Exchange Rate Regimes, Trade, and the Wage Comovements*

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Abstract

The introduction of exchange rate regimes into the standard Ricardian model of trade implies stronger positive nominal wage comovements between trading countries that fix their bilateral exchange rates. Panel regression results based on data from OECD countries from 1973 to 2010 suggest that countries in the European Monetary Union (EMU) experienced stronger positive wage comovements with their main trade partners. In comparison, the positive wage comovements between countries engaged in non-currency-union pegs were weaker. When we restrict the regression to the subsample of the EMU countries, we find a significant increase in wage comovements after these countries joined the EMU in 1999 compared to the pre-euro era.

JEL classification: F1, F3
Keywords: fixed exchange rate regime, currency union, trade, wage comovements

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1 Introduction

The standard Ricardian model of trade is a real model and thus does not explicitly deal with the monetary aspects of trade such as changes in nominal prices and exchange rate. However, as pointed out by Dornbusch, Fischer and Samuelson (1977) and Ito and Ohyama (1985), it is possible to extend the discussion of the standard Ricardian model to deal with the monetary aspects of trade.

The introduction of a nominal exchange rate to the standard Ricardian model generates an interesting theoretical prediction regarding exchange rate regimes, trade, and comovements of nominal wages.[1] The modified Ricardian model predicts that if a country fixes the exchange rate with its main trade partner, then its wage will comove strongly and positively with its partner's wage to preserve the relative prices in trade and maintain the same trading equilibrium. However, if a country floats the exchange rate, then its wage does not necessarily comove with that of its main trade partner, as the exchange rate can adjust to maintain the relative wages and prices. Thus the model predicts stronger comovements of wages between countries that fix their bilateral exchange rates.

In practice, many countries adopt fixed exchange rate regimes, with the extreme case being a currency union. In the 1990s, among the 91 economies studied by Sterne (1999), the number of countries adopting an explicit exchange rate target increased from 30 to 47. In 1999, the creation of the European Monetary Union (EMU) locked in 11 European countries committed to a single currency, and the EMU has been expanding since. However, in the wake of recent crises in peripheral countries in the EMU, economic commentators (for instance, Economist (2010)) suggest that relative to Germany, countries such as Greece and Ireland have wages that are too high for their products to be competitive internationally. Yet, as EMU members, they do not have the option of devaluation to promote their products. Such observations suggest that for countries in

[1] Our interests are in the comovements of nominal wages, so in the following discussion the word "wage(s)" refers to nominal wage(s), unless otherwise noted.

a currency union and countries adopting currency pegs, whether their wages align with those of their main trade partners has important economic consequences.

To the best of our knowledge, however, no previous studies have empirically tested the prediction of the modified Ricardian model that fixed exchange rate regimes enhance the positive effects of trade on wage comovements between countries. This paper now fills this void by testing if wages comove strongly and positively between countries that peg their currencies. The results of panel regressions based on data from 24 OECD countries from 1973 to 2010 suggest that if a country and its main trade partner were in the EMU, then their wages experienced stronger comovements, especially in the longer term. However, for countries engaged in non-currency-union pegs, the positive wage comovements were weaker.

In addition, we run regressions with the sample restricted to EMU countries to determine whether joining the EMU in 1999 was associated with stronger positive wage comovements. We find that for EMU countries, there was a significant increase in wage comovements after joining the EMU, compared to the pre-euro era.

Many previous studies analyze the comovements of wages with other variables, such as output, prices, and (un)employment. Surprisingly, however, there are few studies that analyze the comovements of wages. In fact, as far as we are aware, there are only three studies on the subject.

The first, Budd, Konings and Slaughter (2002), highlights the comovements of wages within a multinational. They show the existence of comovements of wages within a multinational firm through internal risk sharing. The second, Robertson (2000), highlights the comovements of wages between the interior and border regions in a country. He provides evidence for these comovements between the interior and border regions of Mexico, thus indicating that the wage impact of emigration is transmitted to the overall Mexican economy. The third, Lamo, Perez and Schuknecht (2008), highlights the comovements of wages

across sectors within a country. They show strong positive comovements of public and private sector wages over business cycles since the 1960s in the euro area and a number of other OECD countries.[2]

Our paper thus makes the following contributions to both the trade literature and the wage literature. First, because in reality countries often use different currencies, both exchange rates and nominal wages are important determinants of the relative prices of exports to imports. Past trade studies, however, have paid little attention to the monetary aspects of trade. By incorporating the monetary aspects of trade into the Ricardian model and then empirically testing the resulting implications, we reveal the difference in the wage effects of trade under the fixed and floating exchange rate regimes.

Second, we highlight that for countries engaged extensively in trade, the choice of a fixed exchange rate regime will enhance wage comovements between countries. Our results add to the knowledge of wage comovements, as previous work has focused on inter- and intra-country wage comovements due to internal risk sharing within a multinational firm and emigration.

Third, our results add to the knowledge of how an exchange rate peg acts as a nominal anchor. A currency peg or membership of a monetary union is one way to provide a nominal anchor for a country's output prices or inflation rate (Edwards, 1993; Calvo and Vegh, 1994; Willett, 1998). Our results suggest that in addition to providing a nominal anchor for output prices or the inflation rate, a monetary union can provide a nominal anchor for wages.

The rest of this paper is organized as follows. In Section 2, we incorporate a nominal exchange rate into the standard Ricardian model and then derive an empirical question from the model. We document the regression specification and data in Section 3. Section

[2]Lamo et al. (2008) also study causal linkages between public and private sector wages, i.e. the public/private wage leadership. Their causality analysis suggests that although influences from the private sector appear on the whole to be stronger, there are direct and indirect feedback effects from public wage setting in a number of countries as well. See the references in their paper for studies on wage leadership in a particular country (mainly Sweden plus a few others).

4 reports regression results. We offer a discussion of the results in Section 5 and conclude in Section 6.

2 Theory

In this section, we incorporate a nominal exchange rate into the standard Ricardian model of trade and thus address the monetary aspects of trade. We then set up an empirical question regarding exchange rate regimes, trade, and wages that is theoretically meaningful.

Consider the standard Ricardian model. There are two countries: home and foreign. There are two goods: good 1 and good 2. There is one input factor, labor, and the labor endowment is given in each country. The markets are perfectly competitive, and the technology exhibits constant returns to scale.

Suppose that the home country has a comparative advantage in good 1 and that the foreign country has a comparative advantage in good 2. If these two countries start trading with each other, then the home country will produce and export good 1, and the foreign country will produce and export good 2. Because the output price must equal the unit cost under perfect competition, the following zero-profit conditions must hold:

$$P_1 = a_1 W, \tag{1}$$

$$eP_2^* = ea_2^* W^*, \tag{2}$$

where P_1 and P_2^* denote prices of good 1 in the home country and good 2 in the foreign country, respectively; a_1 and a_2^* denote unit labor requirements for good 1 in the home country and good 2 in the foreign country, respectively; and W and W^* denote wages in the home country and in the foreign country, respectively. The variable e is the exchange rate, defined as the price of the foreign currency in terms of the home currency.

In this trading equilibrium, relative prices $P_1/(eP_2^*)$ are determined between the

slopes of the home and foreign production possibility frontiers (PPFs):

$$\frac{a_1}{a_2} < \frac{P_1}{eP_2^*} < \frac{a_1^*}{a_2^*}. \tag{3}$$

Equations (1) to (3) imply

$$\frac{a_2^*}{a_2} < \frac{W}{eW^*} < \frac{a_1^*}{a_1}. \tag{4}$$

Equation (4) indicates that in this trading equilibrium, the corresponding relative wages $W/(eW^*)$ must be greater than the foreign/home unit-labor-requirement ratio for good 2 but less than that for good 1. This relationship between relative prices $P_1/(eP_2^*)$ and relative wages $W/(eW^*)$ is illustrated in Figure 1. Note that we need to also consider demand conditions to determine the exact equilibrium relative prices and wages on the line AB. However, since the specific levels of equilibrium relative prices and wages are not crucial for the following discussion, we do not specify demand conditions and simply assume that the equilibrium relative prices and wages locate at some point on the line AB.

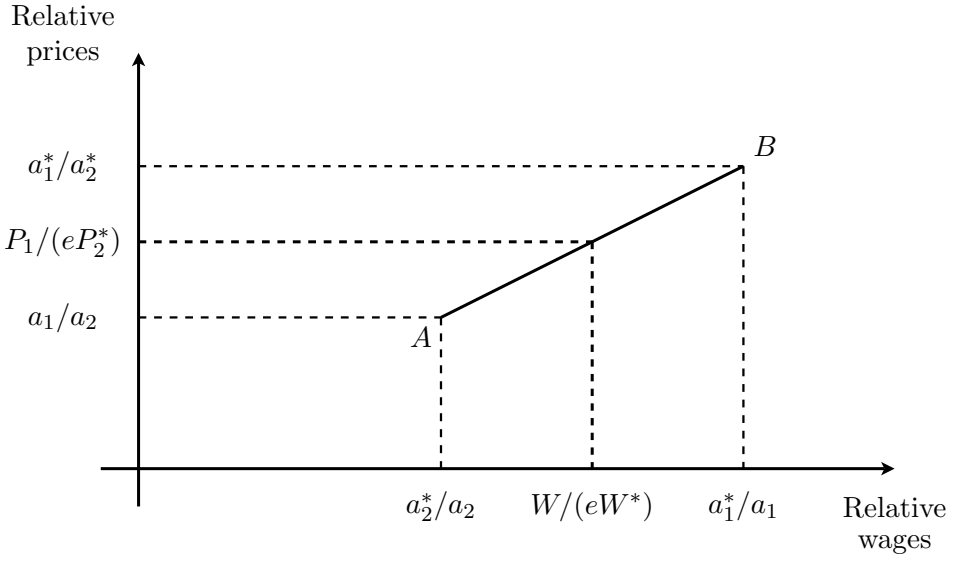

Figure 1: Relative Prices and Relative Wages

Equation (4) can be rewritten as

$$\frac{a_1 W}{a_1^* W^*} < e < \frac{a_2 W}{a_2^* W^*} \tag{5}$$

which indicates that in this trading equilibrium, the corresponding exchange rate e must be greater than the home/foreign unit-cost ratio for good 1 but less than that for good 2.

The Ricardian model is a real model, so trade is determined by real variables, such as relative prices and wages, and is not affected by changes in nominal variables, such as nominal prices and wages. Depending on the exchange rate regime, however, changes in nominal variables have different implications regarding the comovements of wages. To clarify the role of exchange rate regimes, we now analyze the fixed and floating exchange rate regimes separately.

Suppose that the foreign wage W^* increases under the fixed exchange rate regime. To maintain the initial trading equilibrium, the home wage W has to increase proportionally with the foreign wage W^*, leaving the relative wages $W/(eW^*)$ and relative prices $P_1/(eP_2^*)$ constant. Thus wages in the home and foreign countries would comove strongly and positively in the case of the fixed exchange rate regime.

Suppose that, on the other hand, the foreign wage W^* increases under the floating exchange rate regime. If the increase in the foreign wage W^* is completely negated by the change in the exchange rate e in the other direction, then the relative wages $W/(eW^*)$ and relative prices $P_1/(eP_2^*)$ would remain unchanged. No change in the home W is required to maintain the initial trading equilibrium. Hence, there is a possibility that under the floating exchange regime, the home wage does not comove with the foreign wage.

The same arguments also hold when inflation occurs in either country. It can be shown that if the foreign price P_2^* or the home price P_1 increases under the fixed exchange rate regime, then the home and foreign wages W and W^* would comove strongly and positively. On the other hand, if the foreign price P_2^* or the home price P_1 increases under the floating exchange rate regime, then the home and foreign wages W and W^* do not

necessarily comove due to the flexibility in the exchange rate.

We should note that unit labor requirements–labor productivities–have so far been assumed to be constant. If these real variables are changed, however, then relative prices and wages–real variables–will be changed because the slopes of the home and foreign PPFs will be changed. Thus nominal wages in the home country and the foreign country do not necessarily comove strongly and positively even under the fixed exchange rate regime. However, if labor productivities for goods 1 and 2 both increased by the same proportion in each country, then the relative prices and wages would remain unchanged because the slopes of the home and foreign PPFs would remain unchanged. In this scenario, nominal wages in the home country and foreign country should comove strongly and positively under the fixed exchange rate regime.[3]

In this section, we introduce a nominal exchange rate to the standard Ricardian model. The model implies that if the exchange rate with a trade partner is fixed, then the wage in the home country will have stronger positive comovements with the trade partner. On the other hand, if the exchange rate with the trade partner is floating, then the wage in the home country does not necessarily comove with the trade partner due to the flexibility in the exchange rate.[4]

3 Regression Specification and Data

To test empirically whether wages would exhibit stronger positive comovements for countries that peg their currencies, we first estimate the following two baseline models with

[3]If we consider demand conditions and assume that both countries have the same homothetic preferences over the two consumption goods, it can be shown that equilibrium relative wages do not depend on labor productivities. In this case, the comovements of wages are not affected by any changes in labor productivities. In the empirical section, we will include labor productivity in some of the specifications but not in others to recognize the uncertain role of labor productivity.

[4]Note that the arguments developed here also hold in the framework of the standard Heckscher-Ohlin (H-O) model of trade. By incorporating a nominal exchange rate into the standard H-O model and using the factor price equalization theorem, we obtain $W = eW^*$ and $R = eR^*$, where R and R^* are the home and foreign rentals, respectively. Thus it is obvious that under the fixed exchange rate regime, the home and foreign wages W and W^* would comove strongly and positively.

country fixed effects:

$$\begin{aligned}\Delta ln(W_{it}) =& \beta_0 + \beta_1 \Delta ln(W^*_{it}) \\ &+ \beta_2 \cdot peg_{it} \cdot \Delta ln(W^*_{it}) + \beta_3 \cdot trend + u_i + \epsilon_{it} \qquad (6) \\ \Delta ln(W_{it}) =& \gamma_0 + \gamma_1 \Delta ln(W^*_{it}) \\ &+ \gamma_2 \cdot non\ CU\ peg_{it} \cdot \Delta ln(W^*_{it}) \\ &+ \gamma_3 \cdot CU_{it} \cdot \Delta ln(W^*_{it}) + \gamma_4 \cdot trend + u_i + \epsilon_{it} \qquad (7)\end{aligned}$$

where W_{it} is the wage in country i in year t, and W^*_{it} is the wage in country i's base country in period t. Because the model generates predictions based on the nominal wages and exchange rates, we use only the nominal wage as the dependent variable. In specification 1 (equation (6)), peg_{it} is a dummy variable that takes the value 1 if country i's currency is pegged to its base country in period t, and 0 otherwise. In specification 2 (equation (7)), we differentiate between two types of pegs. CU_{it} is a dummy variable indicating that country i and its base country are in a currency union in period t, and $non\ CU\ peg_{it}$ is a dummy variable indicating other types of pegs. The variable $trend$ is a linear time trend, and u_i is the country fixed effect.

If β_2, γ_2 and γ_3 are positive, then the prediction of the modified Ricardian model that wages comove positively and strongly under a fixed exchange rate regime is supported. Because the Ricardian model is a general equilibrium model, we treat both home and foreign wages as endogenous to the model. Hence, in testing whether β_2, γ_2 and γ_3 are positive, we are examining whether there is a positive conditional correlation between home and foreign wage growth under a fixed exchange rate regime. Our empirical work does not attempt, and should not be interpreted as, the identification of the effect of exogenous wage changes in the foreign country on the home wage.

Our empirical analysis uses wage data from the Source OECD (www.sourceoecd.org) which provides detailed wage information of OECD countries starting from 1973. Wage

is measured by the index for nominal hourly earnings in manufacturing sectors. We made this choice because the products of the manufacturing sectors are highly tradable.

The classification of the exchange rate regime follows Klein and Shambaugh (2006), who determine whether a country pegs its currency to the base country, based on the volatility of the exchange rate. In Klein and Shambaugh (2006), country i's base country is the country to which country i pegs its exchange rate or the country with which country i has the most significant trade relationship. We also follow their choice of base countries.[5]

Because we are looking at OECD countries, the currency union is the EMU. The countries included in our sample are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Hungary, Iceland, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Turkey, and the UK. The US is not in the sample because the US does not have a dominant trade-partner to be used as the base country. Our sample covers data from the first quarter of 1973 to the fourth quarter of 2010. The details about the base country, episodes of exchange rate pegs, and data range for each country are documented in Table 1.

The fixed effects in the specifications account for the time-constant idiosyncrasy in the growth in nominal wage, such as country-specific productivity path or inflation in a specific country relative to its base country. We also include a linear time trend to capture the trend in the growth rate of the nominal wages. Such a trend could arise due to the productivity slowdown since the 1970s and the decline in inflation rates in some countries.

4 Empirical Results

4.1 Main Regression Results

We present the estimation results of specification 1 (equation (6)) in Table 2. The top row indicates the frequency at which we calculate the growth rates of the wage in country i and its base country. We choose to use the wage growth over a quarter, a year, two years,

[5]The description of their data can be found at http://www.dartmouth.edu/~jshambau/

and four years. The results in Table 2 suggest that pegs have no significant effect on wage comovements at 5% significance level. This seems unsupportive to our hypothesis.

In Table 3, when we follow specification 2 (equation (7)) to differentiate between the two types of pegs. While the non-currency-union pegs reduce wage comovements at some frequencies, the EMU always increases wage comovements significantly. For instance, at the quarterly frequency, the coefficients on the interaction between the currency union and wage growth in the base country is 0.64. This result implies that if the wage in country i's base country increases by 1%, being in a currency union with the base country predicts an additional increase of 0.64% in country i's wage. Interestingly, at the two-year frequency, the coefficient on the interaction is 0.96, which is close to unity.

In addition, as indicated by the coefficient of wage growth in the base country ($\Delta ln(W_t^*)$) in Tables 2 and 3, wages in general do comove positively between a country and its base country at the quarterly frequency. For instance, the coefficients are 0.27 and 0.23 for the quarterly data, which implies that when the wage in country i's base country increases by 1%, the wage in country i increases by 0.27% and 0.23%, respectively.

By comparing results for different frequencies, we see that the R^2 increases with the length of the time interval. For instance, in Table 3, the R^2 associated with quarterly wage growth is 0.22. When we use the growth rate over four years, the R^2 increases to 0.49, indicating that our simple model appears to have good explanatory power with respect to wage growth in the long run.

Although the baseline specifications (6) and (7) are based on the modified Ricardian model, we recognize that in the framework, there are multiple channels through which the wage in country i will comove with its base country. In particular, the labor productivity growth and CPI inflation of a country are two important determinants of nominal wage in the country. Wage comovements can arise due to a positive correlation in the productivity growth and inflation between two countries. Hence, to differentiate the different channels

of wage comovements, we add labor productivity growth and CPI inflation of a country to the regression. The measure for labor productivity is output per worker in the industrial sectors.[6] With these variables included, we ask whether there are still positive wage comovements not caused by comovements in productivity growth and inflation.

The results associated with this modification are presented in Table 4 and Table 5. Comparing Table 4 to Table 2, we now see pegs in general no longer reduce the positive wage comovements between country pairs. In particular, for wage growth over two years, pegs in general strengthen the positive wage comovements, although the strengthening effects are weak statistically. Comparing Table 5 to Table 3, there are two differences. First, the interaction between the currency union and wage growth in the base country is positive and significant only when we look at growth over two years. Second, the interaction between non-currency-union pegs and wage growth in the base country no longer has a negative and significant coefficient. The coefficient is actually positive and marginally significant for the wage growth over two years. After controlling for productivity growth and inflation, these regression results seem to suggest that the positive effect of currency pegs on wage comovements appears mainly in the intermediate term over two-year periods. We will discuss this finding in more details in Section 5.

4.2 Regression Results Based on EMU Member Countries

In Table 6, we repeat the estimations in Table 5 but restrict the sample to countries currently in the EMU. More specifically, the countries included are Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal, and Spain. The time range remains 1973 to 2010. These estimations serve two purposes. First, we want to explore if non-currency-union pegs worked differently for countries not in the EMU or for countries that later joined the EMU. Second, the additional regressions

[6]The CPI data are obtained from the Source OECD. Labor productivity is computed as the constant-price output in the industry divided by employment in the industry. Both output and employment in the industry are also obtained from the Source OECD.

provide direct evidence of whether joining the EMU is associated with stronger positive wage comovements.

Relative to Table 5, the results regarding the coefficients on non-currency-union pegs in Table 6 are very similar. Non-currency-pegs only strengthened the wage comovements when we focus on the wage growth over two-year intervals. We also run regressions with the countries not in the EMU and find that non-currency-pegs have no strengthening effect on wage comovements, except that the pegs have marginally positive effects when the dependent variable is the wage growth over two-years. To preserve space, we do not report these results in the paper. These regression results indicate that non-currency-pegs had similar effects on wage comovements for countries in and out of the EMU.

Meanwhile, regarding the coefficients on the EMU dummy-base country wage interaction in Table 6, the signs are all positive. Compared to Table 5, the significance level is higher for wage growth over two-year and four-year intervals. Hence, for the same 11 countries, the positive wage comovements with their base countries after joining the EMU are stronger than before joining the EMU.

4.3 Robustness Checks

In unreported regressions, we estimate another pair of alternative specifications by replacing the linear time trend with time fixed effects. The results are similar to Tables 2 and 3, but weaker. However, we believe that time fixed effects are not suitable for testing the theoretical predictions. To see the reason, note that Germany is the reference for almost all countries in the EMU. If our hypothesis is correct, wages in these EMU countries should comove with German wages in each time period. However, when we include the time fixed effects, the regressions will attribute such comovements with the German wages to time-specific effects, rather than attributing them to the currency union, which is a time-constant fundamental.

Finally, we add the dummy variables for pegs in general, currency union, and non-

currency-union pegs to the regressions that are not reported in this paper. These stand-alone dummy variables are almost always insignificant. The insignificance, consistent with the model, also makes sense intuitively, as there is no obvious reason why wage growth rates should be higher or lower in countries that fix their exchange rates.

5 Discussion

In subsection 4.1, we explored the three mechanisms that can lead to comovements in wages. The first is the trade-exchange-rate mechanism. Intuitively, for a country to maintain a stable trade relationship with its base country, its wages must comove positively with the base country to keep relative prices constant if the exchange rate is fixed. Second, wages in the two countries can comove positively due to a correlation in the productivity growth rates. For countries that share close economic relationships, it is conceivable that new technologies spread across borders quickly, leading to common growth in productivity. Third, a positive correlation in inflation can also contribute to positive wage comovements. For instance, hikes in commodity prices typically lead to higher inflation in many countries.

The three channels are not mutually exclusive, as the latter two channels can be present whether or not two countries trade. If they trade, then according to the model, an increase in the wage in country i due to inflation or a productivity gain will lead to a similar rise in the wage in its base country. However, even if the two countries do not trade, common inflation or productivity trends can still cause wage comovements. For instance, if countries i and j do not trade but both import oil from a third country, then an increase in oil prices will lead to inflation and growth in the nominal wages in both countries i and j. Similarly, if countries i and j do not trade final products but share ideas and technologies, then their wages can both rise when a common new technology is adopted in both countries. That said, because in our sample, a country and its base country engage in significant trade, we argue that most of the comovements in wages due

to the common trends in inflation and productivity can be incorporated in the framework of the modified Ricardian model.

Nevertheless, in the regressions in Tables 4 and 5, we include inflation and the productivity growth of country i, which accounts for any comovements in inflation and productivity with its base country. Because these regressions differentiate between the channels, the estimated coefficients of β_2, γ_2 and γ_3 now provide conservative measures of wage comovements described by the model. From Tables 4 and 5, we can see that inflation has strong effects on the wage growth at all frequencies, while productivity growth has a weaker effect on the wage growth over four-year periods. After controlling for inflation and productivity growth, the wage comovements due to the trade-exchange-rate mechanism appear in two-year periods. Because the modified Ricardian model focuses on stable, long-term trade relationships, it is plausible that the predictions of wage comovements only manifest themselves over a longer period of time.

Subsection 4.2 shows the regression results with the sample restricted to the EMU countries. We find that the coefficients on currency-union pegs are all positive and that the significance levels are higher, while the coefficients on non-currency-union pegs change little. This finding indicates that non-currency-union pegs did not work differently for the countries that have never been in the EMU and the countries that joined the EMU in 1999. It also indicates that for EMU countries, there was a significant increase in wage comovements after joining the EMU in 1999, compared to the pre-euro era.

Overall, the empirical results support the predictions of the modified Ricardian model. As indicated by Tables 4 and 5, augmenting equations (6) and (7) with productivity growth better aligns the empirical results with the theory, in the sense that both currency union and non-currency-union pegs strengthen the positive wage comovements between country pairs. Perhaps it is not surprising that non-currency-union pegs only weakly enhanced wage comovements. As Obstfeld and Rogoff (1995) suggest, pegs of this type

often lack credibility. Historically, countries had been known to break their pegs and devalue when the prices of their products were not competitive internationally. If producers expect such devaluations, then there are smaller incentives to align wages to the base country.

Our results are relevant for the debate on whether the EMU is an optimum currency area. The existence of wage comovements suggests that although relative to the US, the EMU originally was less likely to meet the criteria for optimum currency area (Feenstra and Taylor, 2008, p.879), it may have enhanced the economic integration of its members via wage comovements.

Finally, this paper is also related to the literature on the relationship between the relative price of non-traded goods and the bilateral real exchange rate. In two recent papers on the subject, Betts and Kehoe (2006) and Betts and Kehoe (2008), one of the key findings is that for pairs of countries who trade intensively or maintain a stable bilateral real exchange rate, the relative price of non-traded goods has a stronger relationship with their bilateral real exchange rate. In the modified Ricardian model in our paper, the implicit real exchange rate is always one. Although there are no non-traded consumption goods, both the theory and empirical work suggest that if a country fixes its exchange rate with its main partner, then the ratio of the two countries' labor wages, which are the prices of a non-traded factor, should also be stable. Namely, the nominal wages will comove strongly and positively.

6 Conclusion

When a nominal exchange rate is incorporated into the standard Ricardian model of trade, the model predicts that two countries' nominal wages must exhibit strong and positive comovements to maintain this initial trading equilibrium if they fix the bilateral exchange rate. We use the data from 24 OECD countries between 1973 and 2010 to test this

prediction. We find that if a country and its main trade partner were in the EMU, their wages experienced stronger comovements, especially over two-year intervals. For country pairs who engage in non-currency-union pegs, their wages had weaker comovements, in terms of both magnitude and statistical significance. When we restrict our attention to the EMU members, we also find a significant increase in wage comovements after they joined the EMU in 1999 compared to the period before 1999.

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Table 1: Summary of peg episodes and data range

Country	Base country	Episodes of non-currency-union pegs with base country	Wage data range
EMU members since 1999			
Austria	Germany	1975-1998	1973q1-2008q3
Belgium	Germany	1975-1980, 1984-1992, 1994-1998	1973q1-2010q4
Finland	Germany	1975, 1979, 1987, 1990, 1997-1998	1973q1-2010q3
France	Germany	1979-1980, 1984-1985, 1987-1994, 1996-1998	1973q1-2010q3
Germany	US		1973q1-2010q2
Ireland	Germany	1979-1980, 1984-1985, 1987-1992, 1998	1979q1-2010q3
Italy	Germany	1980, 1984, 1986, 1988, 1990-1991, 1997-1998	1973q1-2010q4
Luxembourg	Belgium	1973-1998	1980q1-2010q3
Netherlands	Germany	1975-1976, 1978-1998	1973q1-2010q4
Portugal	Germany		2000q1-2010q4
Spain	Germany	1996-1998	1981q1-2010q3
Country in ERM II			
Denmark	Germany	1975-1976, 1978, 1980, 1983-1992, 1994-2010	1973q1-2010q3
Other countries			
Australia	US		1984q1-2010q3
Canada	US	1973-1974, 1983, 1986, 1990-1991, 1996	1973q1-2010q3
Japan	US		1973q1-2010q3
Korea	US	1992-1994	1992q1-2010q3
Mexico	US		1980q1-2010q3
Hungary	Germany	1999	1995q1-2010q3
New Zealand	Australia	1978-1980, 1988, 1992-1993	1989q1-2010q4
Norway	Germany	1975-1996, 1984, 1990-1991, 1994	1973q1-2010q3
Poland	Germany		1995q1-2010q4
Sweden	Germany	1974-1975, 2003-2004	1973q1-2010q3
Turkey	US		1988q1-2010q3
UK	Germany		1973q1-2010q2

Notes: (1) Prior to 1979, the UK is the base country for Ireland, as the Irish pound had been pegged to the pound sterling. In all regressions, we discard the Irish data before 1979 to avoid complications. (2) ERM II stands for Exchange Rate Mechanism II.

Table 2: Specification 1

	Quarterly	Annual	2-year	4-year
Variables	(1)	(2)	(3)	(4)
$\Delta\ ln(W_t^*)$	0.27	0.23	0.3	0.28
	$(0.13)^{**}$	(0.37)	(0.39)	(0.4)
$Peg_t \times \Delta\ ln(W_t^*)$	-.23	-.03	-.05	-.37
	$(0.14)^{*}$	(0.16)	(0.16)	(0.27)
Linear time trend	-.0002	-.003	-.01	-.05
	$(0.0000455)^{***}$	$(0.001)^{***}$	$(0.004)^{***}$	$(0.02)^{***}$
Const.	0.04	0.14	0.29	0.62
	$(0.005)^{***}$	$(0.03)^{***}$	$(0.07)^{***}$	$(0.17)^{***}$
Obs.	2042	677	316	150
R^2	0.2	0.29	0.37	0.46
F statistic	60.1	56.43	48.51	46.48

Notes: (1) The dependent variable is the wage growth rate as measured by the log change in wages. (2) The variable $\Delta\ ln(W_t^*)$ is the wage growth rate of the base country, and Peg_t is a dummy variable indicating whether a country pegs its exchange rate to its base country via a currency union or other arrangements. (3) The top row indicates the time interval at which the wage growth rates are calculated. (4) The numbers in the parentheses are robust standard errors. (5) *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively. (6) All regressions include country fixed effects.

Table 3: Specification 2

	Quarterly	Annual	2-year	4-year
Variables	(1)	(2)	(3)	(4)
$\Delta\ ln(W_t^*)$	0.23	0.15	0.23	0.16
	(0.13)*	(0.38)	(0.39)	(0.42)
$CU_t\ \times\Delta\ ln(W_t^*)$	0.64	0.78	0.96	0.68
	(0.18)***	(0.33)**	(0.34)***	(0.22)***
$Non\ CU\ peg_t\ \times\Delta\ ln(W_t^*)$	-.35	-.13	-.15	-.53
	(0.12)***	(0.15)	(0.17)	(0.23)**
Linear time trend	-.0002	-.004	-.02	-.06
	(0.0000475)***	(0.001)***	(0.005)***	(0.02)***
Const.	0.04	0.15	0.31	0.69
	(0.005)***	(0.03)***	(0.08)***	(0.18)***
Obs.	2042	677	316	150
R^2	0.22	0.3	0.39	0.49
F statistic	47.72	40.65	33.78	28.93

Notes: (1) The dependent variable is the wage growth rate as measured by the log change in wages. (2) The variable $\Delta\ ln(W_t^*)$ is the wage growth rate of the base country, CU_t is a dummy variable indicating membership of a currency union, and $Non\ CU\ peg_t$ is a dummy variable indicating whether a country engages in a peg other than being a member of a currency union. (3) The top row indicates the time interval at which the wage growth rates are calculated. (4) The numbers in the parentheses are robust standard errors. (5) *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively. (6) All regressions include country fixed effects.

Table 4: Specification 1, with productivity growth and CPI inflation

	Quarterly	Annual	2-year	4-year
Variables	(1)	(2)	(3)	(4)
$\Delta\ ln(W_t^*)$	0.21	0.27	0.2	0.31
	$(0.08)^{***}$	$(0.14)^{**}$	(0.18)	$(0.19)^{*}$
$Peg_t \times \Delta\ ln(W_t^*)$	-.13	0.02	0.18	-.10
	(0.13)	(0.1)	$(0.11)^{*}$	(0.17)
$\Delta ln(a_t)$	-.06	0.02	0.02	0.12
	(0.09)	(0.05)	(0.04)	$(0.06)^{**}$
$CPI\ inflation\ rate_t$	0.55	0.77	0.82	0.8
	$(0.15)^{***}$	$(0.04)^{***}$	$(0.03)^{***}$	$(0.09)^{***}$
Linear time trend	-.0001	-.0008	-.003	-.007
	$(0.0000387)^{***}$	(0.0005)	(0.002)	(0.008)
Const.	0.02	0.03	0.06	0.1
	$(0.005)^{***}$	$(0.02)^{**}$	(0.04)	(0.09)
Obs.	1899	622	295	139
R^2	0.38	0.72	0.77	0.84
F statistic	175.3	260.2	288.08	146

Notes: (1) The dependent variable is the wage growth rate as measured by the log change in wages. (2) The variable $\Delta\ ln(W_t^*)$ is the wage growth rate of the base country, Peg_t is a dummy variable indicating whether a country pegs its exchange rate to its base country via a currency union or other arrangements, $\Delta ln(a_t)$ is the productivity growth, and $CPI\ inflation\ rate_t$ is the inflation rate as measured by the percentage change of CPI. (3) The top row indicates the time interval at which the wage growth rates are calculated. (4) The numbers in the parentheses are robust standard errors. (5) *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively. (6) All regressions include country fixed effects.

Table 5: Specification 2, with productivity growth and CPI inflation

	Quarterly	Annual	2-year	4-year
Variables	(1)	(2)	(3)	(4)
$\Delta\ ln(W_t^*)$	0.19	0.26	0.2	0.31
	(0.08)**	(0.15)*	(0.18)	(0.19)
$CU_t \times \Delta\ ln(W_t^*)$	0.4	0.29	0.61	0.24
	(0.24)	(0.24)	(0.24)**	(0.27)
$Non\ CU\ peg_t \times \Delta\ ln(W_t^*)$	-.16	0.02	0.18	-.09
	(0.13)	(0.1)	(0.11)*	(0.17)
$\Delta ln(a_t)$	-.05	0.02	0.03	0.12
	(0.1)	(0.05)	(0.04)	(0.07)*
$CPI\ inflation\ rate_t$	0.54	0.77	0.81	0.79
	(0.15)***	(0.04)***	(0.03)***	(0.09)***
Linear time trend	-.0001	-.0009	-.003	-.01
	(0.0000452)***	(0.0006)	(0.002)*	(0.009)
Const.	0.02	0.04	0.06	0.11
	(0.006)***	(0.02)*	(0.04)*	(0.09)
Obs.	1899	622	295	139
R^2	0.38	0.72	0.77	0.84
F statistic	141.62	204.29	229.19	104.09

Notes: (1) The dependent variable is the wage growth rate as measured by the log change in wages. (2) The variable $\Delta\ ln(W_t^*)$ is the wage growth rate of the base country, CU_t is a dummy variable indicating membership of a currency union, $Non\ CU\ peg_t$ is a dummy variable indicating whether a country engages in a peg other than being a member of a currency union, $\Delta ln(a_t)$ is the productivity growth, and $CPI\ inflation\ rate_t$ is the inflation rate as measured by the percentage change of CPI. (3) The top row indicates the time interval at which the wage growth rates are calculated. (4) The numbers in the parentheses are robust standard errors. (5) *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively. (6) All regressions include country fixed effects.

Table 6: Specification 2, with productivity growth and CPI inflation, EMU countries only

	Quarterly	Annual	2-year	4-year
Variables	(1)	(2)	(3)	(4)
$\Delta\ ln(W_t^*)$	0.3	0.41	0.49	0.48
	(0.08)***	(0.12)***	(0.23)**	(0.23)**
$CU_t \times \Delta\ ln(W_t^*)$	0.07	0.09	0.64	0.45
	(0.15)	(0.1)	(0.12)***	(0.16)***
$Non\ CU\ peg_t \times \Delta\ ln(W_t^*)$	-.38	-.11	0.12	-.003
	(0.08)***	(0.09)	(0.07)*	(0.06)
$\Delta ln(a_t)$	-.02	0.02	0.08	0.12
	(0.1)	(0.02)	(0.05)*	(0.06)*
$CPI\ inflation\ rate_t$	0.53	0.98	1.05	1.08
	(0.13)***	(0.08)***	(0.1)***	(0.12)***
$Linear\ time\ trend$	-.0001	-.0002	0.0006	0.004
	(0.0000254)***	(0.0002)	(0.001)	(0.006)
$Const.$	0.01	0.002	-.04	-.08
	(0.003)***	(0.008)	(0.03)	(0.08)
$Obs.$	972	320	155	76
R^2	0.44	0.81	0.88	0.94
$F\ statistic$	91.6	96.41	158.99	753.86

Notes: (1) The dependent variable is the wage growth rate as measured by the log change in wages. (2) The variable $\Delta\ ln(W_t^*)$ is the wage growth rate of the base country, CU_t is a dummy variable indicating membership of a currency union, $Non\ CU\ peg_t$ is a dummy variable indicating whether a country engages in a peg other than being a member of a currency union, $\Delta ln(a_t)$ is the productivity growth, and $CPI\ inflation\ rate_t$ is the inflation rate as measured by the percentage change of CPI. (3) The top row indicates the time interval at which the wage growth rates are calculated. (4) The numbers in the parentheses are robust standard errors. (5) *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively. (6) All regressions include country fixed effects.