

## *Discussion*

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The purpose of Coulombe's study is to demonstrate the advantages of price-level stability from the viewpoint of the intertemporal allocation of resources. He concludes from his analysis that there may be little point in trying to reduce the target inflation rate in Canada any further, unless we are prepared to seek the more ambitious goal of stability in price levels. He bases this conclusion on the observation that a marginal reduction in the target inflation rate cannot eliminate the real problem that inflation causes for resource allocation. Only under a system where the price level is stationary is there a clear advantage to the monetary authorities in eliminating trend inflation completely, because such a system greatly simplifies intertemporal comparisons.

Although Coulombe's theoretical analysis is based on a simple model of the economy, it brings out factors that must be considered when determining if the objective of monetary policy should be to stabilize the rate of inflation or the level of prices. The author deserves particular recognition for raising a question that has, despite its importance, evoked little interest among researchers to date.

I am not convinced, however, that Coulombe's study is enough by itself to establish price-level stability as a desirable goal. The theoretical model tends to gloss over nominal rigidities, and it presupposes a credible regime. It thus does not allow us to assess the potential costs, in particular those of adjusting to a new regime. Nevertheless, it serves as a good starting point for examining the overall costs and benefits associated with a price-stability regime. Most of my comments have to do with the empirical

portion of the study, in which I believe there are certain gaps. But first I offer a few remarks about the theoretical portion.

The theoretical analysis shows that a major advantage of a price-stability regime flows from the stabilizing mechanism of expectations that prices will return to their norm. This mechanism makes it easier for the economy to adjust to shocks. For example, if the economy suffers a negative demand shock, prices will fall; this will generate an expectation of higher prices in the future, and thus a reduction in the real *ex ante* interest rate, even before the nominal interest rate has time to adjust. In the same vein, the author shows that the real interest rate can become negative, even when the nominal rate has reached its floor, if prices are sufficiently below their equilibrium level. Therefore, the Summers effect does not apply in a regime of stable prices. This is an important finding, since the constraint represented by the interest rate floor is one of the most compelling arguments in favour of keeping a target inflation rate that is slightly positive.

The problem posed by the interest rate floor is perhaps not so much that the real interest rate cannot become negative since, in a regime where inflation is under control, we can expect that the amplitude of economic cycles will be smaller, thereby reducing the need to generate negative real interest rates. The problem lies, rather, in the fact that in a deflationary situation, we may find ourselves with a very high real interest rate if expectations about price fluctuations are extrapolative.

Of course, the stabilizing mechanism of regressive expectations under a price-level stability regime can operate only if the regime is credible. To gain this credibility, the monetary authorities must show that they can really achieve their goal, and some consensus must emerge as to the benefits of that regime. In the meantime, economic agents are likely to form their inflation expectations with some allowance for a possible return to the old regime. If, as Coulombe maintains, it took 30 years after the gold standard was abandoned before agents recognized the move to a new monetary regime, how long would it take to convince them that the authorities are going to produce long-term price stability—something no central bank has been able to achieve since World War II? Since the advantage of such a regime lies mainly in that its expectations have a stabilizing effect, I encourage the author to discuss the prospects from this viewpoint: What are the factors that would maximize the chances of winning such credibility quickly? Would it be better to set a growth target for the price level? or to reduce inflation closer to zero before introducing price-level stability as a target?

The model is also based on the hypothesis that prices are perfectly flexible. It would be interesting to carry the theoretical analysis further to examine how the presence of price rigidities might affect the results. For

example, if the economy suffers a negative demand shock, would prices adjust downwards quickly enough to generate a lower real interest rate, when the nominal rate is at its floor?

Let me now turn to the empirical results. To verify the predictions from his theoretical model, the author really has no choice other than to turn to the period of the gold standard. The problem, however, is that while that regime succeeded in maintaining a certain degree of price stability over the long term, it was not very effective at preserving price stability over the short and medium term (see Figure 1). Moreover, there are few data covering the period as a whole. The only price series available is for wholesale commodity prices, which is significantly more volatile than a retail price index such as the CPI, and probably not a very accurate reflection of consumer price trends.

In his analysis, Coulombe adopts the hypothesis that prices followed a stationary process over the period, and that economic agents formed their price expectations on the basis of an autoregressive model. The model implies that prices will gradually return to their estimative norm. He then calculates a series for the real *ex ante* interest rate, using the difference between the observed nominal rate and the price-change expectations generated by his model. He compares this series of “real” interest rates with those obtained by Ricketts (at the Bank of Canada) for the years 1952-94, using a regime transfer model to describe inflation expectations. Coulombe claims that the results are consistent with the predictions of the theoretical model: During the gold-standard period, expectations about price changes amplified the swings in real interest rates, since prices were strongly and positively correlated with the nominal rate, and “real” rates were negative on several occasions; over the more recent period, nominal interest rates have been forced to adjust much more.

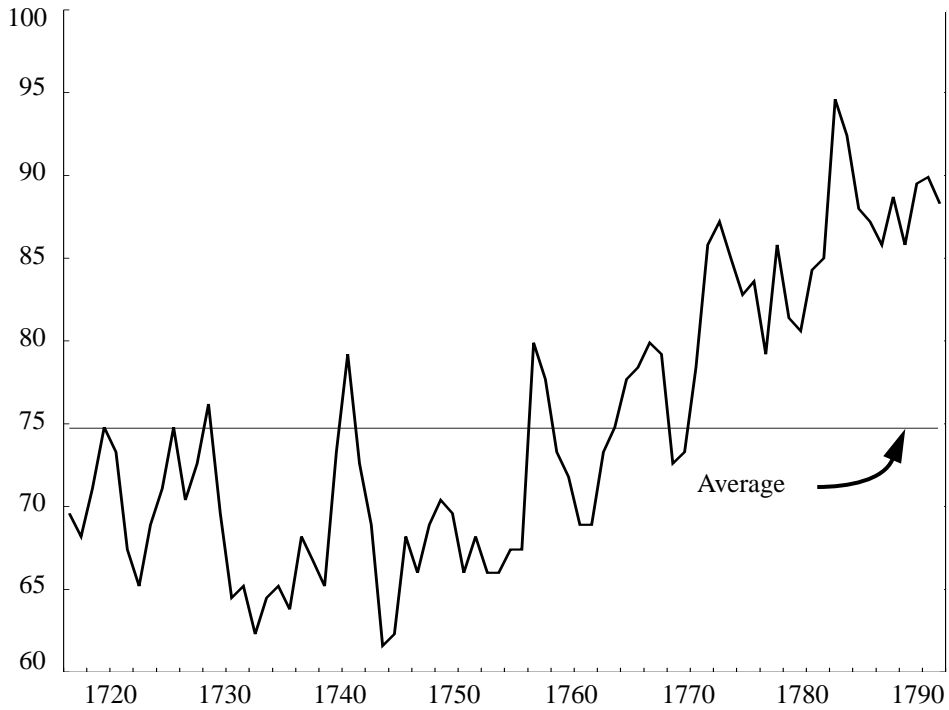
These conclusions depend to a high degree, however, on the hypothesis that economic agents were indeed using a model that anticipated a reversion of prices towards their norm. This is a highly plausible hypothesis, and one that Klein put forward in 1975, but it cannot really be verified.

At least two other hypotheses have been used by researchers examining this period. Fisher (1930) postulated that economic agents formed their expectations about inflation by taking a weighted average of observed inflation rates over a period extending far back into the past. This explanation has been tested repeatedly and rejected owing to the implausibly long lags estimated in the nominal interest rate equations and the low coefficient obtained for the average inflation rate.<sup>1</sup> More recently, Shiller

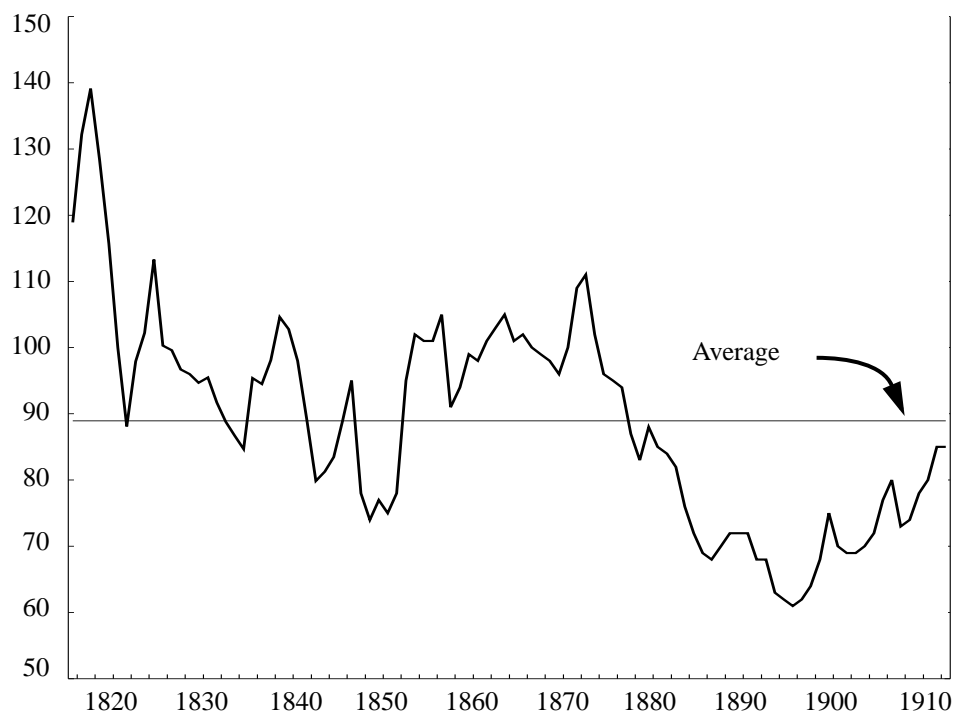
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1. See, for example, Summers (1983), who obtained a maximum coefficient of 0.18 for the long-term interest rate.

**Figure 1**  
**Price Level**  
**1717-1792**



**1816-1913**



Source: Author's calculations based on data supplied by Coulombe.

and Siegel (1977) and Barsky (1987) have maintained that nominal interest rate movements entirely reflected the movements in real rates during the period, because investors had to expect that inflation would be consistently close to zero. This would be the case because the price level essentially followed a random walk and because the inflation rate could not be predicted on the basis of recent observations (that is, there was no persistence in the data). Barsky notes, moreover, that since the inflation rate could not be predicted, empirical tests are of no help in determining whether there was a Fisher effect at work during the gold-standard period. The Fisher effect appeared in data for the 1960s, because inflation had by then become more systematic and, hence, more “predictable.”

The results presented by Coulombe do not really allow us to judge the relative merits of his analysis. I am inclined to view the results more as a revealing illustration than as a rigorous test of his model. I wish also to highlight a few specific points with respect to these results:

1. The hypothesis of price stationarity does not seem very robust. If we perform stationarity tests for the period 1717 to 1913, when the price equation estimation period ends, rather than taking data to 1931 as Coulombe has done, then neither the augmented Dickey-Fuller (ADF) test nor the Phillips-Perron test permits the rejection of the unit-root hypothesis.<sup>2</sup>
2. The author divides the data sample in two to exclude the period of the Napoleonic wars. He then uses equations estimated over the entire set of subperiods to generate inflation expectations. Although it would imply sacrificing some degrees of freedom, it might be preferable to calculate expectations on the basis of estimations that incorporate only the information that was available at each point in time (“rolling forecasts”).
3. Furthermore, the equation estimated for the second period suggests that economic agents formed their expectations by giving a certain weight to the probability that prices would return to their equilibrium value, as well as giving a weight to the current inflation rate. That might lead us to believe that agents were perhaps assigning a certain probability to the hypothesis of a return to a wartime regime of stable

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2. For the period 1717-1913, the ADF test t-statistic for the log of prices (no trend, with a constant term), using two lags in the dependent variable (selected by means of a recursive procedure) is  $-1.93$ . The test's critical value is  $-2.89$  at a threshold of 5 per cent. The ADF test therefore does not allow the unit-root hypothesis to be rejected in this case. Nor does the Phillips-Perron test allow rejection of this hypothesis: the t-statistic is  $-6.79$ , while the critical value at the 5 per cent threshold is  $-13.7$ . For this test, the number of lags is six and is based on the sample size.

inflation.<sup>3</sup> To test this hypothesis, we estimated a Markov model for the entire 1717-1913 period, with two regimes: regime 1, where the price level follows an autoregressive process of order one, and regime 2, where it is the inflation rate that follows an autoregressive process.<sup>4</sup> Figure 2 plots the probability of the second regime against the price level. The results suggest that the probability accorded an inflationary regime remained high during a period of some 10 years after the end of the Napoleonic wars, and that this probability was again strong during the 1840s and 1850s. We should interpret these results with caution, however, since diagnostic tests suggest the presence of specification errors.<sup>5</sup> Nevertheless, the approach deserves to be explored further.

4. In any case, the expectations model put forth by Coulombe would have done little to reduce the degree of uncertainty about future price trends. As noted above, the inflation rate was volatile throughout this period (its standard deviation is 5.4 per cent for the 1717-92 period and 6.3 per cent for the 1816-1913 period), whereas the equations suggest a very gradual return of prices towards their norm. In fact, the percentage of variation in the *rate of inflation* ( $R^2$ ) that is explained by the model is only 4 per cent for the first period, and 12 per cent for the second period.<sup>6</sup> Since the model explains only a small proportion of price changes (see Figure 3), we may assume that many economic agents must simply have used a rule of thumb whereby expected prices are equal to current prices— $E(p_{t+1}) = p_t$ .
5. Finally, the real interest rate, calculated by taking the difference between the yield on perpetual annuities and the anticipated inflation rate for the following year, is of limited usefulness. The inflation rate that matters for buyers of perpetual annuities is the average rate that they anticipate over an infinite time horizon. This rate would thus be much closer to zero than the rate Coulombe has used, even if we accept the rule that prices will adjust towards their norm (which implies that the expected inflation rate decreases asymptotically towards zero).

In the end, I think the author must do more to convince us that economic agents actually used a model where prices were expected to return towards their norm, and that the calculated real rate is a good approximation

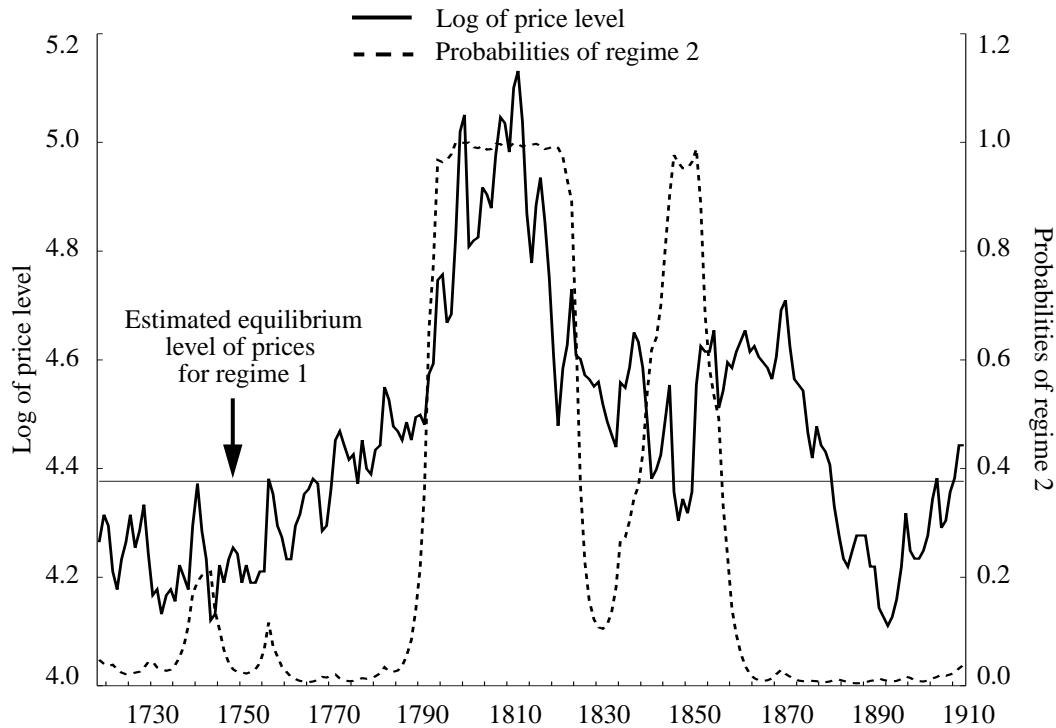
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3. I thank Pierre Duguay for pointing this out.

4. I am indebted to Ron Lange for performing these estimations.

5. Tests indicate the presence of autocorrelation and ARCH effects. Moreover, the coefficient associated with the lagged inflation rate under regime 2 is not estimated with any great precision.

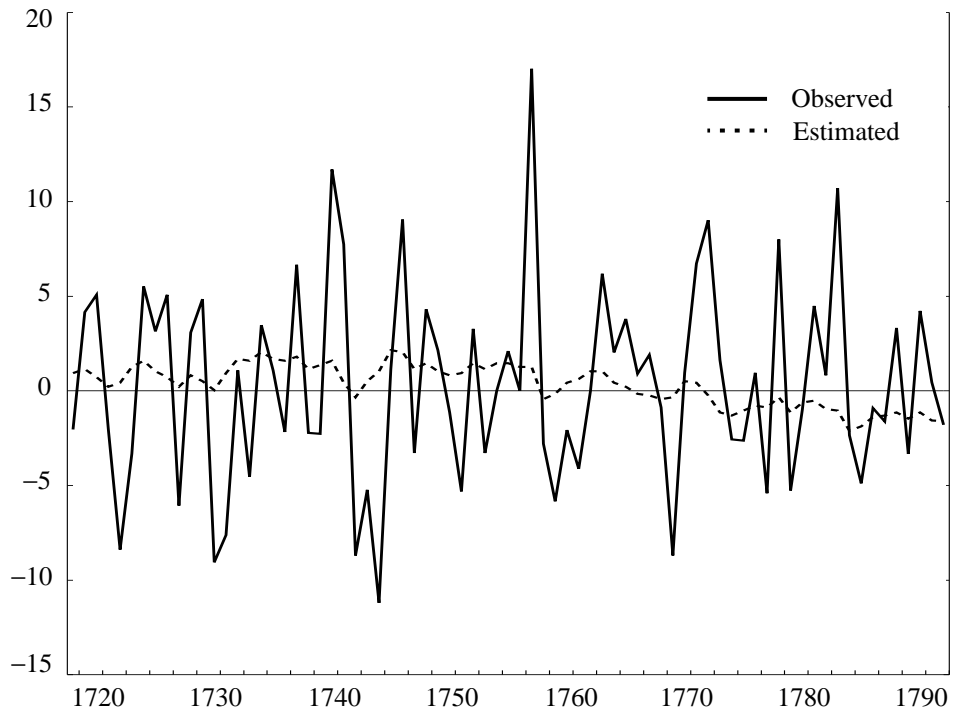
6. This  $R^2$  is obtained by re-estimating the same equations as Coulombe's, but defining the dependent variable as equal to the first difference of the log of the prices.

**Figure 2****Log of Price Level and Probabilities of Regime 2**

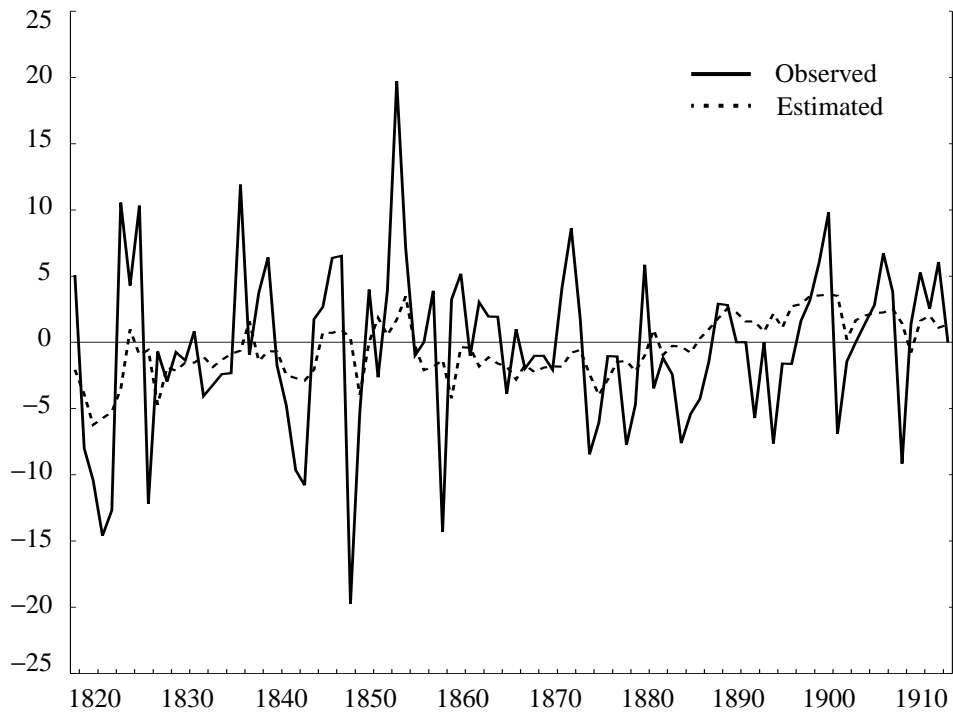
Source: Author's calculations based on data supplied by Coulombe; with the assistance of Ron Lange, who performed the estimations.

for the gold-standard period. That said, the study helps us to a better understanding of the potential benefits of a price-stability regime. The analysis shows that these benefits flow primarily from the expectations-stabilizing mechanism. Until now, the approach in most of the studies comparing various monetary regimes has been to rely on simulations of macroeconomic models, on the hypothesis that the model's parameters and structure do not change, regardless of the rule followed by the monetary authorities. Coulombe's analysis shows the extent to which this approach may be mistaken and may bias the results in favour of a stable inflation regime. When we take into account the fact that expectations are based, at least in part, on a price rule, the results become much more favourable to a regime that targets price stability. We find an example of this in the study by Black, Macklem, and Rose, included in this volume. These results make it clear that more work should be done on this question.

**Figure 3**  
**Inflation Rate**  
**1718-1792**



**1816-1913**



Source: Author's calculations based on data supplied by Coulombe.



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