Assessing the Flexibility of the Labor Market in Chile: An International Perspective

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The unemployment rate in Chile averaged slightly over 6.5 percent throughout a ten-year period of high economic growth that ended in 1997. Unemployment then rose significantly at the outset of the Asian crisis, reaching levels near 11 percent. This broadly coincided with the implementation of a set of legal initiatives that increased protection standards in labor regulation. After the end of the military government in 1990, labor codes began to revert to their previous trend of high levels of regulation, with reforms approved in congress in 1990, 1993 and 2001. These introduced higher costs of dismissal, sanctions against firms that fire without just cause, extended provisions for and broader coverage of union bargaining, and a significant increase in the minimum wage (which was implemented in three stages beginning in 1998). These regulations are closer to the European-style labor market protection than to the Anglo-American tradition, which relies more on market forces. A quick look at the relative performance of unemployment rates under these two approaches can help clarify the controversy generated among economists and policymakers during this period.

One side of the argument holds that the recent trend in unemployment is basically cyclical in nature, responding to the GDP slowdown triggered by the Asian crisis and reinforced by the quick succession of negative external shocks that included a large fall in the terms of trade, September 11, and turbulence in Argentina and Brazil. The persistent behavior of unemployment is thus merely a reflection of persistent shocks and not the result of an intrinsically rigid labor market limited by the current legal framework. This framework, the argument continues, is still far from European standards, especially when de jure regulations are placed in the context of their de facto repercussions in a country with weak legal enforcement. The difference between de jure and de facto regulation is considered in Rama and Artecona (2002) and Calderón and Chong (in this volume).

The other side argues that the recent rise and persistence of unemployment is mainly explained by the growing trend in labor regulations since the early 1990s, which have increased rigidity in the labor market. This has been particularly important since the last reform implemented in 2001, which has, according to this view, significantly discouraged employment creation and caused factor substitution toward capital utilization.[1]

Although the first line of argumentation sustains that significant increases in regulation can coexist with low levels of unemployment conditional on the cyclical position (as they did before 1998), some selected facts make a strong case for the second view. First, it is hard to reconcile the cyclical hypothesis with the evidence of some Southeast Asian economies, which managed to recover rather quickly from the crisis despite being severely affected. Second, an argument that draws on factor substitution trends raise the alert on repeating the European experience of growth with unemployment. Indeed, the recent evolution of relative factor costs suggests that the trend in regulation may indeed have strengthened union bargaining power. Despite sharp levels of unemployment, the path of real earnings remained almost unaltered, showing a steady increase throughout the 1990s, while the cost of capital decreased over the period.[2] Something similar happens with minimum wages: the ratio of the minimum wage to average wages was stable in the mid-1990s and then increased sharply

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1. Bergoeing and Morandé (2003) argue that the discussion of the reform itself generated an anticipated fall of labor demand.
2. An alternative explanation could be posed based on the efficiency wages theory.

after 1999, whereas the share of young workers in total employment declined steadily across the same period. This combination of events supports the view that the minimum wage is way above equilibrium, which is formally sustained by recent evidence in Cowan and others (2003).

Finally, the concern with the level and persistence of unemployment seems particularly well-founded when two additional aspects are considered. First, two opposite forces usually affect the labor supply in the face of rising unemployment: the discouraging effect on job search among workers with worsened employment chances and the marginal worker effect, in which additional family members must join the labor force to augment domestic earnings. The Chilean experience clearly points to a dominant role for the former, as demonstrated by the decrease in labor-force participation and by empirical estimations of the procyclicality of the labor supply (García, 1995). Second, a growing portion of the recent job creation figures corresponds to self-employment in the informal sector, which increased markedly in the late 1990s in response to the Asian crisis. These jobs are typically low in productivity and socially unprotected. The joint effect of the drop in labor participation and the rise in informal jobs implies that reported unemployment figures actually underestimate the extent of the problem.

However suggestive, the above analysis does not assess the degree of rigidity present in the Chilean labor market, as it fails to identify whether observed unemployment reflects a current shock or persistence stemming from lack of market flexibility. In this context, our goal is to measure the relative flexibility of the labor market by using a performance-based indicator that can account for this distinction, in order to rank Chile within a group of countries that includes both members of the Organization for Economic Cooperation and Development (OECD) and emerging economies.

Our indicator is defined as the half-life of unemployment after the economy is hit by a shock, which is compatible with the cyclical rigidity we examine in this paper. When unemployment quickly converges to its natural rate after a shock, the country's labor market is ranked as being highly flexible, no matter what that natural rate of unemployment might be. We do not address the kind of rigidity that would explain differences in the natural rate of unemployment among countries, although the two issues might be related.

The model that guides our empirical approach is very much in the spirit of Dolado and Jimeno (1997) and Balmaseda, Dolado, and

Lopez-Salido (2000), who associate labor market rigidity with the persistence of unemployment in the presence of macroeconomic shocks.[3] Indeed, their international evidence reveals a clear relation between institutional measures of rigidity and the macroeconomic dynamics. Since our main goal is to rank Chile in terms of labor market rigidity, we naturally consider a model for an emerging open economy that is frequently affected by large movements in the terms of trade, in addition to other supply and demand forces.

The model assumes that wages are set in a bargaining framework in which insiders and outsiders interact, following Blanchard and Summers (1986) and Blanchard (1991). This setting is used to introduce rigidity in the labor market, which prevents nominal wages from adjusting rapidly to equilibrium and leads to partial hysteresis of the unemployment rate. Over the very long run, however, unemployment should be zero (after normalizing for the country-specific natural unemployment rate), which is compatible with a vertical aggregate supply and no trend in the natural unemployment rate (Blanchard and Katz, 1997). All shocks could have an impact on unemployment in the short run, though.

The labor market indicator should depend exclusively on labor market rigidity, since it needs to be comparable across countries. However, some of the rigidity indexes found in the related literature also depend on the elasticity of labor supply to real wages. An open economy version of those indexes would further depend on the share of tradable goods consumed in the economy. Our labor market flexibility index depends exclusively on the coefficient of the model associated with labor market rigidity in the wage equation.

The empirical strategy allows us to compute the direct measure of persistence with which to assess the actual performance of labor markets, by simulating responses to properly identified, isolated shocks. We use a structural vector autoregression (SVAR), with the long-run restriction identification strategy developed by Blanchard and Quah (1989). We use the SVAR to study the dynamics of the real wage, the real exchange rate, output, and unemployment in a sample of both OECD countries and emerging markets. The model helps us to impose the long-run restrictions and interpret the shocks. With the purpose of analyzing unemployment persistence, we focus on the impulse response functions of unemployment after the economy is hit by the structural shocks.

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3. Other examples include Fabiani and Rodriguez-Palenzuela (2001) and Viñals and Jimeno (1996).

Our main conclusion is that Chile's labor market reactions to structural shocks are among the most flexible economies, ranking third after Korea and Hong Kong and followed by the United States and Mexico. At the other end of the ranking, Germany, Sweden, Spain, and Colombia have the most rigid labor markets.

The rest of the paper is structured as follows. The first section presents the model. The second describes the empirical strategy and main results. The third section assesses the labor market index, and the final section of the paper concludes.

1. THE MODEL

This section reproduces the basic insights of the model developed in Albagli, García, and Restrepo (2004), starting with aggregate supply and demand. The economy is characterized by the supply of a domestic tradable good by firms, which hire labor as the only factor of production. The technology is assumed to be characterized by constant returns. Aggregate supply is given by

$$y_t = n_t + x_t \; , \tag{1}$$

where x is the productivity of labor and n is aggregate employment (all variables are in natural logs throughout the description of the model). Consumption is divided into the domestic good and an imported good. To obtain aggregate demand, we use IS-LM analysis for an open economy. The saving-investment equilibrium is given by

$$y_t = -aE\left[r_t\right] + q_t + \eta_z z_t + \eta_x x_t + \tau_t \; , \tag{2}$$

where $E\left[r_t\right]$ is the expected real interest rate, q is the real exchange rate, z is the relative price of domestic to foreign goods (the terms of trade), x is labor productivity, and τ is a labor-force shock,[4] while a, η_z, η_x are parameters.

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4. These different shocks are included separately because they can conceivably affect aggregate demand through different channels. For example, productivity and the terms of trade affect permanent income, while the real exchange rate affects aggregate demand through expenditure-switching effects and balance-sheet effects. Although in the long run the real exchange rate is determined by productivity and the terms of trade, in the short run it behaves according to the nominal price rigidities embedded in the present framework, and should therefore be considered separately. The labor supply shock is included as a scaling factor.

Money market equilibrium is described by

$$m_t - p_t = -bi_t + y_t \,, \tag{3}$$

where m is money suply, p is the price level and b is the semielasticity of real money demand with respect to i, the nominal interest rate. Given perfect capital mobility, nominal interest rates depend on the parity condition, which—together with the Fischer equation—leads to aggregate demand:

$$y_t = \frac{a}{a+b}(m_t - p_t) + \frac{ab}{a+b}E\big[p_{t+1} - p_t\big] + \frac{b}{a+b}\big(q_t + \eta_z z_t + \eta_x x_t + \tau_t\big) \tag{4}$$

Domestic producer prices depend on nominal wages and productivity, through

$$p_t^p = w_t - x_t \,. \tag{5}$$

The aggregate price level is then given by a weighted average of domestic and foreign prices:

$$p_t = \gamma p_t^p + (1-\gamma)s_t \,, \tag{6}$$

where s is the nominal exchange rate and γ is the imported fraction of aggregate consumption. The real exchange rate, which is given by $q_t = s_t - p_t$, can be combined with (5) in (6) to obtain consumers' real wages:

$$w_t - p_t = x_t - \frac{(1-\gamma)}{\gamma}q_t \,. \tag{7}$$

We follow the precedent of papers such as Blanchard and Summers (1986) in establishing nominal wage bargaining as a function of union power. In our particular framework, unions negotiate nominal wages at the beginning of the period (before shocks arrive) to keep real wages equal to the previous period's level, as opposed to the real market-clearing or long-run wage *(w – p)**. This is represented by the following wage setting condition:

$$E\big[w_t - p_t\big] = \lambda\big(w_{t-1} - p_{t-1}\big) + (1-\lambda)(w-p)^* \,. \tag{8}$$

where E is the expectations operator and λ represents unions' bargaining power.[5]

Labor supply is modeled as a function of real wages and a labor-force shock,

$$l_t = c(w_t - p_t) + \tau_t \;, \tag{9}$$

where c is the elasticity of labor supply to real wages. Unemployment is then given by

$$u_t = l_t - n_t \;. \tag{10}$$

This basic framework thus defines a long-run equilibrium level of real and nominal variables that depends on four exogenous shocks: namely, shocks to productivity, the terms of trade, the labor supply, and the quantity of money. Each variable is assumed to follow a random walk process:

$$\Delta x_t = \varepsilon_t^x \;, \tag{11}$$

$$\Delta z_t = \varepsilon_t^z \;,$$

$$\Delta \tau_t = \varepsilon_t^\tau \;, \;\; \text{and}$$

$$\Delta m_t = \varepsilon_t^m$$

where $\varepsilon_t^x, \varepsilon_t^z, \varepsilon_t^\tau,$ and ε_t^m are all uncorrelated independent and identically distributed (i.i.d.) shocks.

The economy starts from a position of equilibrium and is then subject to one or more exogenous shocks. The purpose of the model is to highlight how labor market rigidities affect the system's convergence to a new steady state. Once the economy is hit by any of the exogenous shocks, price rigidities stemming from wage bargaining will cause temporary misalignment of the real exchange rate, which directly affects aggregate demand and unemployment.

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5. This wage setting framework implies that after a shock, prices are affected by the contemporaneous movement of the nominal exchange rate but not by movements of the nominal wage, which is fixed for the current period.

1.1 Dynamics

In the long run, real variables such as real wages, output, the real exchange rate and employment depend on real determinants only—namely, productivity, terms-of-trade and labor-supply shocks—through the values of x, z, and τ. From equation (7), the long-run workers' (consumers') real wage is

$$(w-p)^* = x - \frac{(1-\gamma)}{\gamma} q^* , \tag{12}$$

where an asterisk represents a long-run value. Equating supply and demand renders

$$q^* = \frac{(1+c-\eta_x)x - \eta_z z}{1 + c(1-\gamma)/\gamma} . \tag{13}$$

Using equations (12) and (13) in equation (9) and setting $l = n$ in the long run, we get the steady-state value of output:

$$y^* = \left\{1 + c\left[1 - \frac{(1-\gamma)(1+c-\eta_x)}{\gamma + c(1-\gamma)}\right]\right\}x + \left[\frac{c(1-\gamma)\eta_z}{\gamma + c(1-\gamma)}\right]z + \tau . \tag{14}$$

Nominal variables, therefore, adjust to equations (12), (13), and (14), given the monetary stance, such that the price level in the long run is given by

$$p^* = m - y^* . \tag{15}$$

Nominal wages and the nominal exchange rate are finally obtained by adding equation (15) to the respective real values.

The specification of the shocks allows us to derive long-run identifying restrictions, by reducing the model to a system of four equations. These are equations (5), (13), (14), and (10), which relate real producer wages (labor cost), the real exchange rate, output, and unemployment, respectively, to the four exogenous shocks given by equation (11). In the long run, labor costs depend on productivity shocks only; the real exchange rate is affected by both productivity and terms-of-trade shocks; output reflects productivity, terms-of-trade, and labor-supply shocks; and unemployment responds only temporarily to all shocks, being zero

in steady state. The nominal rigidity introduced by wage bargaining, therefore, has no role in the long-run equilibrium.

Turning now to the short run, we analyze the dynamics that are triggered when the system is hit by any of the four shocks, calling for an adjustment in nominal variables in order to reach the new steady state. Although the rigidity introduced by wage bargaining produces symmetric responses of output and employment below and above their long-run levels, we focus only on situations that cause temporal unemployment—that is, shocks that call for a downward nominal wage adjustment. For simplicity, we normalize each variable to zero in the initial state. The timing of the model is the following. First, unions and firms negotiate contracts (nominal wages) at the beginning of the period. Second, the economy is hit by a structural shock, which requires a downward adjustment of the nominal wage to reach the new long-run equilibrium. Since wages are fixed for the present period, prices adjust only partially (through the response of the nominal exchange rate), holding back aggregate demand and causing positive unemployment. Finally, wages are partially adjusted at the beginning of the next period, reflecting the previous real wage level and the new lower steady-state value.

Given the stickiness originating from the wage-bargaining process, prices follow a gradual adjustment path to their full-employment level. The asset channel reacts without this delay, however, so the real exchange rate departs from its long-run level. Thus, output and employment are determined by demand in the short run. If, as the result of a shock, the real exchange rate is below its long-run level, aggregate demand and employment will also be below their long-run levels. In contrast, the labor supply will temporarily rise with respect to its new equilibrium level given the higher real wages (which depend negatively on q); this results in a sharp increase in unemployment.

Panel A in figure 1 presents the comparative statics analysis in the face of a monetary contraction. When m_t falls, aggregate demand moves as a result of two driving forces: the direct impact of the money supply, which lowers demand, and the fall in prices caused by the instantaneous nominal appreciation, which compensates the first effect. The compensation is only partial, however, because nominal wages are fixed at the time of the shock; this ensures a negative dominant effect on labor demand for a given real wage. At the same time, the real wage increases as prices fall, which causes an increase in the labor supply. The result is an expansion of unemployment. This unemployment is gradually reduced as market pressure pushes

down real wages during subsequent nominal wage negotiations. Based on equations (4), (8), (9), and (10), we derive that

$$u_{t+s} = \lambda^s u_t \ , \tag{16}$$

which means that the persistence of unemployment is actually given by the unions' bargaining power, λ. The dynamics of the monetary contraction are simulated in panel B of figure 1, using the Anderson-Moore algorithm for solving dynamic systems. Structural parameters were approximated with Chilean data, varying only the hypothetical level of rigidity.

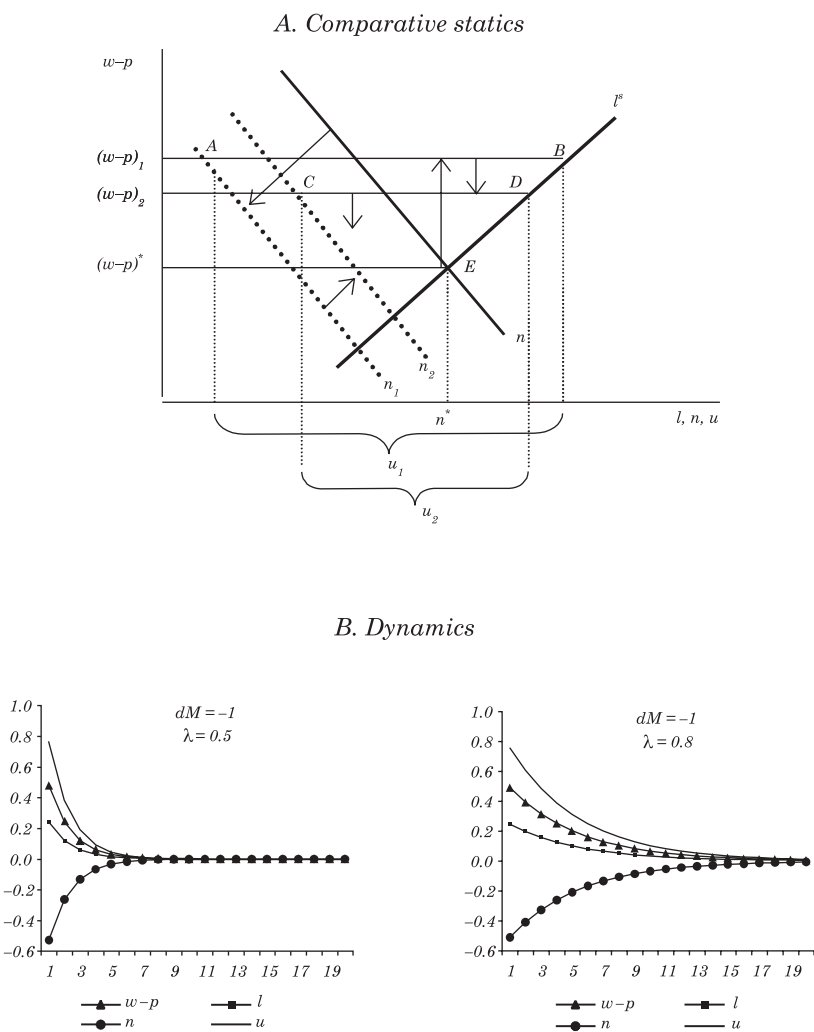## 1.2 Building an Index of Labor Market Rigidity

To create a measure that captures the cyclical persistence of the labor market, we need to build an index that satisfies two necessary conditions. First, it must be related to λ. Second, it must be related only to λ. This stems from the fact that two economies with the same degree of labor rigidity may respond differently in output, wages, and unemployment for a given shock. Such differences arise from the other structural parameters introduced in the model, such as c (the response of the labor supply to the real wage) and γ (the relative importance of the tradable sector).

A standard measure of wage rigidity is the index developed in Layard, Nickell, and Jackman (1991) and Balmaseda, Dolado, and López-Salido (2000), which computes the ratio of the accumulated response of unemployment to the change in the real wage after the shock. This type of measure is not appropriate in our current framework, however, because it depends on c and γ as well.

While the assumption of a constant value of c over a rather homogeneous sample of OECD countries seems acceptable, it is not satisfactory when the sample is extended to include less-developed countries, as we do. Assuming similar degrees of openness further deteriorates the power of the measure. We therefore use an alternative measure that depends only on λ: namely, the half-life of unemployment after a shock, or the number of periods required for unemployment to decrease to one-half of its maximum value. From equation (16), unemployment becomes one-half of its initial level at period s^*, where

$$s^* = \frac{\ln(1/2)}{\ln \lambda} \ , \tag{17}$$

Figure 1. A Monetary Contraction

A. Comparative statics

B. Dynamics

Source: Authors' calculations.

which depends positively and solely on the value of our measure of labor market rigidity.

2. The Empirical Strategy

Since our purpose is to measure unemployment persistence in the presence of shocks, we use the SVAR methodology. In particular, we follow Balmaseda, Dolado, and López-Salido (2000) in identifying the VAR with long-run restrictions, as in Blanchard and Quah (1989) and Clarida and Galí (1994). These authors assume that some shocks have permanent effects on some variables and transitory effects on others and that some shocks may not have any permanent effect on any variable. This procedure fits the intuition of a growing economy in which unemployment goes back to its natural rate, although wages and employment may change because of structural factors, and the supply curve is vertical in the long run.

2.1 Structural Identification

The structural VAR identification, derived directly from the model, provides a clear interpretation of the structural shocks. For clarity, we rewrite several equations taken from the long-run equilibrium of the model:

$$\Delta\left(w-p^p\right)* = \varepsilon^x \ . \tag{18}$$

Only productivity shocks affect the real producer wage in the long run.

$$\Delta q* = \frac{\left(1+c-\eta_x\right)\varepsilon^x}{1+c\left(1-\gamma\right)/\gamma} - \frac{\eta_z\varepsilon^z}{1+c\left(1-\gamma\right)/\gamma} \ . \tag{19}$$

In the long run, the real exchange rate depends only on productivity and the terms of trade.

$$\Delta y* = \left\{1+c\left[1-\frac{\left(1-\gamma\right)\left(1+c-\eta_x\right)}{\gamma+c\left(1-\gamma\right)}\right]\right\}\varepsilon^x + \left[\frac{c\left(1-\gamma\right)\eta_z}{\gamma+c\left(1-\gamma\right)}\right]\varepsilon^z + \varepsilon^\tau \ . \tag{20}$$

Output is affected in the long run by productivity, the terms of trade, and the evolution of the labor force.

$$u^* = 0 . \tag{21}$$

Finally, although all shocks affect unemployment in the short run, the impact is not permanent since unemployment is stationary in a partial hysteresis setting.

The identification is based on the assumption that the matrix of structural long-run multipliers, $\mathbf{C}(1)$, is lower triangular. To find $\mathbf{C}(1)$, it is necessary to first build the matrix $\mathbf{f}(1)\mathbf{\Sigma f}(1)'$ from the reduced form estimation, where $\mathbf{f}(1)$ is the sum of the coefficients, and $\mathbf{\Sigma}$ is the variance-covariance matrix obtained. It is possible to show that $\mathbf{C}(1)$ is the Choleski factor of $\mathbf{f}(1)\mathbf{\Sigma f}(1)'$. Once $\mathbf{C}(1)$ is found, it is easy to compute all the structural coefficients, C, which are used to build the impulse-responses, because $\mathbf{C}_0 = \mathbf{f}(1)^{-1}\mathbf{C}(1)$, and with $\mathbf{C}_0$ all $\mathbf{C}_s$ can be computed given $\mathbf{C}(L) = \mathbf{f}(L)\mathbf{C}_0$.[6]

2.2 Data

We use quarterly data from 1980:1 to 2002:4 for real producer wages (computed with the GDP deflator), the real exchange rate, output, and unemployment. Most countries' data sets come from the OECD database. For non-OECD countries, data were found in the respective central bank's web site and, in some cases, in the International Monetary Fund's *International Financial Statistics* data set. Table 1 reports the source of the time series for each country.

The model assumes that real wages, real exchange rates, and output are integrated processes, while unemployment is stationary.[7] We ran Dickey-Fuller tests for all variables, but in several countries the null hypothesis of a unit root for the unemployment rate could not be rejected (see table 2). However, we follow Balmaseda, Dolado, and López-Salido (2000) in assuming a partial hysteresis setup, because it seems unreasonable to consider the consequences of any

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6. For a detailed explanation, see Clarida and Galí (1994) and Enders (1995).

7. The Dickey-Fuller test rejected the unit root hypothesis for the real exchange rate of Denmark and the Netherlands. We therefore ran the stationary VAR $[\Delta (w - p^p), q, \Delta y, u]$ for these two countries.

Table 1. Quarterly Series Sources[a]

Country	Data span	Unemployment	GDP	GDP deflator	Nominal wage	Real exchange rate
Australia	1984:1–2002:4	OECD	OECD	OECD	OECD[b]	OECD
Austria	1980:1–2002:4	OECD	IMF	IMF	OECD[c]	OECD
Belgium	1980:1–2002:4	OECD	OECD	OECD	OECD[d]	OECD
Canada	1980:1–2002:4	OECD	OECD	OECD	OECD[d]	OECD
Chile	1986:1–2002:4	NSO	Central Bank	Central Bank	NSO[b]	Central Bank
Colombia	1984:1–2002:4	Central Bank	Central Bank	Central Bank	Central Bank[c]	Central Bank
Denmark	1988:1–2002:4	OECD	OECD	OECD	OECD[d]	OECD
France	1980:1–2002:4	OECD	OECD	OECD	OECD[b]	OECD
Germany	1980:1–2002:4	OECD	IMF	IMF	OECD[d]	OECD
Hong Kong	1986:1–2002:4	HKMA	HKMA	HKMA	HKMA[b]	IMF[e]
Italy	1980:1–2002:4	OECD	OECD	OECD	OECD[c]	OECD
Korea	1983:1–2002:4	NSO	Bank of Korea	Bank of Korea	NSO[b]	IMF
Mexico	1981:1–2002:4	OECD	OECD	OECD	OECD[d]	OECD
Netherlands	1980:1–2002:4	OECD	OECD	OECD	OECD[d]	OECD
Spain	1980:1–2002:4	OECD	OECD	OECD	OECD[b]	OECD
Sweden	1980:1–2002:4	OECD	OECD	OECD	OECD[d]	OECD
United Kingdom	1980:1–2002:4	OECD	OECD	OECD	OECD[b]	OECD
United States	1980:1–2002:4	OECD	OECD	OECD	OECD[b]	OECD

a. HKMA: Hong Kong Monetary Authority. IMF: from *International Financial Statistics*. OECD: from *Main Economic Indicators* and *Quarterly Labour Force Statistics* (various issues); unemployment corresponds in all cases to the standardized rate. NSO: national statistics office.
b. All sectors.
c. Industry.
d. Manufacturing
e. Constructed based on trade participation.

Table 2. Dickey–Fuller Unit Root Tests[a]

Country	Real wage (w–p^p)		Real exchange rate (q)		Output (y)		Unemployment (u)	
Australia	–1.75	(–3.46)	–2.81	(–2.89)	–1.68	(–3.46)	–2.81	(–2.90)
Austria	–2.02	(–3.46)	–1.93	(–2.89)	–2.56	(–3.47)	–3.08	(–2.89)
Belgium	–1.12	(–3.46)	–3.19	(–3.46)	–2.89	(–3.46)	–4.20	(–3.47)
Canada	–2.43	(–3.46)	–2.32	(–3.46)	–2.40	(–2.90)	–3.86	(–3.47)
Chile	–1.14	(–2.90)	–1.37	(–2.91)	–2.40	(–2.91)	–2.82	(–2.90)
Colombia	–2.47	(–3.47)	–1.91	(–2.90)	–1.86	(–2.90)	–2.75	(–2.90)
Denmark	–2.28	(–3.49)	–4.78	(–2.91)	–2.89	(–3.49)	–2.74	(–3.49)
France	–2.61	(–3.46)	–2.52	(–2.89)	–2.57	(–3.46)	–2.10	(–2.90)
Germany	–2.94	(–3.46)	–1.94	(–2.89)	–0.66	(–2.89)	–2.63	(–2.89)
Hong Kong	–1.84	(–2.90)	–1.46	(–2.90)	–1.39	(–2.89)	–3.78	(–3.48)
Italy	–2.72	(–2.90)	–1.96	(–2.90)	–1.94	(–3.46)	–2.54	(–2.89)
Korea	–2.46	(–3.47)	–2.77	(–2.90)	–1.61	(–2.89)	–3.44	(–2.89)
Mexico	–1.47	(–2.91)	–2.52	(–2.91)	–2.85	(–3.48)	–2.44	(–2.89)
Netherlands	–1.18	(–2.89)	–4.73	(–3.46)	–0.65	(–2.90)	–4.21	(–3.46)
Spain	–2.86	(–3.47)	–1.85	(–2.89)	–2.69	(–3.46)	–2.21	(–2.89)
Sweden	–1.48	(–3.46)	–2.87	(–3.46)	–1.93	(–3.46)	–2.17	(–2.89)
United Kingdom	–2.14	(–3.46)	–2.23	(–2.89)	–2.40	(–3.46)	–4.14	(–3.46)
United States	–0.25	(–3.46)	–1.55	(–2.89)	–3.01	(–3.46)	–3.04	(–3.46)

Source: Authors' calculations.
a. The values in parentheses are 5 percent critical values.

shock on unemployment as permanent, even in the most rigid econo-mies.[8] We therefore estimated the following stationary VAR, impos-ing the long-run restrictions above described: $[\Delta(w - p^p), \Delta q, \Delta y, u]$'. For the purpose of comparison, we also run a three-variable (closed economy) VAR equivalent to the one found in Balmaseda, Dolado, and López-Salido (2000): $[\Delta(w - p^p), \Delta y, u]$'. Most VARs were estimated using two lags based on the LM multivariate residual test for autocorrelation and the other regular criteria.[9]

2.3 Estimation Results

Given the large number of economies in our sample, we decided to report the impulse responses of a small subgroup of countries with varying degrees of labor market flexibility (see figure 2). The confi-dence intervals were obtained with a bootstrap procedure using 500 replications.[10] In general, a positive productivity shock causes real wages to increase in both the short and long terms. When a terms-of-trade shock hits the economy, real (producer) wages increase only in the short run.[11] In the case of positive labor-force shocks, the re-sponse of real wages tends to be negative in the short run, but it is insignificant in several cases. Real wages also fall in response to a monetary shock (expansion), most notably in the cases of Chile, Co-lombia, and the United States. In Korea and Sweden wages are procyclical, and they do not move in the United Kingdom.

The real exchange rate tends to appreciate when a positive pro-ductivity shock strikes the economy. After a positive terms-of-trade shock, the real exchange rate appreciates in both the short and long
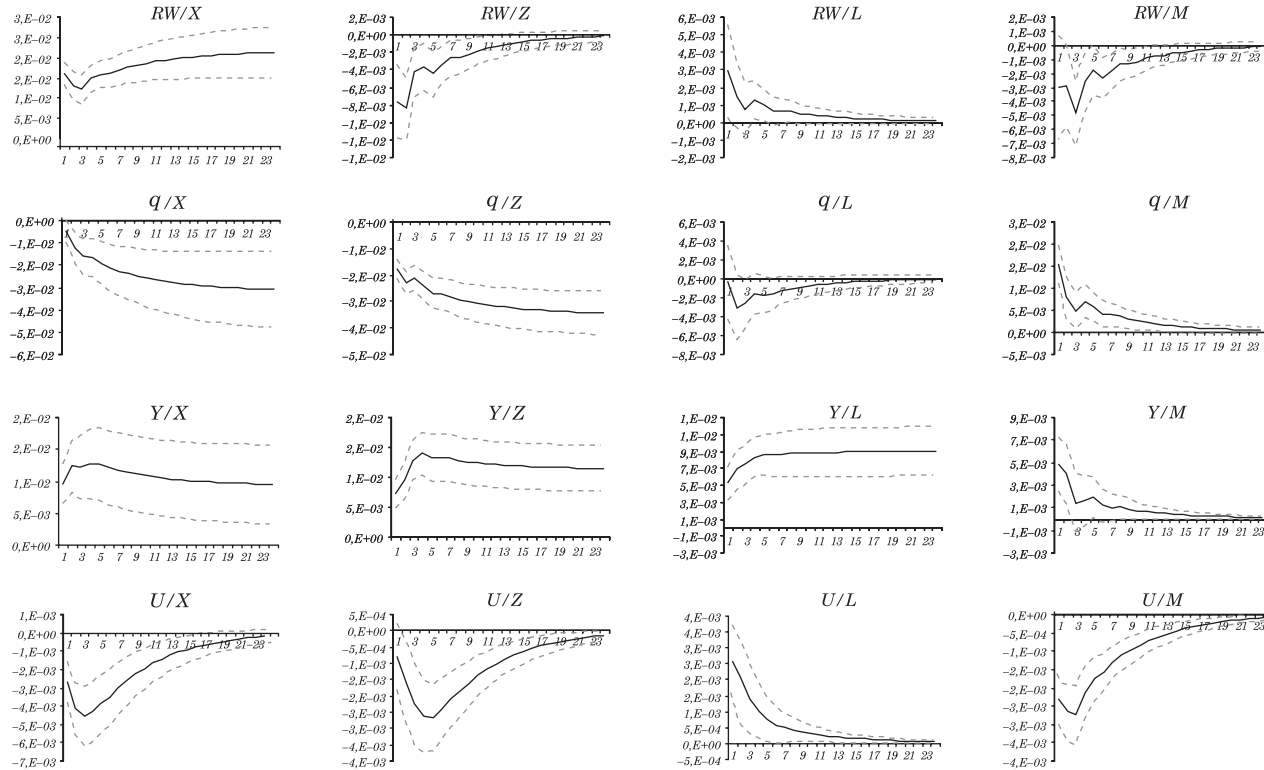
8. We also performed cointegration tests for all countries (as in Balmaseda, Dolado, and López-Salido, 2000); the null hyphotesis of no cointegration among the integrated variables $[w - p, q, y]$ was not rejected. With respect to the empiri-cal rejection of the absence of integration in unemployment series, we agree with several authors mentioned in the paper who treat unemployment as an I(0) pro-cess, regardless of its severe persistence in the short run. From a theoretical perspective, which we consider the most relevant, the unemployment rate can hardly be considered a variable with a forecast of infinite variance.

9. We refer to the Akaike, Schwartz, and Hannan-Quinn information crite-ria. Kilian and Ivanov (2000) analyze which criterion performs better for VARs with different sample sizes.

10. See Benkwitz, Lütkepohl, and Wolters (2001) for an analysis of alterna-tive bootstrap procedures.

11. In Chile and Colombia, real wages go the wrong way, falling in the short run after a positive terms-of-trade shock.
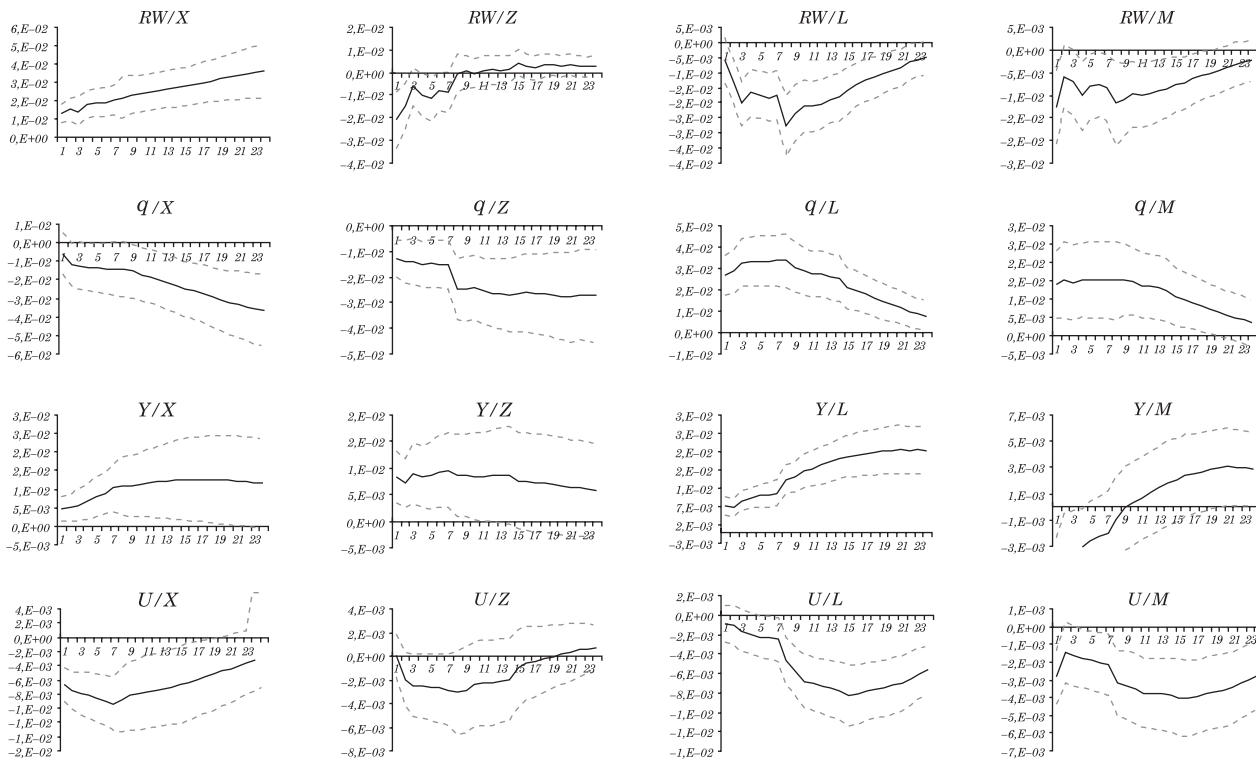
Figure 2. Impulse-Response Functions to Structural Shocks, Selected Countries

A. Chile

Figure 2. (continued)
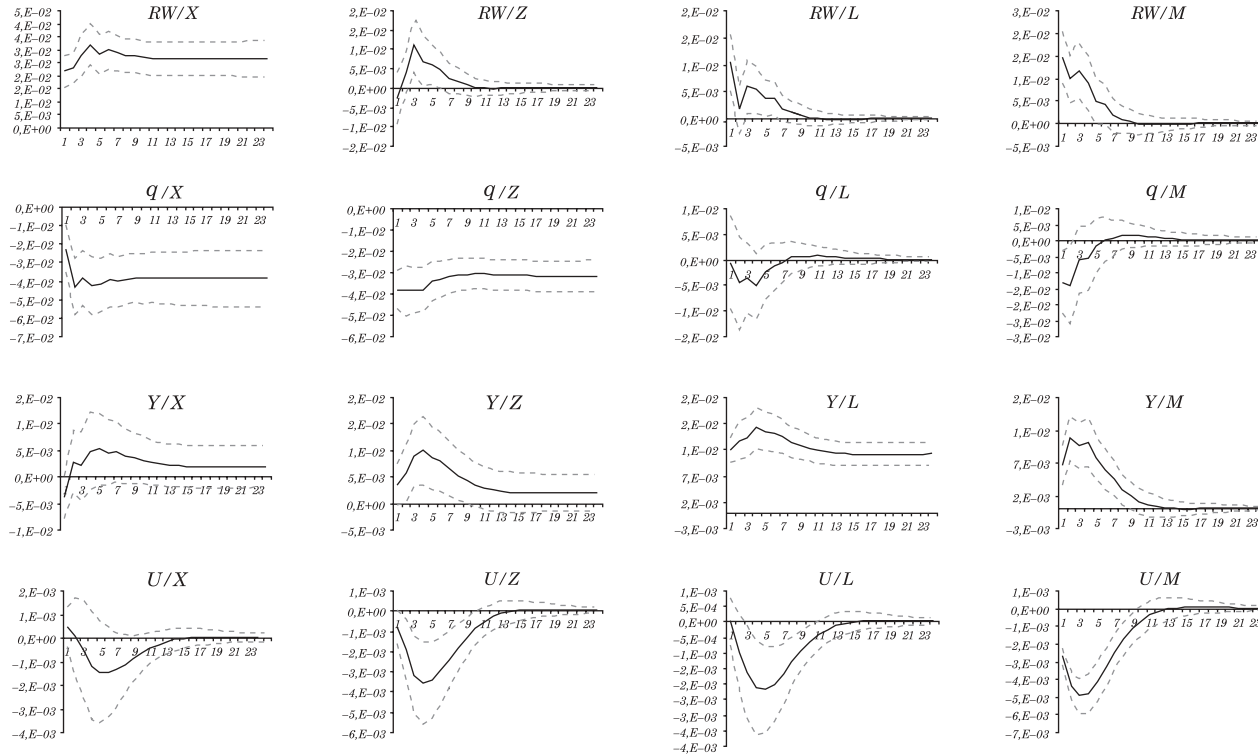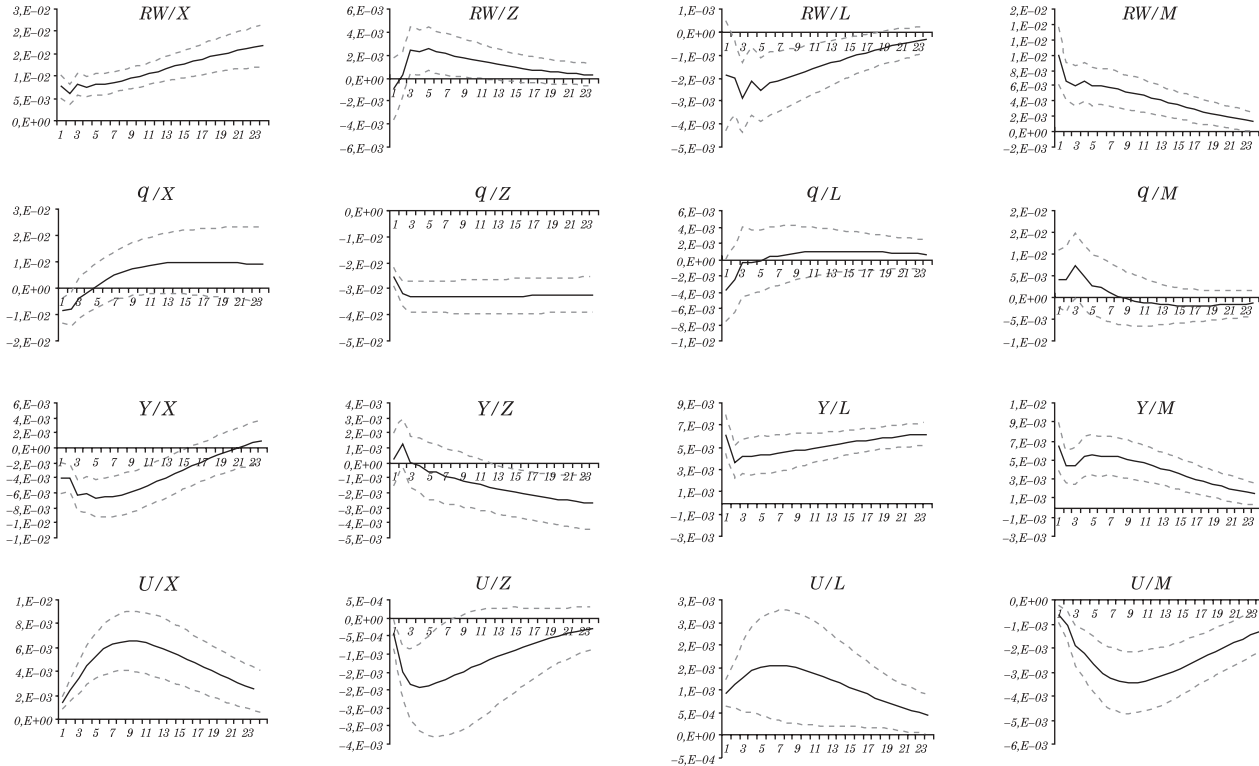

Source: Authors' calculations.

Figure 2. (continued)

Source: Authors' calculations.

C. Korea
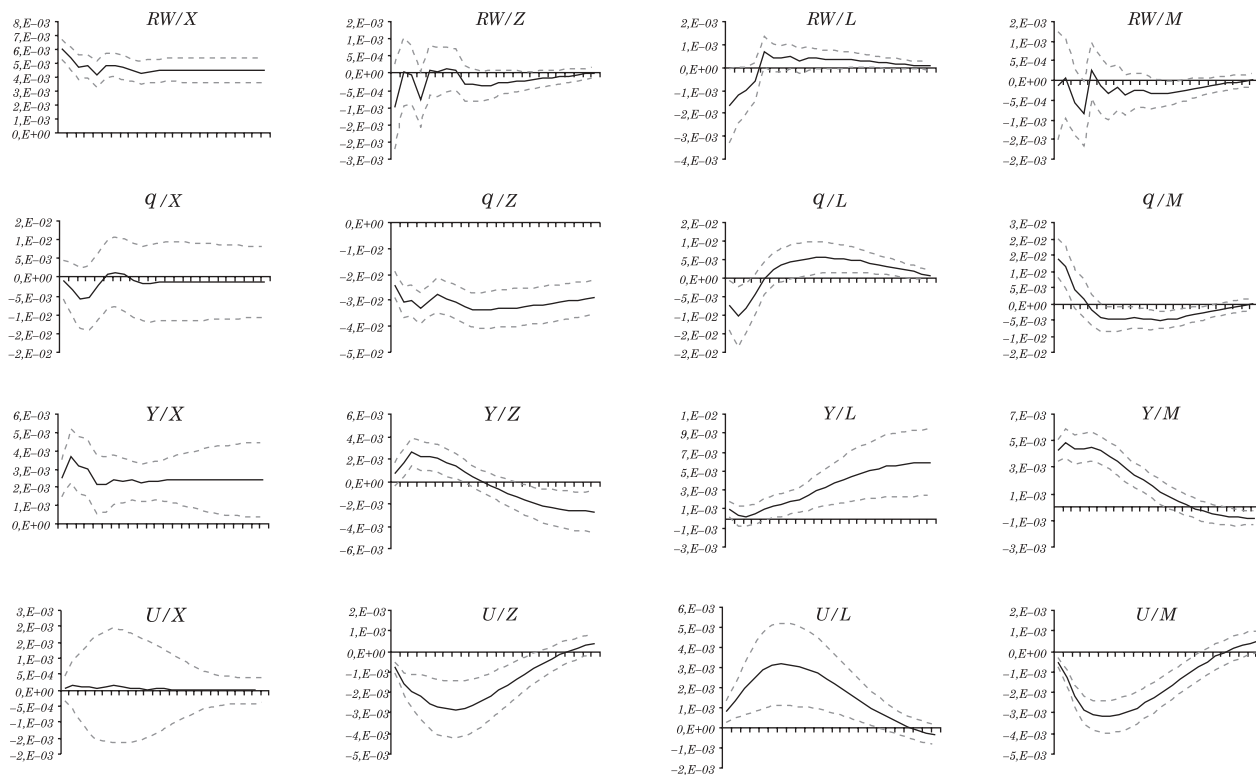
Figure 2. (continued)

Source: Authors' calculations.
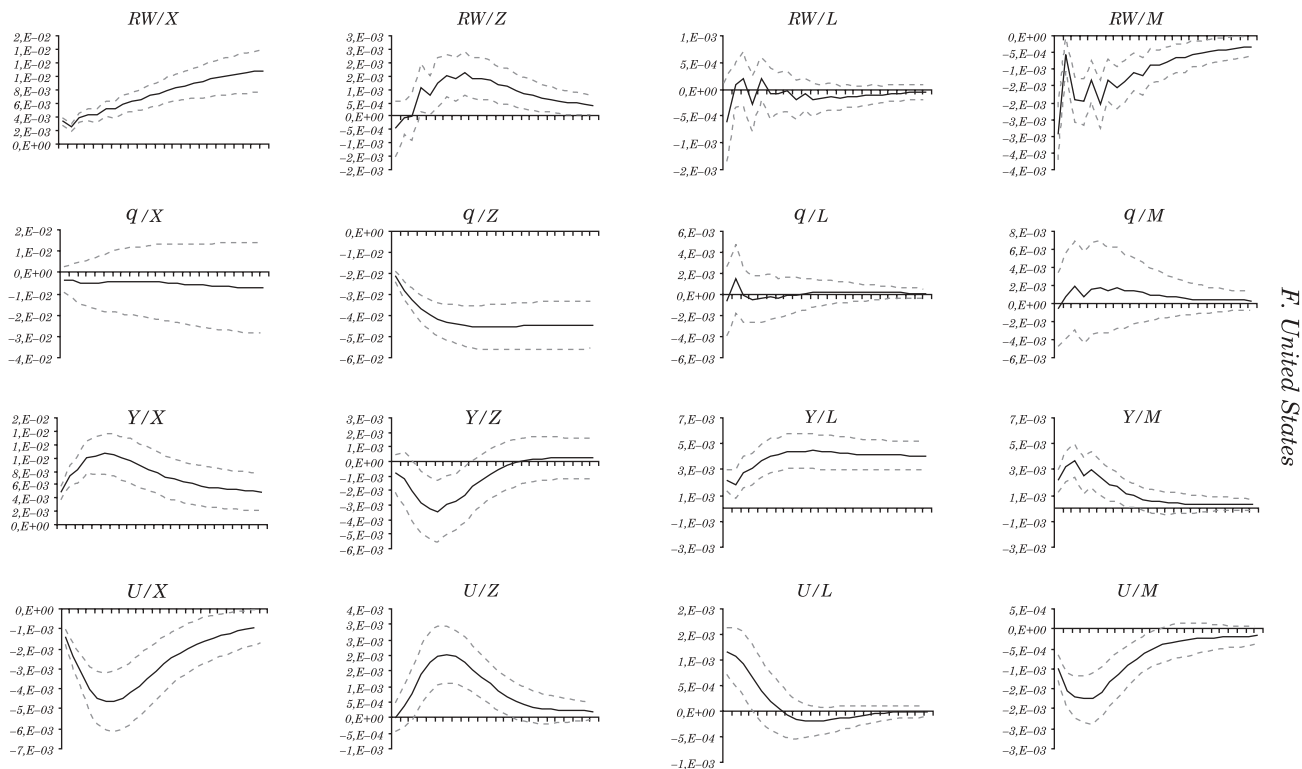
D. Sweden

Figure 2. (continued)

E. United Kingdom

Figure 2. (continued)

Source: Authors' calculations.

F. United States

Table 3. Labor Market Rigidity Indexes

Country	*Average unemployment*[a]	*Closed economy (three variables)*	*Open economy (four variables)*
Hong Kong	3.11	4.25	4.25
Korea	3.37	3.08	4.33
Chile	8.27	5.67	4.63
Mexico	3.39	5.33	5.50
United States	6.30	4.42	5.75
Canada	9.17	5.75	6.75
Netherlands	5.87	6.13	7.33
United Kingdom	7.37	6.92	7.38
Australia	7.96	7.58	7.50
France	9.90	7.63	9.00
Belgium	11.63	9.25	9.38
Italy	10.61	9.58	9.58
Denmark	6.32	9.17	9.67
Austria	5.51	8.58	10.50
Germany	6.85	9.33	10.75
Spain	17.89	11.42	11.38
Sweden	4.94	12.83	12.13
Colombia	12.90	24.50	22.75
Correlation with unemployment		0.54	0.53

Source: Authors' calculations.
a. Corresponds to the OECD standardized rate of unemployment.

terms. The response of the real exchange rate after a labor-force shock is seldom significant. The real exchange rate tends to increase in the short run as a result of a monetary expansion shock. Finally, the response of unemployment after a positive productivity shock is not clear-cut: it increases in many countries, but it does the opposite in several others. Unemployment tends to increase after a labor-supply shock and to decrease with either a terms-of-trade shock or a positive monetary disturbance, but there are exceptions to these trends.

Labor Market Rigidity Index

Table 3 shows the rankings we built by computing the average half-life of the unemployment responses for all shocks. The table reports rankings estimated for both closed- and open-economy specifications (based on three and four variables, respectively). Korea and Hong Kong are the most flexible countries, followed by Chile, Mexico, and the United States. This is consistent with recent evidence for the Korean economy, where unemployment peaked after the Asian crisis but quickly returned to its previous level. On the other hand, Chile is

still relatively flexible in an international context despite the two labor reforms that may have introduced some rigidity into the labor market after 1990.

At the other end of the spectrum, Germany, Sweden, Spain, and Colombia are ranked as the most rigid labor markets. In Colombia, unemployment increased sharply during the 1999 crisis, reaching 20 percent, but it decreased very slowly in 2003. In the middle range of rigidity are Australia, Austria, Belgium, Denmark, and the Netherlands among others. The ranking has a positive and significant correlation with average unemployment, as can be expected.

3. Assessment of the Chilean Labor Market Rigidity Ranking

Can we infer from the rankings presented in table 3 that Chile is a flexible economy in comparison with most of the countries considered? The evidence presented suggests precisely that. Nevertheless, we must mention a number of caveats before precipitating conclusions.

First, the ranking is based on unemployment persistence. Unemployment, however, is a net measure between labor supply and employment, so the rigidity implied by its persistence hides the true origin of market frictions. A rigid labor market can be dominated by an inefficient process of job reallocation, in which case the persistence is best attributed to rigid employment creation. Alternatively, the source of rigidity could be labor market institutions (that is, social security benefits) that foster persistent job search even when hiring prospects are low. In this context, the different correlations between unemployment and labor market participation across countries could help to disentangle the dominant source of rigidity. The fall in labor participation during high unemployment periods would suggest that at least part of this supposed flexibility comes from people exiting unemployment toward inactivity, not employment.

Second, as mentioned in the introduction, a growing part of employment creation is in the form of low-skilled, informal positions of self-employment. Any assessment of flexibility must therefore take into account the extent to which the adjustment actually occurs outside the more formal market. Unfortunately, lack of comparable data on informality among countries over long periods impedes further insights on this issue.

Finally, although the 1990s as a whole were characterized by increasing labor market regulation, reform critics point out that the structural change in adjustment capacity was only triggered by the recent regulations of 1999–2001. Whether this view is sustainable cannot be determined by the methodology presented. The empirical approach adopted here is limited to the small number of data points after the reform. When we ran the same VAR for Chile from 1986 to 1998 and from 1990 to 2002, we found no significant difference relative to the responses of unemployment using the whole sample.

Given these caveats, our performance-based ranking suggests that, when examined using a methodology that properly distinguishes shock responses from the persistent behavior of unemployment, the Chilean labor market appears to be relatively flexible.

4. CONCLUSIONS

In this paper, we ranked labor market rigidity for a sample of eighteen countries, with the purpose of characterizing the relative rigidity of the labor market in Chile. We analyzed the dynamic responses of unemployment in the presence of macroeconomic shocks identified with a structural VAR following Blanchard and Quah (1989). The setting of the empirical approach and the interpretation of the shocks are based on a model with rigidity in the labor market through the insider-outsider bargaining setup, which was popularized by Blanchard and Summers (1986) and is extended for an open economy in Albagli, García, and Restrepo (2004).

The restrictions derived from the model imply that in the long run, real producer wages grow only with productivity; the real exchange rate depends only on productivity and the terms of trade; output is affected by productivity, terms-of-trade, and labor-force shocks; and unemployment converges to its natural rate despite short-run disturbances. The model allows us to build an indicator of rigidity based on unemployment persistence and depending only on the rigidity coefficient of the wage-setting equation: namely, the half-life of unemployment after the shocks. We used this indicator to build rankings that served as the basis of comparison within our sample.

We found that Korea and Hong Kong have the most flexible labor markets, followed by Chile, Mexico and the United States. At the other end of the ranking, Germany, Sweden, Spain, and Colombia are the most rigid countries.

These findings support the view that despite the strict labor regulation introduced in the 1990s, labor market outcomes in Chile are still far from the European experience of high, persistent unemployment. Whether this results from weak institutional enforcement and whether the more recent reforms account for a structural change in labor market dynamics are interesting challenges for future research.

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