ISSN 1651-0852

FIEF Working Paper Series 2003

No. 191

Does Inflation Targeting Matter for Labour Markets? – Some Empirical Evidence

by

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Abstract

This paper investigates the impact of inflation targeting on wage formation and unemployment using a panel of 17 OECD countries 1972-2000. Five of the countries included in the study have combined floating exchange rates with explicit inflation targets during the 1990s. Using a theoretical framework for a small open economy, we present simulation results and empirical tests of the model using two different methods. There is some weak evidence that inflation targeting matters for labour markets.

Keywords: Wage bargaining; monetary regime; equilibrium (un)employment; inflation target; exchange rate target
JEL classification: E24; J50

September 17, 2003

Acknowledgements: We are grateful for comments and suggestions from Mahmood Arai, Lars Calmfors, Sten Johansson, Jan Selén, Juhana Vartiainen and seminar participants at FIEF.

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1 Introduction

In recent years there has been considerable interest in the framework for monetary policy, particularly in countries where the exchange rate regime is flexible. During the 1990s the central banks in several of these countries have combined a flexible exchange rate with inflation targeting. Many observers believe that there are considerable advantages of such inflation targeting. The inflation rate is reduced since agents include the low inflation in their expectations. In addition more stable inflation expectations help reduce inflation variability. This may also have stabilizing effects on real output and (un)employment. In, for example, Sweden even trade unions advocate inflation targeting since it acts as an anchor for well-balanced wage demands in wage bargaining.

The empirical evidence on the effects of inflation targeting are still scarce: Since inflation targeting is a relatively new phenomenon, the time series are still short. The few existing empirical studies indicate that inflation targeting among other things gives rise to steeper Phillips curves and lower inflation expectations (Clifton et al (2001), Sheridan (2001)) as well as lower variability in inflation, output and interest rates (Neuman & Hagen (2002)). However, Ball & Sheridan (2003) claim that the findings in these papers might be spurious. The estimates may reflect "regression to the mean rather than a true effect of targeting".(p.28). When the authors account for this in their estimations using a panel of 20 OECD-countries they cannot find any evidence that the inflation rate, the volatility of the inflation rate, interest rates or output evolve differently in countries with inflation targeting regimes than in other countries: in other words "targeting does not matter".

This paper extends the empirical literature on inflation targeting by investigating whether or not inflation targeting matters for the evolution of labour markets, more specifically wage formation and (un)employment. The theoretical starting point is recent work by Holden (2003) and Vartiainen (2002) using a simple two-sector model focusing on the interaction between wage setters and the central bank. A main result of the theoretical work is that inflation targeting implies a higher (real) wage rate in the tradable sector than exchange rate targeting, while the opposite is true for the non-traded sector. We extend the model of Holden (2003) slightly by explicitly modeling equilibrium (un)employment and show that the size of the non-traded sector is crucial for which regime generates higher employment.

It is not possible to provide an analytical ranking of which regime generates higher employment but we present some simulation results. They indicate that under rather general assumptions equilibrium employment is higher under inflation targeting than exchange rate targeting provided that the non-traded sector constitutes less than 60-70 percent of the economy.

Similar to Ball & Sheridan (2003) the empirical analysis of this paper is based on a panel data set involving a large number of OECD-countries of which five countries have combined floating exchange rates with inflation targeting during the 1990s. We estimate the impact of inflation targeting by using a simple difference-in-differences approach and also by estimating sectorial real wage equations for all countries, as well as separately for inflation targeting economies.

Our main conclusion is that the choice of monetary regime might matter for labour markets. Consistent with the theoretical model, there is some empirical evidence that traded sector real wages are higher under inflation targeting while non-traded sector real wages are unaffected by inflation targeting. We also estimate reduced-form unemployment equations implied by the model. There is some support for unemployment growth being lower when inflation targets are introduced and implemented.

The paper is organized as follows. Section 2 presents the theoretical model serving as a starting point for the empirical work. Section 3 is a slight extension of Holden's model with focus on the analysis of equilibrium (un)employment, followed by a presentation of some simulation results. Section 4 contains a discussion of the predictions of the model and the econometric strategy. Results are presented in Section 5, and Section 6 concludes.

2 Theoretical Framework

We consider the game between large wage setters and the central bank in a two-sector model of a small open economy. The model is a three-stage game with perfect information and is solved by backward induction. In each game, the monetary target is given and considered perfectly credible by all players.[1] In the first stage, the trade union in each sector bargains with the employers' federation over the nominal wage, anticipating the central bank's reaction to wage developments, taking the wage set in the other sector as given. In the second stage, the central bank considers the outcome of the wage bargaining and ensures that the monetary target is fulfilled by means of appropriate adjustments of the nominal exchange rate. In the third stage decisions on production, employment and consumption are made by firms and households respectively.

We start by summarizing a simplified version of the model by Holden (2003) and then extend it slightly by providing an explicit expression for equilibrium employment.

[1] We do not consider credibility issues in this paper. Related literature, mainly theoretical, typically focuses on the impact of central bank independence on wage setting, see Calmfors (2001) for a review.

2.1 *Production, Employment and Consumption*

The economy consists of two sectors indexed $i = N, T$. The good produced in the tradeable (T) sector is traded internationally, and is assumed to be a perfect substitute for traded goods produced in other countries. The good produced in the non-tradeable(N) sector is consumed only domestically. Each sector consists of a large number of identical firms acting on a perfectly competitive goods market. We may therefore consider a representative firm taking wages and prices as given. Firms maximize real profits $\Pi_i = \frac{1}{P}(P_i Y_i - W_i N_i)$ subject to a technology constraint $Y_i = \frac{1}{\delta_i} N_i^{\delta_i}$, where Y_i is output, N_i is labour input and $\delta_i \in (0,1)$. The first order condition for profit maximization gives labour demand in sector i as a decreasing function of the real product wage:

$$N_i = \left(\frac{W_i}{P_i}\right)^{-\eta_i} \tag{1}$$

where η_i is the elasticity of labour demand with respect to the real product wage, $\eta_i = \frac{1}{1-\delta_i}$. The corresponding profit function is $\Pi_i = \left(\frac{1}{\eta_i - 1}\right)\left(\frac{W_i}{P}\right)\left(\frac{W_i}{P_i}\right)^{-\eta_i}$.

There is a fixed number of identical individuals with preferences represented by a Cobb-Douglas utility function $U = C_N^{\gamma} C_T^{1-\gamma}$, where γ is the budget share spent on consumption of the non-traded good.[2] The aggregate price level of the economy, the consumer price index, is a weighted mean of the two sector prices: $P = P_N^{\gamma} P_T^{1-\gamma}$. The nominal income of each individual may be expressed as $I_i = W_i$ if employed in sector i, and $I_i = B_i$ if unemployed, where B_i is an exogenous nominal unemployment benefit. Consumers maximize utility subject to the budget constraint $I_i = P_N C_N + P_T C_T$, taking nominal in-

[2] Cobb-Douglas preferences imply that sector sizes are constant, and allow for an explicit evaluation of the monetary regime. Holden (2003) and Vartainen (2002) consider the slightly more general case with CES-preferences.

come as given, which yields the demand functions $C_N = \gamma \frac{I}{P_N}$ and $C_T = (1-\gamma)\frac{I}{P_T}$ respectively.

2.2 *Goods Market Equilibrium*

In equilibrium there is market clearing in each sector, $C_i = Y_i$, where Y_i is aggregate supply.[3] Rearranging gives the equilibrium condition

$$\left(\frac{1-\gamma}{\gamma}\right)\left(\frac{1+\sigma_N}{\sigma_N}\right)\left(\frac{\sigma_T}{1+\sigma_T}\right)\frac{P_N}{P_T} = \left(\frac{W_T}{P_T}\right)^{-\sigma_T}\left(\frac{W_N}{P_N}\right)^{\sigma_N} \tag{2}$$

where $\sigma_i = \eta_i - 1$ is the output elasticity with respect to the real product wage. The equilibrium condition displays how the relative price and real product wages are related given market clearing.

2.3 *Central Bank Behavior*

The central bank is assumed to act independently of the Government and always achieves its target. The monetary regime is hence perfectly credible, and is identified by whether the central bank follows an inflation target or an exchange rate target. Throughout the paper let subindex j denote monetary regime, $j = E, P$ for the regimes exchange rate target and inflation target respectively.

Since the economy is small, we can take the foreign-currency price of tradeables, P^*, as exogenously given to the domestic economy. According to the law of one price we have $P_T = EP^*$,

[3] Note that market clearing in the non-traded sector $C_N = Y_N$ implies balanced trade. Too see that this is fulfilled in equilibrium, use the fact that nominal output, $PY = P_N Y_N + P_T Y_T$ is equal to aggregate nominal income, i..e $PY = I = P_N C_N + P_T C_T$. Since $C_N = Y_N$ it follows that $C_T = Y_T$.

where E is the nominal exchange rate in domestic currency per units of foreign currency. The central bank therefore makes all policy decisions conditional on the restriction of the law of one price for the traded sector. We assume that an inflation target is equivalent to keeping the consumer price level constant ($d\ln P = 0$). An exchange rate target is assumed to be equivalent to $d\ln P_T = 0$.[4]

2.4 *Regime-specific Elasticities of Prices with Respect to Wages*

The reason that there is a game between wage setters and the central bank is that prices depend on wages i.e. $P = P(W_N, W_T)$ and $P_i = P_i(W_N, W_T)$. In the wage bargaining, agents take into account how their wage claims will affect prices and hence real wages and profits. Define the elasticity of the consumer price with respect to wages as $\epsilon_{ij} = \frac{d\ln P}{d\ln W_i}$ and the elasticity of producer prices with respect to wages as $\varphi_{ij} = \frac{d\ln P_i}{d\ln W_i}$.[5] We will henceforth refer to these elasticities as the "consumer price effect" and the "producer price effect" respectively. These elasticities capture the central mechanisms of the model and will enter the expression for bargained wages.

In order to evaluate equilibrium outcomes under different regimes, we need closed-form solutions of these mechanisms, i.e. the price elasticities as functions of the "deep" parameters of the model. By totally differentiating the equilibrium condition (2) and the aggregate price index, it is possible to determine these

[4] The implicit assumption is thus $d\ln P^* = 0$, i.e. that the foreign-currency price of tradeables is constant. This is not a restrictive assumption. The crucial assumption is that the development of P^* is taken as given.

[5] Note that as wages increase in one of the sectors, this affects prices also in the other sector, i.e. we have cross-effects on the form $\frac{d\ln P_N}{d\ln W_T} \neq 0$ and $\frac{d\ln P_T}{d\ln W_N} \neq 0$. Here we focus only on how wages affect prices in the own sector, since this is what agents care about in the bargaining.

Table 1: Producer and consumer price effects under different monetary regimes

Regime (j)	(1) φ_{Nj}	(2) ϵ_{Nj}	(3) φ_{Tj}	(4) ϵ_{Tj}
Inflation Target (P)	$\frac{(1-\gamma)\sigma_N}{\psi}$	0	$\frac{\gamma\sigma_T}{\psi}$	0
Exchange Rate Target (E)	$\frac{\sigma_N}{1+\sigma_N}$	$\frac{\gamma\sigma_N}{1+\sigma_N}$	0	$-\frac{\gamma\sigma_T}{1+\sigma_N}$

Notes: $\psi = (1-\gamma)(1+\sigma_N) + \gamma(1+\sigma_T)$.

elasticities by imposing $\epsilon_{iP} = 0$ and $\varphi_{TE} = 0$ under an inflation target and exchange rate target, respectively. The results are summarized in *Table 1*.

An inflation target by definition implies $\epsilon_{iP} = 0$. However, the elasticity of non-tradable producer prices with respect to a wage increase in the non-traded sector is given by $\varphi_{NP} = \frac{(1-\gamma)\sigma_N}{\psi} > 0$, where $\psi = (1-\gamma)(1+\sigma_N) + \gamma(1+\sigma_T)$. A nominal wage increase results in a negative supply effect in the sector. This gives rise to inflation pressure which the central bank counteracts in order to achieve the inflation target, by appreciating the nominal exchange rate. At the same time, the fall in production of the non-tradable good leads to a negative effect on aggregate income, affecting demand for the tradable good. This implies a fall in traded-sector prices (measured in domestic currency), and the inflation target is achieved.In the case of a wage change in the tradable sector the elasticity may be written $\varphi_{TP} = \frac{\gamma\sigma_T}{\psi} > 0$. The mechanisms at work are similar to those described above.

Under an exchange rate target, the producer price level in the tradable sector is held constant i.e. $\varphi_{TE} = 0$. The aggregate price level is affected according to the elasticity $\epsilon_{TE} = -\frac{\gamma\sigma_T}{1+\sigma_N} <$

0. As the price level in the tradable sector is held constant by monetary policy, higher wages reduce output in the sector and hence aggregate income. As a result demand for non-tradable goods decreases, implying falling prices of non-tradable goods and consequently lower consumer prices.

Under an exchange rate target changes in non-traded wages affect the prices in the economy according to $\varphi_{NE} = \frac{\sigma_N}{1+\sigma_N} > 0$ and $\epsilon_{NE} = \frac{\gamma\sigma_N}{1+\sigma_N} > 0$. Higher wages in the non-tradable sector imply both higher prices of non-tradable goods and a higher consumer price.

2.5 *Wage Setting*

In each sector the nominal wage is determined by a Nash-bargaining solution between a large union and a large employers' federation. After wage negotiations have been settled, the firms set employment unilaterally. A worker is either fully employed or unemployed and all workers are unionized. The labour force is assumed to be constant in each sector and without loss of generality normalized to one. If a worker loses his job he enters a sector-specific unemployment pool. Workers pay a union fee, τ_i, which is used to finance the unemployment benefit, B_i. An employed worker receives the bargained wage W_i and has utility $V_{Ni} = \frac{W_i}{P} - \tau_i$. An unemployed worker receives the unemployment benefit and enjoys some unobservable utility of leisure, ω, which is equal for all workers. The utility associated with unemployment is therefore $V_{Ui} = \frac{B_i}{P} + \omega$. The union is utilitarian and cares about the utility of its own members according to the objective function $\Lambda_i = N_i \left(\frac{W_i}{P} - \tau_i\right) + (1 - N_i)\left(\frac{B_i}{P} + \omega\right)$. Imposing the budget constraint $N_i\tau_i = (1 - N_i)\left(\frac{B_i}{P}\right)$ and assuming that fall-back utility is given by $\Lambda_{i0} = \omega$, union rents can be written as $\Lambda_i - \Lambda_{i0} = N_i \left(\frac{W_i}{P} - \omega\right)$.

The employer's federation seeks to maximize the profit function, Π_i, and has fall-back utility zero. The wage is hence given by the solution to

$$\max_{W_i}\left[N_i\left(\frac{W_i}{P}-\omega\right)\right]^{\lambda_i}\left[\left(\frac{1}{\eta_i-1}\right)\left(\frac{W_i}{P}\right)\left(\frac{W_i}{P_i}\right)^{-\eta_i}\right]^{1-\lambda_i}$$

subject to

$$\begin{aligned} N_i &= \left(\frac{W_i}{P_i}\right)^{-\eta_i} \\ P &= P(W_N, W_T) \\ P_i &= P_i(W_N, W_T) \end{aligned}$$

where λ_i is the relative bargaining power of the union. Wage setters recognize that they are large enough to influence employment. In addition they regard neither consumer prices nor producer prices as given, but endogenously determined by the outcome of the bargaining. Wage setters take into consideration how the central bank, given the monetary regime, will respond to higher wages. As an inflation target and an exchange rate target imply different exchange rate adjustments, the constraints facing wage setters will differ between the two regimes and across sectors. This asymmetry is a central feature of the model.

The first order condition can be written

$$\begin{aligned} & -\eta_i\left(1-\varphi_{ij}\right)+\frac{W_i/P}{W_i/P-\omega}(1-\epsilon_{ij}) \\ = & -\frac{1-\lambda_i}{\lambda_i}\left[(1-\epsilon_{ij})-\eta_i\left(1-\varphi_{ij}\right)\right] \end{aligned} \tag{3}$$

The left hand side displays the influence on union utility of a wage increase: The first term represents the disutility of reduced employment for the members due to a nominal wage increase. This cost for the union is dampened by the extent to which cost increases in terms of higher wages are passed onto producer prices i.e. the producer price effect as captured by φ_{ij}. The second term is the incremental utility of the union caused by a higher real wage for the members. The right hand side balances the union's incremental utility of a wage increase by the employer's marginal reduction in real profits caused by a wage increase.

Both parties lose from a (positive) consumer price effect, i.e. the extent to which an increase in wages is transmitted to the aggregate price level as captured by ϵ_{ij}, and gain from a (positive) producer price effect, i.e. the extent to which an increase in wages is transmitted to the producer price level as captured by φ_{ij}. Equilibrium real wages will depend on the relative strength of the consumer price effect and the producer price effect. It follows from the first order condition (3), that the producer price effect is given a weight which is always equal to $\eta_i > 1$. On the other hand, the consumer price effect has a weight that is equal to one on the employer's side while the weight depends on the real wage markup on the value of leisure, $\frac{W_i/P}{W_i/P-\omega} \geq 1$, on the union's side.

On general form the real wage in sector i implied by the bargaining may be written as:

$$\left(\frac{W_i}{P}\right)_j = \frac{\eta_i(1-\varphi_{ij}) - (1-\lambda_i)(1-\epsilon_{ij})}{\eta_i(1-\varphi_{ij}) - (1-\epsilon_{ij})}\omega \tag{4}$$

where $i = N, T$, $j = E, P$. The bargained wage is a mark-up on the value of leisure, ω, and the mark-up depends positively on the degree of union power, λ_i, negatively on the elasticity of labour demand and profits as represented by η_i, and the rates of pass-through from wages to prices. The price elasticities in the wage expression, i.e. the producer price effect and the consumer price effect, are strategic in evaluating the impact of the monetary regime on wage setting.

By inserting the regime-specific elasticities of prices with respect to wages described above in equation (4), it is straightforward to show that the ranking of regime-specific real wages satisfies

$$\left(\frac{W_T}{P}\right)_P > \left(\frac{W_T}{P}\right)_E \tag{5}$$

$$\left(\frac{W_N}{P}\right)_E > \left(\frac{W_N}{P}\right)_P \tag{6}$$

This result is consistent with Vartiainen (2002). In order to understand the ranking given by (5) and (6), we need to recall how the producer price effects and the consumer price effects affect wages under the two regimes. The impact of these effects on wage formation is summarized in Table 2.

The reason why real wages in the traded sector are higher under inflation targeting than under exchange rate targeting, is that the (positive) producer price effect under inflation targeting is stronger than the (negative) consumer price effect under exchange rate targeting. The reversed ranking in the non-traded sector, is due to the (positive) producer price effect being so much stronger under exchange rate targeting than under inflation targeting, that the mitigating (positive) consumer price effect under exchange rate targeting is insufficient.

3 Equilibrium Employment

Having established that the monetary regime indeed affects the real wage in the two sectors, the impact of the monetary regime on equilibrium (un) employment remains to be analysed. We now extend the model by Holden (2003), by providing an explicit expression for equilibrium employment and analyse it.

Table 2: Wage formation under different monetary regimes

	Regime-specific elasticities	*Impact on Wages*
Traded Sector		
Inflation target		
	$\varphi_{TP} > 0$	+
	$\epsilon_{TP} = 0$	None
Exchange rate target		
	$\varphi_{TE} = 0$	None
	$\epsilon_{TE} < 0$	+
Real wage ranking		$\left(\frac{W_T}{P}\right)_P > \left(\frac{W_T}{P}\right)_E$
Non-traded sector		
Inflation target		
	$\varphi_{NP} > 0$	+
	$\epsilon_{NP} = 0$	None
Exchange rate target		
	$\varphi_{NE} > 0$	+
	$\epsilon_{NE} > 0$	-
Real wage ranking		$\left(\frac{W_N}{P}\right)_E > \left(\frac{W_N}{P}\right)_P$

For each regime we have a system consisting of a horizontal wage curve for each sector, equation (4), a labour demand curve in each sector, equation (1) and a relative price determined by equilibrium on the goods market, equation (2). These five equations determine five endogenous variables: $\frac{W_T}{P}$, $\frac{W_N}{P}$, N_N, N_T and $\frac{P_N}{P_T}$. Here we focus on the case where production technology is equal across sectors, i.e. when $\eta_N = \eta_T = \eta$. Solving the system above and using the fact that aggregate employment is given by the sum of employment in the two sectors , i.e. $N = N_N + N_T$, equilibrium employment is given by[6]

$$N_j = \left(\frac{1}{1-\gamma}\right)^{(1-\gamma)} \left(\frac{1}{\gamma}\right)^{\gamma} \left(\frac{W_T}{P}\right)_j^{-(1-\gamma)(\eta-1)} \left(\frac{W_N}{P}\right)_j^{-\gamma(\eta-1)} \cdot \left(\gamma \left(\frac{W_N}{P}\right)_j^{-1} + (1-\gamma)\left(\frac{W_T}{P}\right)_j^{-1}\right) \tag{7}$$

where as before $j = E, P$ and sector-specific wages are given by evaluating equation (4) for both regimes and sectors. Note that since the wage curve is horizontal, it is the labour demand curve that identifies employment in employment-real wage-space. Due to the complicated functional form, we are not able to derive an explicit ranking of equilibrium employment. But by simulating equilibrium employment we focus on some interesting cases that provide some insight into the predictions of the model.

3.1 *Simulating Equilibrium Employment*

The model has several features that are not crucial to the analysis of the monetary regime, such as the elasticity of labour demand and bargaining power. We can therefore assume $\lambda_N = \lambda_T = \lambda$ without altering the central mechanisms of the model. But since the ranking of sector-specific wages, as given by (5) – (6), indicate that the effects of the regime is quite the opposite for the two sectors, one may suspect that the overall outcome is closely related to which sector is the dominant one, i.e. which sector is larger. In what follows we therefore focus on sector size captured by γ and start by looking at some limiting values. For the extremely open economy, $\gamma \longrightarrow 0$, or the closed economy, $\gamma \rightarrow 1$, aggregate employment is unaffected by the monetary

[6] Recall that the labor force is normalized to one in each sector, so that aggregate equilibrium unemployment is given by $2 - N$.

Table 3: Simulated threshold values of γ^*, non-traded sector size

Parameter	λ	ω	η	γ
	.5	1	1.10	.6178
	.5	1	1.5	.6823
	.5	1	8	.9137
	.9	1	1.10	.6616
	.9	1	1.5	.7245
	.9	1	8	.9296

Notes: γ^* is defined by $N_P(\gamma^*) = N_E(\gamma^*)$ and $N_P(\gamma) > N_E(\gamma)$ $\forall \gamma < \gamma^*$. All simulations were carried out using MATLAB 6.5.

regime[7]. Perhaps this seems surprising at first, but the intuition is simple: When $\gamma \to 0$ an exchange rate target is equivalent to an inflation target since the traded sector then constitutes the entire economy and we get $P = P_T$. In the case when $\gamma \to 1$ there is only one feasible regime since the non-traded sector constitutes the entire economy; $P = P_N$. In both cases, the model collapses.[8]

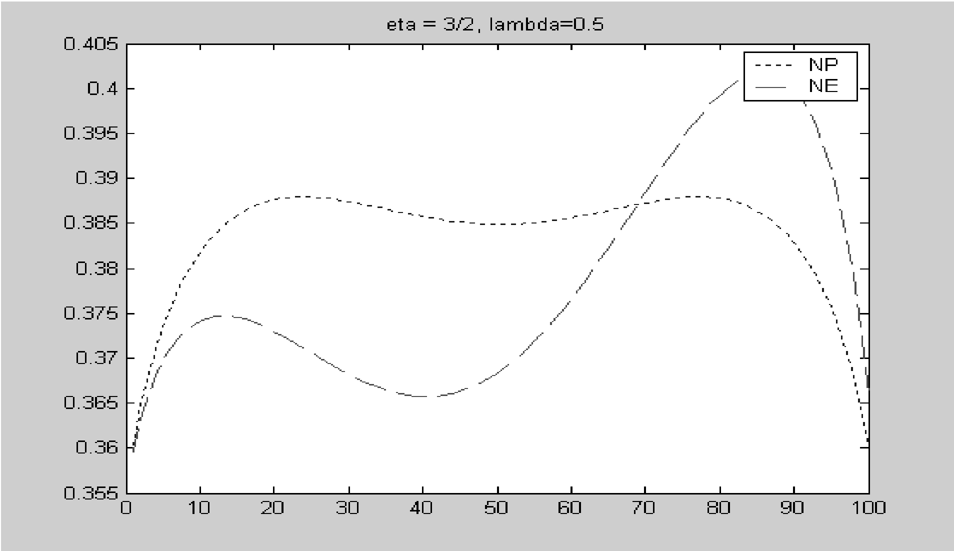
However, turning to the intermediate case where $0 < \gamma < 1$ it is possible to run some numerical simulations. Some results are presented in *Table* 3 and indicate that for plausible values of the labour demand elasticity, relative sector size is crucial for which regime generates higher equilibrium employment.

The importance of the non-traded sector size, or the openness of the economy, for the equilibrium outcome is clearly displayed in *Figure*s 1 and 2, demonstrating how aggregate employment varies non-linearly with γ.

[7] That is, $\lim_{\gamma \to 0} N_p = \lim_{\gamma \to 0} N_E$ and $\lim_{\gamma \to 1} N_p = \lim_{\gamma \to 1} N_E$.

[8] The result is related to proposition 5 in Cukierman & Lippi (1999), saying that at least two unions are required in order for the monetary regime to have an impact on equilibrium employment.

Figure 1: Simulated aggregate employment as a function of openness (γ)



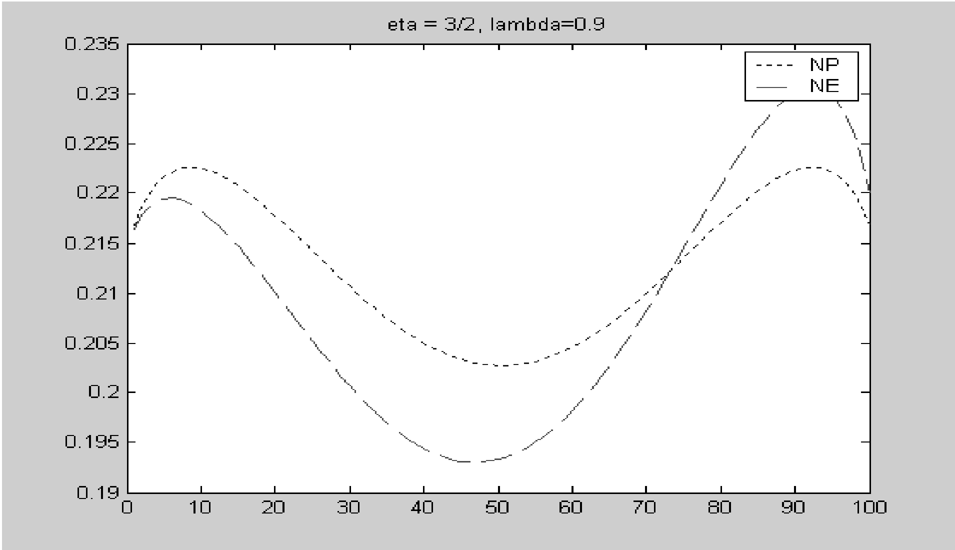
Notes: Openness (γ) is measured in percent on the X-axis.
NP = employment under an inflation target.
NE = employment under an exchange rate target.
Parameter values: $\eta = 3/2, \lambda = .5$.

The main simulation result is that equilibrium employment is generally higher under an inflation target than under an exchange rate target in an economy with a non-traded sector that constitutes less than 60-70 percent of the economy.[9] The result is explained by one or several of three candidate equations: the real wage ranking given by equations (5) and (6), and the employment equation (7). There are mainly two channels through which the sector size affects these equations.

First, the strength of the real wage ranking in (5) and (6) vary with γ, since γ enters into the expressions for the consumer and producer price effects given in *Table 1*.

[9] The results are stronger the more elastic is labor demand ($\eta \to \infty$). Recalling that $\eta = (1-\delta)^{-1}$, constant returns to scale, $\delta \to 1$ implies $\eta \to \infty$ why aggregate employment is higher under inflation targeting than exchange rate targeting under rather general assumptions.

Figure 2: Simulated aggregate employment as a function of openness (γ)

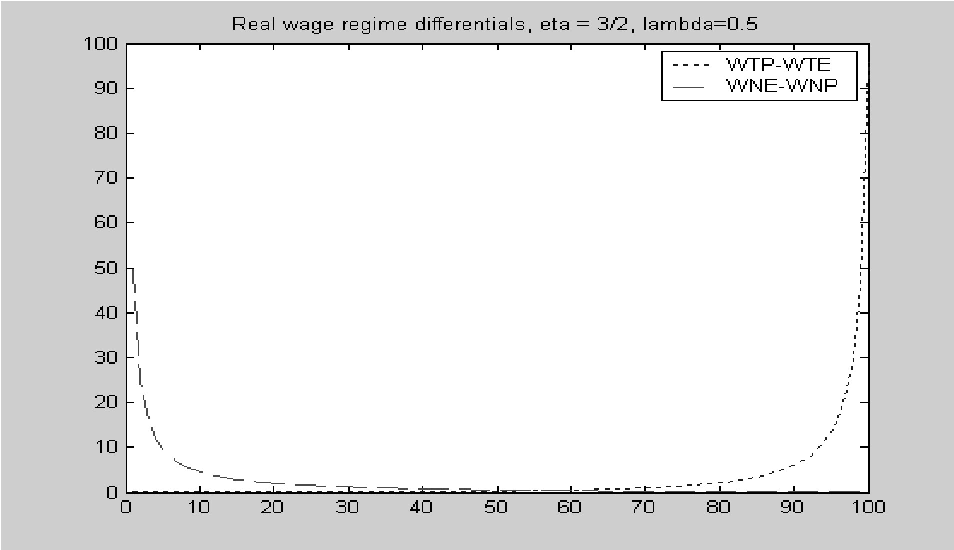


Notes: Openness (γ) is measured in percent on the X-axis.
NP = employment under an inflation target.
NE = employment under an exchange rate target.
Parameter values: $\eta = 3/2, \lambda = .9$.

Second, γ enters directly as a parameter in the complicated functional form of the employment equation. Since γ enters in several of these expressions it is not possible to identify one single reason why employment seems to be higher under inflation targeting than exchange rate targeting for rather low values of γ. We can make an attempt by assessing the relative strength of the real wage ranking in (5) and (6) while varying γ between 0 and 1. The results of this exercise are shown in figures 3 and 4.

The ranking in equations (5) and (6) is valid for all plausible parameter values, more specifically for all $\gamma \in (0, 1)$. However, the strength of the ranking, i.e. the regime differentials $\left(\frac{W_T}{P}\right)_P - \left(\frac{W_T}{P}\right)_E$ and $\left(\frac{W_N}{P}\right)_E - \left(\frac{W_N}{P}\right)_P$ are functions of γ since real wages are functions of the consumer and producer price effects, which in turn are functions of γ. The graphs of the real wage differentials

Figure 3: Simulated real wage regime differentials as a function of openness (γ)



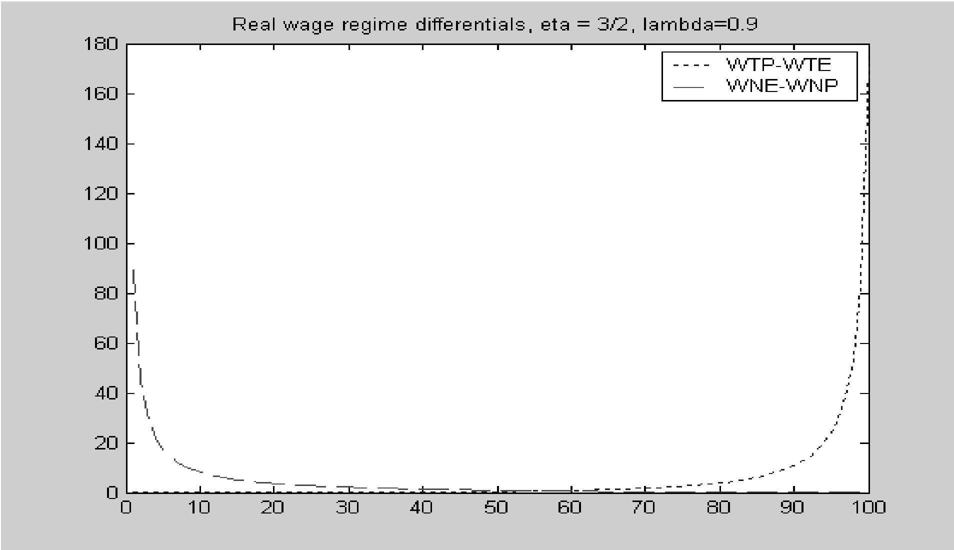
Notes: Openness (γ) is measured in percent on the X-axis.
$WTP - WTE$ = traded sector differential.
$WNE - WNP$ = non-traded sector differential.
Parameter values: $\eta = 3/2, \lambda = .5$.

show that they are larger for extreme values of γ.[10] These results are explained by taking the limits of the producer and consumer price effects in *Table 1* as $\gamma \to 0$ and $\gamma \to 1$, respectively and by evaluating their effects on wage formation summarized in *Table 2*.

Perhaps more interestingly, we note that for the calculated threshold values γ^*, given by the intersection of the graphs in Figures 3 and 4, the real wage differentials are very small. It therefore seems likely that the main simulation results are driven by the functional form of the employment equation rather than the regime-specific wage differentials.

[10] Formally, we note that $\lim_{\gamma\to0}\left(\frac{W_T}{P}\right)_P - \left(\frac{W_T}{P}\right)_E = 0, \lim_{\gamma\to1}\left(\frac{W_T}{P}\right)_P - \left(\frac{W_T}{P}\right)_E = \infty$ while the reverse is true for non-traded real wage differentials, i.e. $\lim_{\gamma\to0}\left(\frac{W_N}{P}\right)_E - \left(\frac{W_N}{P}\right)_P = \infty$ and $\lim_{\gamma\to1}\left(\frac{W_N}{P}\right)_E - \left(\frac{W_N}{P}\right)_P = 0$.

Figure 4: Simulated real wage regime differentials as a function of openness (γ)



Notes: Openness (γ) is measured in percent on the X-axis.
$WTP - WTE$ = traded sector differential.
$WNE - WNP$ = non-traded sector differential.
Parameter values: $\eta = 3/2, \lambda = .9$.

To sum up, the simulation results indicate that under rather general assumptions inflation targeting produces higher employment than exchange rate targeting. However, we need actual data to be able to say something about the real world and in the following sections we perform an empirical analysis.

4 Empirical Analysis

To empirically assess the importance of the monetary regime for wages and (un)employment, we use panel data on 17 OECD countries from the period 1972-2000.[11] We focus on countries that have combined inflation targets (denoted IT) with floating exchange rates. The countries included in the study are Aus-

[11] Data description and definitions are given in the appendix.

Table 4: Countries included in the study

Country	*Average N-sector size*	*Regime* [a]	*Date for Announcement of IT* [b]	*Actual Regime Switch* [c]
Australia	.24	*IT*	1993	1994
Belgium	.29			
Canada	.28	*IT*	1991	1994
Denmark	.33			
Finland	.30	*(IT)*	1993	1994
France	.28			
Germany	.26			
Ireland	.23			
Italy	.25			
Japan	.21			
Netherlands	.33			
New Zeeland	.23	*IT*	1990	1993
Norway	.29			
Spain	.20	*(IT)*	1995	1996
Sweden	.33	*IT*	1993	1995
UK	.26	*IT*	1992	1993
US	.21			

Notes: Countries excluded due to lack of data: Austria, Greece, Hungary, Iceland, Korea, Luxembourg, Portugal, Switzerland, Turkey.
[a] IT = Inflation Targeting.
[b] Source: Cottarelli & Giannini (1997).
[c] Source: Ball & Sheridan (2003), *Table* 1. Actual regime switch refers to the date constant inflation targeting was introduced in the country at hand.

tralia, Canada, New Zeeland, Sweden and the United Kingdom, thus excluding Finland and Spain having combined inflation targets with membership in the EMU. *Table 4* lists the countries in the study together with the years they switched regimes. We use two different approaches in testing for the impact of inflation targeting on labour markets. First, a very simple difference-in-differences approach, and second, a full-scale dynamic panel framework. Results are presented in Section 5.

4.1 *A First Simple Test of the Impact of Inflation Targeting*

When trying to evaluate the impact of a regime switch on a variable, it is important to exercise some caution. It may be the case that countries that adopt inflation targeting have different characteristics than countries not adopting inflation targets and vice versa. It may therefore be hard to determine whether it is in fact inflation targeting that has changed the situation for targeting economies, or if there are some other factors that cause such a development. For instance, it is hardly surprising that an economy with hyperinflation has a flatter growth path of inflation once an inflation target is introduced, while the opposite may be true for low inflation economies.

We avoid this problem by applying the difference-in-differences technique used by Ball and Sheridan (2003). The idea is to control for regression to the mean by adding initial values to cross section regressions of mean values of our key variables, calculated before and after the introduction of inflation targeting.

Suppose we are interested in evaluating the effect of inflation targeting on a variable Y. Denote by T_i the point in time in country i when the country introduced inflation targeting. For non-targeters, we choose these breakpoints to be the same for all countries in the group and given by the average year among targeters. We then define

$$IT_i = \begin{cases} 1 \text{ if country } i \text{ is an inflation targeter} \\ 0 \text{ otherwise} \end{cases}$$

Suppose data ranges over the period $[T_0, T]$. We then calculate the following measures for all countries

$$\bar{Y}_i^{pre} = \frac{1}{(T_i - T_0)} \sum_{t=T_0}^{T_i} Y_{i,t}$$

$$\bar{Y}_i^{post} = \frac{1}{(T - (T_i + 1))} \sum_{t=T_i+1}^{T} Y_{i,t}$$

for $i = 1, ...I$. We then run the following regressions

$$\bar{Y}_i^{post} - \bar{Y}_i^{pre} = \tau + \kappa IT_i + \zeta \bar{Y}_i^{pre} + \epsilon_i \quad (8)$$

for $i = 1, ...I$. Including $\bar{Y}_i^{pre}$ ensures that we avoid regression to the mean, i.e. κ, if significant, captures a true effect of targeting.[12]

Although the above method is appealing in its simplicity, it has several drawbacks. First, the collapse of the panel to a cross-section implies that we are forced to estimate over very few observations. Second, we would like to allow for a richer specification in testing the predictions of the model, and this calls for a more sophisticated method. Consequently, we proceed by an attempt to turn the theoretical model into an econometric specification, accounting for possible effects of inflation targeting.

4.2 *Taking the Model to the Data*

An important feature of the theoretical model is the fact that the two sectors are affected differently by the monetary regime. In testing the implications of the model one should optimally use sectorial data on all variables suggested by the model. However, due to data unavailability, we can only partly meet this requirement by using sectorial data on wages, but aggregate data on the other variables. The empirical analysis thus hinges on the

[12] A sketchy proof is given by Ball and Sheridan (2003).

assumption that for instance bargaining power is equal across sectors.

Recall the main prediction by the theoretical model as given by equations (5) and (6): The traded sector real wage is higher under an inflation target than under an exchange rate target while the non-traded sector real wage is lower under an inflation target than under an exchange rate target. In an attempt to test the empirical validity of this result, we start by estimating real wage equations for the traded and non-traded sectors.

The bargained real wage in sector i as given by equation (4) is a function of bargaining power (λ_i) and the regime-specific price elasticities, i.e the consumer price effect (ϵ_{ij}) and the producer price effect (φ_{ij}). Empirically, we summarize these mechanisms by estimating the following function

$$WiP = f(UNION, \Delta \log CPI, \Delta \log PPI, u, RHO) \qquad (9)$$

where WiP is the empirical counterpart to the theoretical real wage in sector i, $UNION$ is the empirical counterpart to bargaining power, and $\Delta \log CPI$ and $\Delta \log PPI$ are the consumer and the producer price effects respectively. Two additional variables, frequently used in the literature, are added *ad hoc* to the econometric model: The unemployment rate (u), presumably affecting the bargaining power of the worker and the unemployment benefit (RHO), presumably affecting the value of being unemployed.[13]

Note that although we have theoretical predictions for how bargaining power and the consumer and producer price effects affect the real wage in general, according to equation (4), the elasticities of the real wages with respect to these variables are

[13] In our theoretical model we assume that unions bear the costs of their own unemployment, by letting the workers finance the members that are rendered unemployed. Therefore, the unemployment benefit does not show up in the wage equation.

not regime-specific. Specifically, we expect $f_1 > 0, f_2 < 0, f_3 > 0$ and that these effects are equally strong regardless of regime. What we do have is theoretical predictions for equilibrium values of the consumer and producer price effects under different monetary regimes. However, we do not have any theoretical predictions for how an arbitrary incremental change in the consumer and producer price effects affects the real wage under different monetary regimes. Consequently, we include these arguments in (9) merely as controls, and focus on possible effects of the monetary regime captured by dummy variables. For the *ad hoc* variables, the conventional priors in the literature are $f_4 < 0$ and $f_5 > 0$, respectively.

We also estimate unemployment equations based on (7), assuming that the labour force is constant. Our simulation results suggest that unemployment should be lower under inflation targeting provided that the non-traded sector constitutes less than 60-70 percent of the economy. Actual data, presented in *Table 2*, suggests that the size of the non-traded sectors of the countries in the study is approximately 27 percent on average. We therefore expect unemployment levels to fall when inflation targeting is introduced. Since real wages are endogenously determined in the model, we estimate reduced form equivalents to the unemployment equation suggested by (7). The unemployment equation can be described by the following function

$$u = g(\gamma, UNION, \Delta \log CPI, \Delta \log PPI, RHO) \qquad (10)$$

where we again include the unemployment benefit as an *ad hoc* determinant. Following the discussion above, we have no priors for the signs of these effects. We focus on the effect of inflation targeting as captured by dummy variables and pay little attention to the explanatory variables suggested by the above function.

4.3 *Econometric Method*

Having established which variables should be included in the empirical study, we need to determine how to isolate the effect of the monetary regime on wages and unemployment. Suppose we are interested in estimating the model

$$Y_{it} = \sum_j \alpha_j X_{ijt} + \epsilon_{it} \tag{11}$$

where we have longitudinal data on $j = 1, ..., J$ independent variables, $i = 1, ..., I$ countries over the period $t = 1, ..., T$. We are interested in assessing the impact of inflation targeting on the estimated relationship, and define

$$IT_{it} = \begin{cases} 1 \text{ if country } i \text{ has an inflation target at time } t \\ 0 \text{ otherwise} \end{cases}$$

We then estimate the following model

$$Y_{it} = \sum_j \alpha_j X_{ijt} + IT_{it} * \sum_j \beta_j X_{ijt} + \mu IT_{it} + \epsilon_{it} \tag{12}$$

where $i = 1, ..., I$, i.e. we interact the inflation target with the explanatory variables and estimate the model on all countries in the sample. Suppose for simplicity that all variables are in logs. The interpretation of β_j is that countries that at some point have introduced an inflation target have an elasticity of Y with respect to X that is on average β_j per cent higher than a country without an inflation target. Moreover they have a value of Y that is on average μ per cent higher than non-inflation targeting countries.

In order to verify that it is the introduction of the inflation target rather than the properties of the specific economies that causes a potential difference between inflation targeting economies and economies without inflation targets, we next focus on countries that have implemented inflation targets. Denote the number of countries that have adopted and implemented inflation targets by I_{IT}. We then run the following regression

$$Y_{it} = \sum_j \theta_j X_{ijt} + IT_{it} * \sum_j \xi_j X_{ijt} + \nu IT_{it} + \epsilon_{it} \qquad (13)$$

for $i = 1, ..., I_{IT}$, i.e. for inflation targeting countries only. As in the previous model, interacting all variables with the IT-dummy allows for the impact of the independent variables on the dependent variable being regime-specific. Although we have no theoretical predictions for how the regime should alter the elasticities in the models, we prefer to start from a rich specification in order to avoid imposing possibly false constraints on the data.

The estimated coefficient of the IT-dummy, $\hat{\upsilon}$, now captures a possible structural break at the time the target was implemented. Provided that $E(\epsilon_{it}) = 0$, we obtain

$$\begin{aligned} E(Y_{it}|IT_{it} &= 0) = \sum_j \theta_j X_{ijt} \\ E(Y_{it}|IT_{it} &= 1) = \nu + \sum_j (\theta_j + \xi_j) X_{ijt} \end{aligned}$$

To test the hypothesis that there is a structural break at the time the inflation target was introduced, we look for significant estimates of ν and the $\xi_j : s$. A significant estimate of ν indicates that the introduction of an inflation target has shifted the level of Y by μ percent on average, an effect that is indeed due to the introduction of inflation targeting. Hence, by this two-step procedure, we avoid the problem of regression to the mean (compare the discussion above).

Finally note that the model provides theoretical predictions about levels in wages and unemployment, but offers no insight into growth rates. We can therefore not take into account non-stationarities that are likely to be present in some of the data by estimating first differences when testing the theoretical model. Lags of variables are used when we think they affect future wage formation and unemployment. In order to reduce possible auto-correlation we add a lag of the dependent variables to the independent variables. We estimate fixed effects models, controlling for the overall evolution of the world economy by adding year dummies.

5 Empirical Results

5.1 *The Difference-in-differences Approach*

The results from estimating equation (8) based on the difference-in-differences approach described above are given in *Table 5.* Throughout we perform some sensitivity analysis by using a long period (starting 1972) and a short period (starting 1985) when calculating the average values prior to the inflation target, i.e. the values referred to as initial values in the tables.

In order to test the method, we first investigate whether inflation rates have decreased in countries that have introduced inflation targets. Contrary to Ball and Sheridan (2003), the results in columns (1) and (2) indicate that inflation rates decrease when inflation targets are introduced and implemented.

Turning to the implications of the theoretical model, we next investigate whether the sectorial real wage ranking according to equations (5) and (6) is confirmed by the data. The results in columns (3)-(6) imply that the inflation target has no significant effects on real wages. In addition, the estimations in columns (7) and (8) indicate that unemployment rates are unaffected by the inflation target. Hence, this simple test indicates that important labour market variables are unaffected by inflation targeting.

Table 5: Difference-in-differences estimations, implementation dates

Dependent variable	$\Delta\pi$	$\Delta\pi$	ΔRWT	ΔRWT	ΔRWN	ΔRWN	Δu	Δu
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample	long	short	long	short	long	short	long	short
c	.007	.014**	.073*	.054**	.023	.078*	2.979*	2.752**
	(.004)	(.003)	(.036)	(.025)	(.043)	(.043)	(1.439)	(1.196)
IT	-.007*	-.008*	-.074	-.054	-.033	-.079	.038	.243
	(.003)	(.004)	(.068)	(.047)	(.083)	(.082)	(1.427)	(1.249)
Initial	-.808**	-.835**	.196**	.057**	.282**	.061**	-.113	-.304**
value	(.053)	(.065)	(.009)	(.006)	(.006)	(.004)	(.221)	(.136)
R^2_{adj}	.933	.920	.963	.856	.992	.899	-.100	.144
$F-value$	132.87	110.31	245.27	57.44	1204.61	85.59	.877	2.59

Notes: Dependent variable defined as $\Delta Y = Y^{post} - Y^{pre}$.
IT refers to the year the inflation target was implemented.
Inflation π is defined as $\pi = d\log CPI$.
White Heteroscedasticity-Consistent standard errors in parenthesis.
Significance codes: ***=1%, **=5%, *=10%.

Following Ball and Sheridan, we distinguish between the date the target was announced and the date it was implemented (compare *Table 4),* and re-run all regressions using announcement dates instead of implementation dates (as in *Table 5).* As shown in *Table A1* in the Appendix, the main result is robust to this modification, i.e. wages and unemployment are unaffected by the inflation target.

5.2 *The Wage Equations*

We next turn to the results from estimating the real wage equations implied by the theoretical model.

Table 6 reports the estimates of the traded sector real wage equation, equation (9), along with interaction terms for inflation

Table 6 : Estimations of traded-sector real wage equations 1972-2000. Dependent Variable: $\log RWT$*, fixed effects*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All	All	IT	IT	All	All	IT	IT
$\log RWT_{-1}$	.931***	.932***	.880***	.901***	.932***	.934***	.838***	.886***
	(.008)	(.008)	(.038)	.030	(.017)	(.016)	(.056)	(.042)
$UNION_{-1}$	-.095	-.042	.120	.134	.109	.099	-.270	.326
	(.224)	(.208)	(.579)	(.355)	(.217)	(.199)	(.805)	(.394)
$d\log CPI_{-1}$	-.445***	-.449***	-.523**	-.538**	-.370***	-.366***	-.739**	-.653**
	(.107)	(.105)	(.256)	(.236)	(.120)	(.116)	(.320)	(.292)
$d\log PPI_{-1}$	.251**	.253**	.340*	.343*	.289***	.288***	.579**	.545***
	(.103)	(.101)	(.198)	(.179)	(.096)	(.093)	(.229)	(.203)
u_{-1}	-.003***	-.003***	-.004***	-.004***	-.002***	-.002***	-.004*	-.003*
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.002)	(.002)
$\log RHO_{-1}$	.000	.000	-.002	-.004	-.001	-.001	-.002	-.007
	(.002)	(.002)	(.014)	(.013)	(.002)	(.002)	(.015)	(.014)
IT	.160	.008*	.257	.017**	.091	.009*	-.170	.007
	(.137)	(.005)	(.172)	(.007)	(.143)	(.005)	(.295)	(.010)
$IT \cdot \log RWT_{-1}$	.014	.	.015	.	.006	.	-.023	.
	(.018)	.	(.018)	.	(.019)	.	(.024)	.
$IT \cdot UNION_{-1}$	-.331	.	-.330	.	-.171	.	1.469	.
	(.750)	.	(.824)	.	(.810)	.	(1.205)	.
$IT \cdot d\log CPI_{-1}$	.177	.	.128	.	.163	.	.389	.
	(.469)	.	(.557)	.	(.485)	.	(.617)	.
$IT \cdot d\log PPI_{-1}$	.072	.	.003	.	.175	.	.032	.
	(.370)	.	(.425)	.	(.422)	.	(.544)	.
$IT \cdot u_{-1}$	-.003	.	-.003	.	-.002	.	.004	.
	(.003)	.	(.004)	.	(.003)	.	(.006)	.
$IT \cdot \log RHO_{-1}$	-.019	.	-.044	.	-.011	.	-.016	.
	(.027)	.	(.034)	.	(.026)	.	(.041)	.
Year dummies	No	No	No	No	Yes	Yes	Yes	Yes
Durbin's h	.067	.120**	-.048	-.035	.057	.060	-.066	–.039
	(.061)	(.056)	(.134)	(.125)	(.061)	(.061)	(.146)	(.139)
R^2_{adj}	.999	.999	.999	.999	.999	.999	.999	.999
T	29	29	29	29	29	29	29	29
N	17	17	5	5	17	17	5	5

Notes: White Heteroscedasticity-Consistent standard errors in parenthesis. Significance codes: ***=1%, **=5%, *=10%.

targeting (IT) under the assumption of fixed country-specific effects. The estimates in column (1) show a strong autoregressive coefficient, indicating high real wage persistence. The estimate of the consumer-price-effect ($d\log CPI_{-1}$), the producer-price effect ($d \log PPI_{-1}$) and the unemployment rate (u_{-1}) all display expected signs and are statistically significant at conventional levels whereas this is not true for union density ($UNION_{-1}$) and unemployment benefits (RHO_{-1}). In column (2) we isolate the effect of the inflation target, removing the insignificant interaction terms. The results show that inflation targeters on average have higher real wages in the traded sector than non-targeters. In order to determine whether this is a true effect of targeting, we estimate over IT-countries only, which yields the estimates in columns (3) and (4). When reducing the model and focusing on the IT-dummy in isolation in column (4), we see that inflation targeting indeed causes higher real wages in the traded sector. This is consistent with our theoretical model, and evidence that inflation targeting matters for wage formation. However, including year dummies in columns (5)-(8) indicates that traded sector real wages are higher in IT-countries, but that this effect is not due to inflation targeting.

Table 7 reports results from estimating non-traded sector real wage equations. Unlike in *Table 6*, the strategic explanatory variables such as the consumer and producer effects have the expected signs, but on low levels of significance. Contrary to the results for the traded sector in *Table 6*, the estimate of the IT-dummy in column (2) shows that the real wage tends to be lower in the non-traded sector in IT-countries. However, the insignificant estimate of the coefficient for the IT-dummy in column (4), suggests that non-traded real wage levels are unaffected by the introduction of inflation targeting. Hence, the fact that non-traded real wages are lower in IT-countries, is due to other factors than the introduction of inflation targeting. The main results do not change when year dummies are included in columns (5)-(8).

Table 7 : Estimations of non traded-sector real wage equations 1972-2000. Dependent Variable: $\log RWN$, *fixed effects*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All	All	IT	IT	All	All	IT	IT
$\log RWN_{-1}$	.939***	.932***	.926***	.890***	.919***	.906***	.928***	.916***
	(.013)	(.013)	(.031)	(.035)	(.018)	(.019)	(.042)	(.043)
$UNION_{-1}$	-.754**	-.453	-1.916**	-.780	-.536	-.371**	-2.403*	-.650
	(.351)	(.290)	(.878)	(.487)	(.340)	(.276)	(1.243)	(.499)
$d\log CPI_{-1}$	-.221	-.262*	-.234	-.357	-.109	-.143	-.154	-.211
	(.138)	(.136)	(.287)	(.265)	(.151)	(.147)	(.359)	(.335)
$d\log PPI_{-1}$	.122	.142	.253	.356*	.191	.213	.432	.517*
	(.143)	(.141)	(.229)	(.206)	(.136)	(.133)	(.300)	(.279)
u_{-1}	-.001	-.001	-.002	.001	-.001	-.001	.001	.004*
	(.001)	(.001)	(.002)	(.001)	(.001)	(.001)	(.003)	(.002)
$\log RHO_{-1}$	-.001	-.001	.015	.012	-.003	-.003	.025	.024
	(.004)	(.004)	(.013)	(.012)	(.004)	(.004)	(.018)	(.016)
IT	-.164	-.015*	-.321	-.008	-.071	-.020**	-.685	-.008
	(.258)	(.008)	(.311)	(.010)	(.267)	(.008)	(.453)	(.022)
$IT \cdot \log RWN_{-1}$	.012	.	.315	.	.017	.	-.014	.
	(.018)	.	(.225)	.	(.020)	.	(.028)	.
$IT \cdot UNION_{-1}$	.171	.	1.023	.	-.183	.	1.473	.
	(.694)	.	(1.000)	.	(.742)	.	(1.314)	.
$IT \cdot d\log CPI_{-1}$	.295	.	.306	.	.254	.	1.054	.
	(.983)	.	(1.053)	.	(1.036)	.	(1.125)	.
$IT \cdot d\log PPI_{-1}$	.297	.	.084	.	.348	.	.366	.
	(.880)	.	(.936)	.	(.909)	.	(1.087)	.
$IT \cdot u_{-1}$	-.006*	.	-.003	.	-.005	.	.006	.
	(.004)	.	(.004)	.	(.004)	.	(.008)	.
$IT \cdot \log RHO_{-1}$	.069	.	.086	.	.047	.	.135	.
	(.056)	.	(.061)	.	(.057)	.	(.078)	.
Year dummies	No	No	No	No	Yes	Yes	Yes	Yes
Durbin's h	.117*	.142**	-.021	.064	.159***	.184***	.066	.088
	(.061)	(.060)	(.103)	(.100)	(.063)	(.062)	(.153)	(.140)
R^2_{adj}	.999	.999	.999	.999	.999	.999	.999	.999
T	29	29	29	29	29	29	29	29
N	17	17	5	5	17	17	5	5

Notes: White Heteroscedasticity-Consistent standard errors in parenthesis. Significance codes: ***=1%, **=5%, *=10%.

A natural step is then to investigate whether or not the monetary regime matters for unemployment. Recall that the simulation results show that unemployment levels are likely to be lower under inflation targeting than under exchange rate targeting.

Table 8 : Estimations of reduced-form unemployment growth equations 1972-2000. Dependent Variable: du, fixed effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All	All	IT	IT	All	All	IT	IT
du_{-1}	.373***	.362***	.394***	.336***	.337***	.327***	.270*	.262**
	(.064)	(.061)	(.144)	(.114)	(.058)	(.056)	(.151)	(.117)
$d\gamma_{-1}$	64.988***	65.550***	13.728	22.401	55.285***	55.124***	-14.167	1.507
	(12.166)	(11.603)	(24.150)	(19.265)	(10.550)	(10.118)	(18.623)	(16.481)
$dUNION_{-1}$	.016	.025	-.021	.009	.041	.053**	.155**	.096**
	(.038)	(.030)	(.084)	(.041)	(.036)	(.030)	(.076)	(.048)
$d\log CPI_{-1}$	12.395***	11.850***	11.156**	9.556*	4.321	3.988	-.224	-1.236
	(3.745)	(3.637)	(5.587)	(5.083)	(3.500)	(3.391)	(5.737)	(5.254)
$d\log PPI_{-1}$	-7.358**	-7.023**	-3.550	-3.193	-4.539	-4.402	5.050	4.811
	(3.207)	(3.140)	(3.678)	(3.445)	(2.791)	(2.718)	(3.888)	(3.571)
$d\log RHO_{-1}$	-.083	-.104	-.824	-1.078	-.245	-.249	-1.248	-1.393*
	(.282)	(.280)	(.706)	(.652)	(.225)	(.231)	(.847)	(.769)
IT	-.436***	-.375**	-.487***	-.593***	-.115	.050	-.656	-.531
	(.165)	(.150)	(.168)	(.168)	(.199)	(.166)	(.759)	(.550)
$IT \cdot du_{-1}$	-.234**	.	-.241	.	-.332**	.	-.175	.
	(.115)	.	(.173)	.	(.145)	.	(.224)	.
$IT \cdot d\gamma_{-1}$	-5.898	.	41.849	.	-33.838	.	19.088	.
	(23.651)	.	(31.872)	.	(28.565)	.	(31.855)	.
$IT \cdot dUNION_{-1}$	.075	.	.101	.	.080	.	-.062	.
	(.054)	.	(.095)	.	(.064)	.	(.093)	.
$IT \cdot d\log CPI_{-1}$	-19.543**	.	-17.521	.	-10.709	.	-20.741	.
	(9.383)	.	(10.839)	.	(10.870)	.	(14.201)	.
$IT \cdot d\log PPP_{-1}$	10.804	.	6.683	.	-2.004	.	-6.876	.
	(8.963)	.	(9.319)	.	(10.493)	.	(9.669)	.
$IT \cdot d\log RHO_{-1}$	-5.697*	.	-4.615	.	-8.361**	.	-5.640	.
	(2.990)	.	(3.127)	.	(3.616)	.	(3.537)	.
Year dummies	No	No	No	No	Yes	Yes	Yes	Yes
Durbin's h	.038	.093	.290*	.265	.145	.182	.242	.227
	(.100)	(.064)	(.169)	(.177)	(.118)	(.118)	(.197)	(.221)
R^2_{adj}	.336	.340	.244	.260	.491	.492	.520	.525
T	29	29	29	29	29	29	29	29
N	17	17	5	5	17	17	5	5

Notes: White Heteroscedasticity-Consistent standard errors in parenthesis. Significance codes: ***=1%, **=5%, *=10%.

However, due to severe non-stationarities in the unemployment series, estimating unemployment equations in levels might reflect spurious correlations rather than genuine relationships. We have therefore chosen to estimate unemployment equations in terms of first differences, using the explanatory variables suggested by theory. Estimating such equations indicate how the unemployment growth rate is affected by the monetary regime. However, this is an effect for which we have no theoretical predictions and the models should not be seen as tests of the theory.[14]

[14] In fact we made an attempt at estimating unemployment equations in

According to theory, the regime may cause shifts in unemployment levels, and such shifts are not captured in these equations. The results from estimating reduced-form unemployment growth equations are given in *Table 8*. The models in columns (1) and (2) show that IT-countries have lower unemployment growth rates than other countries, and the estimates in columns (3) and (4) suggest that these features are indeed due to inflation targeting. However, these effects vanish when controlling for aggregate effects by including year dummies in columns (5)-(8).

In sum, there is weak empirical evidence for some of the theoretical predictions of the model. Traded-sector real wages are higher under inflation targeting. We identify this effect as being due to targeting and not to common characteristics of targeting economies. These effects vanish when year dummies are included. There is no support for the corresponding ranking of non-traded sector real wages. The unemployment equation should not be seen as a test of the theory, but lends some support to unemployment growth rates being lower under inflation targeting.

One should be aware that the dynamic panel approach generating the results in Tables 6 and 7 is not without problems. First, we note the suspiciously high goodness of fit. The R^2-adjusted of .99 leads us to suspect that there may be trends present in the data, and that these trends may account for the results. Therefore, at first glance it seems like a good idea to use de-trended data. Unfortunately, de-trending the data implies removing structural shifts that may be due to the inflation target.[15] Since the aim of the analysis is to test for possible ef-

levels, but the results were uninterpretable and plagued by heavy autocorrelation.

[15] Suppose there is a positive shift in levels caused by the inflation target. Removing a trend in such a graph means removing a steeper trend than the

fects of inflation targeting, de-trending is an inappropriate procedure.

Second, the OLS-estimates might be biased and inconsistent when including an autoregressive component. On one hand, dropping the lagged dependent variable generates severe autocorrelation. The suggested remedy is to use GMM when estimating dynamic panels, but since we have very few cross-sectional observations, in particular when estimating over inflation targeting countries only, GMM estimation is not an option. On the other hand, the bias in the OLS-estimates tends to zero as T tends to infinity, why the bias in our sample of 29 years, is likely to be small.

Third, the high estimate of the autoregressive component implies that it would be favorable to estimate first differences of the dependent variable. But since we only have theoretical predictions for levels of the variables, first difference estimation is not an option when testing the theory.

Fourth, an obvious limitation is that we only to some extent can use sectorial data when estimating the model. Until better sectorial data is available, we conclude that the results should be interpreted with caution. In sum, the results presented in this paper suggests that inflation targeting might matter for labour markets.

6 Concluding Remarks

This paper analyses whether or not inflation targeting matters for the labour market outcome. The analysis is based on simulation results and panel data regressions on 17 OECD-countries of which five countries have combined an explicit inflation target with floating exchange rates during the 1990s. The main

actual trend, i.e. the trend subject to a positive parallell shift at the time the inflation target is introduced.

conclusion of the paper is that inflation targeting might matter for labour markets.

The simulation results suggest that under rather general assumptions inflation targeting produces lower unemployment (or higher employment) than exchange rate targeting. The size of the non-traded sector, i.e. the degree of openness of the economy, is crucial to which regime generates higher equilibrium un(employment).

Consistent with the theoretical model, there is some empirical evidence that traded sector real wages are higher under inflation targeting while non-traded sector real wages are unaffected by inflation targeting. Finally we find some evidence that the unemployment growth path is flatter in countries that have introduced inflation targeting, an effect that is indeed due to the monetary regime.

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Appendix

Data are from the OECD. Data on unemployment benefits and trade union density are from the OECD database *Labour Market Statistics.* All other data are from OECD *Economic Outlook, No. 70.*

u_t :	Unemployment rate.
CPI_t :	Consumer price index
PPI_t :	The GDP-deflator
γ_t :	Non-traded sector size. Government consumption as a share of total consumption
$UNION_t$:	Trade union density rates
RHO_t :	Index of gross unemployment benefit rates
RWT_t :	Real traded-sector consumer wage, hourly wage rate deflated by consumer prices
RWN_t :	Real non-traded-sector consumer wage, hourly wage rate deflated by consumer prices

Table A1: Difference-in-differences estimations, announcement dates

Dependent variable	$\Delta\pi$	$\Delta\pi$	ΔRWT	ΔRWT	ΔRWN	ΔRWN	Δu	Δu
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample	long	short	long	short	long	short	long	short
c	.007*	.015**	.069*	.050**	.018	.073*	2.818*	2.604**
	(.004)	(.003)	(.034)	(.023)	(.041)	(.040)	(1.453)	(1.198)
IT	-.005	-.007	-.071	-.051	-.029	-.075	.360	.574
	(.003)	(.004)	(.065)	(.044)	(.079)	(.078)	(1.442)	(1.251)
Initial	-.792**	-.811**	.198**	.060**	.284**	.062**	-.055	-.262*
value	(.049)	(.062)	(.009)	(.005)	(.006)	(.005)	(.223)	(.136)
R^2_{adj}	.937	.922	.967	.882	.993	.914	-.109	.102
$F-value$	142.55	113.70	276.04	72.22	1358.72	101.36	.067	2.08

Notes: Dependent variable defined as $\Delta Y = Y^{post} - Y^{pre}$.

IT refers to the year the inflation target was implemented.

Inflation π is defined as $\pi = d\log CPI$.

White Heteroscedasticity-Consistent standard errors in parenthesis.

Significance codes: ***=1%, **=5%, *=10%.

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