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The Unemployment Effect of Exchange Rate Volatility
in Industrial Countries

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The Unemployment Effect of Exchange Rate Volatility in Industrial Countries

By Horst Feldmann

Abstract

Using data on 17 industrial countries from 1982 to 2003 and controlling for a wide array of factors, this paper finds that higher exchange rate volatility increases the unemployment rate. The magnitude of the effect is small. The results are robust to variations in specification.

JEL classification: E24, F31, F41, J64

Keywords: exchange rate volatility, unemployment

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1. Introduction

There are various hypotheses according to which exchange rate volatility may affect unemployment. Some papers argue that this effect depends on the characteristics of the labor market. Specifically, Andersen and Sørensen (1988) argue that if trade unions are strong, volatile exchange rates may lead to excessive wage hikes, lowering employment. Similarly, Belke and Kaas (2004) argue that if labor market rigidities improve workers' bargaining position, thus increasing wages and lowering the net return to firms, higher exchange rate volatility is likely to induce firms to delay job creation. According to Belke and Gros (2001), even a temporary increase in exchange rate volatility can induce firms to postpone the creation of jobs since volatile exchange rates raise the uncertainty of future earnings and thus the 'option value of waiting' (Dixit 1989). They argue that although this concept concerns investment projects, hiring workers represents an investment in the sense that there are high costs to reversing this decision, particularly if dismissal regulation is strict.

Volatile exchange rates may also increase unemployment via lower investment in physical capital. Investment may be reduced because higher volatility usually entails increased uncertainty. However, as Darby et al. (1999) argue theoretically, the effect of exchange rate volatility on investment may be either negative or positive, depending on specific characteristics of the respective industry such as scrapping prices, opportunity costs of waiting as well as input costs and output prices.

So far there are only few empirical studies analyzing the effect of exchange rate volatility on unemployment. In a series of papers, Belke and coauthors study the impact of exchange rate volatility in the Mercosur area (Belke and Gros 2002a), in central and eastern Europe (Belke 2005), within the EU (Belke and Gros 2001) and between Euroland and the US (Belke and Gros 2002b). In each case they find exchange rate volatility to adversely affect unemployment. Focusing on the case of Germany, Stirböck and Buscher (2000) also find some evidence that higher volatility increases unemployment.

There are also few studies on the investment effect of exchange rate volatility. For example, Goldberg (1993) finds that, in the United States, exchange rate volatility tended to expand investment in manufacturing durables industries in the 1970s, but was more likely to be associated with investment contractions in the 1980s. Furthermore, she finds that it tended to

depress investment in US non-manufacturing industries. Darby et al. (1999) find that, between the mid-1970s and the mid-1990s, exchange rate volatility depressed investment in Germany, France, Italy, the United Kingdom and the United States.

This paper studies empirically the impact of exchange rate volatility on unemployment. It innovates in three important respects. First, it is the first to use data from all major industrial countries. Second, it uses a new index of exchange rate volatility. Third, in contrast to previous papers, it employs a large set of controls.

2. Data and methodology

Our variable of interest uses GARCH (1, 1) volatility of real effective exchange rate monthly percentage change (for definitions and sources of all variables, see Table 1). As the data on our other variables are in annual frequency, we calculate annual averages of the monthly exchange rate volatility data. GARCH measures of conditional volatility are a good proxy for uncertainty since the latter is best defined as the variance of the stochastic, unpredictable component of a variable. They are also superior to unconditional measures such as the standard deviation since the latter ignore relevant information on the random process generating the exchange rate. Therefore, our measure of exchange rate volatility appears to be better suited than the ones used in previous papers studying the unemployment effect of exchange rate volatility, which almost exclusively use the standard deviation.

To avoid omitted variables bias, we control for the impact of all other major factors that have been found to determine the unemployment rate. This is in contrast to all previous papers estimating the unemployment effect of exchange rate volatility, which use hardly any controls. In our baseline specification, we control for six major labor market institutions as well as for product market regulation, business cycle fluctuations, their interaction with exchange rate volatility and the share of trade in GDP. In our first robustness check, we use random rather than fixed effects to control for unobserved country-specific effects. In our second robustness check, we use a measure of centralization rather than coordination of wage bargaining. In our third check, we substitute labor and consumption tax rates for the tax wedge. In our fourth and fifth checks, we use disaggregated measures of employment protection legislation and unemployment benefits, respectively. In our sixth, seventh and eighth checks, we additionally control for active

labor market policies, central bank independence and macroeconomic shocks, respectively.¹ Each regression also controls for the impact of time trend. All explanatory variables are lagged by one year to lessen concerns about possible simultaneity bias and to allow for slow adjustment.

Our sample includes Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Spain, Sweden, Switzerland, United Kingdom and United States. The sample period is 1982 to 2003.²

3. Results

The coefficient on ‘exchange rate volatility’ is statistically significant in each of our regressions (Table 2). Higher volatility is correlated with higher unemployment in the following year. In most robustness checks, the size of the coefficient is very similar to the estimate from our baseline specification.

In line with previous studies, our results suggest that the magnitude of the effect is small. Specifically, a one standard deviation increase in the ‘exchange rate volatility’ variable is associated with an increase in unemployment of between 0.21 and 0.36 percentage points, *ceteris paribus*.³

We also examine the possibility of reverse causality. Table 3 presents four regressions with the unemployment rate as an explanatory variable and exchange rate volatility as the dependent variable. While regression 1 uses the unemployment rate as the sole explanatory variable, regressions 2 to 4 additionally use variables that might affect the volatility of exchange rates. In none of these regressions do we find any evidence of causality running from the unemployment rate to exchange rate volatility. Thus the estimates reported in Table 2, which indicate a statistically significant adverse effect of exchange rate volatility on unemployment, are likely to be causal.

¹ Since Hall and Franzese (1998) argue that the effect of central bank independence may depend on the degree of wage bargaining coordination, we also employ an interaction term.

² Both the number of countries and the length of the sample period are determined by data availability.

³ These figures are based on the smallest and the largest coefficient on ‘exchange rate volatility’ from the regressions presented in Table 2.

Finally, a brief comment on our estimates for the control variables used in our regressions to explain the unemployment rate (Table 2). By and large, they accord with the previous literature on the determinants of unemployment (for a survey, see Bassanini and Duval 2006, Annex 1). For example, we find that higher labor taxes, higher unemployment benefits replacement rates, tighter dismissal protection for workers with regular contracts, lower expenditure on active labor market policies, less central bank independence and stronger macroeconomic shocks are likely to raise unemployment. Additionally, we find a higher degree of trade openness to be associated with a lower unemployment rate. These results, as well as the significant estimates for the other controls, underline the importance of controlling for all major factors that affect the unemployment rate when analyzing the impact of exchange rate volatility.

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Table 1. List of variables

	Definition	Source
Active labor market policies	Public expenditure on active labor market programs per unemployed worker as a decimal fraction of GDP per capita	Bassanini and Duval (2006)
Average unemployment benefits replacement rate	Gross unemployment benefits as a decimal fraction of previous gross wage earnings. Averages across two income situations (100% and 67% of average production worker earnings), three family situations (single, with dependent spouse, with spouse in work) and three different unemployment durations (first year, second and third years, fourth and fifth years of unemployment)	Bassanini and Duval (2006)
Central bank independence	The index ranges from 0 to 1 with higher values representing more independence. It assesses both the legal status of the central bank and its reputation for independence	IMF (2003)
Collective bargaining coverage	Employees covered by collective wage bargaining agreements as a decimal fraction of all wage and salary earners in employment with the right to bargaining	Visser (2009)
Consumption tax rate	Total amount of consumption tax paid in a country as a decimal fraction of total consumption. The consumption tax rate is derived from National Accounts	Bassanini and Duval (2006)
Employment protection legislation	Indicator of the stringency of employment protection legislation. Unweighted average of measures for regular and temporary contracts. The ratings are scaled to range from 0 (least restrictive) to 0.6 (most restrictive)	Bassanini and Duval (2006)
Employment protection legislation regular contracts	Indicator of the stringency of employment protection legislation for regular contracts. The ratings are scaled to range from 0 (least restrictive) to 0.6 (most restrictive)	Bassanini and Duval (2006)
Employment protection legislation temporary contracts	Indicator of the stringency of employment protection legislation for temporary contracts. The ratings are scaled to range from 0 (least restrictive) to 0.6 (most restrictive)	Bassanini and Duval (2006)
Exchange rate volatility	Annual average of GARCH(1,1) volatility of real effective exchange rate monthly percent change	IMF (2008)
Initial unemployment benefits replacement rate	Gross unemployment benefits during the first year of unemployment as a decimal fraction of previous gross wage earnings. Averages across two income situations (100% and 67% of average production worker earnings) and three family situations (single, with dependent spouse, with spouse in work)	Bassanini and Duval (2006)
Interest rate shock	Difference between 10-year nominal government bond yield (in %) and annual change in the GDP deflator (in %)	Bassanini and Duval (2006)
Labor tax rate	Total amount of tax paid on labor earnings in a country as a decimal fraction of total labor costs. The labor tax rate is derived from National Accounts	Bassanini and Duval (2006)
Openness	Ratio of exports and imports of goods and services to GDP	World Bank (2009)

Table 1. List of variables (cont.)

	Definition	Source
Output gap	The gap between actual and potential output as a percentage of potential output	OECD (2009)
Product market regulation	Indicator of regulatory impediments to product market competition in the following seven non-manufacturing industries: gas, electricity, post, telecoms (mobile and fixed services), passenger air transport, railways (passenger and freight services) and road freight. The ratings are scaled to range from 0 (least restrictive) to 0.6 (most restrictive)	Bassanini and Duval (2006)
Tax wedge	Sum of personal income tax plus employee's and employer's social security contributions less cash benefits as a decimal fraction of total labor cost for an employee earning the average production worker wage; single-earner couple with two children	Bassanini and Duval (2006)
Terms of trade shock	Logarithm of the relative price of imports weighted by the share of imports in GDP [$(M/Y) \log (P_M/P_Y)$]	Bassanini and Duval (2006)
Total factor productivity shock	Deviation of the logarithm of total factor productivity from its trend. Trend growth rate of total factor productivity calculated using the Hodrick-Prescott filter ($\lambda = 100$)	Bassanini and Duval (2006)
Trade union density	The share of workers affiliated to a trade union; decimal fraction	Bassanini and Duval (2006)
Unemployment benefits duration	Unemployment benefit duration in years	Bassanini and Duval (2006)
Unemployment rate	Unemployed as a percentage of the civilian labor force (harmonized rates)	OECD (2007)
Wage bargaining centralization	The dominant level(s) at which wage bargaining takes place. 5-point classification: 1 = national or central level; 0.75 = national or central level with additional sectoral, local or company bargaining; 0.5 = sectoral or industry level; 0.25 = sectoral or industry level with additional local or company bargaining; 0 = local or company bargaining	Visser (2009)
Wage bargaining coordination	Degree of coordination of wage bargaining. 5-point classification: 1 = economy-wide bargaining, based on enforceable agreements between the central organizations of unions and employers affecting the entire economy or the entire private sector, or based on government imposition of a wage schedule, freeze or ceiling; 0.75 = mixed industry and economy-wide bargaining: central organizations negotiate non-enforceable central agreements (guidelines) and/or key unions and employers associations set a pattern for the entire economy; 0.5 = industry bargaining with no or irregular pattern setting, limited involvement of central organizations and limited freedoms for company bargaining; 0.25 = mixed industry- and firm-level bargaining, with weak enforceability of industry agreements; 0 = none of the above, fragmented bargaining, mostly at company level	Visser (2009)

Table 2. Regressions to explain the unemployment rate^{a)}

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Baseline specification	Random effects substituted for fixed effects ^{b)}	Wage bargaining centralization substituted for wage bargaining coordination	Labor & consumption tax rates substituted for tax wedge	Employment protection legislation split into two components	Average unemployment benefits replacement rate split into two components	Active labor market policies added	Central bank independence added	Macroeconomic shocks added
Exchange rate volatility	2.91*** (0.95)	2.92*** (0.96)	2.91*** (0.95)	2.25* (1.11)	2.47** (0.85)	2.66*** (0.90)	2.77** (1.02)	2.54** (0.87)	1.72* (0.91)
Trade union density	4.93 (7.90)	-1.22 (3.09)	4.66 (7.65)	4.00 (5.33)	10.70 (9.08)	6.31 (7.47)	5.29 (6.74)	6.40 (7.77)	7.33 (7.32)
Collective bargaining coverage	4.27 (3.55)	4.95** (2.31)	4.56 (3.55)	3.99 (3.57)	4.68 (3.26)	4.58 (3.58)	4.99 (3.30)	4.54 (3.60)	5.72* (2.86)
Wage bargaining coordination	-0.64 (0.55)	-0.85 (0.56)		-1.08* (0.51)	-0.62 (0.54)	-0.83 (0.63)	-0.51 (0.54)	-1.68 (1.24)	-0.72 (0.50)
Tax wedge	18.01*** (4.74)	16.37*** (4.69)	18.15*** (4.63)		17.81*** (4.86)	18.47*** (4.90)	15.89*** (4.33)	17.78*** (5.13)	13.28*** (4.57)
Employment protection legislation	-0.47 (7.69)	-3.79 (5.83)	-0.43 (7.35)	-0.39 (6.48)		-0.09 (7.21)	6.46 (7.22)	-1.26 (8.15)	-1.79 (6.66)
Average unemployment benefits replacement rate	5.37 (3.14)	4.01* (2.26)	5.15* (2.87)	0.09 (2.83)	5.91* (2.82)		8.10** (2.79)	6.42* (3.10)	1.60 (2.93)
Product market regulation	1.13 (3.51)	1.35 (3.35)	1.45 (3.49)	0.67 (4.22)	1.99 (3.90)	1.64 (3.08)	-2.42 (2.98)	0.98 (3.90)	-1.29 (3.90)
Output gap	-1.09*** (0.30)	-1.10*** (0.29)	-1.07*** (0.29)	-0.96** (0.33)	-1.06*** (0.28)	-1.09*** (0.30)	-0.92*** (0.25)	-1.09*** (0.28)	-0.92*** (0.22)
Exchange rate volatility * output gap	0.68 (0.40)	0.67* (0.39)	0.64 (0.39)	0.47 (0.45)	0.64 (0.38)	0.68 (0.41)	0.55 (0.37)	0.68* (0.37)	0.44 (0.28)
Openness	-5.61** (1.98)	-5.46*** (1.66)	-5.72** (2.04)	-4.43** (2.02)	-5.01*** (1.67)	-5.29** (1.86)	-5.89*** (1.95)	-4.97** (1.96)	-8.35*** (2.29)

Table 2. Regressions to explain the unemployment rate^{a)} (cont.)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Baseline specification	Random effects substituted for fixed effects ^{b)}	Wage bargaining centralization substituted for wage bargaining coordination	Labor & consumption tax rates substituted for tax wedge	Employment protection legislation split into two components	Average unemployment benefits replacement rate split into two components	Active labor market policies added	Central bank independence added	Macroeconomic shocks added
Wage bargaining centralization			-0.84 (0.56)						
Labor tax rate				28.97*** (9.40)					
Consumption tax rate				13.60 (11.48)					
Employment protection legislation regular contracts					20.17* (10.72)				
Employment protection legislation temporary contracts					-1.27 (3.80)				
Initial unemployment benefits replacement rate						5.03*** (1.54)			
Unemployment benefits duration						0.27 (0.84)			
Active labor market policies							-2.74*** (0.49)		
Central bank independence								-3.29* (1.72)	
Central bank independence * wage bargaining coordination								2.20 (2.06)	

Table 2. Regressions to explain the unemployment rate^{a)} (cont.)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Baseline specification	Random effects substituted for fixed effects ^{b)}	Wage bargaining centralization substituted for wage bargaining coordination	Labor & consumption tax rates substituted for tax wedge	Employment protection legislation split into two components	Average unemployment benefits replacement rate split into two components	Active labor market policies added	Central bank independence added	Macroeconomic shocks added
Total factor productivity shock									11.77* (6.00)
Terms of trade shock									13.70** (4.86)
Interest rate shock									0.22** (0.08)
Number of observations	332	332	332	329	332	332	332	332	326
R^2 (within)	0.65	0.64	0.65	0.66	0.67	0.66	0.68	0.67	0.71
F -statistic	42.01***		65.17***	53.62***	22.91***	122.82***	190.92***	65.09***	6916.14***
Standard error of regression	1.16	1.25	1.16	1.15	1.13	1.14	1.10	1.13	1.03

^{a)}Pooled least squares estimates with country-specific fixed effects, except for regression 2 which uses generalized least squares with country-specific random effects. The sample consists of 17 industrial countries. The sample period is 1982 to 2003. All explanatory variables are lagged by one year. All regressions additionally control for the impact of time trend. Robust standard errors, adjusted for clusters at the country level, are reported in parentheses. ***(**/*) denotes statistically significant at the 1%(5%/10%) level.

^{b)}The Wald χ^2 statistic is 434.30***. The Hausman test is not applicable since the model fails to meet its asymptotic assumptions.

Table 3. Testing for reverse causality^{a)}

	Dependent variable: exchange rate volatility			
	Fixed effects regressions			Random effects regression ^{b)}
	(1)	(2)	(3)	(4)
Unemployment rate	-0.001 (0.003)	-0.000 (0.004)	0.000 (0.007)	-0.001 (0.006)
Output gap		0.001 (0.004)	0.002 (0.007)	0.001 (0.006)
Openness		-0.164** (0.073)	-0.132 (0.118)	-0.070 (0.071)
Total factor productivity shock			0.106 (0.633)	0.139 (0.564)
Terms of trade shock			0.026 (0.185)	-0.030 (0.193)
Interest rate shock			0.000 (0.004)	0.001 (0.003)
Number of observations	332	332	326	326
R^2 (within)	0.00	0.02	0.02	0.01
F -statistic	0.71	5.33***	2.64*	
Standard error of regression	0.08	0.08	0.08	0.09

^{a)}Pooled least squares estimates with country-specific fixed effects, except for regression 4 which uses generalized least squares with country-specific random effects. The sample consists of 17 industrial countries. The sample period is 1982 to 2003. All explanatory variables are lagged by one year. All regressions additionally control for the impact of time trend. Robust standard errors, adjusted for clusters at the country level, are reported in parentheses. ***(**/*) denotes statistically significant at the 1%(5%/10%) level.

^{b)}The Wald χ^2 statistic is 9.05. The Hausman test is not applicable since the model fails to meet its asymptotic assumptions.