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**Working Paper**

## Inflation Targeting Is a Success, So Far: 100 Years of Evidence from Swedish Wage Contracts

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## **Inflation Targeting Is a Success, So Far: 100 Years of Evidence from Swedish Wage Contracts**

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### **Abstract:**

Inflation targeting was adopted by several countries, including Sweden, in the 1990s. We evaluate the Swedish inflation targeting regime since 1995 using a novel approach based on a unique data set on the characteristics of collective wage agreements between 1908 and 2008. First, we establish that the length of wage contracts decreases in response to an increase in “macroeconomic uncertainty” across policy regimes. Second, using contract length as the assessment criteria for regime performance, we find that the inflation targeting regime of 1995–2008 stands out as an exceptionally stable policy regime as judged by the willingness of wage contract-makers to repeatedly commit to three-year non-indexed wage agreements. In addition, inflation targeting gained instant credibility in the sense that the labor market organizations entered long-term wage agreements at the same time as this new regime was announced. Inflation targeting has thus reduced macroeconomic uncertainty compared to previous regimes adopted in Sweden during the 20<sup>th</sup> century. Our approach to evaluate inflation targeting is different from the traditional one commonly based on cross-section samples comparing inflation outcomes. Instead we focus on the actual decisions of private-sector wage setters under different monetary regimes. Judging from their behavior across a century of observations, inflation targeting in Sweden is a success – at least so far.

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*Keywords: Inflation targeting, policy regime, contract length, wage indexation, Lucas critique, Sweden, credibility*

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# 1. Introduction

Inflation targeting has recently emerged as a promising framework for monetary policy. It has been adopted, explicitly or implicitly, by a number of central banks worldwide. However, solid evaluations of the performance of inflation targeting compared to alternative monetary regimes are few and contradictory. One reason is the relative short existence of inflation targeting. Another reason, and a major one, is the lack of detailed information on how inflation targeting has impacted on the behavior of wage- and price-setters compared to the impact of alternative monetary policy frameworks in history.

In this study we develop a novel assessment of inflation targeting. We study changes in the length of collective wage agreements in Sweden between 1908 and 2008 to evaluate a variety of policy regimes, including the inflation targeting regime officially in force since the mid-1990s. We use the willingness by private sector agents to commit to long nominal contracts as our assessment criteria for regime performance. In short, a credible commitment to nominal stability on the part of policy makers should be reflected in the behavior of the private sector.

We use a uniquely long and consistent series of the length of new collective wage agreements, which covers the whole industrial sector in Sweden between 1908 and 2007. Such a long series, not available for any other country as far as we know, enables us to analyze the evolution of contract-makers' perception of a variety of policy regimes and in particular to evaluate the current inflation-targeting regime in a secular perspective.

A policy regime is often defined as an equilibrium condition such that agents' decision and expectation rules are consistent with the prevailing policy rule.<sup>1</sup> To our knowledge, existing evaluations of historical policy regimes have used only macroeconomic outcomes and assumed that the agents' decision and expectation rules have been stable during periods within a constant policy regime.

Wage contract length is a direct measure of the design of a decision rule, namely the decision rule for setting wages during the contract period. Shorter contracts imply faster revisions of wages to shocks. We find that length has seldom been constant within policy regimes periods and hence we question the assumption that history can be divided into stable regimes according to policy rules.

A clear exception emerges in our data: the current inflation targeting regime displays long, three-year, non-indexed wage contracts since its beginning. The stability and almost immediate credibility of this regime makes it a success in an historical perspective.

We thus conclude that the inflation targeting regime 1995-2008 stands out as an exceptionally stable policy regime as judged by the willingness of wage contract-makers to repeatedly commit to three-year non-indexed wage agreements. So far, inflation targeting appears to be a success by reducing macroeconomic uncertainty compared to previous regimes adopted in Sweden including the gold standard before and after World War I, the price level targeting of the 1930s, the Bretton Woods period of fixed exchange rates and the full employment standard in the 1970s and 1980s.

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<sup>1</sup> See Leijonhufvud (1983) and Bordo and Schwartz (1999, p. 152) and the references therein.

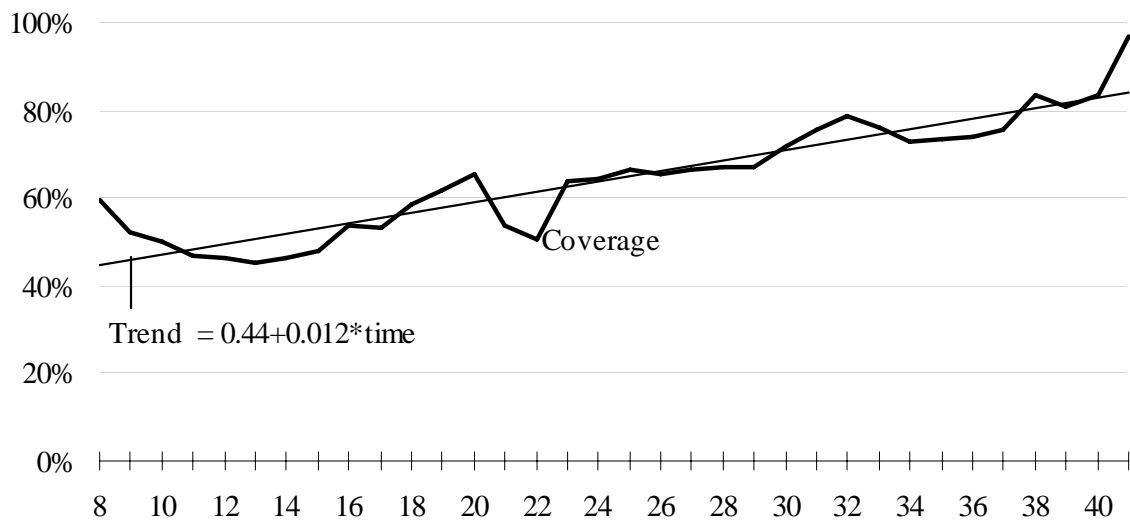
We perform the analysis in two steps. In the first inductive step, we use a new test to establish a *long-run* negative relation between macroeconomic uncertainty and contract length across policy rule periods. In the second deductive step, based on the finding in the first step, we use length as a proxy for uncertainty in the *short run*. Here, we use qualitative evidence to uncover sources of variation in uncertainty and find that uncertainty over the policy rule is the main source of the short-run variation in contract length. Hence, we conclude that for most of the time policy regimes have been evolving rather than being fully stable or constant over time. At a general level, the evidence supports the Lucas critique, the claim that changes in the policy regime cause changes in private sector decision rules.

Our study is organized as follows. Section II presents the institutional framework and the data. Section III reviews previous work on the relation between contract characteristics and policy rules. Section IV develops a new test of Gray's (1978) contract length hypothesis and presents the evidence in favor of it. Section V, the main section, analyzes the short-run evolution of contract length across monetary regimes to gain insight into transitions between and the credibility of policy rules. Here we focus on a comparison between the inflation targeting of 1995-2008 and earlier regimes. Section VI concludes.

## **2. Institutional Background and Data Sources**

Collective bargaining began in Sweden in the beginning of the 20<sup>th</sup> century and spread quickly. A yearly official publication on collective wage agreements was initiated in 1908,

which is the start year of our sample.<sup>2</sup> About 60 percent of all industrial workers were covered by such agreements in 1908 and from the beginning of World War II virtually all of them as shown in figure 1.



*Figure 1:* Coverage of collective agreements in the industrial sector 1908-1942.  
*Source:* SOS: *Kollektivavtal* 1909-1939, *Sociala meddelanden* 1940-1942.

Many of the characteristic features of the of the Swedish labor market were established at an early stage. The organizations were highly centralized and national agreements for whole industries were concluded already before World War I. From 1906 the agreements cover both unionized and non-unionized workers.<sup>3</sup>

<sup>2</sup> *Statens officiella statistik: Kollektivavtal* 1908-1922, *Statens officiella statistik: Arbetsinställelser och kollektivavtal samt förlikningsmännens verksamhet* 1923-1938, and *Sociala meddelanden* 1939-42.

<sup>3</sup> Fregert (1994, ch. 5) gives an overview of the development of the Swedish bargaining system and the legal framework pertaining to it.

There are two institutional changes with a potential effect on contract length as described in the next section. First, central wage bargaining for the entire blue-collar sector was introduced in 1952 and ended in 1992. The Swedish Trade Union Federation (LO) and the Swedish Employers' Federation (SAF) set average wage changes, which were incorporated into the national agreements made by the member organizations. After 1992, the majority of agreements have been synchronized with identical length. Second, central inflation indexation agreements between LO and SAF were introduced during World War II and were used intermittently until 1990.

We have used the official sources for the coverage of collective agreements for 1908-1942 and the length of new contracts for 1908-1919. The length series after 1919 is constructed from a table in the annual reports of LO (*Verksamhetsberättelse till landssekreteriatet*) on the number of workers, who have contracts which are known on December 31 to expire in a certain month in the future.<sup>4</sup> For the 1952-1987 period, we have used a publication containing the central wage agreements and after that LO's annual reports.<sup>5</sup> For a full description of the sources and construction of the data, see Fregert (1994: ch. 6).

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<sup>4</sup> The reason for using this source is that the official statistics only give the number of new agreements in different length categories between 1908 and 1942, but not the number of workers. The expiration data can be used to construct the length of new contracts, weighted by the number of workers. In practice, there is little difference between the two sources except around 1928, when a few large bargaining areas choose one-year contracts.

<sup>5</sup> *De centrala överenskommelserna 1952-1987*, Stockholm: Landsorganisationen, 1988. Bengt Blomqvist at LO kindly supplied his own data on the decentralized agreements after 1992.

### 3. Policy Rules and Endogenous Wage Contracts

#### 3.1. *Gray's Length Hypothesis*

Nominal wage contracts attain macroeconomic significance because they make wages sticky when contracts are less than fully contingent. With perfectly contingent contracts, wages change as they would if they were renegotiated for every shift in the demand and supply for labor (barring risk aversion). Real world wage contracts, however, are typically not contingent at all or contingent only on inflation, which leads to contracts of limited length.

In Gray's (1978) model of contract length, the contract-makers agree to a path of nominal wages over the contract life equal to the path of expected equilibrium nominal wages. Due to shocks to labor demand, nominal and real, the equilibrium nominal wage changes over time. Gray (1978) assumed that the shocks follow random walks. Thus, shocks have permanent effects on the equilibrium wage and the contract wage will be expected to deviate from the equilibrium wage increasingly over the contract life and cause increasing efficiency losses. The efficiency loss over the contract's life corresponds to the sum over time of the expected dead-weight loss triangles in the labor market caused by the shocks. The expected efficiency loss at the signing of the contract for a future point in time is directly proportional to the expected forecast variance of the wage shock, in turn equal to the forecast horizon times the one-period forecast variance by the random walk assumption.<sup>6</sup> The average efficiency loss per period then increases in direct proportion to contract length and the one-period forecast variance of the shocks.

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<sup>6</sup> The shock's effect on the labor demand schedule is linear, which implies that changes in the dead-weight triangle areas are proportional to the square of the shock, hence the variance in expected value terms.



The trade-off between short contract length, which minimizes the average efficiency loss, and a long contract, which minimizes the per-period cost of an assumed fixed set-up cost, is shown by Gray (1978: eq. B2, p.18) to result in optimal contract length being equal to:

$$\text{Contract length} = \sqrt{\frac{\text{Set - up cost}}{\text{Var}(\text{one - period forecast error of wage shocks})}} \quad (1)$$

Consequently, length decreases in the variance of the one-period forecast error of the wage shocks with an elasticity of -0.5. The variance is a weighted average of the real and nominal shocks affecting labor demand, with weights depending on the slopes of labor supply and demand schedules. For convenience, we label the variance “macroeconomic uncertainty”.

Gray (1978) also demonstrated that inflation indexation is a substitute for length reductions, since it reduces the forecast errors. Thus indexed contracts should be longer than non-indexed ones.<sup>7</sup> Groth and Johansson (2004) extended Gray’s model by considering the degree of centralization of the wage bargaining system as a determinant of contract length. In their model, total contracting costs increase when bargaining changes from an intermediate to a central level, as coordination costs increase faster than the savings of the fixed set-up costs that can be shared between unions. Centralization from an intermediate level thus increases contract length according to (1).

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<sup>7</sup> Gray (1978) also showed that the incidence and degree of inflation indexation depend positively on the relative incidence of nominal to real shocks. Our focus is on length, but we also discuss indexation episodes. See section 5.

### **3.2. *Contract Length and the Policy Regime***

The optimal length equation (1) does not explicitly refer to the policy regime. The connection has been made in later contributions by considering how the policy rule affects macroeconomic uncertainty. Fischer (1980) and Fethke and Policiano (1981) made the case for stabilization policy in the form of contingent feedback rules based on the policy-makers' information advantage, when contract-makers are precluded from acting on new information because they are bound by contracts. Contingencies in policy rules may be seen as substitutes for using contingencies in contracts as stabilization instruments. More recently Calmfors and Johansson (2006) analyze how shorter contract length and increased indexation may substitute, though imperfectly, for the loss of monetary policy when a country enters into a monetary union.

McCallum (1983) made the connection between the number of contingencies of a feedback rule and the length of wage contracts. He suggested that efficient stabilization policy should be regarded as a joint venture between policy-makers and contract-makers, who jointly minimize the costs of stabilization. Since it can be presumed that it is easier for the policy-makers to include contingencies in the policy rule than it is for the contract-makers to include them in the wage rule, an efficient stabilization policy should lead to long and non-indexed contracts.

The most efficient policy rule, from the contract-makers' perspective, would be a rule with wage inflation as the target.<sup>8</sup> In contrast, a rule that uses price inflation as the target neutralizes nominal shocks, but lets the contract-makers adjust to supply shocks.<sup>9</sup> Thus, one determinant of length, and likely a major one, is the policy regime through its effect on macroeconomic uncertainty. Macroeconomic uncertainty measures the degree to which exogenous shocks affect the equilibrium wage. Only in the extreme case of perfect wage stabilization would the effect of shocks vanish. Thus variation in length may be due to either changes in the policy regime or in the incidence of exogenous shock variability.

This drawback of using contract length as a policy evaluation measure is shared with other studies evaluating inflation targeting regimes, which adopt what Vega and Winkelried (2005) label an "absolute" approach. Absolute evaluations pit inflation targeting regimes against the previous regime(s). Vega and Winkelreid (2005) instead propose a "relative" approach, as does Lin and Ye (2007). They control for non-policy determinants of the inflation outcome, by pitting inflation targeters against non-inflation targeters with similar characteristics, using statistical matching methods.

Still, we are of the opinion that length is a useful measure of regime performance, in particular as a complement to other measures. First, length, by virtue of being an uncertainty proxy, is potentially a welfare measure as it reflects the dead-weight loss in the labor market. There is a long theoretical and empirical line of thought, linking the costs of inflation to its uncertainty, rather than its observed mean and variability, measures commonly used in

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<sup>8</sup> Among suggested contemporary rules, the nominal GDP rule comes closest to such a rule and, hence, would lead to the longest contracts.

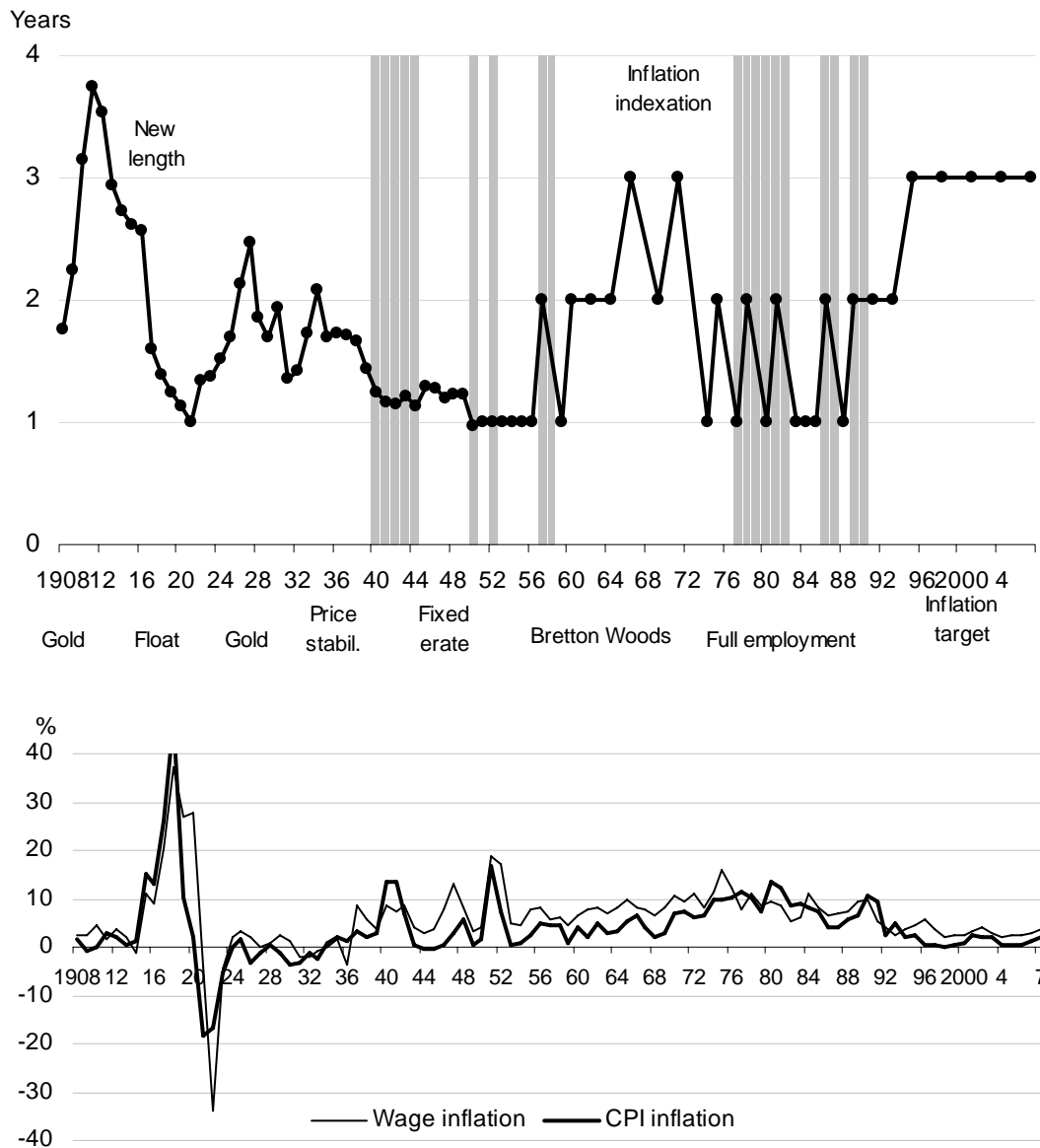
<sup>9</sup> Stabilizing nominal wages was suggested by Keynes. Nominal wage and nominal GDP stabilization, and also the so-called inverse productivity rule for prices, are closely related and have a long tradition, see Fregert (1993) and Selgin (1995).

current inflation targeting evaluation studies. Second, our historical and "absolute" approach compares the current inflation targeting regime to seven other regimes, not just the most previous one in time.

Third, we complement the statistical long-run regime comparisons with historical evidence to discuss if the source of perceived macroeconomic uncertainty originated from the regime or from underlying shocks. Specifically, in section 5 we focus on the transitions between regimes, when the regime change may dominate over other influences. Here the yearly length data has a clear advantage over variability measures of inflation and output computed over several years. This seems to be the implicit assumption of Fischer's (1986: footnote 8), suggestion that changes in contract characteristics should be a good indicator of regime changes.

#### **4. The Cross-Regime Relation between Uncertainty and Contract Length**

Length and indexation of collective wage agreements in the industrial sector are displayed in figure 2 for the period 1908-2005. The length measure is the average length of new collective agreements created during the year. Bars represent central indexation agreements. Details on the indexation agreements are given in the data appendix. Since the data cover virtually the whole population of existing collective agreements, we can safely draw conclusions about the actual evolution of contract length and inflation indexation.



*Figure 2: Top: Length (line) and Central Inflation Indexation Agreements (bars) of New Collective Agreements in the Industrial Sector in Sweden, 1908-2007.*

*Source: See section II.*

*Bottom: Nominal Hourly Industrial wage- and CPI-inflation.*

*Source: Statistisk årsbok, various issues.*

The following features stand out:

- Contract length varies between a minimum of one and a maximum of four years.
- Contract length displays no trend over time.
- Contract length is sluggish: it increases and decreases over several years.

- Long contracts emerge during the three most stable periods as judged by the standard deviation of wage inflation (see table 1): the classical gold standard 1908-1914, the end of the Bretton Woods period 1966-1974, and the inflation targeting regime 1995-2005.
- The most recent period 1995-2005 is the longest stable period, with four consecutive three-year non-indexed contracts.
- Inflation indexation has been used extensively in the two most volatile periods: World War II and the 1977-1990 period as judged by the standard deviation of wage or price inflation (see table 1), with the exception of World War I as discussed below.

Thus the data suggest a strong connection between stable regimes and long and non-indexed wage contracts, which we now test.

Table 1: Monetary policy regimes in Sweden 1908-2007.

		Contract length. years	CPI inflation			Wage inflation		
			Mean	SD <sup>e</sup>	SD rank	Mean	SD	SD rank
1908-1913	Gold standard	2.89	1.07	1.82	2	2.94	1.58	2
	Floating exchange rates <sup>a</sup>	1.73	6.4	19.9	8	10.4	20.3	8
1914-1922	Gold standard	1.78	-1.3	2.6	5	0.6	2.3	4
1923-1931	Price stabilization	1.68	0.8	1.9	3	1.6	2.5	5
1932-1939	Paper standard	1.16	5.2	5.5	7	8.3	5.1	7
1940-1952	Dollar-gold standard <sup>b</sup>	1.75	3.5	2.2	4	7.3	1.7	3
1953-1971	Full employment standard <sup>c</sup>	1.46	7.9	2.7	6	8.7	2.7	6
1972-1992	Inflation targeting <sup>d</sup>	2.83	1.5	1.2	1	3.2	1.0	1
1993-2007								

Sources: CPI and hourly wage in the industrial sector: *Statistisk årsbok*, various issues. Contract length: see section 2.

Notes:

<sup>a</sup> Notes were redeemable into gold until 1921, but gold imports were prohibited from 1914 and gold exports from 1916, which allowed the *krona* to float against gold currencies.

<sup>b</sup> To avoid the Korea inflation in the early 1950s, the Bretton Woods period starts in 1953. Sweden joined in August 1951.

<sup>c</sup> Fixed exchange rate with devaluations in 1976, 1977 (twice), 1981, and 1982.

<sup>d</sup> A low inflation target of 2 percent was declared by the *Riksbank* in January 1993 to be valid from 1995 after the switch to floating exchange rates in November 1992.

<sup>e</sup> SD = standard deviation; SD rank: from low to high.

Previous tests of Gray's length hypothesis are based on yearly data from the USA and Canada, and employ regressions of new length on estimated *ex ante* uncertainty measures of CPI-inflation or underlying nominal and real uncertainty.<sup>10</sup> Here we test the hypothesis as a long-run proposition by regressing new length on the *ex post* nominal wage-inflation variance with observations of averages over the policy rule periods given in table 1. The policy rule

<sup>10</sup> Recent evidence, which supports Gray's hypothesis, is provided by Christofides and Peng (2006) for Canada 1976-2000 and Rich and Tracy (2004) for the United States. 1970-1995. Both survey earlier studies, in particular the various *ex ante* uncertainty measures used. A few studies have investigated the separate effects of nominal and real (productivity) uncertainty to test Danziger's (1988) hypothesis that increased real uncertainty lengthens contracts when workers are risk-averse. Murphy (2000) found evidence in support of Danziger's hypothesis for the U.S., but it could not be confirmed by Rich and Tracy (2004).

periods are defined by reference to the exchange rate arrangement, which closely follow the evolution of the international exchange rate system. In section VI, we present the policy rules in more detail. The test is in the spirit of Lucas's (1980) test of the quantity theory as a long-run proposition using long-run averages of inflation and money growth displayed in scatter diagrams. He demonstrated that the longer the averages, the tighter the quantity theory relation became, as temporary and extraneous influences on inflation were eliminated.

Our test uses the variance of wage-inflation over a longer period as a proxy for macroeconomic uncertainty. This is a perfect proxy under the assumptions in Gray (1978), which we demonstrate in three steps. First, the shock variance in Gray's formula is proportional to the forecast variance of the equilibrium nominal wage. This can be seen by recognizing that the exogenous shocks cause efficiency losses, measured by dead-weight triangle areas, which are due to the deviations between the contractual wage (equal to the expected equilibrium wage) and the equilibrium wage. The expected losses (areas) are thus proportional to the square of the expected wage deviation, that is, its variance.

Second, the one-period unconditional wage inflation variance is equal to the one-period forecast variance of the equilibrium nominal wage. In other words, the observed wage inflation one-period variance over a longer period is a perfect proxy of macroeconomic uncertainty. Let  $\tau$  be contract length,  $w$  the actual logarithmic wage, and  $w^{eq}$  the equilibrium logarithmic wage. The equilibrium wage *level* follows a random walk with drift such that:  $w_t^{eq} = w_{t-1}^{eq} + drift + \varepsilon_t$ , with  $E_{t-1}(\varepsilon_t) = 0$  and one period-forecast variance  $\sigma_\varepsilon^2$  of wage inflation (or level) and  $t$ -period forecast variance  $t\sigma_\varepsilon^2$ . Between renegotiations the actual wage level follows the expected path of equilibrium wage level:  $w_t = w_{t-1} + drift$ . At renegotiation, the



contract wage catches up with the shocks to the equilibrium wage that have occurred since the

previous renegotiation:  $w_t = w_{t-1} + drift + \sum_{i=1}^{\tau} \varepsilon_{t-i}$  .

The unconditional one-period variance of actual wage *inflation*,  $dw$ , is the time-weighted average of the one-period variance of wage inflation in: 1) periods between renegotiations (=

*drift*) and 2) periods of renegotiations ( $= drift + \sum_{i=1}^{\tau} \varepsilon_{t-i}$ ), such that:

$$\sigma_{dw}^2 = \text{Var}(dw) = \frac{\tau-1}{\tau} \cdot \text{Var}(drift) + \frac{1}{\tau} \cdot \text{Var}(drift + \sum_{i=1}^{\tau} \varepsilon_{t-i}) = \frac{\tau-1}{\tau} \cdot 0 + \frac{1}{\tau} \cdot \tau \cdot \sigma_{\varepsilon}^2 = \sigma_{\varepsilon}^2 . \quad (2)$$

Thus, the unconditional (long-run) actual wage inflation variance,  $\sigma_{dw}^2$ , is equal to the one-period forecast variance of the equilibrium wage level,  $\sigma_{\varepsilon}^2$ .

Third, over longer periods perceived ex ante uncertainty, which determines contract length, should approach the true uncertainty. Over a longer period we may assume “rational expectations” of second-order moments such that the contract makers’ *perceived* uncertainty matches *actual* uncertainty.<sup>11</sup> The *ex ante* forecast variance over equilibrium wages is thus revealed in the long run as the *ex post* variance of wage inflation.

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<sup>11</sup> Blanchard (1979) analyzed the transition to second-order rational expectations in a model of endogenous choice of the degree of wage indexation with one-period wage contracts. In his model actual wage variability is a function of the perceived variability and only in the long-run rational expectations equilibrium do they coincide. Here, the equilibrium wage variability is independent of length, as seen by (2), and hence there is no simultaneity between the behavior of the economy and contract length.

In our application, we cannot assume that perceived uncertainty and actual uncertainty have become equal. As pointed out above, contract length has rarely been stable and there appears to be long transition periods between policy rule periods. The wage inflation variance may still be used as a proxy of perceived uncertainty, provided most of the variation in uncertainty across regimes is captured by variation in true uncertainty. The variation in true uncertainty across regimes, captured by the variance of wage inflation, may in turn be due to the inherent differences in policy rules or in the incidence of exogenous shocks.

The estimated regression is:

$$\ln \tau_i = \beta_0 + \beta_1 \text{central}_i + \beta_2 \text{index}_i + \beta_3 \ln \sigma_{dw,i}^2 + e_i, \quad (3)$$

where  $\sigma_{dw,i}^2$  the variance of wage inflation for regime  $i$ ,  $\text{index}_i$  is a dummy for indexation in regime  $i$  ( $=1$  for 1940-1951 and 1974-1992),  $\text{central}_i$  is a dummy for central wage bargaining in regime  $i$  ( $=1$  for 1952-1973 and 1974-1992) and  $e$  the residual. The observations are the period averages given in table 2. Our test amounts to testing the joint hypothesis of: a) the length hypothesis according to (1), and b) the validity of the uncertainty proxy. If the proxy is poor, the length coefficient,  $\beta_3$ , will be insignificant, even though a) is true.

A clear negative relation between new contract length and the variability of wage inflation is depicted in figure 3. The top figure shows the data in original form. The bottom figure displays the data in logarithmic form. Further support for the negative length-uncertainty relation is that changes in average length between consecutive periods are all in the opposite direction of changes in uncertainty, as seen by the negatively sloped lines connecting consecutive periods.

The regression results are given in table 2 with World War I excluded.<sup>12</sup> The estimated elasticity of length with respect to the variance of wage inflation is -0.29, which is statistically significant at the one-percent level. We take this as clear evidence in favor of Gray's hypothesis as a long-run proposition. Taken at face value her functional form is rejected as the estimated elasticity of -0.29 is statistically different from -0.5, but should be interpreted as a higher bound, since the uncertainty proxy is subject to an error-in-variables bias. Previous studies have not tested Gray's prediction of the uncertainty elasticity being -0.5 as they have used linear specifications. We ran the reverse regression with the logarithm of the wage variance as the dependent variable. The estimate is -3.4 ( $t = 15$ ). Following Leamer and Klepper (1984), we can be confident that the effect is negative and bounded by these two numbers. In other words, the proxy problem is not so severe as to overturn the negative relation.

The statistically significant negative effect of centralization on length is opposite the expected positive sign. One interpretation is that centralization decreased total negotiation costs in Sweden due to the existence of the central organizations LO and SAF, which could negotiate for their members without significant increases in coordination costs. Finally, inflation indexation did not significantly increase length as expected.

Taken together, we believe the graphical and statistical evidence provide strong evidence in favor of Gray's length hypothesis.

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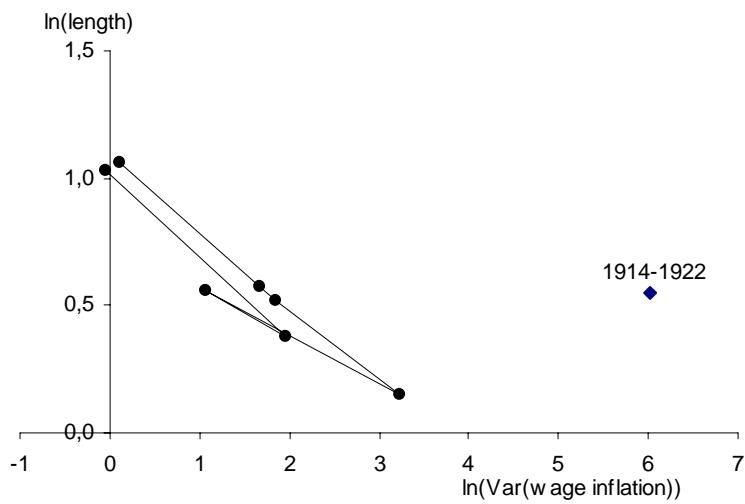
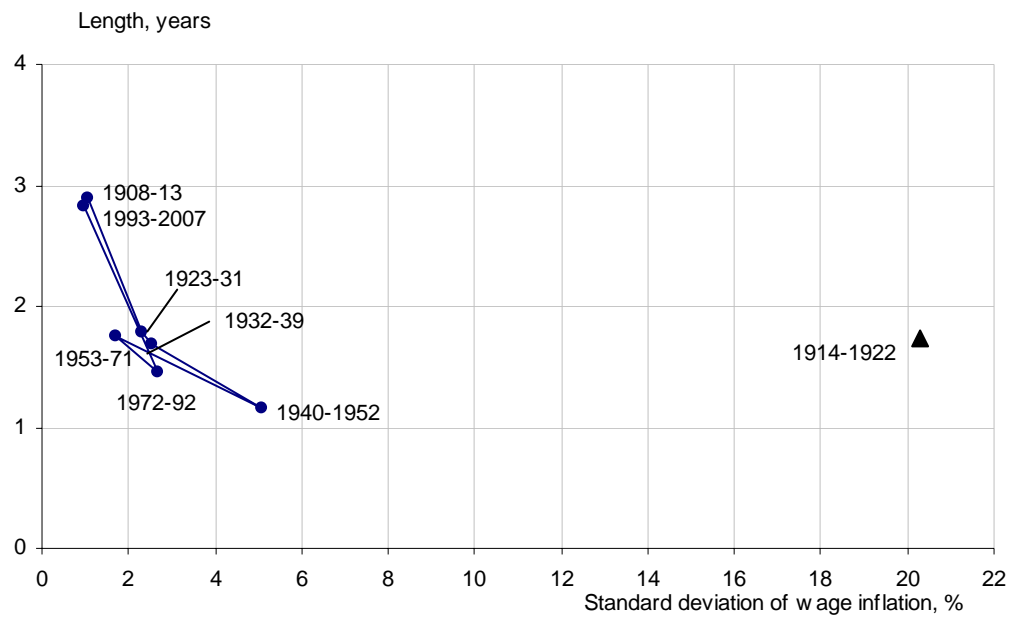
<sup>12</sup> World War I is a clear outlier as seen in figure 3. Wage and price inflation variability changed drastically from the previous stable Classical Gold Standard to the most volatile period in the 20<sup>th</sup> century. Contract-makers who had just begun to use collective agreements were faced with a massive change in macroeconomic uncertainty beyond their previous experience. Contract-makers took their time to catch up to the new policy rule during World War I as further discussed in section 5.

Table 2: Regression result: ln(contract length) dependent variable.

	<i>Coefficient</i>	<i>Standard error</i>	<i>p-value</i>
Intercept	1.059**	0.026	0.000
ln(Var(w))	-0.293**	0.019	0.001
CPI index dummy	0.054	0.047	0.334
Central bargaining dummy	-0.173	0.033	0.013
$\bar{R}^2 = 0.99$			
N = 7			

\*\* significant at the 1 percent level.

Note: The data on length and wage inflation are given in Table 1. The CPI-index dummy is 1 in the 1940-1952 and 1972-1992 periods. The central bargaining dummy is 1 in the 1953-1971 and the 1972-1992 periods.



*Figure 3: Top: Average New Length of Collective Agreements and the standard deviation of wage inflation per Policy Rule Period Defined in table 1. Bottom: Logarithmic Data.*

## 5. The Within-Regime Relation between Uncertainty and Contract Length

The finding that average new contract length *across* regimes can be explained by macroeconomic uncertainty leads us to use contract length as an indicator of uncertainty also *within* regimes. Thus, we take changes in contract length from year to year to reflect changes in perceived uncertainty. We use qualitative evidence from contemporary sources to find the source of this variation in uncertainty within regimes. Most of the variation, we find, is due to changes in credibility of the regime. These changes may, but need not, materialize as increased variability. Consequently, changes in credibility are difficult to capture with any quantitative measure, including previously used *ex ante* measures. Specifically, we identify some periods as mutual learning processes of "confidence building" or "confidence destruction". We also identify the sources of some changes due to perceived real shock uncertainty. For each policy rule period listed in table 1, we first describe the policy regime and then the evolution of contract length and indexation.

*The classical gold standard 1908-1914.* Sweden was a member of the classical gold standard during 1873-1914. After the secular deflation between 1873 and 1895, low and stable inflation set in. The constitution guaranteed the convertibility of the notes of the *Riksbank*, the central bank of Sweden, into gold at a fixed price. The length of new wage contracts increased during 1908-1911 to 3.7 years and then fell to 2.7 in 1914 as seen in figure 2. The maximum length of 3.7 years in 1912 is probably not an indication of optimum length, but rather the result of pressures from employers to extend agreements favorable to them, reached

after the workers' setback in the general strike of 1909.<sup>13</sup> Between 1909 and 1913, coverage also declined from 60 to 44 percent as seen in figure 1. While length and coverage were not stable in 1908 to 1913, the generally long contracts testify to a strong belief in the gold standard as a credible nominal anchor.

*Breakdown of the gold standard 1914-1924.* A combination of external and internal shocks, including policy shocks, unleashed by the outbreak of World War I in 1914, created the most volatile macroeconomic period in Sweden during the 20<sup>th</sup> century. Notes and gold were convertible throughout the war until 1921, but Sweden left the international gold standard by prohibiting gold exports in August 1914, so that the Swedish *krona* could depreciate relative to gold and inflation could rise above that in the gold countries. In 1916, the *krona* was allowed to appreciate relative to gold by the decision to prohibit gold imports. The insulation from gold combined with an erratic and expansionary monetary policy and trade-related swings in the real exchange rate resulted in high and variable inflation between 1915 and 1919, with peaks in 1917 and 1918 around 30 percent. The period ended with deflation in 1921-22, with the price level decreasing by 40 percent as the *krona* returned to the old gold parity.

The newly created collective agreement system thus came under great stress, but survived due to a number of gradual adaptations. First, the length of collective agreements decreased between 1914 and 1919 as seen in figure 1, with the largest drop in 1917. In 1919, the length of new contracts was down to one year. A leading candidate to explain the inertia is the initial widespread belief that the war would be short. In addition, inflation was low until the end of

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<sup>13</sup> This is the interpretation of the long-term observer and union insider Sigfrid Hansson (1938, p. 219).

1915. The gold standard at the old parity rate was regarded as the normal state of affairs and World War I as a temporary disturbance. At the same time, it is clear that uncertainty over future inflation was the driving force behind the reduction of contract length as stated by the official statistical yearbook of collective agreements for 1916:

The shortening of the average duration of the collective agreements must, of course, be assigned to the uncertain situation in business life after the outbreak of the war and especially the large fall in the value of money which makes wage payment in money for longer periods very difficult. (*Statens officiella statistik: Kollektivavtal*, 1916, p.7.)

A second adaptation was the introduction of formal and informal inflation indexation. As inflation became evident, workers found themselves caught in long agreements, many concluded before the war, but with no protection against inflation.<sup>14</sup> The Swedish Trade Union Confederation (LO) organized a conference in 1916 on the "dear times", which called for "dear times compensation" (*dyrtidstillägg*) in addition to outstanding agreements. Many wage earners also received such compensation. According to the annual reports of LO, 32 percent of all LO workers received some compensation in 1916, a number which increased year by year until 1918 when virtually every worker received compensation outside the agreement.<sup>15</sup> Thus, the side payments envisaged by Barro (1977) appeared. Some agreements also became formally indexed to the consumer price index from 1917 in the non-traded goods sector. An official investigation of all agreements valid on 31 December 1920, found that 20 percent had indexation clauses.<sup>16</sup>

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<sup>14</sup> Furthermore, the first official consumer price index in Sweden did not appear until 1917.

<sup>15</sup> For more details, see Fregert (1994, p. 178, table 9.1).

<sup>16</sup> *Statens officiella statistik: Kollektivavtal i Sverige vid årskiftet 1920/21*, 1922. The first CPI indexation agreement was signed in 1917 by the union of the electrical workers.



New strains appeared with the decision made in 1920 to return to the pre-war gold-*krona* parity. The policy had wide support among economists and political parties, but was opposed by business groups and the unions, which feared economic disruptions through a deflationary policy.<sup>17</sup> A speedy deflation between the fall of 1920 and the spring of 1922 lowered the domestic price level by 40 percent and resulted in a peak unemployment rate of 30 percent and widespread labor unrest. With contract length down to one year, two further adaptations appeared during the deflation: abandonment of collective agreements altogether, as coverage went down from 66 in 1920 to 50 percent in 1922 (figure 1), and pre-set contractual wage changes within the year.<sup>18</sup>

Clearly the 1914-1922 period cannot be described as a true policy regime with policy-makers and contract-makers matching each others' decision rules. Yet contract changes were not haphazard. Through the gradual reduction to a length of one year, inflation indexation, extraordinary *ex post* inflation compensation, and temporary abandonment of some agreements, the collective agreement system survived. World War I became a learning period which left a permanent legacy of a minimum contract length of one year and the option of inflation indexation.

*The interwar gold standard 1922-1931.* Sweden returned to gold at the old parity, *de facto* in 1922 by fixing the *krona*-dollar exchange rate through intervention – the first country in Europe to do so – and *de jure* in 1924. The return to the old gold parity through a costly deflation illustrates the power that the gold standard rule exercised over monetary thinking.

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<sup>17</sup> See Fregert and Jonung (2004) for a detailed analysis of policy- and contract-makers' reactions during the deflations of 1921-22 and 1931-33.

<sup>18</sup> Generally it was the employers who refused new agreements. According to the Annual Report of SAF (*Verksamhetsberättelse* (1921, pp 18-19)), SAF desired collective agreement, but "where this has not been possible to achieve reasonable terms, one has used the alternative of working without an agreement." This indicates a strong, but not unconditional support for collective agreements.

There was a widespread belief among economists, politicians and the general public that once the gold standard had been reintroduced, it would create stability and economic growth, as it had before the war.

And indeed after the return to gold in 1922, the Swedish price level did quickly stabilize to a path of slow deflation for the rest of the decade, while uncertainty declined. This process was reflected in a gradual increase in contract length from one year in 1922 to two years in 1927. However, contract length did not return to the pre-1914 level, which suggests that the interwar gold standard never achieved the credibility held by the prewar gold standard. Its limited credibility may be explained by the fact that the international gold standard never was fully restored. The attempts to re-establish it through international conferences and the associated negotiations over war reparation were closely followed by the labor market parties. The uncertainty over the future of the international monetary system is clearly seen in the annual reports of the central labor market organizations, LO and SAF, and in their journals.

The slow deflation during the 1920s raised real wages without the need for renegotiation. Wage contracts were simply prolonged to an increasing degree with no changes in the wage. In 1929, 30 percent of all agreements were prolonged. All collective agreements contained automatic prolongation clauses which extended the terms for one year if no party gave notice. Thus the 1920s policy rule effectively turned into a wage stabilization standard, but with considerable *ex ante* uncertainty which did not materialize *ex post*.

Contract length declined between 1928 and 1932 due to increasing uncertainty about the future.<sup>19</sup> In the fall of 1930, SAF “urged great caution” and recommended that no member should enter into collective agreements longer than a year owing to the unusually large deflation connected with the international downswing (SAF annual report 1930, p. 31). The sharpest fall occurred in 1931-32 during the period between Sweden leaving gold in September 1931 and the crisis connected to the suicide of the Swedish financier Ivar Kreuger in March 1932.

*Domestic price stabilization 1932-1939.* When Britain left gold in early September 1931, Sweden followed suit shortly after. The *Riksbank* and the government made a public announcement that the aim of Swedish monetary policy should be to stabilize the internal purchasing power of the *krona*. The *Riksbank* thus became the first central bank in history to openly adopt a price stabilization rule, more specifically Knut Wicksell's norm.<sup>20</sup> The *Riksbank* immediately began to collect and publish a weekly consumer price index to be used as a guide for the new monetary regime. The price level was stable during most of the 1930s as seen in figure 2.

After 1931, two-year contracts came back and were in the majority until 1937. The length of contracts then decreased in 1938, for two reasons. Firstly, strains between the fixed exchange rate, pegged in 1933, and the domestic price stabilization goal appeared in 1936 when the

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<sup>19</sup> The decline in contract length in 1928 may be explained by uncertainty caused by a new labor tribunal created to handle new labor legislation, including the first regulation of collective agreements. There was also an unusually large number of labor conflicts as well as a contested election, all contributing to uncertainty and the decrease in contract length in 1928.

<sup>20</sup> The *Riksbank* asked three prominent economists to give advice on the new monetary regime. Some questions dealt with the problem of establishing the new regime. The economists' answers can be interpreted as a contribution to the present debate on changes in the monetary regime and inflation targeting. See Jonung (1979) and Berg and Jonung (1999).

British price level began to increase and calls for an appreciation went unheeded (Jonung and Berg 1999, p. 544). Secondly, growing fears of a new war further increased uncertainty.

*Paper standard in a controlled economy 1939-1951.* Contract- and policy-makers were much better prepared for World II than for World War I. The outcome was also considerably more stable, as seen in table 1, yet no credible nominal anchor replaced the price stabilization norm of the 1930s as evidenced by a string of one-year contracts with inflation indexation clauses from 1940 to 1943 and again in 1950.

The finance minister Ernst Wigforss declared early in 1940 a new policy rule, though couched as a modification of the price stabilization rule of 1931, namely that economic policy should “hinder price increases beyond what is called for by the worsened supply situation”.<sup>21</sup> Similar statements were made during the war and it was also declared to be the rule after the war. In 1944, the parliament ratified the goal that “prices should move in inverse proportion to general productivity”. By that time, prices had been stable since 1942 and the goal seemed feasible. An attempt to uphold it was made in 1946 by the decision to appreciate the *krona* by 14.3 percent against the pound. The goal, however, soon lost credibility as inflation came back in 1947 (3 %, 1948: 5%) and references to it ceased.

The unions wanted to avoid a repetition of the real wage erosion that occurred during World War I and the employers wished to secure labor peace.<sup>22</sup> The higher risk of inflation during World War II was immediately recognized. At a LO conference in October 1939, the member

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<sup>21</sup> *Bankoutskottets utlåtande* Nr 23, 1940, p. 7.

<sup>22</sup> For example as expressed by the trade union editor Albin Lind (1940, *Fackföreningsrörelsen* nr 20): “In this situation it is enough if the union movement points out that it would be a naïve miscomprehension, if anybody would believe in the repetition of 1914-1918 in terms of the distribution of the war burden across social groups.” The reference to an earlier episode clearly illustrates how difficult it may be to capture yearly changes in uncertainty by rolling regressions or ARCH-type regressions as used in previous short-run ex ante tests.

unions were advised to include inflation indexation clauses in their wage agreements. A central inflation indexation agreement was signed by the LO and the SAF in December 1939 for 1940 with a stipulation that all individual agreements should have a minimum length of one year.<sup>23</sup> Indexation was regarded as a way of coping with uncertainty as stated in the preamble to the agreements such as in 1940: "With respect to the present situation of crisis..." (1940).<sup>24</sup> The intended degree of compensation was about 75 percent, but the actual compensation only came to about 43 percent due to lagged adjustment. SAF, who initially opposed indexation, accepted it because of the stipulation of a minimum length.

The initial high degree of indexation indicated a belief that shocks were mainly to be nominal, testifying to a low belief in the government's declared policy rule. *Ex post*, macroeconomic developments during World War II turned out to be different from developments during World War I. In particular, War II experienced a larger negative supply shock ingredient. Effective blockades and the closeness of fighting, with Denmark and Norway occupied by German forces and Finland attacked by the Soviet Union, reduced international trade and raised the prices of imports. Erik Lindahl (1943) estimated that of the total price increase of 50 percent between 1939 and 1943, 20 percent was due to "scarcity inflation".<sup>25</sup> The indexation agreements were changed to a lower effective degree in the subsequent agreements of 1941, 1942 and 1943 (see table 1) after pressure and criticisms from SAF, the government (fearing that indexation would fuel inflation) and economists.

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<sup>23</sup> In fact, the agreement was only a promise to induce members to include the clause, as the central organizations did not have the power to enforce them. However, virtually all members followed this recommendation.

<sup>24</sup> "With respect to the sharpened situation of crisis...." (1941). The SAF journal *Industria* referred to the 1940 indexation agreement as "the capitulation of both (parties) against the uncertain."

<sup>25</sup> Erik Lindahl was a strong proponent of the policy rule that prices should move in inverse proportion to productivity since the 1920s, see Fregert (1993).

With stable prices after 1942 and price controls from 1943, the indexation clause was dropped in the 1944 agreement. Belief in the government's ability to implement the inverse productivity rule for the price level, and later low inflation, was hedged, however, as evidenced by the continuation of one-year agreements. When Sweden, together with several other European countries, devalued in 1949, indexation was reintroduced in the 1950 agreement. The instability in contract characteristics during the 1940s caused by instability in the policy rule indicates that the 1940-1951 period does not qualify as a policy regime in the equilibrium sense.

*The Bretton Woods period 1951-1973.* Sweden fixed the *krona* to the dollar, and thus to gold, by joining the Bretton Woods agreement in 1951. The Bretton Woods period turned out to be almost as stable as the current low inflation regime as seen in table 1. In contrast to the current period, however, but in parallel with the restoration of the international gold standard in the 1920s, the new dollar-gold-based regime gradually gained in credibility. Length of new wage agreements increased from one- and two-year contracts in the 1950s to two-year contracts in 1960 to 1966, culminating in the three-year contracts of 1966-1969 and 1971-1973.

The internal policy rules developed gradually to cope with the requirements of the dollar-gold-based Bretton Woods system. The restrictions on domestic fiscal and monetary policy were tighter than under the previous gold standards due to the combination of a fixed exchange rate and the implicit ban on international borrowing. Since no international borrowing was possible, the current account could only remain negative for as long as the foreign exchange reserves lasted. Barring devaluation of the currency, which was never

contemplated in Sweden as it was in the UK in 1967, demand growth had to be managed so as not to outstrip growth in real output.

The international Bretton Woods system was complemented by a new domestic policy framework developed in the late 1940s by the labor union economists Gösta Rehn and Rudolf Meidner and adopted by the Social Democratic government. The so-called Rehn-Meidner model implied that the government should stabilize prices through restrictive fiscal policy and counteract increasing unemployment by active labor market policies, while the labor market parties' wage agreements should not jeopardize price stability. The 1950s and 1960s also saw a substantial increase in the scope of labor market policies as well as innovations in demand management, for example the so-called investment fund system.<sup>26</sup>

A major change occurred with the introduction of central wage agreements for the blue-collar sector first in 1952 and then from 1956 until 1992. The immediate cause of the 1952 central wage agreement was the international inflationary impulse in 1951 induced by the Korean War. LO became concerned about the erosion of real wages and, in particular, the uneven compensation between groups due to the timing over negotiations. The solution was found in the first general central wage agreement between the SAF and the LO, which then also synchronized individual union agreements tied to the central agreement. The agreement contained an indexation clause which, from SAF's point of view, was seen as a concession to lower wage increases. Together, these elements brought about a rapid change in contract

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<sup>26</sup> See Lindbeck (1975, ch. 4) for an overview of stabilization policy in the 1950s and the 1960s, and Taylor (1982) for an analysis of the Swedish investment funds system as a policy rule.

characteristics, i.e. the introduction of indexation, a fall in length (two-year agreements becoming one-year agreements) and synchronization.<sup>27</sup>

The first three-year agreement in 1966 contained an innovation that made it easier to enter into long contracts. A perennial problem was the so-called wage drift, i.e. wage changes above the compensation agreed upon in the wage settlements, which occurred unevenly. A new clause was introduced to protect those unions that fell behind due to wage drift (*förtjänstutvecklingsgarantier*). Such clauses were then included in all subsequent agreements. LO made it a condition for writing a three-year agreement.

The declines in length in 1959 and 1968 that deviate from the general pattern can be explained by specific uncertainty factors. The 1959 one-year agreement was due to uncertainty about the outcome of the referendum on the new social security system (*ATP-systemet*). The two-year 1970-1971 agreement can be linked to the sudden downturn caused by an unexpectedly drastic monetary tightening to reverse an outflow of foreign exchange reserves.

To sum up, the parallelism between growth in credibility, evolution of the policy framework and collective agreement design indicates that the Bretton Woods period was not a stable equilibrium regime. Its zenith, from 1966 to 1971, was a short one.

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<sup>27</sup> In Taylor's (1980) staggered contract model, shocks have persistent effects because wages only adjust gradually due to a combination of staggered contracts and concerns about relative wages. Thus, the fixed contract structure assumed in Taylor's model may not survive a large aggregate shock. The rise of centralization in 1952 in order to synchronize shows how the Taylor model contains its own seeds of destruction as the combination of relative wage setting, staggered contracts and aggregate shocks are not compatible.



*Full employment standard 1973-1992.* The international fixed exchange rate system collapsed in the early 1970s. Following the first oil price shock of the 1970s (OPEC I), the prime goal of Swedish stabilization policy was to maintain full employment by accommodation, at the expense of exchange rate stability and low inflation. Sweden was a member of the European exchange rate agreement “the European snake” between 1973 and 1977. This policy resulted in several devaluations (in 1976, twice in 1977, 1981, 1982 and the collapse of the fixed exchange rate in 1992) and a considerably higher rate of inflation in Sweden than in most other OECD countries, but also in lower unemployment rates. The policy rule from the mid-1970s to the early 1990s should be characterized as a full employment policy rule accompanied by a wage-price spiral caused by the use of devaluations to accommodate wage increases.<sup>28</sup>

The fall of the fixed exchange standard and rising uncertainty about future inflation contributed to a shortening of contract length and a return of indexation. Two-year agreements were concluded for 1975-1976, 1978-1979, 1981-1982 and 1984-1985. All the two-year agreements had indexation clauses except for 1975-1976. Thus, rather than length being reduced in response to increased uncertainty, indexation was chosen for protection, reflecting nominal uncertainty rather than real uncertainty. The agreements shortly after the two oil shocks, 1974 and 1980, were of one year's duration and not indexed. These shocks presumably created uncertainty about future oil prices; that is, uncertainty about real shocks consistent with Gray's analysis. The one-year agreement in 1977 was indexed, when according to the SAF economist Karl-Olof Faxén: “uncertainty was especially large concerning the business cycle, inflation, and tax changes”.

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<sup>28</sup> See Horn and Persson (1988) for a model of the wage-price spiral with recurrent devaluations.

In the mid-1980s, when the public as well as the government had gradually learnt the costs and consequences of accommodation, several economists began to argue for a return to a non-accommodation policy rule using the fixed exchange rates as an irrevocable nominal anchor.<sup>29</sup> Policy shifted in the early 1990s to non-accommodation which, in combination with an international recession and an overvalued currency led Sweden into its worst post-war crisis with unemployment exceeding ten percent. In November 1992, the *Riksbank* was forced to abandon the fixed exchange rate after a period of speculative attacks.

*Inflation targeting 1993-2007.* In January 1993, shortly after the switch to a floating exchange rate rule in the fall of 1992, the *Riksbank* board declared an explicit low inflation target ( $2\% \pm 1\%$ ) to be enforced from January 1995. The speed of the transition to this new regime of low inflation is without parallel as judged by the contract-makers choice of first non-indexed two-year contracts in 1993 and then three-year contracts in 1995 and thereafter. The present regime of inflation targeting is also the longest period of high credibility in the 100 years we study. It should be added, that the *Riksbank* has declared that it follows a so-called flexible inflation targeting regime, that is, it allows supply shocks to affect the inflation rate in the short run, to limit fluctuations in the output gap; a regime close to a nominal income stabilization regime.

During the 1990s, Sweden, like many other countries, underwent major institutional changes. Fiscal policy has followed a new budget law with strict pre-announced spending limits since 1996. The *Riksbank* was made independent in 1999. In addition, Sweden has followed the Maastricht criteria, while staying out of the Exchange Rate Mechanism, and deciding in a

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<sup>29</sup> The policy switches in the post World War II period are analyzed by Jonung (1999) as the outcome of an adaptive learning process.

referendum in 2003 with a 56 percent no-vote *not* to join the euro area. The high credibility, as judged by the first three-year agreement in 1995, was established before these institutional changes.

Our comparison of the behaviour of wage-setters across the wide variety of regimes adopted by Sweden 1908-2008 demonstrates clearly that the inflation targeting regime is associated with less macroeconomic uncertainty than any other regime. In this sense, it stands out as a successful regime. Of course, there is no guarantee that inflation targeting will remain associated with long-term contracts but so far this has been the case.

The international debate on the macroeconomic effects of inflation targeting has not been decisive. No consensus has emerged yet. There are basically two positions, one being critical of inflation targeting as being a form of monetary policy window dressing, without any significant beneficial impact on macroeconomic outcomes; the other being positive towards inflation targeting, suggesting that it has contributed to lower inflation than otherwise. There are several reasons for this inconclusiveness. One is, of course, that inflation targeting has been adopted for a fairly short period of time. We simply lack enough observations. The other reason is that low inflation has characterized the world economy since the adoption of inflation targeting in the early 1990s, thus making it difficult to identify the impact of inflation targeting in cross section studies involving targeters and non-targeters.<sup>30</sup> We believe that the approach in this study, resting on data for a very long period, and thus from a variety

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<sup>30</sup> The positive case for inflation targeting is given for example in Bernanke et al (1999), Leiderman and Svensson (1995) and Truman (2003) and the negative by Friedman (2004). The empirical evaluations comparing inflation targeters to others during the last 15 years point in different directions. Vega and Winkelried (2005) find a significant effect on the inflation outcome of inflation targeting, while Ball and Sheridan (2005) and Lin and Ye (2007) cannot find a significant effect. A different approach is taken by Mihov and Rose (2008) who compare the duration of inflation targeters to fixed exchange rate regimes. They find that inflation targeting regimes have lasted longer and with a better inflation outcome than the control group as is true for Sweden when we compare the inflation targeting regime to all the previous regimes in last 100 years.

of monetary regimes, and focused on the behaviour of private-sector agents is a way of circumventing the weaknesses of cross-section studies dealing with inflation outcomes – the standard approach taken in the literature on evaluating inflation targeting.

## **6. Conclusions**

We have explored a unique data set on wage contract length to evaluate all the policy rules in Sweden during the past 100 years, including the most recent one of inflation targeting adopted in the early 1990s. On the basis of both long-run quantitative and short-run qualitative evidence, we conclude that wage contract length can serve as an excellent measure of the contract-makers' perception of regime credibility and regime stability.

As judged by the contract makers' willingness to make long nominal wage commitments, most of the policy regimes during the 20th century have met little success until the advent of the current inflation targeting regime. The classical gold standard and the late Bretton Woods period also saw long non-indexed contracts, but not for extended periods. Three periods can be characterized as unstable in relation to the other regimes: the 1940s, the 1970s, and the 1980s. Three periods are gradual transition periods: from high to low credibility (the 1910s) and from low to high credibility (the 1920s and the 1950s). The 1930s price stabilization rule is difficult to characterize, but should perhaps be labeled a semi-stable regime. The inflation targeting regime after 1995 with three-year non-indexed contract stands out in a secular perspective both for its instant credibility and for its long duration. We thus conclude: inflation targeting is a success in Sweden, so far.

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## Data appendix

Year	CPI-indexation	Length, years	Coverage, %	Wage inflation, %	CPI-inflation, %
1908	-	1.75	0.60	2.42	1.49
1909	-	2.25	0.52	2.59	-0.96
1910	-	3.15	0.50	4.50	0.00
1911	-	3.74	0.47	1.46	2.94
1912	-	3.54	0.46	3.78	2.05
1913	-	2.93	0.45	1.84	0.30
1914	-	2.73	0.46	-1.15	1.31
1915	-	2.61	0.48	11.11	13.88
1916	-	2.56	0.54	8.87	12.26
1917	-	1.59	0.53	20.56	23.23
1918	-	1.39	0.59	37.06	38.49
1919	-	1.24	0.62	26.98	9.87
1920	-	1.13	0.66	27.87	1.86
1921	-	1.00	0.54	-4.13	-20.4
1922	-	1.34	0.50	-33.97	-18.32
1923	-	1.37	0.64	-4.49	-5.59
1924	-	1.52	0.64	1.86	0.00
1925	-	1.70	0.67	3.35	1.71
1926	-	2.13	0.65	1.94	-3.45
1927	-	2.46	0.67	0.17	-1.18
1928	-	1.85	0.67	0.78	0.59
1929	-	1.69	0.67	2.39	-1.18
1930	-	1.93	0.72	1.43	-3.64
1931	-	1.36	0.75	-2.10	-3.14
1932	-	1.42	0.78	-2.24	-1.28
1933	-	1.72	0.76	-0.87	-2.61
1934	-	2.08	0.73	0.00	0.66
1935	-	1.69	0.73	1.74	1.95
1936	-	1.73	0.74	-3.51	1.28
1937	-	1.71	0.76	8.55	3.14
1938	-	1.66	0.84	5.58	1.83
1939	-	1.44	0.81	3.80	2.99
1940	1	1.24	0.84	8.58	12.69
1941	1	1.16	0.97	7.26	12.64
1942	1	1.15		8.54	6.62
1943	1	1.21		4.01	0.43
1944	1	1.13		2.77	-0.43
1945	-	1.29		3.75	-0.43
1946	-	1.27		7.60	0.43
1947	-	1.20		13.23	2.95
1948	-	1.22		8.20	5.65
1949	-	1.22		3.1	0.39
1950	1	1		4.11	1.55
1951	-	1		18.96	15.63
1952	1	1		17.22	6.99
1953	-	1		4.73	0.61
1954	-	1		4.29	0.91
1955	-	1		7.84	2.39
1956	-	1		8.27	4.89

1957	1	2	5.78	4.40
1958	1	-	6.00	4.21
1959	-	1	4.48	0.77
1960	-	2	6.37	4.01
1961	-	-	7.61	2.19
1962	-	2	8.03	4.70
1963	-	-	6.80	2.94
1964	-	2	8.01	3.07
1965	-	-	9.77	5.05
1966	-	3	8.22	6.36
1967	-	-	7.87	3.97
1968	-	-	6.37	2.02
1969	-	2	8.27	2.69
1970	-	-	10.55	6.66
1971	-	3	9.35	7.17
1972	-	-	11.21	5.83
1973	-	-	8.26	6.46
1974	-	1	11.26	9.47
1975	-	2	15.72	9.33
1976	-	-	12.10	9.87
1977	1	1	7.65	10.74
1978	1	2	10.93	9.61
1979	1	-	8.45	6.92
1980	1	1	9.48	12.76
1981	1	2	8.57	11.44
1982	1	-	5.44	8.20
1983	-	1	5.99	8.57
1984	-	1	10.91	7.70
1985	-	1	8.18	7.10
1986	1	2	6.66	4.14
1987	1	-	6.83	4.14
1988	-	1	7.44	5.66
1989	1	2	9.47	6.23
1990	1	-	9.81	9.97
1991	-	2	5.35	8.91
1992	-	-	3.92	2.26
1993	-	2	2.28	4.55
1994	-	-	3.49	2.17
1995	-	3	4.36	2.50
1996	-	-	5.53	0.46
1997	-	-	3.81	0.53
1998	-	3	2.22	-0.16
1999	-	-	2.65	0.48
2000	-	-	2.58	0.98
2001	-	3	4.37	2.41
2002	-	-	3.14	2.13
2003	-	-	2.96	1.91
2004	-	3	1.95	0.37
2005	-	-	2.98	0.46
2006	-	-	2.97	1.36
2007	-	3	4.49	2.14

*Sources:* Length: Average new length of collective agreements, see section 2. Indexation, see the data appendix. Wage inflation: hourly wage among industrial workers, *Lönestatistisk årsbok*, various issues, CPI-inflation: Statistics Sweden, [www.scb.se](http://www.scb.se).

Central Indexation Agreements 1940-2007.

Year	Release	Actual inflation, %	Release level, %	Degree <sup>a</sup>
1940	yes	14	3.3	0.75
1941	yes	11	5.0	0.9
1942	yes	5	4.9	0.6
1943	no	0	5.9	0.9
1944	no	0	5.9	0.9
1950	no	3	1	escape
1957-	no	4	6	escape
1958	no	4	6	escape
1977	yes	11	8	0.3
1978-	no	10	7	escape
1979	yes	7	5	escape
1980	yes	14	5	0.5
1981-	no	12	8.9 <sup>b</sup>	0.65
1982	yes	9	6.5 <sup>b</sup>	0.65
1986-	no	4	3.2	escape
1987		4		
1989-	yes	6	6	<sup>c</sup>
1990	Yes	10	4	escape

Sources: *Landsorganisationens verksamhetsberättelser* (Annual reports of The Swedish Trade Union Federation) and *De centrala överenskommelserna mellan LO och SAF 1952-1987, 1986*. Stockholm: Landsorganisationen. Inflation refers to the December to December change in the consumer price level from *Statistisk årsbok*, various issues.

Notes:

<sup>a</sup> The degree of compensation is calculated as the elasticity of the nominal wage with respect to the relative change in the consumer price level at the wage and price levels existing at the conclusion of the agreement. For actual numbers, see Fregert (1994: Table 8.2). This overstates the actual degree of compensation for the 1941-1944 agreements, as they gave a fixed raise at the release level, which implies a decreasing elasticity with respect to inflation. For 1981-1982, the degree of compensation above the threshold is given. Escape (clause) signifies that the agreement gave right to new negotiations without a preset degree of compensation.

<sup>b</sup> The release level was conditioned on the consumer price level exclusive of fossil fuels.

<sup>c</sup> The degree of compensation depended negatively on the relative wage position.

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