the higher "disguised" unemployment) is, and the greater the poverty rate.[22] However, this explanation does not appear to be sufficient; in the cross-country econometric results discussed later, I control indirectly for the size of the informal sector by using income per capita as a regressor, and the negative correlation between unemployment and poverty persists.

Specifically, to assess the relationship between these two variables over time, as well as across countries, I specify and estimate a cross-country regression model, using unbalanced panel data for a group of developing countries. The dependent variable is either the headcount index, or the poverty gap, based on the $1.08 a day international poverty line. Based on my previous results (see Agénor (2002*a*, 2002*b,* 2003*a*)), the following explanatory variables were included in the regressions, in addition to the unemployment rate (see Appendix A for more precise definitions and sources):

- $INFL$ is the inflation rate in terms of consumer prices;
- $LGDPPC$ is the log of GDP per capita at PPP exchange rates, which captures the level of economic development and economic growth;
- $REALEX$ is the rate of change of the real effective exchange rate (defined such that an increase is a depreciation);

[22] In some regions, however, this does not appear to hold. In MENA countries, a good part of unemployment is "voluntary" in nature and affects the educated; as a result, the link between unemployment and poverty tends to be weak. Indeed the World Bank (2003) found that, using on micro data, poverty and labor market status are only weakly correlated in that region.

- $VREALXL$ is a measure of macroeconomic volatility, which consists of rolling standard deviations of the real exchange rate;
- $TARIFF$ is the average tariff rate (total tariff revenue divided by the value of imports).

I have discussed at length elsewhere the rationale for considering these variables (see Agénor (2002*a*, 2002*b,* 2003*a*)), so only a brief justification is offered here. Inflation (which is a tax on non-indexed financial assets, such as currency holdings) lowers the overall purchasing power of households and tends to raise poverty. An increase in real GDP per capita is expected to be negatively correlated with the poverty rate. The effect of a real exchange rate depreciation is in general ambiguous. It may lead to a reduction in poverty if it benefits small farmers in the tradable sector (as is the case in many low-income developing countries); but if at the same time it is accompanied by a significant increase in the cost-of-living index in urban areas (as a result of a rise in the domestic price of imported goods), overall poverty may increase. The average tariff rate is a proxy for the degree of trade openness, or "real" globalization, and is expected to have a nonlinear effect on poverty (see Agénor (2003*a*)): to the extent that trade liberalization entails short-run adjustment costs (as a result of a reduction in employment in import-substitution industries, for instance) poverty may rise initially; over time, as liberalization continues, and tariffs continue to fall, the expansion of employment in export industries may lead to lower poverty. This is tested by using both the average tariff rate, and its squared value, as regressors; the tariff rate itself is expected to have a negative effect on poverty, whereas its squared value is expected to have a positive effect.

The data on poverty rates are taken from the World Bank and cover countries for which at least two observations are available, and for which data on the unemployment rate are available from the ILO. These requirements give a relatively small sample, consisting of 11 countries and 40 observations (see Appendix A). The first estimation method that I use is OLS with fixed effects. The results are reported in Table 1, columns (1) and (2) for the headcount index, and columns (4) and (5) for the poverty gap. The difference between (1) and (2), and (4) and (5), is that the change in the real exchange rate, and the volatility measure based on it, are entered separately, because of colinearity between the variables. But the results are very similar. Inflation raises poverty whereas higher income per capita tends to reduce it. A real exchange

rate depreciation and a higher degree of real exchanger rate volatility tend both to increase poverty. The tariff rate and its squared values have the expected sign—greater trade openness (a reduction in tariffs) tends to increase poverty at first, and reduces it beyond a certain threshold, a result consistent with the "globalization-poverty curve" discussed by Agénor (2003*a*) in a more general setting. The open unemployment rate also appears to have a non-monotonic effect on poverty; lower unemployment is associated with higher poverty, but there is also a "positive" effect kicking in, at sufficiently high levels of poverty. These results corroborate those shown in Figure 8, which are based on a simple cross-section regression.[23] But again, caution is needed in interpreting the positive segment of the curve, due to the small number of data points in that range.

To account for possible simultaneity problems with the control variables, I also used an instrumental variables procedure with fixed effects. In the first step, inflation, unemployment, income per capita, and the rate of depreciation of the real exchange rate (or the index of volatility based on it) were all regressed on the lagged values of each variable at $t-1$, $t-2$, and $t-3$, as well as the tariff rate and its squared value. In the second step, the predicted values from these regressions were introduced in the poverty regression, together with linear and quadratic terms in the tariff rate. The estimation results are shown in columns (3) and (6) for the two measures of poverty. By and large, the estimates obtained with OLS and fixed effects are unaffected. The real exchange rate variable loses its significance and has the wrong sign, but the volatility index based on it retains the correct sign. Most importantly for the issue at hand, the degree of significance of the coefficients on the unemployment rate and its squared value, as well as their size, increases. This is particular so for the linear term, indicating a steeper trade-off. Finally, I repeated all the regressions using the *employment ratio* (as measured by the ratio of employment to total population) instead of the open unemployment rate, on the ground that employment and total population are measured with a greater degree of precision than the labor force—perhaps because of the difficulty of measuring accurately changes in participation rates. The results are shown in Table 2, and are very similar to those reported in Table 1—except that the coefficients on the linear and quadratic terms in the em-

[23] The difference of course is that the cross-section regression attempts to explain the cross-country variation in poverty rates on the basis of the independent variables only, whereas the panel regressions "explain" some of the variation through separate intercepts (or fixed effects).

ployment ratio have the opposite sign (as expected), and the quadratic term in the employment ratio, when the poverty gap is used and the instrumental variables methodology is applied, is only borderline significant. Overall, therefore, the results suggest that poverty and unemployment display indeed a trade-off across countries. The next step of course would be to determine what exactly is the source of this trade-off—for instance, differences in labor regulations that make wage shocks to operate differently across countries, as suggested by the model of Bean and Pissarides (1993) discussed earlier. This could be done by estimating a simultaneous equations system in unemployment and poverty rates, which introduces explicitly an index of labor market regulations and other variables susceptible of affecting unemployment—such as the presence of a binding minimum wage or a compensation scheme for the unemployed.

4 A Structural Approach

Yet another approach that can be used to gauge the extent to which poverty-unemployment trade-offs are important, depending on the origin of shocks, is to performs simulations with a numerical model. I do so here with the Mini-IMMPA model (for Integrated Macroeconomic Model for Poverty Analysis), which has been developed at the World Bank to quantify poverty reduction strategies in developing countries.[24] An appealing feature of the model, for the purpose at hand, is its detailed treatment of the labor market and the sources of unemployment in a "typical" developing-country context. I first describe the macro component of the model, emphasizing the production side and the structure of the labor market, and explains briefly how it is linked to a household survey for poverty analysis. Other features of the model (such as the composition of aggregate demand, the determination of prices, and the distribution of income flows) are briefly summarized in Appendix B. I then report simulation results associated with two types of labor market reforms: a cut in the minimum wage, and a reduction in payroll taxes on unskilled labor in the formal sector.

[24] See Agénor (2003*b*), Agénor, Izquierdo and Fofack (2003), Agénor, Fernandes, Haddad, and van der Mensbrugghe (2003), and Agénor, Jensen, Verghis, and Yeldan (2003).

4.1 Production and the Labor Market

The structure of production and the labor market in Mini-IMMPA are summarized in Figure 9. The basic distinction on the production side is that between rural and urban sectors. The rural sector 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. Gross output of each type of goods is given by the sum of value added and intermediate consumption. Value added in the rural sector (where land is in fixed supply) is assumed to be produced with land and a composite factor, which consists of (unskilled) labor and public capital. Value added in the urban informal sector depends only on labor and is subject to decreasing returns to scale. Value added in the public sector is measured by the government wage bill, and employment is exogenous. Private formal production uses as inputs both skilled and unskilled labor, as well as public and private capital. Skilled labor and private physical capital have a higher degree of complementarity (lower degree of substitution) than physical capital and unskilled labor.

Unskilled workers are employed in both the rural and urban sectors, whereas skilled workers are employed only in the urban formal economy. Wages in the rural and urban informal sectors adjust to equilibrate supply and demand. Unskilled workers in the urban economy may be employed either in the formal sector, in which case they are paid the minimum wage, or they can enter the informal economy and receive the going wage. The nominal wage for skilled labor in the private sector is determined on the basis of a "monopoly union" approach. The consumption real wage is set by a representative labor union, whose objective is to maximize a utility function that depends on deviations of both employment and the consumption wage from their target levels, subject to the firm's labor demand schedule. The union's target wage is related negatively to the skilled unemployment rate. Education is a pure public good; the flow of unskilled workers who become skilled is a function of the effective number of teachers in the public sector and the stock of public capital in education.

Incentives to rural-urban migration depend on the differential between expected rural and urban wages in Harris-Todaro fashion. The expected (unskilled) urban wage is a weighted average of the minimum wage in the formal sector and the going wage in the informal sector. The degree of

mobility of the unskilled labor force between the formal and the informal sectors is also imperfect, and is a function of expected income opportunities. The supply of labor in the informal economy is obtained by subtracting the supply of labor in the formal urban sector from the urban unskilled labor force, which grows as a result of "natural" urban population growth and migration of unskilled labor from the rural economy. Moreover, some urban unskilled workers acquire skills and leave the unskilled labor force to increase the supply of skilled labor in the economy. Finally, firms in the urban formal sector are subject to a payroll tax on unskilled labor.

4.2 Link with a Household Survey

The procedure followed here to assess the poverty effects of policy shocks involves linking the "structural" macro component described earlier to a household income and expenditure survey, in order to calculate both the headcount index and the poverty gap. This procedure, which is discussed at length in Agénor, Chen, and Grimm (2003) and Agénor, Izquierdo and Fofack (2003*b*), involves the following steps:

- **Step 1**. Classify the data in the household survey into the five categories of households contained in the macro framework—workers in the rural sector, those in the urban (unskilled) informal economy, urban unskilled workers in the formal sector, urban skilled workers in the formal sector, and profit earners (see Appendix B).

- **Step 2**. Following a shock, generate real growth rates in per capita consumption and disposable income for all categories of households, up to the end of the simulation horizon.

- **Step 3**. Apply these growth rates separately to the per capita (disposable) income and consumption expenditure for each household in the survey. This gives a new vector of absolute income and consumption levels for each group.

- **Step 4**. Calculate poverty indicators, using the new absolute nominal levels of income and consumption for each individual and each group, and after updating the initial rural and urban poverty lines to reflect increases in rural and urban price indexes.

- **Step 5**. Using rates of growth of employment and unemployment, adjust the composition of the sample of each household group, as given in the survey.

- **Step 6**. Compare the post-shock poverty indicators with the baseline values to assess the impact of the shock on the poor.

4.3 Policy Shocks

In what follows I examine the poverty and employment effects of two types of labor market reforms: a cut in the minimum wage and a reduction in the payroll tax rate on unskilled labor paid by firms in the private formal sector. Discussions of minimum wages and changes in the taxation of labor have indeed figured prominently in the recent debate on labor market reforms in developing countries (see, for instance, the World Bank (2003)), and assessing whether these policies may entail trade-offs between unemployment reduction and poverty alleviation is timely. In both cases, I consider only permanent shocks and focus on the first 10 periods after the shock. In addition, for the payroll tax experiment, three alternative budget financing rules are considered: domestic borrowing with no offsetting tax change; and offsetting, revenue-neutral increases in either sales taxes on private formal sector goods or income taxes on profit earners.[25]

4.3.1 Reduction in the minimum Wage

Simulation results associated with a 10 percent reduction in the minimum wage are shown in Table 3, which displays absolute percentage changes from the baseline solution of unemployment (both skilled and unskilled) and poverty rates (for informal sector households, formal unskilled households, and skilled households), as measured by the poverty gap. The experiment assumes that the government borrows domestically to finance its deficit. Because the model is "savings driven", this policy implies an offsetting adjustment in private capital formation, in order to maintain the aggregate balance between savings and investment.[26]

[25] The calibration procedure and parameter values used in these simulations are described in Agénor (2003). Detailed tables summarizing the simulation results are available upon request.

[26] How this "transfer" of private savings to the government takes place is not explicitly specified; one can think of a "pure" financial intermediary operating in the background.

The impact (or first year) effect of the reduction in the minimum wage is an increase in the demand for unskilled labor in the private sector of the order of 4.3 percent. The increase in demand is met by the existing pool of unskilled workers seeking employment in the urban sector. As a result, the unskilled unemployment rate drops significantly, by 2.8 percentage points in the first year. The cut in the minimum wage, by reducing the relative cost of unskilled labor, leads to substitution among production factors not only on impact but also over time. Because unskilled labor has a relatively high elasticity of substitution with respect to the composite factor consisting of skilled labor and physical capital, the lower cost of that category of labor gives private firms in the formal sector an incentive to substitute away from skilled labor and physical capital. In turn, the fall in the demand for that category of labor puts downward pressure on skilled wages, which drop by 1.6 percent in the first period. On impact, labor supply is fixed in the rural sector and the informal economy, so the level of employment does not change in either sector—and neither does the level of activity (real value added in both sectors is constant). The rise in real disposable income and real consumption of rural and informal sector households leads to higher value added prices and higher wages in both sectors. But value added prices go up by slightly more than wages in the second and subsequent periods, implying a fall in the product wage in both sectors and a rise in employment.

Over time, changes in wage differentials affect both rural-urban and formal-informal migration flows, and therefore the supply of labor in the various production sectors. The expected unskilled wage in the formal economy is constant on impact. Despite the increase in unskilled employment in the private sector in the first period (implying a higher perceived probability of finding a job in that sector), the fall in the minimum wage is large enough to entail a reduction in the urban expected wage. At the same time, rural sector wages rise, thereby magnifying the fall in the expected urban-rural wage differential. In the second period, the drop in this differential (measured in proportion of the rural wage) is 8.7 percentage points; it persists over time, despite narrowing down. As a result, the inflow of unskilled workers in the informal sector (measured in proportion of the total supply of unskilled labor in the urban sector) falls, by about 1.2 percentage points in periods 2 and 3. In turn, the reduction in labor supply leads to an increase in informal sector wages throughout the adjustment period. This increase in the informal sector wage, coupled with the reduction in the minimum wage (as well as the expected wage in the urban formal private sector, despite the higher

employment probability) leads to a sharp drop in period 2 in the expected formal-informal wage differential. As a result, the number of unskilled workers willing to queue for employment in the urban private sector falls. The reduction in the number of job seekers, coupled with the sustained effect of the cut in the minimum wage on labor demand, explains the large impact on unemployment, which averages about 11 percent in the long run.

Although the behavior of nominal wages in the rural sector reflects essentially changes in value added prices on impact (as noted earlier), over time it is also affected by changes in output (induced by changes in households' disposable income and expenditure) and migration flows. After an initial increase in nominal wages, lower migration flows to urban areas begin to put downward pressure on rural wages, which end up falling (in nominal terms) by 1.6 percent in period 9 and 1.8 percent in the last period of the simulation horizon. As also indicated earlier, the reduction in the cost of unskilled labor induces a substitution away from skilled labor, which brings a sustained fall in skilled wages in nominal terms. However, the overall effect on labor demand is not large; skilled employment in the private formal sector falls in the long run only slightly. And because the supply of skilled labor remains roughly constant throughout (public investment in education and the number of school teachers are held constant at their baseline values), the increase in the skilled unemployment rate mirrors the drop in employment. The reason for the small effect on skilled employment is that the direct substitution effect associated with the reduction in the minimum wage is offset by a fall in the skilled wage, resulting from general equilibrium effects—the drop in the nominal skilled wage is lower in relative terms than the fall in the value added price of the urban private formal sector, implying a rise in the product wage, and thus dampening the demand for labor.

Changes in real consumption and disposable income lead to significant differences in poverty patterns among urban households. As shown in Table 3, the poverty drops by 1.5 percentage points for informal sector households on impact, but increases for both categories of workers in the formal sector (by 1 and 0.3 percentage points, respectively, for skilled and unskilled households). In the long run, poverty falls for unskilled workers in both the informal and formal sectors, whereas the slight increase in poverty recorded on impact for skilled workers persists. For that group of workers, the behavior of poverty tends to mirror the behavior of unemployment. Thus, the simulation results suggest the existence of a potential short-run trade-off between unemployment and poverty: although the reduction in the mini-

mum wage raises unskilled employment in the formal sector, it also increases poverty for those households employed in that sector. There is also a potential longer-run trade-off, resulting from the fact that poverty among skilled workers increases (albeit slightly), both in the short and the long term.

4.3.2 Cut in Payroll Tax on Unskilled Labor

Simulation results associated with a 10 percentage-point reduction in the payroll tax rate on unskilled labor are also shown in Table 3. The results correspond, as noted earlier, to three alternative budget financing rules: a non-neutral change involving domestic borrowing (that is, an endogenous adjustment in private investment, as in the previous case) with no offsetting tax change; a revenue-neutral increase in sales taxes on private formal sector goods; and a revenue-neutral increase in income taxes on profit earners.

Consider first the case of domestic borrowing. The impact effect of a reduction in the payroll tax rate is qualitatively similar to a cut in the minimum wage, as discussed earlier: by reducing the effective cost of unskilled labor, it tends to increase immediately the demand for that category of labor. The unskilled unemployment rate drops by 5.9 percentage points in the first year, and in the long run by an average of 2.5 percentage points. The reduction in the "effective" cost of unskilled labor also leads firms in the private formal urban sector to substitute away from skilled labor and physical capital, leading to a reduction in skilled employment, which rises by about the same amount as in the previous experiment. The behavior of the (expected) urban-rural wage differential follows a pattern qualitatively similar to the one described in the previous experiment, although the magnitude of the initial effects are not as large. Most importantly, the expected formal-informal wage differential, however, *increases* now in the second period. The reason is that the minimum wage does not change this time around, and the increase in unskilled employment in the private formal sector raises the probability of finding a job there, increasing thereby the expected formal sector wage. As a result, therefore, there is an *increase* in the number of unskilled job seekers in the formal economy, which therefore mitigates over time the initial reduction in unemployment. Changes in poverty among urban household groups follows a similar pattern as before. The reduction in poverty in the informal sector is, however, less marked, largely because wages do not increase by the same amount—because the fall in open unskilled unemployment is less dramatic, less workers seek employment in the formal sector. In

addition, the impact effect on poverty among formal unskilled households is now negligible. Nevertheless, the same type of trade-offs identified earlier emerge.

Consider now the case where the effect of the cut in payroll taxes on overall tax revenue is offset by either an increase in sales taxes on private formal sector goods. In both cases, the impact and longer-run effects of the shock are qualitatively similar to those described earlier, although their magnitude differs. In particular, movements in the informal sector wage are less pronounced, in part because changes in rural-urban migration flows are not as large. The most important difference is that when the cut in payroll taxes is "financed" by an increase in the sales tax, the initial reduction in poverty among formal unskilled households disappears—to a large extent because the price of the consumption basket of that category of households goes up by about the same amount as disposable income. Thus, even if unemployment falls for that category of households, poverty is barely affected (in fact, it increases slightly).

Overall, therefore, the results indicate that, depending on the policy shock, there may be short- and longer-term trade-offs between unemployment reduction and poverty alleviation among household groups. In addition, the nature of these trade-offs depends on the nature of the financing rule that accompanies these shocks.

5 Concluding Remarks

The purpose of this paper has been to discuss analytically and assess empirically the potential short- and long-term trade-offs that may arise between reducing poverty and lowering unemployment in developing countries. The first part provided a general discussion of the channels through which such trade-offs may arise. It was noted that the expansion in employment (resulting from either favorable productivity shocks or lower wages) may be skewed toward low-paying jobs, resulting in an increase of the numbers of "working poor." It then presented a simple overlapping-generations model of endogenous growth, due to Bean and Pissarides (1993), to illustrate the trade-offs between unemployment, growth and poverty. In the model, unemployment is created by matching frictions in the labor market. The analysis showed that an increase in workers' bargaining power leads to higher wages, which discourages firms from opening new vacancies. This tends to raise unemploy-

ment. At the same time, a higher income for workers was shown to increase savings, which can stimulate growth and thereby reduce poverty. The net effect on the pool of savings cannot be determined *a priori*—and thus neither can the effect on growth and unemployment. Nevertheless, it is possible for the model to generate an inverse correlation between unemployment and poverty.

The second part used two econometric techniques to assess empirically the relevance of these trade-offs: a VAR framework and cross-country regressions. Impulse response functions derived from VAR models estimated for Brazil and Chile showed no short-run trade-off between these variables, for neither output or wage shocks. However, it was also noted that improvements in the quality of the data used, and the application of more sophisticated forms of VAR models, could deliver different results. The regression results, by contrast, do show a negative relationship between unemployment and poverty, even after controlling for various other determinants of poverty (inflation, income per capita, macroeconomic stability, and the degree of trade openness), and using different econometric estimation techniques (OLS and instrumental variables with fixed effects).

The third part used a structural macro model built specifically for labor market and poverty analysis, the Mini-IMMPA framework developed by Agénor (2003*b*). Simulation results showed that labor market reforms can induce both short- and long-run trade-offs between the *composition* of unemployment and poverty. Specifically, it was found that, following a cut in the minimum wage, unskilled unemployment and poverty rates in the formal sector may well move in opposite directions for particular household groups. In addition, although unskilled unemployment and poverty among urban unskilled households may both fall in the long run, skilled unemployment and poverty among urban skilled households may well increase. A trade-off may therefore exist between the composition of unemployment and the composition of poverty. The thrust of the foregoing discussion is thus that, to the extent that these trade-offs exist, the nature of the social welfare function becomes crucial in choosing a given policy path.

Appendix A
Variables Definition and Data Sources

The first part of this Appendix describes the sources of the data for Brazil and Chile used in this paper. VAR estimates are based on the period 1981-2002 for Brazil and 1981-2001 for Chile. All series are detrended using the modified band-pass filter proposed by Christiano and Fitzgerald (2003), as discussed in the text, and are defined as follows:

- Y_CYC: Cyclical component of real GDP calculated as the log difference of real GDP and its trend component. Data source for real GDP for Brazil is the World Bank's *World Development Indicators* (WDI), and for Chile it is the Central Bank of Chile (CBC).

- $POVER\_CYC$: Cyclical components of the poverty gap (for Brazil) and the urban headcount index (for Chile). For Brazil, the source is IPEA (www.ipea.gov.br), and for Chile unpublished estimates by the CBC, which are based on an urban poverty line defined as twice the cost of a representative basket of food.[27]

- $WAGE\_CYC$: Cyclical component of the real minimum wage (for Brazil) and the unskilled real wage (for Chile). The source for Brazil is IPEA and for Chile is CBC (based on INE surveys).

- $UNEMP\_CYC$: Cyclical component of the aggregate unemployment rate (for Brazil), and the unemployment rate in the Santiago metropolitan area (for Chile). The source for Brazil is IPEA (from the monthly employment survey of IBGE) and for Chile it is the CBC (based on the monthly survey of the Universidad de Chile).

The second part of this Appendix presents the list of countries included in the regression results presented in Tables 1 and 2, a more precise definition of the variables used in the regressions, and sources of the data.

Regressions are based on the following list of countries (years of observation on poverty rates in parentheses): Brazil (1985, 1988, 1989, 1993, 1997), Colombia (1988, 1991, 1995, 1996), Costa Rica (1986, 1990, 1993, 1996), Indonesia (1996, 1998), Mexico (1992, 1995), Pakistan (1990, 1993, 1996), Peru

[27] An unpublished note, prepared by Elias Albagli of the Central Bank of Chile, describes in more detail these estimates of the poverty rate in Chile.

(1994, 1996), Philippines (1985, 1988, 1991, 1994, 1997), Sri Lanka (1990, 1995), Thailand (1981, 1988, 1992, 1996, 1998), and Venezuela (1981, 1987, 1989, 1993, 1995, 1996). These countries are all those for which at least two data points on poverty (as measured by the poverty gap and headcount index) and the unemployment rate were simultaneously available in the ILO and World Bank databases.

The variables used in regressions are defined as follows:

- POV: Poverty gap and headcount index, calculated with a poverty line of \$1.08 a day. Source: World Bank Global Poverty Monitoring Database.
- $UNEMP$: Unemployment rate, defined as the ratio of the labor force that is without work but is available for and seeking employment, to the total labor force. Source: *Key Indicators of the Labor Market* database (ILO).
- $INFL$: Inflation rate in terms of consumer prices. Source: WDI.
- $REALEX$: Percentage change in the real effective exchange rate. A rise is a depreciation. Source: *International Financial Statistics*, IMF.
- $LGDPPC$: Log of GDP per capita measured at purchasing power parity exchange rates. Source: WDI.
- $TARIFF$: Average tariff rate, defined as the ratio of import duties over imports. Source: WDI.

Appendix B
Other Features of Mini-IMMPA

This Appendix summarizes briefly some of the other features of mini-IMMPA, in addition to the production and the labor market structure, which as described in the text.

Both the informal and public sector goods are nontraded. Total supply in each sector is thus equal to gross production. Rural 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. The demand for imported versus domestic rural and private urban goods is a function of relative domestic and import prices and of the elasticity of substitution between these goods. Allocation of output of rural and private urban formal sector goods to exports or the domestic market occurs along each sector's production possibility frontier. Efficiency conditions require that firms equate the domestic-export relative price to the opportunity cost in production.

For the rural and informal sectors, aggregate demand consists only 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, in addition, of investment demand. Total demand for intermediate consumption of any good is the sum of the share of this good in the consumption of other sectors. Final consumption for each production sector is the summation across all categories of households of nominal consumption of this sector's good. Total private investment by urban firms consists of purchases of urban formal private goods only.

The net or value added price of output is given by the gross price net of indirect taxes, less the cost of intermediate inputs. 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. Because the transformation function between exports and domestic sales of the rural and urban private goods is linear homogeneous, the domestic sales prices are derived from the sum of export and domestic expenditure on rural and private goods divided by the quantity produced of these goods. 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. For the rural 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. The nested production function of private formal urban goods is once again linearly homogeneous; prices of the composite inputs are derived in similar fashion. The price of capital is constructed as using the investment expenditure identity, which involves public good and private-formal urban good. 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.

Firms' profits in all sectors are defined as revenue minus total labor costs. Firms' income in the rural and informal sector is equal to their profits, whereas firms' income in the formal urban economy is equal to their profits minus corporate taxes and interest payments on foreign loans. Household income consists of salaries, distributed profits, and government transfers. Households are defined according to both labor categories and their sector of location. There are five categories of them: workers in the rural sector, workers in the urban informal sector, skilled workers in the urban formal sector, unskilled workers in the urban formal sector, and profit earners. The rural household comprises all workers employed in the rural sector. The urban informal household consists of workers in the informal sector. The unskilled (skilled) urban formal household consists of all unskilled (skilled) workers employed in the formal sector. Households in the rural sector and in the informal urban economy own the firms in which they are employed. Income of rural sector households is equal to the sum of transfers from the government and production revenue. Income of the urban formal skilled and unskilled households depends on government transfers and salaries. 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 to finance investment, and transfer the remainder to profit earners (who also receive transfer payments).

Each category of households saves a constant fraction of its disposable income, which is equal to total income minus income tax payment. The portion of disposable income that is not saved is allocated to consumption. The accumulation of capital over time depends on the flow level of investment and the depreciation rate. 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, gov-

ernment savings, and foreign borrowing by firms. 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 profit earners (in which case the model is "investment driven").

All value added in the production of public goods is distributed as wages. Government expenditures consist of government consumption and public investment, which consists of investment in infrastructure, education, and health. Infrastructure and health capital affect the production process in the private sector as they both combine to produce the stock of public capital. 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. Thus, the fiscal deficit is equal to tax revenue minus transfer payments, current expenditure on goods and services, total wage payments, and total investment expenditure. Finally, the external constraint implies that any current account surplus (or deficit) must be compensated by a net flow of foreign capital, given by the change in private and public foreign borrowing.

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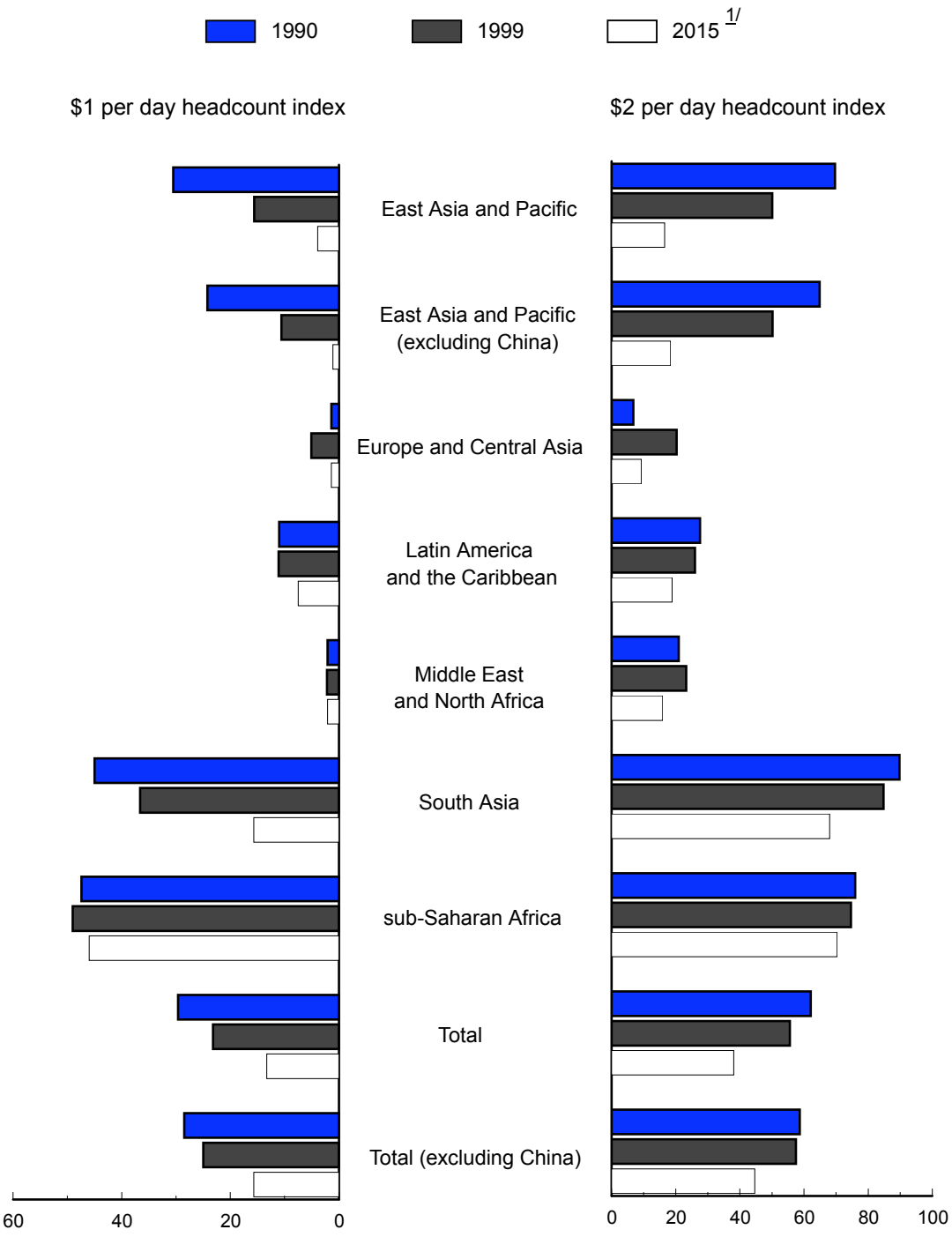
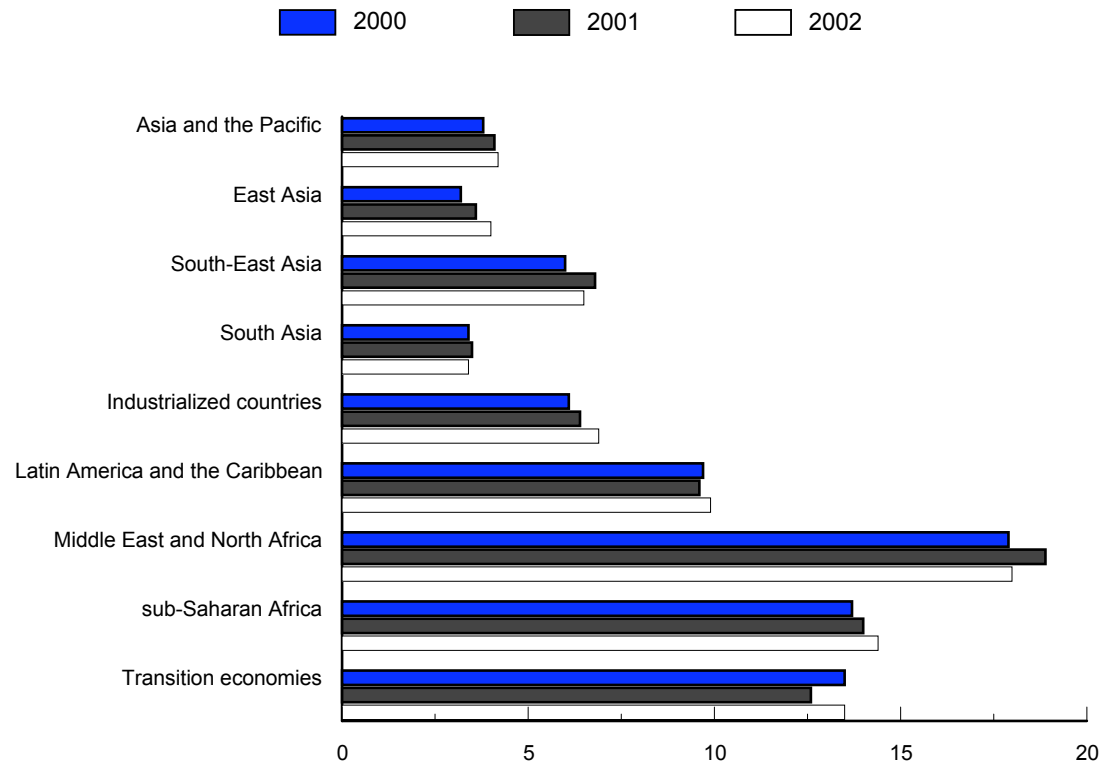
Figure 1
Poverty Headcount Index, 1990-2015
(In percent)



Source: World Bank.

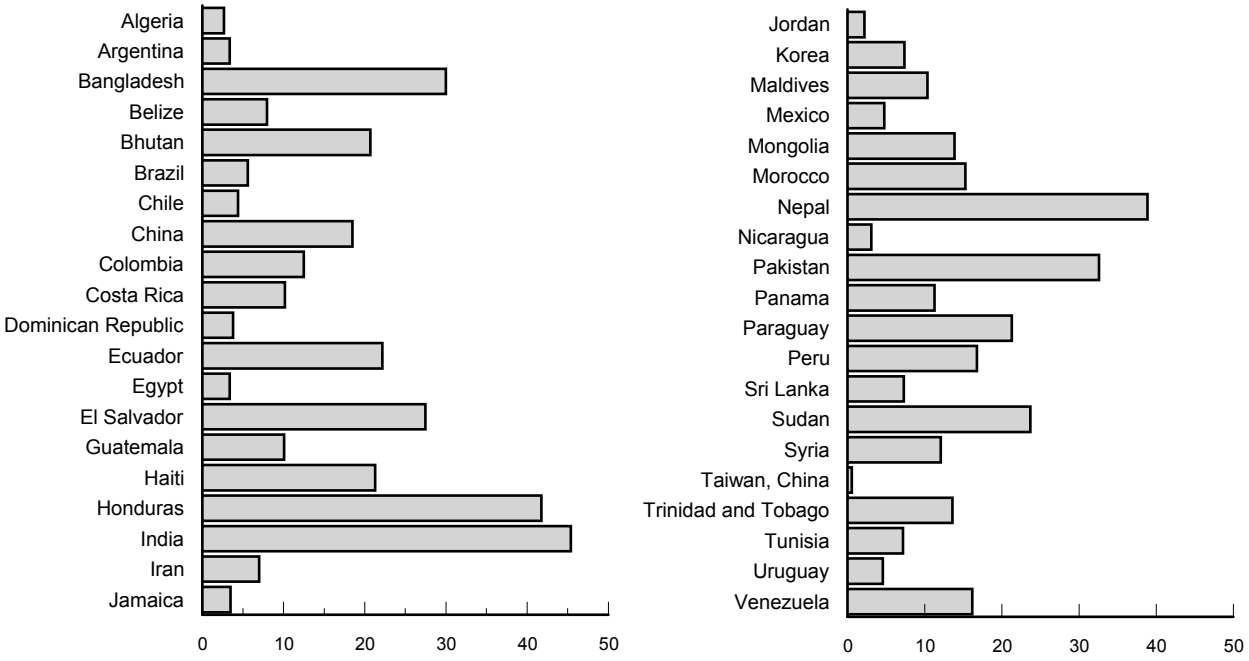
1/ Projections.

Figure 2
Unemployment Rates by Region, 2000-02
(In percent)



Source: International Labor Organization.

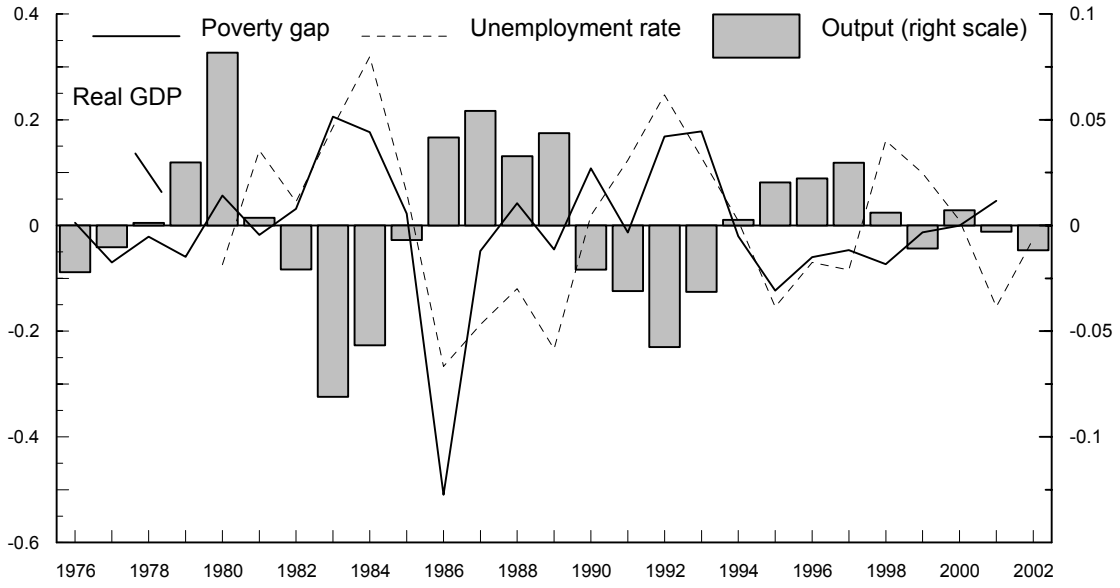
Figure 3
Proportion of Working Poor [1/]
(In percent of labor force)

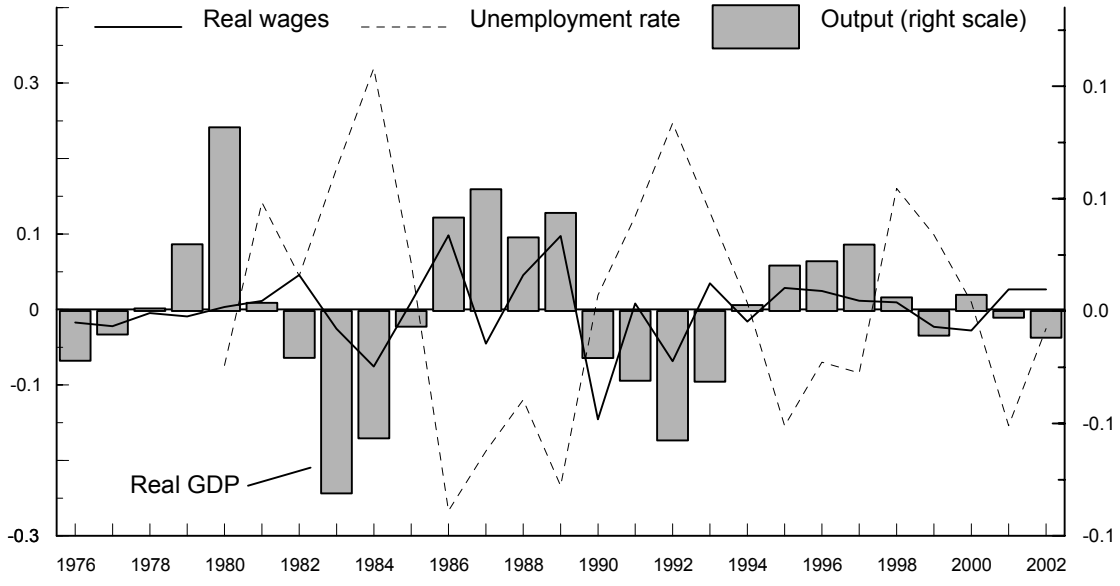


Source: International Labor Organization.

1/ The working poor are workers that do not earn enough to lift themselves and their families above the US 1.08 dollar a day poverty line.

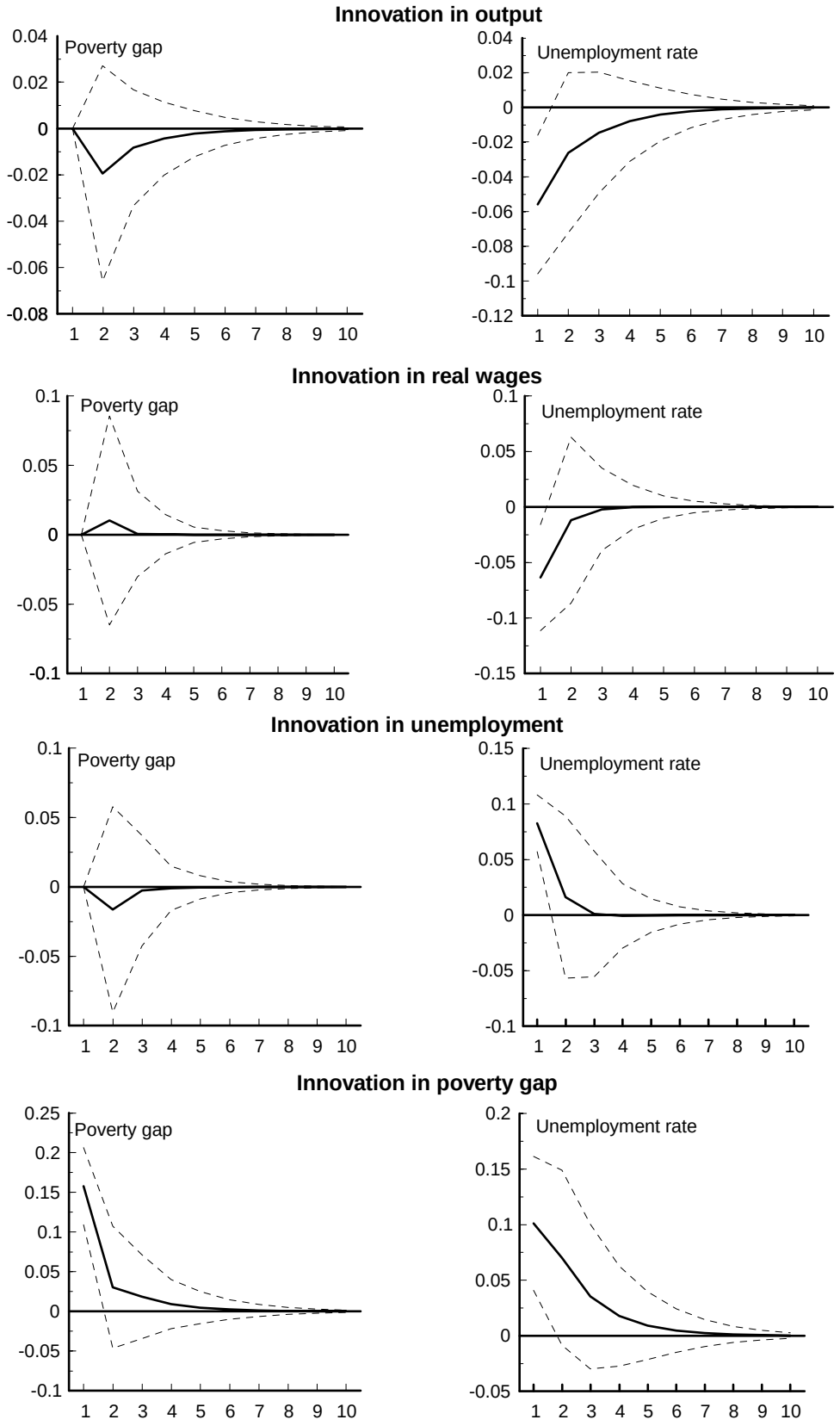
Figure 4
Brazil: Cyclical Components of Real GDP, Unemployment Rate,
Real Wages, and Poverty Gap, 1976-2002 1/





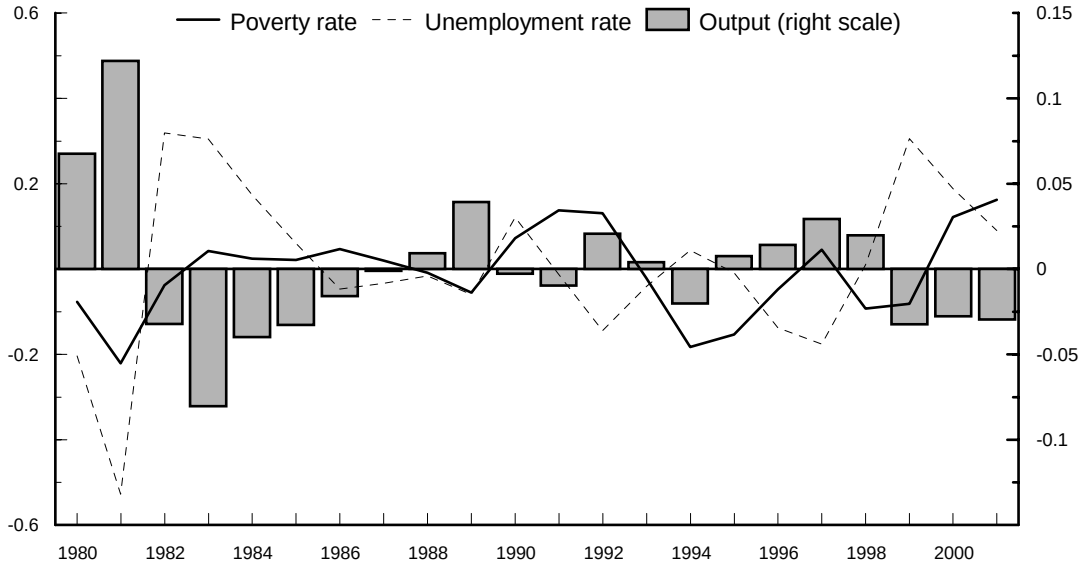
1/ The cyclical component of each variable is defined as the log difference of the variable from its trend value calculated by using the Baxter-King filtering method.

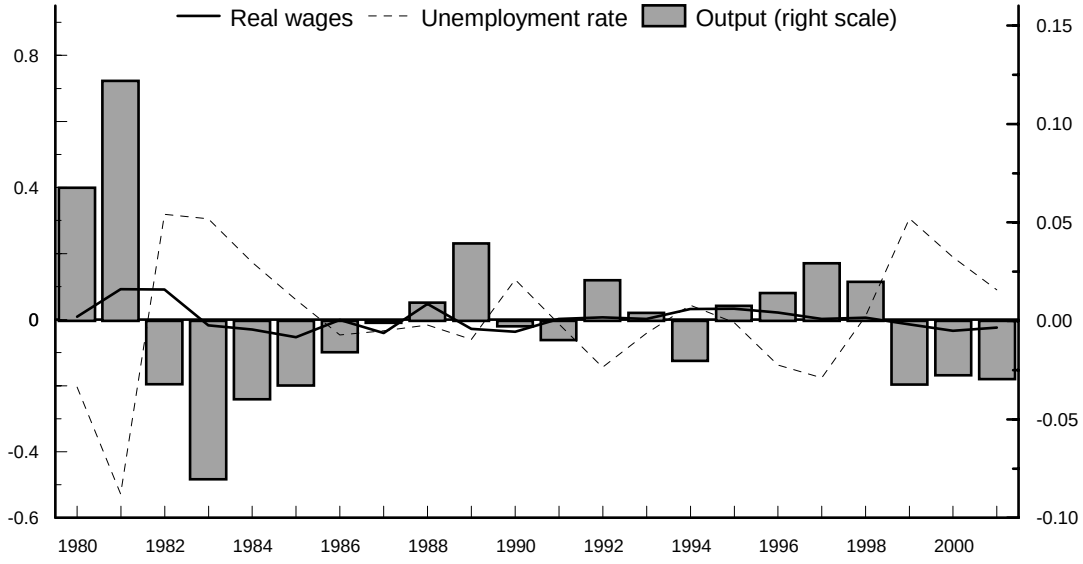
Figure 5
Brazil: Impulse-Response Function to One Standard Deviation to Cyclical Output, Poverty, Wages, and Unemployment



Note: Cyclical components of each variable are used. The VAR model is estimated using a one-period lag.

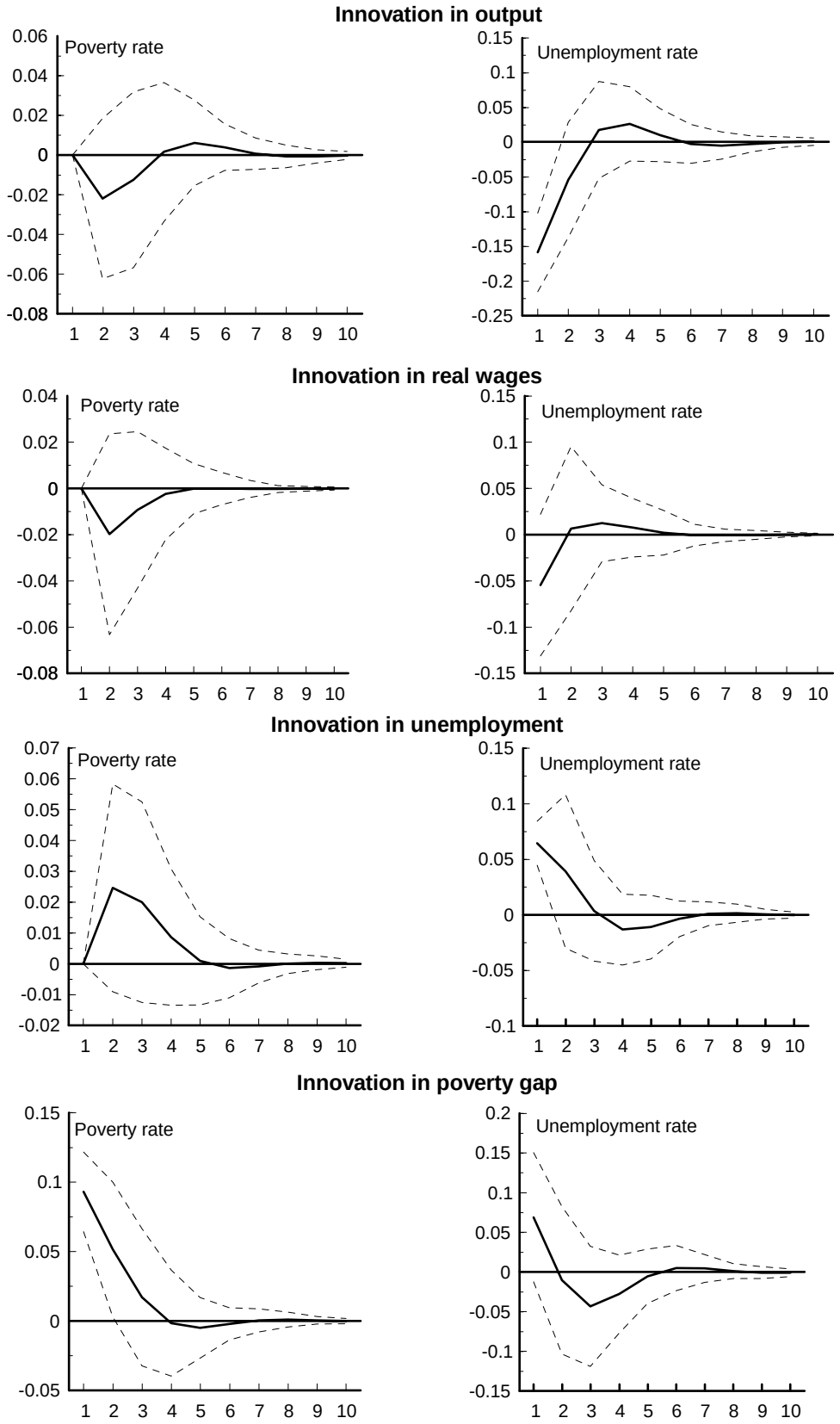
Figure 6
Chile: Cyclical Components of Real GDP, Unemployment Rate,
Real Wages, and Poverty Rate, 1980-2001 1/





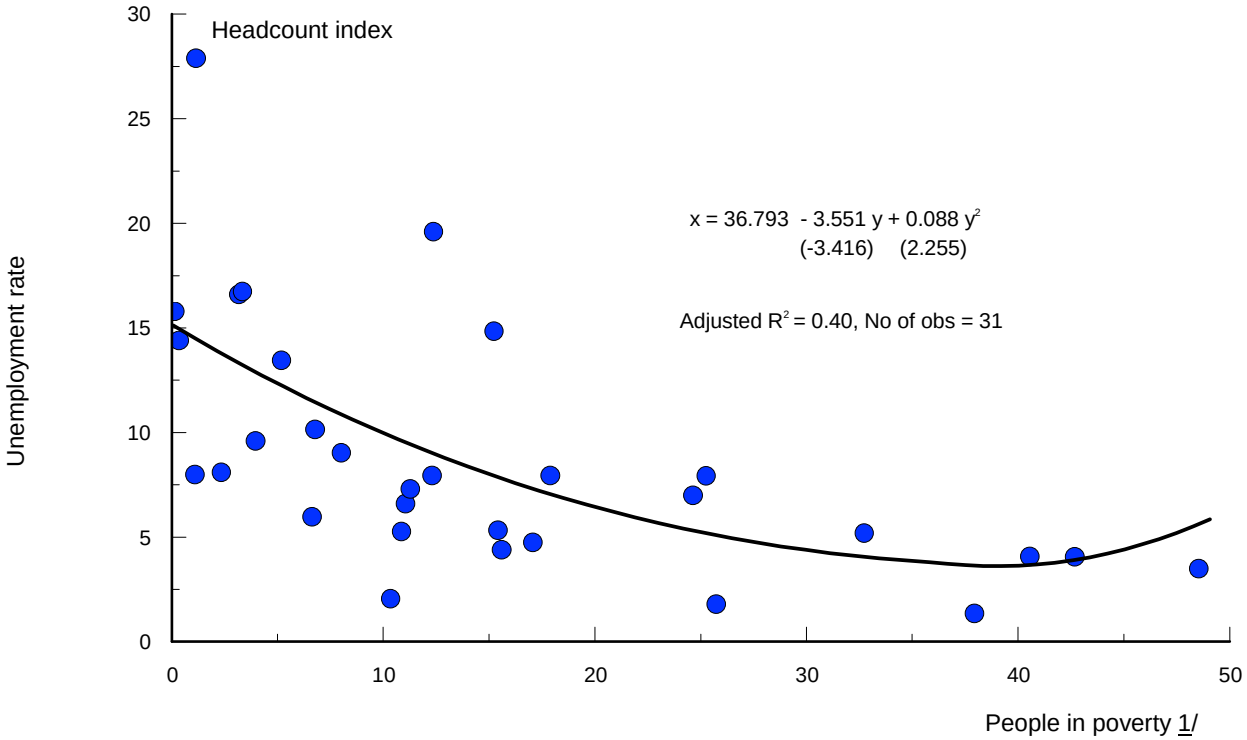
1/ The cyclical component of each variable is defined as the log difference of the variable from its trend value calculated by using the Baxter-King filtering method.

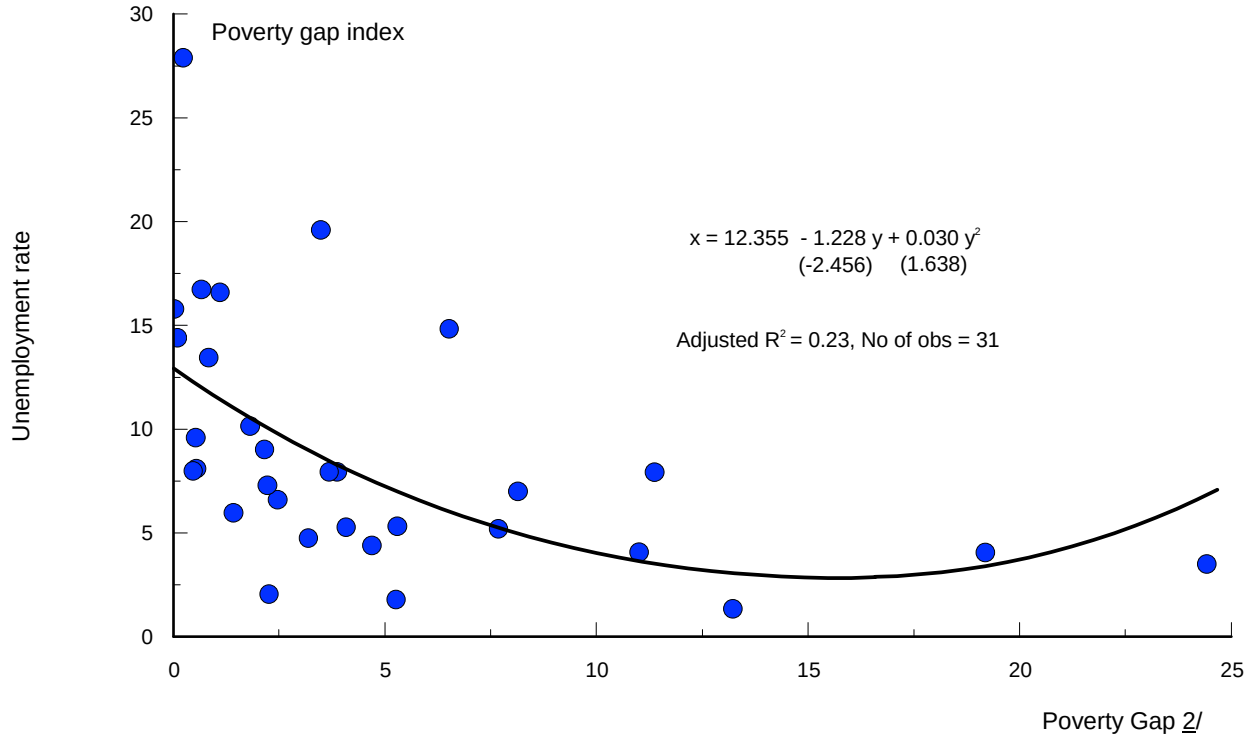
Figure 7
Chile: Impulse-Response Function to One Standard Deviation to Cyclical Output, Poverty, Wages, and Unemployment



Note: Cyclical components of each variable are used. The VAR model is estimated using a one-period lag.

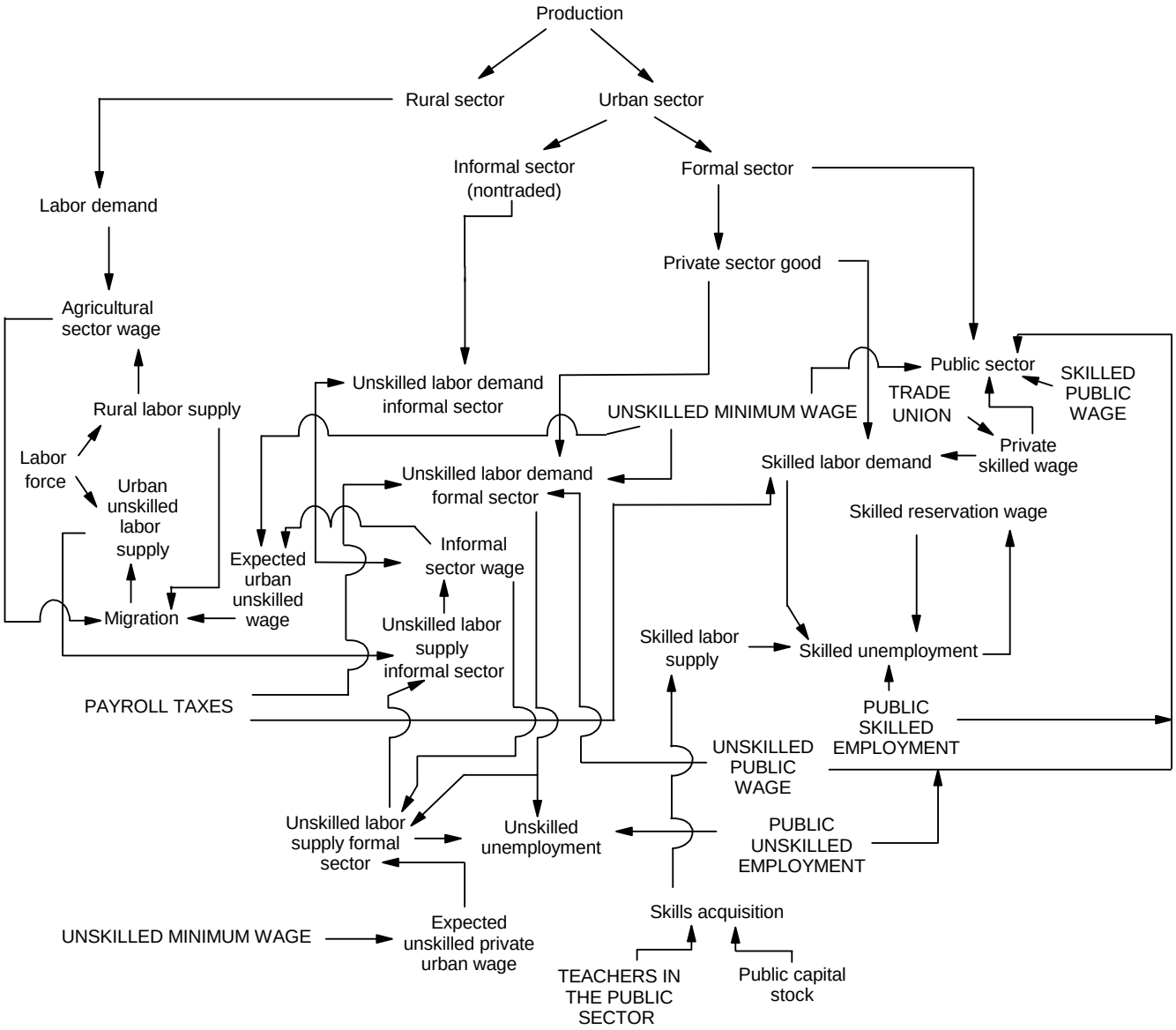
Figure 8
Developing Countries: Unemployment and Poverty
(in percent)





Source: World Bank Global Poverty Monitoring and ILO.
1/ Proportion of the population earning 1.08 U.S. dollar or less a day, various survey years.
2/ Poverty gap at 1.08 U.S. dollar or less a day, various survey years.
Note: Sample consists of 31 countries for which data are provided in the World Bank Global Poverty Monitoring (http://www.worldbank.org/research/povmonitor/) and ILO.

Figure 9
Production Structure and the Labor Market



Source: Agénor (2003*b*).

Table 1
Developing Countries: Unemployment Rate and Poverty, 1981-98

	Dependent variable: Headcount Poverty Index			Dependent variable: Poverty Gap		
	(1)	(2)	(3)	(4)	(5)	(6)
UNEMP	-0.033	-0.029		-0.010	-0.008	
	(-1.895)	(-2.048)		(-2.153)	(-2.034)	
UNEMP_SQ	0.002	0.001		0.001	0.001	
	(2.002)	(1.919)		(2.199)	(1.852)	
IVUNEMP			-0.091			-0.028
			(-3.497)			(-2.491)
IVUNEMP_SQ			0.005			0.002
			(2.409)			(2.200)
INFL	0.007	0.006		0.003	0.003	
	(4.132)	(4.115)		(7.410)	(6.842)	
IVINFL			0.047			0.021
			(15.192)			(9.318)
REALEX	0.087			0.021		
	(2.139)			(1.759)		
IVREALEX			0.373			0.129
			(1.472)			(1.341)
VREALXL		0.198			0.034	
		(2.103)			(1.249)	
LGDPPC	-0.176	-0.200		-0.053	-0.056	
	(-9.802)	(-3.299)		(-8.241)	(-3.310)	
IVLGDPPC			-0.188			-0.047
			(-5.374)			(-3.309)
TARIFF	-1.282	-1.420	-2.049	-0.606	-0.652	-0.902
	(-3.074)	(-3.679)	(-5.712)	(-4.027)	(-4.437)	(-6.106)
TARIFF_SQ	3.202	3.361	5.503	1.860	1.973	2.929
	(2.764)	(3.156)	(5.629)	(4.304)	(4.921)	(7.044)
Adj. R2	0.816	0.807	0.817	0.762	0.743	0.772
Total panel Observations	40	38	38	40	38	38
Standard error of regression	0.041	0.042	0.041	0.014	0.014	0.014

Note: t-statistics are in parentheses. The estimation technique is ordinary least squares with fixed effects in columns (1), (2), (4) and (5), and two-stage least squares in columns (3) and (6). The headcount index is the ratio of population earning less than USD 1.08 per day. The poverty gap is the mean shortfall from the poverty line of USD 1.08 per day, expressed as a percentage of the poverty line. UNEMP is the rate of unemployment, UNEMP_SQ is its squared value. IVUNEMP is the instrumental variable of UNEMP (fitted values obtained by regressing UNEMP on the growth rate of GDP per capita (purchasing power parity) at *t*-1, *t*-2 and *t*-3, TARIFF, and TARIFF_SQ). IVUNEMP_SQ is the squared value of IVUNEMP. INFL is the annual change in the consumer price index. IVINFL is the instrumental variable of INFL (fitted values obtained by regressing INFL on INFL at *t*-1, *t*-2 and *t*-3, TARIFF, and TARIFF_SQ). REALEX the annual change in the real effective exchange rate index (a rise is a depreciation). IVREALEX is the instrumental variable of REALEX (fitted values obtained by regressing REALEX on REALEX at *t*-1, *t*-2 and *t*-3, TARIFF, and TARIFF_SQ). VREALXL is the volatility measure of the real effective exchange rate, calculated as the ratio of the standard deviation of the variable for t, t-1, t-2 and t-3 to the average value for the same period. LGDPPC is the log of the GDP per capita (purchasing power parity). IVLGDPPC is the instrumental variable of LGDPPC (fitted values obtained by regressing LGDPPC on LGDPPC at *t*-1, *t*-2 and *t*-3, TARIFF, and TARIFF_SQ). TARIFF is the average tariff rate and TARIFF_SQ is its squared value.

Table 2
Developing Countries: Employment Ratio and Poverty, 1981-98

	Dependent variable: Headcount Poverty Index			Dependent variable: Poverty Gap		
	(1)	(2)	(3)	(4)	(5)	(6)
EMP	8.513	9.036		2.661	2.310	
	(3.325)	(3.539)		(2.850)	(2.504)	
EMP_SQ	-8.438	-9.567		-2.388	-2.124	
	(-3.169)	(-3.411)		(-2.451)	(-2.156)	
IVEMP			6.393			1.414
			(6.546)			(2.206)
IVEMP_SQ			-6.295			-1.036
			(-5.628)			(-1.572)
INFL	0.005	0.005		0.003	0.002	
	(2.431)	(2.596)		(4.812)	(5.032)	
IVINFL			0.033			0.013
			(2.008)			(1.523)
REALEX	0.088			0.023		
	(3.014)			(2.642)		
IVREALEX			0.241			0.201
			(0.982)			(1.856)
VREALXL		0.218			0.038	
		(2.914)			(1.703)	
LGDPPC	-0.165	-0.172		-0.060	-0.063	
	(-3.208)	(-3.519)		(-3.370)	(-3.092)	
IVLGDPPC			-0.185			-0.073
			(-3.697)			(-3.184)
TARIFF	-0.763	-0.948	-1.291	-0.411	-0.497	-0.392
	(-1.628)	(-2.255)	(-2.222)	(-2.508)	(-3.385)	(-1.687)
TARIFF_SQ	3.011	3.236	4.720	1.703	1.856	1.635
	(2.756)	(3.274)	(2.857)	(4.254)	(5.033)	(2.430)
Adj. R2	0.850	0.839	0.889	0.788	0.755	0.788
Total panel Observations	40	38	31	40	38	31
Standard error of regression	0.037	0.038	0.033	0.013	0.014	0.013

Note: t-statistics are in parentheses. The estimation technique is ordinary least squares with fixed effects in columns (1), (2), (4) and (5), and two-stage least squares in columns (3) and (6). The headcount index is the ratio of population earning less than USD 1.08 per day. The poverty gap is the mean shortfall from the poverty line of USD 1.08 per day, expressed as a percentage of the poverty line. EMP is the ratio of employment to total population, EMP_SQ is its squared value. IVEMP is the instrumental variable of EMP (fitted values obtained by regressing EMP on the lagged values of EMP at *t*-1, *t*-2 and *t*-3, TARIFF, and TARIFF_SQ). IVEMP_SQ is the squared value of IVEMP. INFL is the annual change in the consumer price index. IVINFL is the instrumental variable of INFL (fitted values obtained by regressing INFL on INFL at *t*-1, *t*-2 and *t*-3, TARIFF, and TARIFF_SQ). REALEX the annual change in the real effective exchange rate index (a rise is a depreciation). IVREALEX is the instrumental variable of REALEX (fitted values obtained by regressing REALEX on REALEX at *t*-1, *t*-2 and *t*-3, TARIFF, and TARIFF_SQ). VREALXL is the volatility measure of the real effective exchange rate, calculated as the ratio of the standard deviation of the variable for t, t-1, t-2 and t-3 to the average value for the same period. LGDPPC is the log of the GDP per capita (purchasing power parity). IVLGDPPC is the instrumental variable of LGDPPC (fitted values obtained by regressing LGDPPC on LGDPPC at *t*-1, *t*-2 and *t*-3, TARIFF, and TARIFF_SQ). TARIFF is the average tariff rate and TARIFF_SQ is its squared value.

Table 3
Reductions in the Minimum Wage and Payroll Tax Rate: Simulation Results
(Absolute deviations from baseline)

	Periods									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
10 Percent Cut in Unskilled Labor Minimum Wage										
Unemployment rate (urban formal sector)										
Unskilled	-2.90	-11.63	-9.63	-10.52	-10.63	-10.89	-11.08	-11.25	-11.19	-11.01
Skilled	0.29	0.14	0.19	0.19	0.19	0.20	0.20	0.20	0.21	0.21
Poverty Gap (urban)										
Informal	-1.52	-0.58	-0.96	-0.97	-1.06	-1.12	-1.17	-1.22	-1.26	-1.30
Formal unskilled	1.01	-0.90	-0.51	-0.69	-0.72	-0.78	-0.82	-0.86	-0.89	-0.91
Formal skilled	0.31	0.17	0.22	0.21	0.22	0.22	0.22	0.21	0.22	0.23
10 Percentage Points Cut in Unskilled Labor Payroll Tax Rate - Non Neutral										
Unemployment rate (urban formal sector)										
Unskilled	-5.89	-5.21	-3.79	-3.86	-3.55	-3.34	-3.10	-2.88	-2.66	-2.46
Skilled	0.31	0.23	0.25	0.24	0.25	0.25	0.25	0.25	0.25	0.25
Poverty Gap (urban)										
Informal	-1.55	-0.92	-1.03	-0.94	-0.90	-0.85	-0.80	-0.75	-0.71	-0.66
Formal unskilled	0.06	-0.91	-0.60	-0.61	-0.53	-0.48	-0.42	-0.36	-0.30	-0.25
Formal skilled	0.33	0.25	0.28	0.27	0.27	0.26	0.25	0.25	0.25	0.26
10 Percentage Points Cut in Unskilled Labor Payroll Tax Rate - Sales Tax Neutral										
Unemployment rate (urban formal sector)										
Unskilled	-2.07	-2.05	-1.88	-1.71	-1.54	-1.37	-1.21	-1.05	-0.90	-0.76
Skilled	0.25	0.25	0.25	0.25	0.26	0.26	0.26	0.26	0.26	0.26
Poverty Gap (urban)										
Informal	-0.49	-0.44	-0.40	-0.37	-0.33	-0.29	-0.25	-0.22	-0.19	-0.15
Formal unskilled	-0.31	-0.30	-0.25	-0.20	-0.15	-0.11	-0.06	-0.02	0.02	0.06
Formal skilled	0.24	0.24	0.25	0.25	0.25	0.24	0.24	0.24	0.25	0.26
10 Percentage Points Cut in Unskilled Labor Payroll Tax Rate - Income Tax Neutral										
Unemployment rate (urban formal sector)										
Unskilled	-3.56	-3.49	-3.40	-3.30	-3.19	-3.09	-2.98	-2.87	-2.76	-2.66
Skilled	0.18	0.19	0.19	0.19	0.19	0.20	0.20	0.20	0.20	0.20
Poverty Gap (urban)										
Informal	-1.05	-1.03	-1.00	-0.98	-0.95	-0.93	-0.90	-0.87	-0.85	-0.82
Formal unskilled	-0.35	-0.34	-0.32	-0.30	-0.27	-0.24	-0.22	-0.19	-0.17	-0.14
Formal skilled	0.44	0.46	0.48	0.49	0.49	0.48	0.48	0.49	0.52	0.54