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Aspects of the Swiss Labor Market

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Abstract

This paper presents an analysis of the behavior of the Swiss labor market, which emphasizes both changes to labor supply and real wage inflexibility as determinants of recent unusually high levels of unemployment. Supply responses in the past meant that measured unemployment rates were rarely high. The paper suggests that these responses also meant that real wages were probably less responsive to shocks as a result. Econometric tests reported in the paper broadly confirm these suggestions, and imply that the level of unemployment consistent with stable inflation has risen in Switzerland.

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Summary

Until recently, unemployment in Switzerland was rarely high. This was often interpreted as evidence that the Swiss labor market was flexible; economic shocks were absorbed with little variation in unemployment. The recent rise in unemployment to over 5 percent has cast doubt on this interpretation, and attention has focused on the role of fluctuations in labor supply--both from changes in female participation rates and from foreign workers entering and exiting the labor market--in producing low levels of measured unemployment. The characterization of the Swiss labor market as flexible is, accordingly, questionable.

The present study investigates these issues using a standard wage-price model. Unlike other studies of the Swiss labor market, it uses co-integration methods to estimate long-run relationships in the model. Also, in light of the labor supply changes discussed earlier, since unemployment is a misleading indicator of labor market tightness, the equation estimated here uses an alternative measure based on employment.

The estimated equations are plausible. By transforming the measure of labor market tightness we are able to obtain a value of the nonaccelerating inflation rate of unemployment (NAIRU), which is estimated to be about 1.5 percent of the labor force in the early 1990s, suggesting that over half of unemployment was structural. The important determinants of changes in the NAIRU according to the econometric results are the level of unemployment benefits and external shocks, including changes in the real exchange rate. The paper also presents evidence suggesting that real wages in Switzerland have been and continue to be rigid.

I. Introduction and Overview

In the past, the virtual absence of unemployment in Switzerland has often been interpreted as evidence of a well-functioning and flexible labor market. Economic shocks during the 1970s and 1980s which led to large increases in unemployment elsewhere in Europe apparently had little effect in Switzerland as unemployment barely edged over 1 percent. The recent increase in Swiss unemployment to over 5 percent during the recession of the early 1990s suggests that this interpretation is based on an imperfect understanding of the workings of the Swiss labor market.

To interpret these developments, we argue that the historical absence of unemployment in Switzerland has been due to the way in which changes in labor supply have offset economic shocks. In the past, women and foreign workers tended to exit the labor market when labor demand declined. However, more foreign workers attained permanent resident status during the 1980s, the participation rate of women rose, and unemployment insurance coverage and benefits increased, all of which made the labor supply less responsive to cyclical downturns. Supply responses in the past precluded, at least in part, the need for real wages to adjust when demand changed. The gradual disappearance of such supply responses has meant that cyclical unemployment, which was hidden during past recessions, has become more visible. In turn, higher levels of unemployment suggest that real wages are not flexible in Switzerland as is often assumed. To analyze the behavior of real wages in Switzerland, a model of wage and price behavior is estimated. The econometric evidence suggests that wages have been, and presently are still, rigid in Switzerland, and that this is a major factor accounting for the increase in the Swiss unemployment rate. In addition, the recent increase in unemployment also reflects the emergence of a higher level of structural unemployment, although it is difficult to quantify the magnitude of this precisely due, in part, to data limitations.

The paper is organized as follows: Section II discusses recent developments in the Swiss labor market and Section III reviews explanations for the increase in unemployment. To estimate the natural rate of unemployment, Section IV models the wage and price determination process and provides estimates of real wage rigidity. Section V concludes.

II. Recent Developments

The recession of 1991-93 in Switzerland illustrated that a significant change occurred in the way that the labor market responds to cyclical fluctuations in aggregate demand (Chart 1). During the recessions of 1975-76 and 1982, unemployment remained at about one percent, despite considerable declines in real GDP--especially in 1975-76. In contrast, during the more mild recent recession, the unemployment rate began to increase in 1990 and reached a peak of 5.2 percent in February 1994. Its subsequent gradual decline reflects primarily the effect of the unemployed who have reached benefit termination and therefore drop out of the labor force, rather than the creation of new jobs.

This increase in unemployment has not uniformly affected various regions, groups of workers, and industries. According to data from May 1994, the unemployment rate is higher in West Switzerland and Tessin (7.0 percent) than in German-speaking Switzerland (3.9 percent). Unemployment rates for women are slightly higher than for men; and are considerably higher for resident foreign workers (8.5 percent) than for Swiss (3.7 percent); although resident foreign workers represent about 20 percent of the Swiss population, they account for about 40 percent of unemployed persons. While no major sector has been spared from an increase in the unemployment rate, the hardest hit sectors have been textiles, graphic arts, metallurgy, and restaurant and hotel services.

Developments in employment have mirrored these changes in unemployment. For example, relative to the decline in GDP, the decline in employment in the recent recession was considerably greater than in either the 1975-76 recession or the 1982 recession.[1] By the end of 1993, employment had fallen by 6.5 percent, from its peak of 3.6 million in 1991. These job losses have affected men and women similarly, although the decline for women was slightly higher. In terms of nationality, Swiss workers have experienced a 6.1 percent decline as compared to 8.4 percent decline for foreign workers.

III. Explaining Unemployment

The factors which account for Switzerland's historically low unemployment rate and the recent sharp increase stem from three major sources: (1) statistical problems in measuring unemployment; (2) significant changes in the behavior of labor supply during cyclical downturns; and (3) a rise in structural unemployment related primarily to increasingly generous unemployment benefits.

1. Statistical problems

The historically low unemployment in Switzerland is to some extent a statistical artifact which reflects the unique problems associated with

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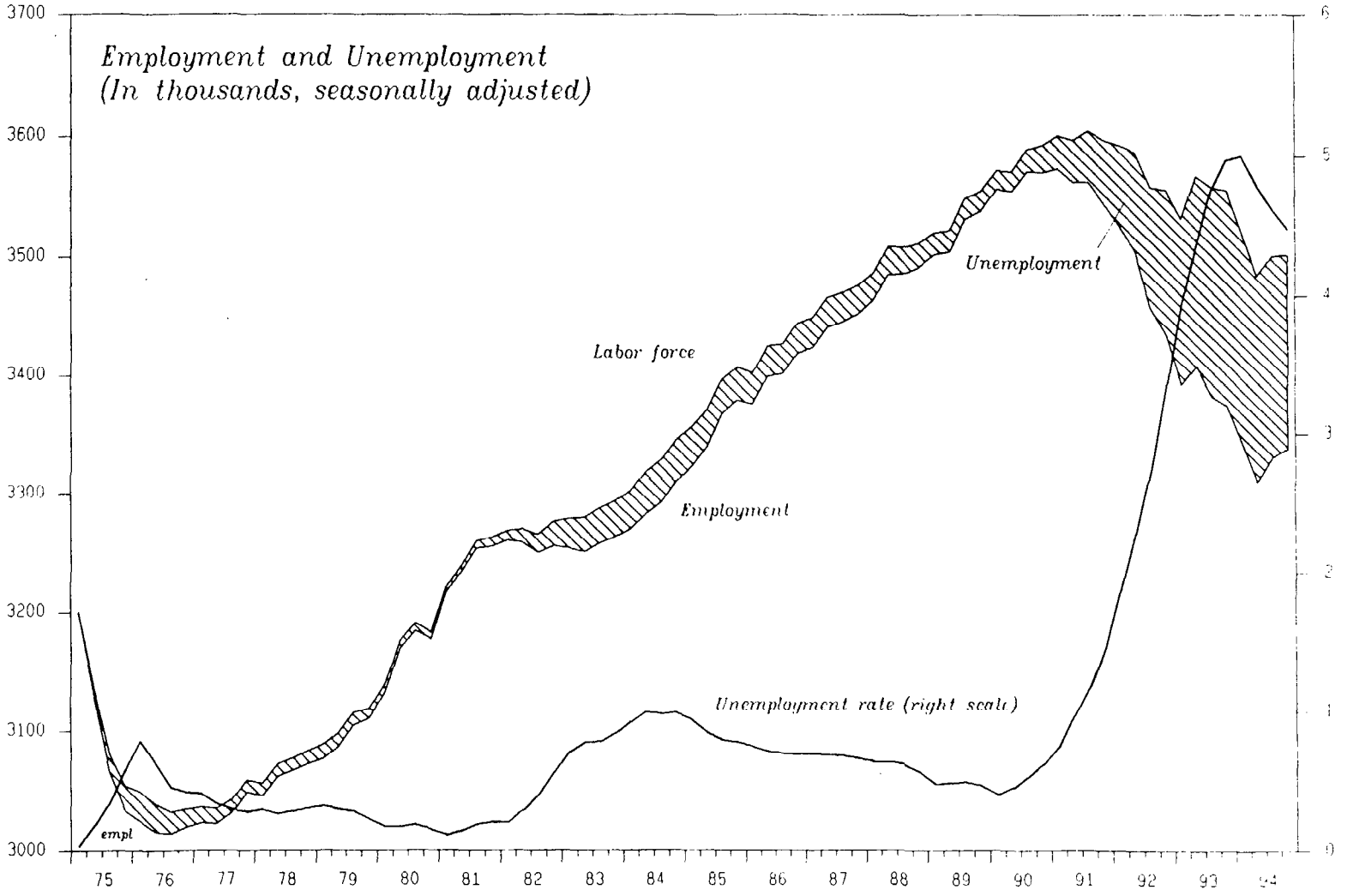
[1]The ratio of the percent change in employment to the percent change in real GDP peaked at 3 in the second quarter of 1976, as compared to 8.5 in the second quarter of 1992.

Chart 1
Switzerland: Labor Force, Employment and Unemployment



Source: Swiss Institute for Business Cycle Research.

Swiss unemployment data.[1] The number of unemployed is calculated by local unemployment offices where job-seekers must register to receive their unemployment benefits. Until 1974, less than 20 percent of the labor force was covered by unemployment insurance. Therefore, the remaining 80 percent of the workforce had little incentive to register as unemployed if they lost their job. As a result, the Swiss unemployment rate seriously under-represented the number of unemployed. In 1977, however, unemployment insurance coverage was extended to all workers, which over time has vastly improved the reliability of the unemployment rate. Therefore, caution is warranted in drawing conclusions about labor market tightness from the unemployment rate, especially prior to the 1980s. Despite the substantial improvements in the coverage of unemployment data, unemployment still remained below one percent prior to the recent recession.

2. Changes in labor supply

The changing behavior of labor supply is an important explanation of the recent increase in unemployment (Chart 1). During the 1975-76 recession, real GDP declined by 6.7 percent in 1975 but unemployment reached only 0.89 percent, because the drop in the demand for labor was matched by an equivalent decrease in labor supply.[2] Foreign workers left Switzerland and permanent residents and particularly women withdrew completely from the labor force rather than registering as unemployed.[3] In contrast, during the recent recession, for the period 1990:Q4 to 1994:Q1, about 300,000 jobs were

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[1]Employment statistics may also fail to provide an accurate picture of labor market developments. The difficulties stem from the data collection methodology employed. Every five years, population and company employment censuses are taken. Between censuses, an employment index is used to extrapolate the number of employed. This method worked well during the 1970s; but during the 1980s, when the extrapolated series were compared to the 1985 census, the former predicted a considerably lower level of employment. An analysis of this discrepancy revealed that the shortfall of the extrapolated series is attributable to the failure of the employment index to record the strong increase in employment in the service sector. This suggests that the extrapolation method may overestimate the magnitude of cyclical declines in employment. There is consequently some concern that the observed sharp decline in employment in the recession of the early 1990s may be somewhat exaggerated (Sheldon (1993)).

[2]During the 1975-76 recession, approximately 410,000 workers lost their jobs. Of this total about 211,000 were foreign workers who left Switzerland without ever registering as unemployed. Of the jobless workers remaining, only 7 percent registered as unemployed, while the other withdrew from the labor market. In contrast, during the 1982 recession, employment declined by about 92,000 workers; about one-third of these workers were foreign and left Switzerland; and of the remaining jobless, about 25 percent registered as unemployed. See Projer (1993) and Sheldon (1988).

[3]For a discussion of foreign worker policy in Switzerland, see Gaillard and Salzberger (1993).

lost, unemployment increased by about 164,000 workers, and the discrepancy between the changes in employment and unemployment narrowed substantially compared with the previous recessions. This time the increase in the number of unemployed was offset only to a modest degree by foreign workers leaving Switzerland and permanent residents withdrawing from the labor force. Foreign labor supply thus tended to act less as "buffer" in offsetting the effects of any decrease in labor demand.

In sum, since the 1970s, the supply of Swiss and foreign workers in Switzerland has become less flexible in responding to fluctuations in labor demand, making unemployment more visible during a recession. There are three explanations for this change. First, during the economic boom years of the 1980s, greater numbers of low-skilled foreign workers were granted permanent resident status to alleviate a labor shortage (Chart 2). As residents, these workers qualify for the same unemployment benefits as Swiss workers, and are therefore less likely to leave Switzerland during a recession.[1] Second, since the 1970s, female labor force participation increased, with women no longer exiting the labor market to the same degree as previously in response to cyclical downturns (Chart 3). Third, broader unemployment insurance coverage also increased the number of workers registering as unemployed at given rates of job losses.

3. Structural issues

In addition to the greater visibility of cyclical unemployment during the recent recession, evidence suggests that structural problems may also be a factor in explaining the increase in unemployment. First, measures of the natural rate of unemployment have increased in the recent period. Second, the Beveridge curve (which plots the inverse relationship between unemployment and job vacancies) appears to have shifted out to the right over time.[2] Both of these indicators suggest an increase in structural unemployment, which will not disappear when the economy has completely recovered from the recession. Factors which have figured in the discussion on the increase in structural unemployment include: (a) generous increases in unemployment benefits; (b) mismatch between unemployed workers, jobs, and skills; and (c) other factors affecting structural unemployment such as taxes and the terms of trade.

a. Unemployment benefits

Since unemployment insurance became compulsory in 1977, benefits have steadily become more generous (Table 1). In 1984 a federal law on

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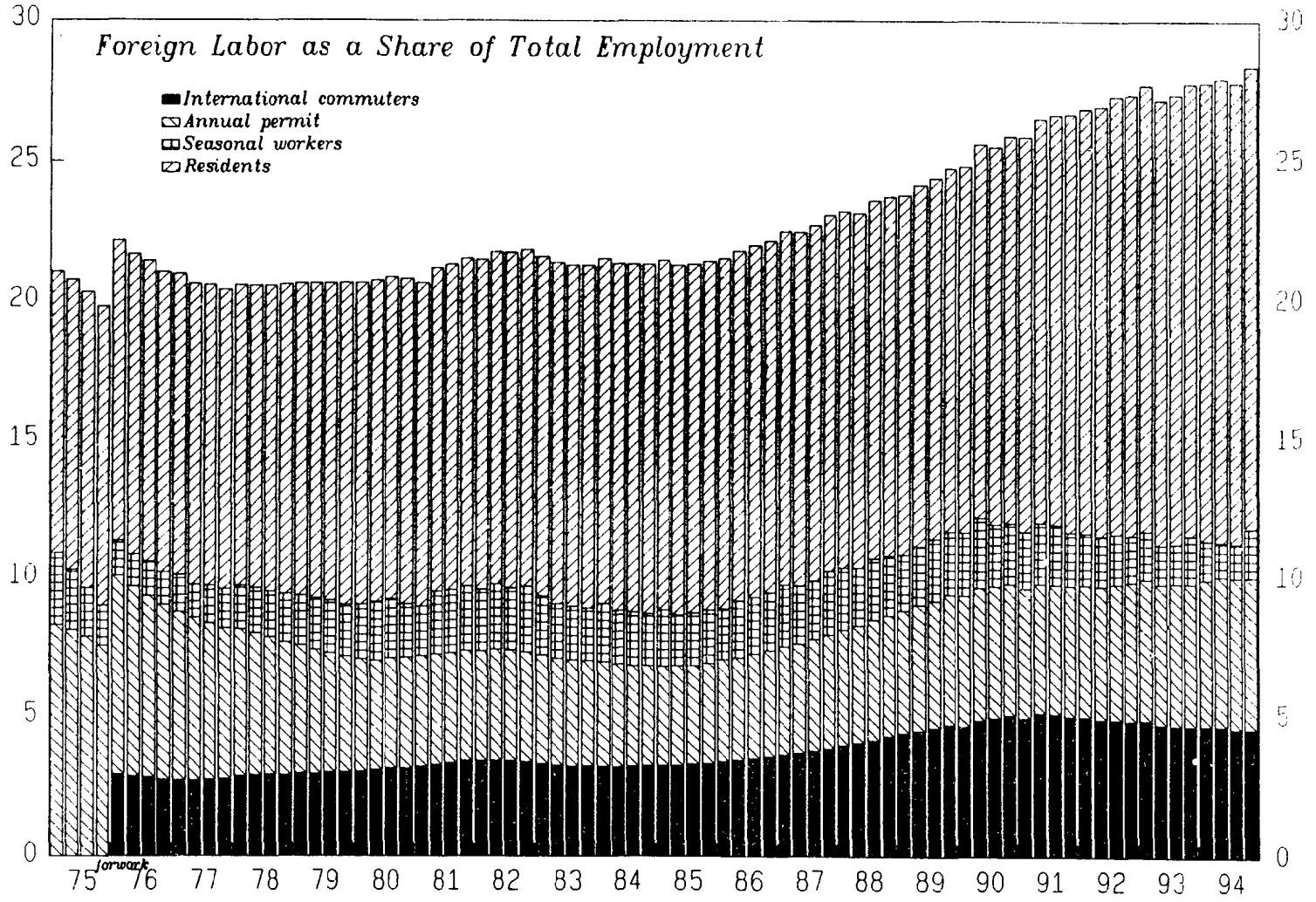
[1]Another consequence of granting permanent resident status to low-skilled foreign workers is that these workers are more likely to become and remain unemployed during a downturn. In 1993, foreign workers accounted for 25 percent of the employable population, but represented 40 percent of the unemployed.

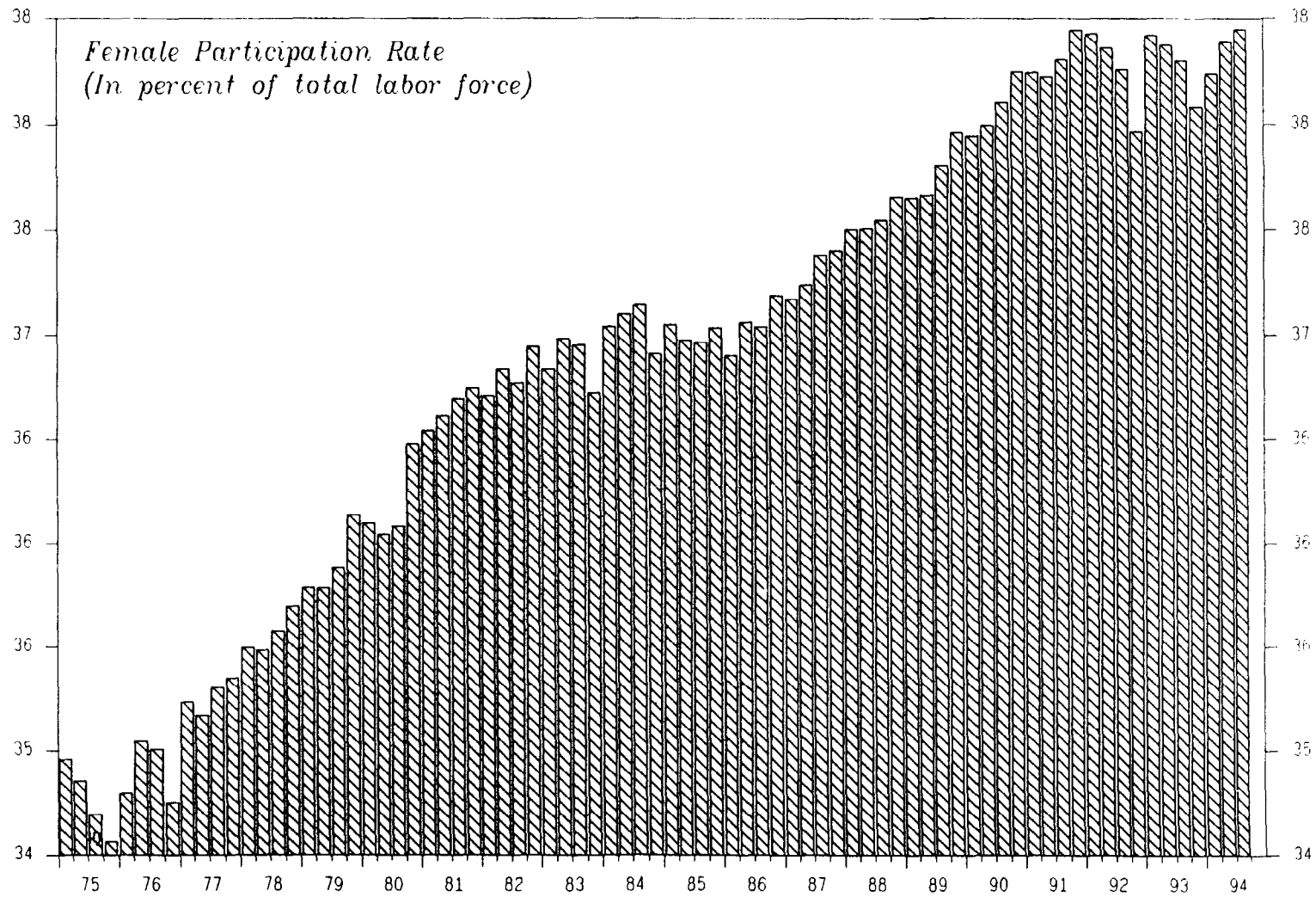
[2]See OECD (1993).

Chart 2
Switzerland: Foreign Labor as a Share of Total Employment



Source: Swiss Institute for Business Cycle Research.

Chart 3
Switzerland: Female labor Force Participation Rate



Source: Swiss Institute for Business Cycle Research; and OECD "Quarterly Labor Force Statistics".

Table 1. Switzerland: Unemployment Benefits, 1972-1993

Year	Maximum Benefits: Percent of salary	Maximum Benefits: Sw F per Day/Month	Duration Number of days	Contribution percent of salary
1972	60/85	48/1248	90/135	Sw F 12 (min)
1973	65/70	80/2080	90/135	Sw F 12 (min)
1974	65/70	120/3120	90/135	Sw F 12 (min)
1975	65/70	120/3120	120/150[1]	Sw F 12 (min)
1976	65/70	120/3120	150/180	Sw F 12 (min)
1977[2]	65/70	150/3900	150/180	0.4
1978	65/70	150/3900	150/180	0.8
1980	65/70	150/3900	150/180	0.5
1982	65/70	150/3900	150/180	0.3
1983	65/70	223/5800	150/180	0.3
1984[3]	70/80	223/5800	85/250	0.6
1990	70/80	223/5800	85/250	0.4
1991	70/80	312/8100	85/250[4]	0.4
1992	80	312/8100	85/250	0.4
1993	70/80[5]	312/8100	170/300-400[6]	2.0[7]

Source: OECD, Economic Surveys: Switzerland, 1993, (Paris: OECD, 1993).

[1]For 120, from 16th of April onwards. For 150, from 17th November onwards (for particular categories of insured).

[2]Transitory regimes from 1st April onwards.

[3]Federal law on unemployment insurance.

[4]In a certain number of cantons particularly hit by unemployment, the maximum duration was increased to 300 days (decision of the Federal Council).

[5]From 1st April onwards.

[6]On 1st January, the Federal Council decided a duration of 300 days as the maximum delay for Switzerland. From 1st April onwards, this delay was prolonged to 400 days (Urgent Federal Decree).

[7]On 1st January.

unemployment insurance increased benefits from 65 to 70 percent of income (or 70 to 80 percent if married). The duration of compensation was set at 85 to 250 days according to the contribution record, with a system of gradually reducing benefits by 5 percentage points after 85 days and by a further five points after 170 days. Benefits were not decreased for a person over the age of 55. The contribution rate was also raised in 1984, to 0.6 percent of salary, from the 0.3 percent set in 1982.

At the beginning of 1992 the benefit amount was standardized at 80 percent for all workers. The descending scale of daily benefits was abolished for workers aged 45 and over, and the duration of compensation for that category as well as for the disabled was extended to 300 days. The graduated scale of unemployment benefits was abolished in several cantons and then in Switzerland as a whole on Jan. 1, 1993. (Benefits were set at 80 percent of salary). In April of 1993 further changes were made in response to higher unemployment. The maximum period of compensation was extended to 400 days and the level of compensation was lowered to 70 percent for all those drawing daily benefits of more than SwF 130 (about 25 percent of unemployed). At the same time, the contribution rate was increased from 0.4 percent to 2 percent of salary.

These increases in benefits since the late 1970s have resulted in maximum daily benefits rising faster than nominal wages, and the maximum duration of compensation doubling since 1977. A comparison among Switzerland, United States, France, and Germany shows that unemployment benefits are most generous in Switzerland.[1]

Recent microeconomic research in Sheldon (1993) on this issue supports the view that increases in unemployment benefits increased the duration of unemployment, and may have added to structural unemployment.[2] However, the experience with more generous benefits thus far has not been sufficiently long to determine with certainty whether incentives to work and search for employment have been considerably affected. Nonetheless, an analysis of cross-section data reveal the existence of disincentives to work. Sheldon (1993), for example, tests the effects of the benefits system by examining the probability of exiting from unemployment for a given duration--so-called hazard functions--from the second half of 1991 onwards. He finds that less than 20 percent of the unemployed obtained a job and exited unemployment during the first month of joblessness. Slightly more than 20 percent exited

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[1]For example, to qualify for unemployment benefits in Switzerland, an individual must have worked at least 6 months over the last two years; this amounts to a contribution period of one-fourth (6/24). In contrast, the contribution period in Germany and France is one-third and one-half, respectively. The minimum payment duration is also longer in Switzerland than in the other countries in the sample (Sheldon (1993)).

[2]These findings are generally confirmed by the results we report in Section IV below. These results have been found in other countries as well; see, for example, Mortensen (1986) and Nickell (1990).

during the second month, and thereafter the exit rate continued to decline until the twelfth month of unemployment was reached (which, prior to 1992, was the longest possible duration of unemployment), when the exit rate increased dramatically. This sharp rise in the exit rate suggests that the unemployed may delay starting a new job until their unemployment benefits have been exhausted. As of January 1992, the maximum duration of benefits has increased from about 12 months to 20 months. Since this change, the duration of unemployment has increased as well. These results should, however, be interpreted with caution. There are a number of unemployed who exhaust their benefits without being able to find a job. Although this observation tempers the suspected magnitude of unemployment insurance abuse, the results indicate that duration effects of the unemployment insurance system should be monitored closely.

Macroeconometric evidence reported in Section IV indicates that real unemployment benefits have had some effect in raising real wages and thus in lowering employment at given levels of demand.[1] Moreover, these results suggest that the structural level of unemployment has risen, in part, due to increases in real benefits.

b. Mismatch

A factor which is often thought to account for increases in actual and structural unemployment is mismatch between unemployed workers and jobs and between the skills and location of unemployed workers. It should be added, however, that previous studies on various European countries reveal that mismatch probably contributes little to the rise in unemployment.[2] Two types of mismatch can be distinguished: between the skills of available workers and the skills required for available jobs; and between the location of available workers' and the location of jobs.

Increased structural unemployment may reflect greater skill mismatch between unemployed workers and available jobs. Sheldon (1993) has calculated a mismatch indicator which measures the distribution of job openings and the skills of the unemployed over a range of job classifications. Based on these data, mismatch between the demand and supply of jobs appears to have declined over the period August 1975 to December 1992. Although there was a small increase in mismatch between the demand and supply of jobs in the recovery phase of the early 1980s, no trend increase emerged. These results suggest that skill mismatch has not significantly contributed to the current higher level of unemployment. Empirical evidence reported in Section IV confirms this finding.

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[1]This finding is consistent with evidence from other OECD countries in which the impact of unemployment benefits, where significant, tends to be modest in size. See, for example, Adams and Coe (1990), and Calmfors (1990).

[2]Bean (1994).

To test the possible role of mismatch further, another approach to is to examine whether unemployment is regionally concentrated. Projer (1993) calculates the Gini coefficient of concentration,[1] and concludes that while unemployment has tended to be concentrated in particular regions, the strength of this effect has varied considerably over time.[2] When economic conditions improved in the mid-1980s, the regional concentration of unemployment actually increased, reaching a peak in 1990. By contrast, after the recent recession began, regional disparities were reduced. A similar pattern was obtained for the 1982 recession.[3] The Gini coefficient during the recent recession is about the same as in previous downturns, which suggests that regional disparities in unemployment have not worsened even though unemployment rates during the recent recession were much higher.

c. Other factors

Other factors such as changes in taxes and import prices can also affect unemployment by changing the desired real wage, and hence the level of unemployment at which real wage aspirations of employees and firms can be equated.[4] Based on econometric results presented in Section IV, changes in taxes in Switzerland do not appear to have accounted for much of the recent change in unemployment. Much of the increases in average rates of tax imposed on employers and employees occurred in the late 1970s, well before the increase in unemployment took place. The exception is the average ratio of indirect taxes which increased significantly from the mid-1980s; but this fell at the end of 1992, so it does not seem to help account for recent high levels of unemployment. While there is some evidence from other countries that taxes have increased real consumption wages and, thereby, unemployment, these results are not clear cut. For example, although taxes rose in EC countries in the last two decades, they also increased in low unemployment countries like Japan.[5] The terms of trade may also affect trend unemployment as an increase in the terms of trade allows increased wage demands to be met without fuelling inflation at given levels of unemployment. The empirical results reported below confirm that the terms of trade do have a significant affect on real wages in Switzerland.

IV. Analysis of Swiss Wage Behavior

This section provides an analysis of the Swiss labor market, and first discusses the importance of wage flexibility. Following this, a simple econometric model of wages and prices is described, which is used to derive

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[1]Using a Lorenz curve, a Gini coefficient is calculated for each quarter. The Lorenz curve is obtained by ranking the cantons according to the number of unemployed and drawing a diagram of their accumulated shares in the total number of employed and the total number of unemployed.

[2]Similar evidence is also provided in Sheldon (1993).

[3]Lewin (1983).

[4]See Layard, Nickell, and Jackman (1991).

[5]Bean (1994).

an estimate of the structural level of unemployment for the recent period in Switzerland and to quantify the extent of real wage rigidity.

1. Wage flexibility

As labor supply has become less flexible, and therefore no longer offsets shocks to labor demand, greater interest attaches to the question of real wage flexibility. Fundamentally, the flexibility or rigidity of real wages depends largely on the wage bargaining process. Wage bargaining in Switzerland is decentralized, with decisions on wages typically made at the firm level, and relations between labor and management usually cooperative; these characteristics are generally associated with the presence of real wage flexibility.[1] Yet in the past the responsiveness of labor supply to shocks has precluded the need for real wages to adjust. Indeed, some previous estimates suggest that real wages in Switzerland are relatively rigid; evidence presented below confirms these results.

Because it is difficult to infer the degree of flexibility directly from wage behavior, a more indirect approach is needed. To quantify the responsiveness of wages, the estimated parameters from econometric wage and price equations can be used to infer the degree of real wage rigidity. Thus real wages will be more rigid, the smaller is the effect of excess supply of labor (normally proxied by unemployment (u)) upon both nominal wages (w) and prices (p).[2] This can be illustrated with the aid of a simplified wage and price model, to convey the essential ideas involved. To facilitate the presentations, this model is based on a pure form of the "natural rate" hypothesis, so both wage and price equations include price "surprises", which move the real side away from its equilibrium. Thus, a simplified real wage equation, with the addition of a price inflation "surprise" term, proxied by $\Delta^2 p$, is

$$w - p = \gamma_0 - \gamma_1 u - \gamma_2 \Delta^2 p \qquad (1)$$

In turn, a simplified form of the price equation is

$$p - w = \beta_0 - \beta_1 u - \beta_2 \Delta^2 p \qquad (2)$$

By eliminating the real wage in (1) and (2) we obtain a Phillip's curve of the form:

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[1]See, for example, Danthine and Lambelet (1987) and Calmfors and Driffil (1988).

[2]For a more complete discussion see Layard, Nickell, and Jackman (1991).

$$\Delta^2 p = -\frac{\beta_1+\gamma_1}{\beta_2+\gamma_2}\left[u-\frac{\beta_0+\gamma_0}{\beta_1+\gamma_1}\right] \qquad (3)$$

The term, $\beta_1+\gamma_1$, in equation (3) represents how much real wage flexibility there is in the economy. Because unemployment changes to bring about a compatibility between the real wage plans of bargainers and price setters, this term reflects the extent to which increases in unemployment reduce the difference between the prevailing real wage and the equilibrium real wage. In turn its inverse, $1/(\beta_1 + \gamma_1)$, represents the degree of real wage rigidity. The larger this indicator of real wage rigidity is, the more unemployment needs to change to restore discrepancies between the prevailing and equilibrium real wage. Nominal wage rigidity in turn is given by $(\beta_2 + \gamma_2)/(\beta_1 + \gamma_1)$, and shows the cumulative effect of reducing inflation by one point (recall that the Phillips curve above is in second difference form), and is often described as the "sacrifice ratio."

2. Previous studies

Econometric studies of real wage rigidity in Switzerland have yielded inconsistent results. For example, Grubb, Jackman, and Layard (1983) found that Switzerland had the lowest measure of real wage rigidity of 19 major OECD countries over the period 1960-80. Layard, Nickell, and Jackman (1991) using data for the period 1960-90, also found that Switzerland had low real wage rigidity when compared to other OECD countries. While these results are apparently consistent with Switzerland's wage bargaining process, at the same time they appear inconsistent with the role of labor supply in offsetting shocks to labor demand, discussed in Section III. In fact, these studies are methodologically flawed, because they use the Swiss unemployment rate as a measure of labor market tightness--a measure which is seriously biased as previously noted. Other studies using an alternative, and in our judgement more accurate, measure of labor market tightness, have found that real wages are relatively rigid. Coe (1985), for example, found that Swiss real wages are more rigid than in many other OECD countries, including Canada, France, Italy, United Kingdom, Belgium, Sweden, and the United States. In his study, labor market tightness was proxied by the ratio of employment divided by the labor force lagged by one year, thereby eliminating the statistical biases associated with using the Swiss unemployment rate. Results consistent with Coe (1985) have also been obtained by Gaillard (1990), and Blattner, Hess, Jeger, and Klingen (1993) using similar proxies for the unemployment rate. Using the variable proposed in Coe (1985), our empirical results based on a longer sample period confirm these studies, and suggest that real wages remain rigid, despite the disappearance of labor supply responses in offsetting shocks to labor demand.

3. Modelling wage and price behavior

a. Wage model

To test the degree of wage and price flexibility in the Swiss labor market, we use a bargaining model for wages which assumes that wages are determined in a bargain by the firm and union, but where the firm sets the level of employment according to the product demand schedule (the so-called "right to manage" model).[1]

The wage bargain is assumed to be the solution of a Nash bargaining model which is derived from the optimal conditions for maximizing the "Nash product" $(\Omega - \Omega_0)^{\rho} (\Pi - \Pi_0)^{1-\rho}$ where $\Omega(\cdot)$ is the unions' utility function, $\Pi(\cdot)$ is the firms' profit function, ρ is an index of relative bargaining strength and Ω_0 and Π_0 are the levels of the unions' utility and the firms' profits if no bargain is achieved.[2] Such a general formulation clearly allows for a wide range of alternative bargaining structures, including one where unions play a limited role in wage setting, as in Switzerland. Many of the wage equations obtained from this general approach show that the markup of the consumption real wage depends on the degree of labor market tightness (which we measure by employment divided by the labor force lagged one year, *lmt*), relative bargaining strength, and productivity (*pr*), and wage "push" variables, (*Zw*) (see e.g. Joyce (1990)). We start from this general form for the wage equation in log linear form.

$$w = p + pr + \gamma_1 \, lmt + \gamma_2 \, Zw. \qquad (4)$$

Equation (4) is the basic equation used in the estimation below for the level of the real wage. The wage "push" variables which are used in the statistical tests reported below include real unemployment benefits, labor market mismatch, employment taxes, direct taxes, indirect taxes, and the terms of trade.

b. Price equation

The theoretical basis of the price equation is less clear. Under the assumption of imperfectly competitive product markets (an assumption invariably made in the "right to manage" model), the first order condition for profit maximizing with a constant returns to scale technology, $Y = F(AN, K)$, where Y is net output, K is capital (assumed fixed), and A is labor augmenting technical progress, is

$$F_N(\cdot) = MW/PA \qquad (5)$$

In this equation, M is the markup of price over marginal cost. In log linear form this gives:

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[1] See Layard, Nickell, and Jackman (1991).
[2] See Nickell and Andrews (1983).

$$n-k = \alpha_1 (p-w-m) + (\alpha_1 - 1) a \quad (6)$$

where $\alpha_1 = \sigma/S_R$, σ is the elasticity of substitution, S_R the share of capital in total cost, and $\alpha_1 = \ln A$. As imperfect competition is assumed, (6) gives the joint determination of employment and prices, but in the model which follows, it is assumed that prices are set first. Hence the equation written in terms of the markup is:

$$p = w + m + \beta_1 (n - k) + (\beta_1 - 1) a, \quad (7)$$

where $\beta_1 = 1/\alpha_1$.

To extend this model to the open economy, we assume, as in Layard, Nickell and Jackman (1991), that the markup over cost in equation (7), depends upon the real exchange rate (rxr).[1] If we also include the assumption that the markup depends on cyclical movements in demand as well, then $m = m(rxr, cu)$ in equation (7). This results in an equation with prices as a function of unit labor costs ($w - pr$), where we use labor productivity (pr) as the measure of productivity (rather than the capital labor ratio as suggested by (7)), the real exchange rate (rxr) and capacity utilization (cu):

$$p = w - pr - \delta_1 rxr - \delta_2 cu + \delta_3 Zp \quad (8)$$

where Zp are exogenous push factors on prices. Equation (8) is the basis of the price equation estimated below.

The model as a whole--both wage and price equations--centers on "explaining" equilibrium capacity utilization, where equilibrium is defined as that level of utilization of labor and other resources where price setting by firms (conditioned on expected wages) and wage setting (conditioned on expected prices) are mutually compatible. In other words, as price mark-ups by firms and wage setting by bargainers each depend upon labor utilization (or capacity utilization, which can be translated, approximately, into labor utilization), equilibrium labor utilization occurs when pricing and wage plans are compatible. However, exogenous factors ("push" variables) can alter price or wage setting both at given labor utilization and for given expectations about prices and wages, and so will lead to changes in the equilibrium rate of labor utilization. Among the "push" variables, the degree of unionization, the level of unemployment benefits, and the degree of mismatch in the economy have frequently been identified as important examples in other countries.[2]

Thus if the real wage from (4) is compatible with the price markup over wages given by (8), then it follows that

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[1]The real exchange rate is actually the inverse of the competitiveness indicator which is used by Layard, Nickell, and Jackman (1991).

[2]See Layard, Nickell, and Jackman (1991).

$$lmt^* = g_1 rxr + g_2 cu + g_3 Zp + g_4 Zw \qquad (9)$$

(where $g_1 = -\delta 1/\gamma 2$, etc.) gives an expression for equilibrium in the labor market tightness variable lmt^* akin to the familiar NAIRU (the Non Accelerating Inflation Rate of Unemployment). In this formulation the equilibrium degree of labor market tightness--that which is required for non-accelerating inflation--is a function of the real exchange rate, capacity utilization and the push variables, which we have earlier noted as comprising real unemployment benefits, various tax rates and the terms of trade. It would be possible to simplify this equilibrium equation further by substituting, for example, the terms of trade by the real exchange rate, assuming a fixed relationship between them. We have retained the specification above, however, since this is what is implied by the preferred versions of the underlying single equations, and since we did not want to introduce further approximations into the calculations reported below. Finally, capacity utilization may be substituted out of this equation by assuming a fixed relation between it and *lmt*. In this case we can derive the equilibrium value for *lmt* as a function of the *rxr* and the push variables.

4. Empirical analysis

A two-stage Error Correction Model (ECM) is used to estimate the wage and price equations ((4) and (8)). The levels equations for the real wage and price markup respectively are treated as the equilibrium part of a dynamic equation (for Δw and Δp respectively). In turn, the long-term determinants of real wages and prices are identified by estimating cointegrating equations, by Johanson's maximum likelihood procedure.[1]

Because cointegration depends on having nonstationary variables in the model, Dickey-Fuller and Augmented Dickey-Fuller tests on the level of integration of each of the variables are given in the next section. Then, co-integration tests for wage and price equations are described, leading finally to the estimated dynamic equations for wages and prices.

a. Time series behavior of the data

Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF) tests are given in Table 2, where the variables are in logs unless otherwise stated, and the sample is 1975Q2 - 1992Q4. Of these results, most are relatively unambiguous and are generally integrated of order 1, although the mismatch variable is clearly I(0). The exceptions are prices and nominal wages. Here the variables do not appear simply I(1) or I(2) judging by the diverse results for the DF and ADF statistics. The alternative hypothesis that these variables are I(1,1)--integrated of order one at both the zero and seasonal frequency--is a possibility, and we have treated them as such in

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[1]These methods are discussed in detail in Banerjee, Dolado, Galbraith, and Hendry (1993).

Table 2. Dickey-Fuller and Augmented Dickey-Fuller Tests for a Unit Root[1]

	Level		Difference	
	DF	ADF(4)	DF	ADF(4)
Prices (*p*)	-1.3	-3.4	-5.2*	-2.6
Nominal Wages (*w*)	-1.2	-3.2	-5.4*	-2.3
Real Wages (*w-p*)	-1.3	-1.4	-8.2*	-3.3
Unemployment Rate (*u*)	3.0	-1.7	-3.9	-0.1
Labor Market Tightness (*lmt*)	5.2	2.0	0.1	2.6
Terms of Trade (*tot*)	-2.6	-2.7	-10.1*	-4.1*
Productivity (*pr*)	-7.8*	-1.8	-23.2*	-3.2
Real Unemployment Benefits (*rben*)	-0.8	-1.9	-6.2*	-4.1*
Unit Labor Cost (*ulc*)	-2.4	-3.0	-10.0*	-3.6*
Import Prices (*pm*)	-2.0	-2.7	-6.6*	-3.6*
Output Gap (*YGAP*)	-6.0*	-2.6	--	--
Employer's Tax (*T1*)	-1.5	-2.4	-2.7	-2.6
Employee's Tax (*T2*)	-1.2	-2.6	-3.2	-2.9
Indirect Tax (*T3*)	1.4	-1.0	-3.1	-2.0
Mismatch (*mm*)	-10.2*	-3.5*	--	--

*Indicates significance at the 5 percent level.

[1]Dickey-Fuller tests (DF) and Augmented Dickey-Fuller Tests with four lags (ADF(4)), include a time trend. Tests are conducted over the sample period 1975Q4 to 1992Q4. The critical value is 3.47 for both the DF and ADF(4) tests. Except for *YGAP*, *T1*, *T2*, and *T3* levels of variables are specified in logs, and differences are first differences of logs.

the following sections.[1] The unemployment rate is nonstationary, underscoring the problems of interpreting this variable which we have already described. In contrast, the alternative labor market tightness variable (*lmt*), appears to be integrated of order one. This variable moves inversely to the more conventionally used unemployment rate, in that an increase (decrease) in *lmt* has a positive (negative) effect on real wages. Finally, the mismatch variable, *mm*, is I(0), which suggests it cannot be included in a cointegrating vector, a result adding further confirmation to previous results for Switzerland that the mismatch variable does not contribute to the explanation of the level of real wages.

b. Wage equations

The likelihood ratio tests showed that there was one co-integrating vector, with the real wage (w-p) depending on labor market tightness (*lmt*), real benefits (*rben*), productivity (*pr*), and the terms of trade (*tot*). The equation was in accordance with prior theory on how the various explanatory variables affect real wages:[2]

$$w\text{-}p = 3.22\ lmt + 0.81\ pr + 0.11\ tot + 0.32\ rben \qquad (10)$$

The residuals from this version of the real wage equation are used as the error-correction term in conventional fashion in the dynamic equation below. It did not prove possible to find co-integrating vectors where the real wage depends on the employers', employees' or indirect taxes. Nor was it possible to get equations with correctly signed tax effects.

A second stage equation for nominal wage inflation is shown below with t-statistics in parenthesis:

$$\begin{aligned} \Delta_4 w = {} & 0.01 \ + \ 0.06\ \Delta\Delta_4\ p(-1) \ + \ 0.87\ \Delta_4\ w(-1) \\ & (3.28) \quad (1.4) \qquad\qquad (16.77) \\ & - 0.26278\ \Delta rben(-4) \ - \ 0.08\ RES(-3) \\ & (5.4) \qquad\qquad (2.78) \end{aligned} \qquad (11)$$

$$R^2 = 0.93,\ \chi^2_1(4) = 5.14,\ \chi^2_2(2) = 0.25,\ \chi^2_3(1) = 0.16$$

where RES is the vector of residuals for the real wage equation (10). In this equation, χ^2_1 refers to the Lagrange Multiplier (LM) test of serial correlation, χ^2_2 the Bera-Jarque test for normality, and χ^2_3 an LM test for heteroscedasticity. These summary statistics are satisfactory. The signs

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[1]Tests such as the Dickey-Hasza-Fuller (DHF) test are appropriate for this. On the basis of this, both prices and wages appear to be I(1,1), as the estimated ADF(4) statistics are -6.3 and -4.8 respectively (compared with a 95 percent cut-off value of -4.46).

[2]The Eigenvalue test results are as follows: $r \geq 1 = 38.0$ as compared to a critical value of 28.7; and $r \geq 2 = 11.2$ as compared to a critical value of 17.9.

and significance of the coefficients in the equation are also acceptable, including the sign on changes in real benefits which was found to be negative. One interpretation of this is that increases in benefits initially weaken real wage claims (so nominal wage increases do not increase as fast as they otherwise would). In the long run, its effect on the level of real wages is positive, as given in the estimated cointegrating vector (10).

c. Price equations

A fairly satisfactory econometric model is obtainable for prices, using, as with the wage equation, a two-stage estimation of the dynamic equation. The first stage for the levels of the price equation used prices as a function of unit labor cost and the real exchange rate. The likelihood ratio tests showed the presence of the two co-integrating vectors.[1] Of these, one was theoretically plausible

$$p = 0.86\ ulc - 0.39\ rxr \qquad (12)$$

A dynamic ECM equation which uses this equation as the stabilizer term is as follows:

$$\begin{aligned} \Delta\Delta_4 p = {} & -0.01 - 0.06\ \Delta\Delta_4 p\ (-2) - 0.01\ \Delta_4 rxr - 0.14\ \Delta_4 ulc\ (-3) \\ & (2.95) \quad (2.96) \qquad\qquad (0.04) \qquad\quad (3.22) \\ & + 0.08\ YGAP\ (-1) - 0.07\ YGAP\ (-2) - 0.15\ RES \\ & (2.05) \qquad\quad (1.9) \qquad\quad (2.00) \end{aligned} \qquad (13)$$

$$R^2 = 0.29,\ \chi_1^2(4) = 6.50,\ \chi_2^2(2) = 0.24,\ \chi_3^2(1) = 0.02.$$

Capacity utilization (*YGAP*) effects were found in this model in the dynamic equation only; this is not only consistent with the statistical properties of the data, but also makes economic sense. The measure of utilization used here is output deviations from a non-linear time trend (*YGAP*), which is stationary.

5. NAIRU

Using the formula given by (9) we can use the estimated wage and price equations to derive an estimate of the equilibrium rate of utilization of the labor force (a non-accelerating inflation value of labor market tightness or NAIRLMT). In turn, using a number of reasonable approximations, we can derive a value of the NAIRU from this. The basis of this calculation is fairly straightforward. We first obtain a value of the

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[1]The Eigenvalue test result is $r \geq 2 = 25.76$ as compared to a critical value of 19.9.

NAIRLMT from versions of equation (10) and (12), where the restriction of a unit coefficient on productivity is imposed in each. In addition, capacity utilization (*cu*) is substituted by *lmt*, so that the equation "solves" for *lmt*. To do this we estimate a simple statistical equation between *cu* and *lmt*. Finally, we convert the equilibrium value of *lmt* into an equilibrium value for unemployment, assuming, as seems plausible given our discussion in Section III, that unemployment has measured the state of excess supply in the labor market reasonably accurately since 1990.

Cointegrating equations for the wage and price equations were estimated with the restriction of a unit coefficient on productivity imposed:

$$p = w - pr - 0.25rxr \tag{14}$$

$$w = p + pr + 2.40\ lmt + 0.12\ tot + 0.22\ rben \tag{15}$$

Incorporating the capacity utilization term from the dynamic price equation, and using an estimated equation between capacity utilization and *lmt*, gives a simple relationship between *lmt* and the remaining variables in equations (14) and (15) above. This can be used to derive an equilibrium value of *lmt* by using average values of the right hand variables for 1990-92, which is converted into equilibrium unemployment by using the average relationship between *lmt* and unemployment over the same period. The estimates and accompanying calculations suggest the NAIRU is about 1.52 percent. This is markedly higher than the OECD estimate based on an expectation augmented Phillips curve of 0.7 percent.[1] The estimate suggests therefore that by 1992 more than a half of unemployment was structural.

6. Estimated wage rigidity

Equations (14) and (15), which are analogous to equations (1) and (2) can also be used to derive the extent of real wage rigidity in Switzerland. From the restricted version of the estimated model, the index of real wage rigidity (RWR) in Switzerland for the complete sample, 1975Q4-1992Q4 is 0.31 ($= 1/(\beta_1 + \gamma_1)$).

One way to assess this estimate is to compare it with other published estimates, even if these comparisons cannot be very precise as different researchers used different modelling procedures to those used here and, in some cases, different sample periods. Unlike other studies, this one, for

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[1]Based on average values of the right hand side variables for the period 1975Q4-1989Q4, this methodology yields an historical estimate of the NAIRU of 0.16 percent, which is largely consistent with other estimates for this period, see OECD (1993). Other estimates reported in OECD (1994) give much larger values for the NAIRU for the recent past. These are based on very different methodologies however. For example, one estimate using a Hodrick-Prescott filter, gives 3.1 percent for the NAIRU in 1993. The drawback with this estimate is that it is largely determined by the movement in actual unemployment itself.

example, uses cointegration methods in estimating the long-run behavior of the model. Notwithstanding these difficulties, the estimated real wage rigidity we report appears to be quite high and is consistent with results reported in Coe (1985). Layard, Nickell, and Jackman (1991), for example, estimate a level of RWR of 0.7 for the U.K. and 0.52 for Spain, each of which are countries with reputedly inflexible labor markets which might be expected to show real wage resistance. Interestingly they infer that Switzerland has low real wage resistance, as their estimate of RWR is 0.17, but their finding is significantly affected by their use of measured unemployment in the wage equation.[1] For reasons we set out earlier, use of this measure probably overstates the flexibility of the Swiss labor market. The interpretation of our finding is that the Swiss labor market has to respond significantly in the face of an adverse real shock; real wages do not react sufficiently to offset the effect of a real shock on the labor market, so these shocks tend to produce marked effects on unemployment in consequence.

V. Conclusion

This discussion of the factors underlying the recent increase in Swiss unemployment has emphasized the way in which changes in policies toward foreign workers, the participation rate of women, and the coverage of unemployment insurance have resulted in labor supply becoming less responsive to shocks to aggregate activity. As a result, cyclical unemployment which was hidden during previous recessions, became more visible during the recent recession. In addition, when changes in labor supply offset economic shocks, it was not necessary for real wages to adjust fully to clear the labor market. As labor supply has become less flexible, the extent of real wage rigidity has become a far more important issue and its impact on unemployment is now perceptible. Econometric evidence presented in this paper suggests that real wages have been, and continue to be, quite rigid in Switzerland. This is a possible explanation for the emergence of unemployment during the recent recession. In addition to these cyclical factors, there has also been an increase in structural unemployment which will not completely disappear when the economic recovery in Switzerland is complete. A number of factors were tested to determine if they appear to have contributed to increasing structural unemployment, including changes in taxes (including employment taxes), indicators of labor market mismatch, unemployment benefits, the terms of trade, and the real exchange rate. According to our results, unemployment benefits, the terms of trade, and the real exchange rate appear to be significant factors in contributing to the increase in structural unemployment.

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[1]Similar findings of relatively low real wage rigidity are reported in Grubb, Jackman, and Layard (1983).

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