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The Impact of Low Inflation on Job Search Errors of Unemployed Workers

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by

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Abstract

This paper suggests that inflation has the potential to cause job search errors that produce non-trivial increases in the unemployment rate. The analysis is conducted in the context of a job search model calibrated to be a close reflection of the Canadian labour market. When individual job searchers incorrectly perceive the location of the distribution of alternative wages, they may either reject acceptable offers or accept offers that should have been rejected. Simulation results show that modest wage-level errors can have an appreciable effect upon the unemployment rate when all job searchers make the same error. Furthermore, non-linearities in the relationship between offer arrival rates and re-employment probabilities imply that even if individual-level expectational errors average to zero, there can be an increase in the unemployment rate. To the extent that the level of inflation is linked to the variability of inflation and relative wages, this gives a reason why an economy might be expected to perform better at lower inflation rates and provides some support for a low target level of inflation.

Résumé

Le présent document suggère que, dans un contexte de recherche d'emploi, l'inflation peut entraîner des erreurs qui produisent des augmentations non triviales du taux de chômage. Cette analyse est effectuée à l'aide d'un modèle de recherche d'emploi étalonné de manière à refléter le marché du travail canadien. Lorsqu'un chercheur d'emploi perçoit incorrectement la position de la distribution des salaires, il peut être amené à rejeter une offre acceptable ou à accepter une offre qu'il aurait dû rejeter. Les résultats des simulations numériques montrent que de légères erreurs d'anticipation sur les salaires peuvent avoir des répercussions appréciables sur le taux de chômage lorsque produites par tous les chercheurs d'emploi. De plus, des non-linéarités dans la relation entre la probabilité de recevoir une offre d'emploi et la probabilité qu'un chômeur se trouve un emploi implique que même si la moyenne des erreurs commises est égale à zéro, qu'il puisse y avoir une augmentation du taux de chômage. Ainsi, dans la mesure où le niveau de l'inflation est lié à la variabilité de l'inflation ou à celle des salaires relatifs, il est raisonnable de s'attendre à une meilleure performance de l'économie lorsque l'inflation est gardée à des niveaux faibles.

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1. Introduction

The Bank of Canada recently announced that a decision regarding appropriate future inflation targets would be reached before the end of 2001 and that, in the meantime, the Bank will monitor the Canadian economy's "... ability to perform well under conditions of low inflation..." (Bank of Canada (1998), p.56). For the economy to perform well in a low inflation environment, the benefits of low inflation must exceed the costs. The costs associated with low inflation have been considered by Fortin (1996) and Akerlof, Dickens and Perry (1996, henceforth ADP) who have examined the interactions between low inflation and downward nominal wage rigidity. In the absence of off-setting benefits to further inflation reductions, the Fortin and ADP studies argue in favour of maintaining the Bank of Canada's current 1 to 3 percent targets for inflation rather than moving toward lower bands or a zero-inflation target.

Since the publication of the Fortin and ADP results, research by Groschen and Schweitzer (1997) has sought to quantify both the ADP wage-rigidity costs of low inflation and the benefits of eliminating inflation in order to determine the net benefit or cost of low inflation. Like the Groschen and Schweitzer analysis, this paper provides an explanation for a possible positive relationship between inflation and unemployment due to distortion of information. We show that inflation can cause significant unemployment-related costs in the labour market when workers must engage in job search and information about the distribution of alternative wages is imperfect.

The possible link between inflation and job search implies that the choice of inflation targets matters for labour market policy in general and not just for the Bank of Canada. If inflation has the potential to induce job-search errors, then institutions such as Human Resources Development Canada (HRDC) may need to investigate possible policy responses such as informing the unemployed about wage distributions and optimal search methods. HRDC is in fairly close contact with unemployed workers who are seldom familiar with sources of wage and labour market data. This means that HRDC front-line personnel are well placed to dispense tailor-made information that could help prevent unemployed persons from making costly errors.

The existing study by Groshen and Schweitzer looks at two specific ways that inflation affects labour markets. The first effect is that studied by Fortin and ADP in which inflation "greases" the labour market by allowing for downward adjustment of real wages in declining occupations even if nominal wages are downwardly rigid. Groshen and Schweitzer measure the size of this grease effect in their empirical work but also quantify an offsetting “sand in the works” welfare-reducing cost of inflation. The “sand” effect of Groschen and Schweitzer results from the possibility that firms’ compensation decisions may be suboptimal when inflation leads to inappropriate firm-wide salary increases. This is because firms are assumed to select a salary differential that reflects their desired position in the labor market. A firm may wish to pay efficiency wages, for example, to attract high-quality applicants but this might not be achieved if the general level of wages is actually rising more rapidly than the firm had assumed.

This cost of inflation-induced errors examined by Groshen and Schweitzer is entirely driven by distortions to employer compensation decisions. The true cost of the sand effect could be even higher if inflation also leads to sub-optimal strategies on the part of workers. In fact, inflation can also impede the functioning of the labour market by leading job seekers to incorrectly accept or reject job offers because of confusion between real and nominal wages.

Individual-level search errors can affect aggregate unemployment in two ways. First, wage errors could be highly correlated across individuals, as would be the case during periods of transition between inflation rate regimes. Such correlated errors would be less likely to occur during a period of non-zero but stable inflation (although a debate exists regarding whether inflation becomes less stable as the level rises). Even if the inflation rate is perfectly stable, however, inflation may actually raise the unemployment rate because individual job search errors can have asymmetric effects upon unemployment. This paper shows that in an optimal job search framework, two workers can make equal and opposite expectational errors that yield a decrease in job-finding rates and an increase in average unemployment durations.

This paper begins by examining the way that inflation can affect search decisions. As described in Section 2 of the paper, this analysis builds upon the earlier analysis of Björklund and Holmlund (1981) but extends their analysis by endogenizing the reservation wage. In Section 3, the theoretical model of job search behaviour developed in Sargent (1987) is generalized by introducing a probability of receiving a job offer. This extended model is then roughly calibrated to the features of the Canadian economy in Section 4 and used to obtain several interesting results about the relationship between wage distributions, job offer arrival rates, and re-employment probabilities in Section 5. In Section 6, a benchmark model of job search behaviour is compared with the results of search with inappropriate wage distributions due to incorrect expectations of the general level of wages and prices. Section 7 shows that non-trivial labour market costs result from moderate inflation rate errors. A short concluding section ends the paper.

2. The Impact of Inflation on Job Search Outcomes

The question of whether unexpected inflation can influence the duration of unemployment has been analysed in the past by Björklund and Holmlund (1981) using Swedish and US. data. Björklund and Holmlund consider a stationary search environment where aggregate demand can affect the duration of unemployment through three channels: the arrival rate of job offers, the reservation wage, and a "detection-lag" due to slow adjustment of the perceived wage distribution. The authors relate aggregate job-finding rates to vacancies and the ratio of actual to expected wages using a time-series regression. While this permitted a reduced-form analysis of the inflation-unemployment relationship, it did not allow a structural analysis of the three channels by which aggregate demand affects the job-finding rate.

In a paper with similar objectives to this one, Tommasi (1994) investigated the impact of relative price variability on product market search. Tommasi shows that variability of relative prices reduces the information content of current prices and, when linked with the "well-documented correlation between inflation and relative price variability" (p. 1385), this implies a welfare cost of inflation. Like Tommasi, we appeal to existing evidence about the link between the level of inflation and the variability of relative prices. This evidence suggests even if inflation is stable, higher levels of inflation are associated with greater dispersion of relative wages and prices. While some authors such as Parsley (1996) have questioned the size and persistence of the inflation—price variability correlation, the correlation itself seems to be an established fact.

To date, quantitative analysis of the three structural channels outlined by Björklund and Holmlund has been scarce. Authors have either ignored the links between reservation wages and arrival rates or they have focussed on determining the sign of the derivative of the re-employment probability with respect to the arrival rate. Examples of this latter approach include Burdett and Ondrich (1985) and Van den Berg (1994). In this literature, the goal is often to find the weakest conditions under which unambiguous predictions for the sign of this relationship are obtained, and not the sign itself. The importance of the magnitude of this derivative is that it determines whether arrival rate variations can be offset by changes in the reservation wage, a crucial question for the issues addressed in the current paper.

Existing empirical work has yielded some ambiguous results regarding the relationship between the rate at which job offers arrive and the rate at which the unemployed find jobs. Based on an analysis of British data, Lancaster and Chesher (1983) found an elasticity of the duration of unemployment with respect to the arrival rate of job offers that varied from -0.09 to -0.19 for groups selected according to their average duration.

On the other hand, empirical work by Jones (1988) and Lynch (1983) has shown that the unemployed typically receive very few offers and seldom reject offers that are received so that unemployment durations are largely determined by arrival rates and the elasticity would be close to -1.0. This important role for arrival rates does not at first seem to be consistent with the relatively low elasticities reported by Lancaster and Chesher.

The results of this paper can potentially reconcile these views by showing that elasticities of duration with respect to arrival rates can range from -0.04 to -1.0 as offer arrival rates vary. This is because there exists a critical arrival rate, below which job offers are so scarce that the optimal reservation wage strategy is to accept all offers. For offer arrival rates in this region, an elasticity of -1.0 is obtained as in the work of Jones and Lynch. If, on the other hand, offers arrive at a rate above this critical level, searchers adjust their reservation wages to reflect variations in the arrival rate of offers and this largely neutralizes the effect on unemployment duration, thus producing the low elasticities of the type found by Lancaster and Chesher. The following sections of the paper use an artificial economy to demonstrate these results and to quantify the impact of expectational errors upon job search behaviour.

3. Optimal Sequential Job Search when Offers Do Not Arrive Every Period

This section presents a qualitative analysis of a model of stationary search where the unemployed receive a job offer with a probability 8 per period. Sargent (1987) examines this model in the case of an offer that arrives every period and we extend it here to the situation where the job-offer arrival rate can vary between 0 and 1. If an offer is received, it is drawn from a wage-offer distribution that can be described by the density function f(*w*). If no offer is received, or if it is refused, then the agent receives an unemployment compensation *b* per period and, with probability l, receives a wage offer of w' one month later from the same wage distribution.

Given this environment, unemployed agents choose a reservation wage which varies with f(*w*), *b*, and the offer arrival rate 8. This situation can be described by the following Bellman's equation which gives the value of having a current job offer at a wage *w* and behaving optimally:

$$V(w) = \max\left\{ \frac{w}{1-b},\ b + l\ \ b \int V(w')\ \mathrm{f}(w')\ \mathrm{d}w' + (1-l)\ \ b\ \ V(0) \right\}. \qquad (1)$$

The terms of this functional equation have the following interpretation. The two arguments of the max operator pertain to the two possible search strategies: accept the job offer or reject it. If the offer is accepted, the worker is assumed to continue to work at that wage forever. With a discount factor of *b*, this gives a present value of $w/(1-b)$.

The second argument of the max operator is for the case where an offer is rejected and it has three elements. This first is the compensation *b* received while unemployed and the second and third represent the discounted expected values of continuing to search next period and acting optimally. An offer is received with probability l in the following period and the expected value of having a wage offer in this next period and behaving optimally is the expected value of *V*(*w*) given the wage distribution. Following Manuelli and Sargent (1987), we assume that the case where no offer is received next period is equivalent to receiving an offer at a wage of zero and this gives the final term in the second argument of the max operator in (1).

To solve the stationary dynamic programming problem described by the functional equation in (1), it is first necessary to find *V*(0). The reservation wage is defined at the critical wage that separates acceptable wage offers from those which will be rejected. Notice that for any wage offer at or below the reservation wage, the second argument of the max operator defines the value function and $V(w)$ does not vary with w for $w \leq w^r$. This means that:

$$V(0) = V(w^r) = w^r/(1-b)\,.$$

This expression for $V(0)$ can then be substituted into the functional equation (1). As in Sargent (1987), we use the fact that the reservation wage is the wage that equates the two arguments of the max operator in equation (1) to equate the two sides of the functional equation and split up the integral at the reservation wage and obtain

$$\frac{w^r}{1-b}\int_0^{w^r} \mathrm{f}(w')\,\mathrm{d}w' + \frac{w^r}{1-b}\int_{w^r}^{\infty} \mathrm{f}(w')\,\mathrm{d}w' = b + \frac{l\,b}{1-b}\int_0^{w^r} w^r\,\mathrm{f}(w')\,\mathrm{d}w' + \frac{l\,b}{1-b}\int_{w^r}^{\infty} w'\,\mathrm{f}(w')\,\mathrm{d}w'$$
$$+\frac{(1-l)bw^r}{1-b}\int_0^{w^r} \mathrm{f}(w')\,\mathrm{d}w' + \frac{(1-l)bw^r}{1-b}\int_{w^r}^{\infty} \mathrm{f}(w')\,\mathrm{d}w'.$$

Collecting together the integrals from 0 to w^r and from w^r to ¥ and then applying some straightforward simplification yields a reservation wage implicitly defined by the equation:

$$w^r = b + l\,\frac{b}{1-b}\int_{w^r}^{\infty} (w' - w^r)\,\mathrm{f}(w')\,\mathrm{d}w'. \quad (2)$$

For completed unemployment spells, the distribution of the post-unemployment wage is described by the conditional probability density function (pdf):

$$\mathrm{f}\,(w \mid w \geq w^r)\,. \quad (3)$$

The distribution of waiting times until a job is found and accepted is obtained by noting that in each period the probability of leaving unemployment is:

$$l\int_{w^r}^{\infty} \mathrm{f}\,(w)\,\mathrm{d}w. \quad (4)$$

The reservation wage determined by the optimal search problem has a clear impact upon job-finding probabilities and thus also the length of time that an individual spends in unemployment.

The ultimate goal of this paper is to determine whether using an incorrect density function in equation (2) can change the reservation wage to a sufficient extent that the re-employment probability in (4) changes substantially. To understand this effect, it is useful to examine in greater detail the impact of the value of *8* upon the reservation wage and thus the probability of finding a job. Important non-linearities in this relationship explain why positive and negative expectational errors can have different impacts upon unemployment and it is thus crucial that the nature of these non-linearities be well documented.

4. Calibration of the Generalized Search Model

To obtain the quantitative information used in this section of the paper, numerical rather than analytical methods are used. An empirical wage distribution is specified and parameterized so as to provide a rough match to the features of the Canadian economy. The parameterization used here is intended only to be plausible and the objective of the paper is not to search for the best depiction of the wage structure of the Canadian economy. Rather, the functional forms and parameter values are chosen to permit tractable results with reasonable parameter values.

A useful wage distribution that has been previously employed in job search studies is the Pareto distribution that has the density function:

$$\mathrm{f}(w) = \begin{cases} \dfrac{a\ w_0^a}{w^{a+1}} & \text{if } w > w_0, \\ 0 & \text{otherwise}. \end{cases} \tag{5}$$

This distribution has been used in numerous past studies of unemployment such as Jones (1988) and Lancaster and Chesher (1983).[1]

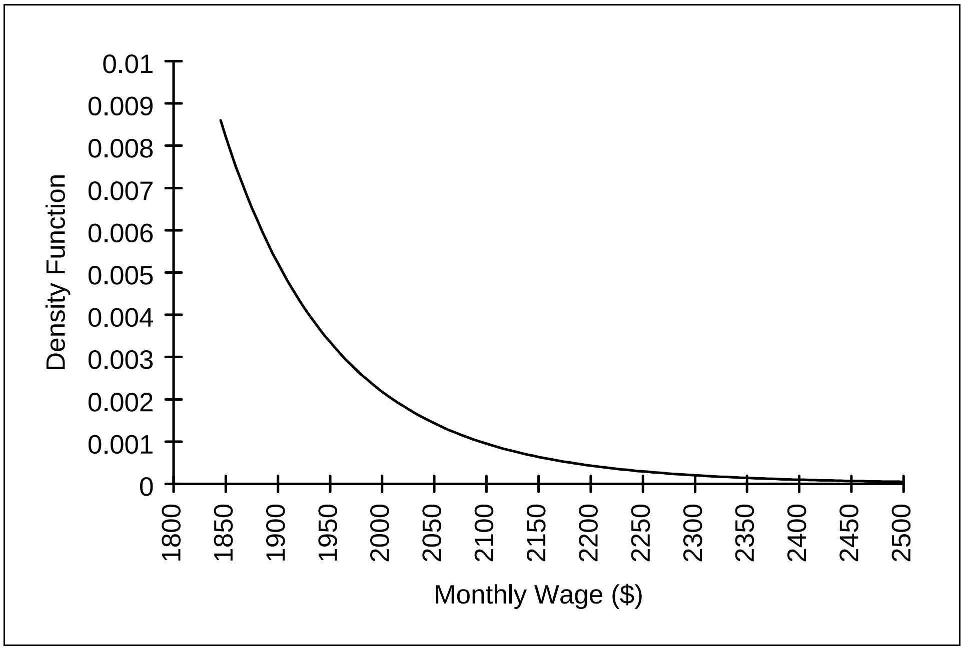
In the spirit of calibration analysis used in the quantitative/computational approach to macroeconomics, the parameters ″ and w_0 of the Pareto distribution are fitted to roughly correspond with Canadian average monthly salaries in the 1990s. An average monthly salary of $1,967 was used and this produces an average annual salary of $23,603. This is achieved by setting a scale parameter (w_0) of 1,844, a variance parameter (″) equal to 16, and measuring salaries in dollars. The variance of the wage distribution used here is just slightly lower than those used by Lancaster and Chesher or Jones.

Figure 1 graphs the Pareto density function as parameterized above. While this graph may seem to state that salary offers of less than $1,844 are never observed, such a restriction is clearly false and a more appropriate interpretation is that salaries below this level are never acceptable given the empirically observed offer arrival rates. In this case, the Pareto distribution is capturing the

[1] A virtue of this density is that it allowed the Mathematica software package to yield solutions for the reservation wage implicitly defined in equation (2).

tail of the offer distribution in the acceptable region. Furthermore, the wage distribution studied in this paper pertains to a typical *representative individual* with average characteristics. In other words, these are wages that may be offered to a single person rather than a range of wages relevant for a group of individuals. At the aggregate level, the distribution of observed wages is a mixture over many such individual distributions with the mixing probabilities being determined by the distribution of characteristics over the population. The aggregate wage distribution will also vary over the business cycle and with determinants of productivity such as the capital stock or the level of technology. For any individual, however, the salary distribution is certainly narrower than the range of salaries for the entire economy.

Figure 1: True Pareto Nominal Wage Distribution



The non-work income term reflects Employment Insurance compensation. In this case, it is set at $865.45, approximately 44 percent of the average monthly wage assumed in the paper. This factor is less than the prevailing Employment Insurance replacement rate to reflect the fact that unemployment insurance benefits expire after one year. The particular value of 44 percent was chosen along with a discount factor of 0.9755 because these two values combine to yield an average unemployment duration close to that observed in the Canadian economy. Although a discount rate of 0.9755 is theoretically valid, such a value for b is a very low value for a monthly model.

The average duration of unemployment is given by equation (4) and, once the wage distribution is determined, it is a function of the remaining three parameters *b*, l, and *b*. With the parameter values chosen here, varying the offer arrival probability from 0.05 to 1 gives durations of unemployment from 20 months to 4.63 months. With an arrival rate of 0.2, the average duration of unemployment is 5 months. These values are close to the average durations of completed unemployment spells of 14.1 to 19.6 weeks calculated in Corak (1996). We cannot get durations as short as 14.1 weeks, however, without either further reducing the non-work term *b* or further increasing the rate at which the future is discounted. In our judgement, further reduction of these figures would not be desirable. Also, while other combinations of *b* and *b* might produce similar re-employment probabilities, they have little impact upon the results presented in the paper and we prefer the values given here.

One interpretation of the difficulty encountered in matching average durations of unemployment with this search model is that in the standard search searchers are given too much of an incentive to be selective when evaluating job offers due to the assumption that jobs and individuals last forever. In this paper, we are forced to correct for this by discounting the future at an unusually high rate. Such a method was also used by Blanchard (1985) to introduce a finite horizon into an infinite horizon model. In future work, it would be desirable to explore the impact of explicitly adding a job-loss probability to the model. Given that the focus of the current paper is the impact of expectational errors, we do not pursue this approach and rely instead upon the use of an adjusted discount factor to obtain a reasonable base search model.

5. The Impact of the Offer-Arrival Rate on Unemployment to Employment Transitions

To examine the implications of the calibrated search model for the relationship between the offer-arrival rate and the job-finding probability, numerical solutions for the reservation wage are obtained over a range of values for the offer arrival rate. This is accomplished because the Pareto distribution permits a solution for the reservation wage. Essentially, it is possible to calculate the quantity:

$$b + l \frac{b}{1 - b} \int_{w^r}^{\infty} (w - w^r)\, \mathrm{f}(w)\, \mathrm{d}w \tag{6}$$

as a function of the reservation wage once values are specified for the two parameters of the Pareto distribution. This expression can then be used to find the reservation wage that solves equation (2).

This numerical solution procedure was repeated for a range of values for the arrival rate probability on the grid [0.00, 0.05, 0.10, ..., 0.95, 1.00]. Table 1 provides the reservation wage, probability of acceptance for an offer, expected duration of unemployment and probability of finding a job for each of the values in this grid range. Figure 2 illustrates the behaviour of the reservation wage from Table 1 and shows how the reservation wage is initially below the lowest wage bound in the wage distribution. As the job offer probability rises, workers become more demanding and raise their reservation wages. As the arrival rate approaches one, the reservation wage converges to $2,029 per month.

As Table 1 and Figure 3 show, these results for the reservation wage have a significant impact on re-employment probabilities when the arrival rates is low. For such low rates, all offers received are accepted and the probability of finding a job is consequently determined entirely by the offer arrival rate. In Figure 3, the relationship between the re-employment probability and the offer arrival rate is a straight line with unit slope for arrival rates of 0.2 or below. Afterward, the slope becomes quite flat as variations in reservation wages largely offset changes in arrival rates.

Figure 2: The Response of the Reservation Wage to the Offer Arrival Rate

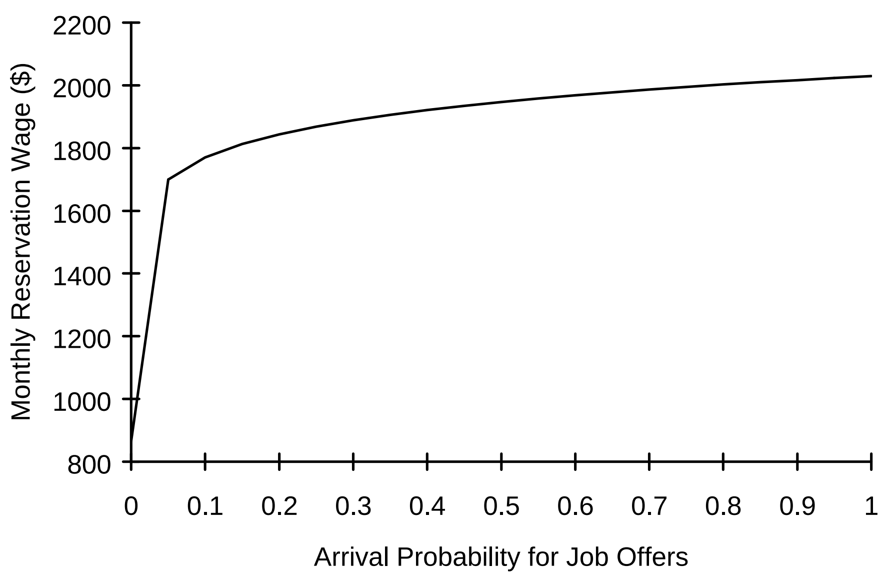
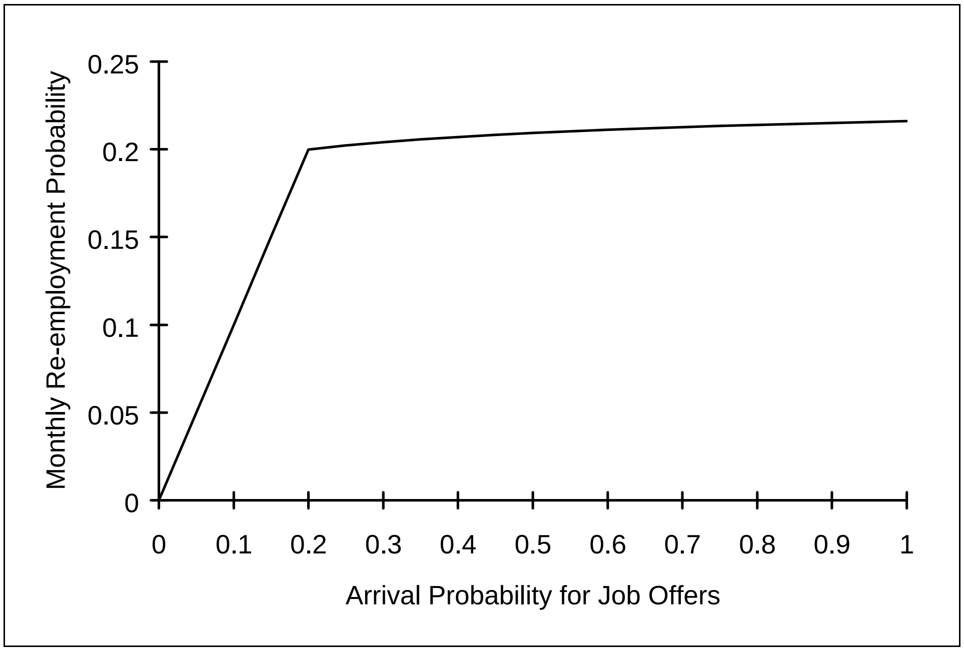


Table 1: Arrival Rates, Reservation Wages, and Re-employment Probabilities

Offer Arrival Probability	Reservation Wage	Acceptance Probability	Expected Duration	Job Finding Probability
0.00	$865	1.000	∞	0
0.05	$1,699	1.000	20.0 months	0.050
0.10	$1,770	1.000	10.0 months	0.100
0.15	$1,813	1.000	6.67 months	0.150
0.20	$1,844	1.000	5.00 months	0.200
0.25	$1,869	0.809	4.94 months	0.202
0.30	$1,889	0.680	4.90 months	0.204
0.35	$1,906	0.588	4.86 months	0.206
0.40	$1,921	0.518	4.83 months	0.207
0.45	$1,935	0.462	4.80 months	0.208
0.50	$1,947	0.419	4.78 months	0.209
0.55	$1,958	0.382	4.76 months	0.210
0.60	$1,968	0.352	4.74 months	0.211
0.65	$1,978	0.326	4.72 months	0.212
0.70	$1,987	0.304	4.70 months	0.213
0.75	$1,995	0.284	4.69 months	0.213
0.80	$2,002	0.267	4.67 months	0.214
0.85	$2,010	0.252	4.66 months	0.214
0.90	$2,017	0.239	4.65 months	0.215
0.95	$2,023	0.227	4.64 months	0.216
1.00	$2,029	0.216	4.63 months	0.216

Figure 3: Response of the Re-employment Probability to the Offer Arrival Rate



One implication of Figure 3 is that, at least for the individual illustrated here, offer arrival rates produce little variation in job finding probabilities for all but very low arrival rates. For example, an increase in the arrival rate from 25 percent per month to 75 percent per month only raises the re-employment probability from 20.2 to 21.3 percent. One way of obtaining the result that changes in re-employment probabilities reflect arrival rate variation (as the survey by Devine and Kiefer (1993) suggested) is to suppose that arrival rates are very low so that all offers are accepted.

6. The Effect of Misperceived Wage Distributions

An important result of the previous section is that there is a critical offer-arrival rate, below which all job offers will be accepted, at an arrival rate of roughly 20 percent per month.[2] Whenever the arrival rate is below this level, only the "job availability" effect of Björklund and Holmlund can give a link from aggregate demand to unemployment duration. With arrival rates below the critical level, inflation-induced wage errors have no impact upon unemployment unless reservation wages rise to the point where some offers begin to be rejected.

If significant effects of errors were possible only when arrival rates were very high, then these errors would have little consequence because searchers would soon get a chance to receive other offers and update their priors about the offer distribution. In our calibrated model economy, this does not happen: with a 25 percent arrival rate some offers are refused. If this refusal were an error, the average worker would have to wait 4 months before another offer was received.

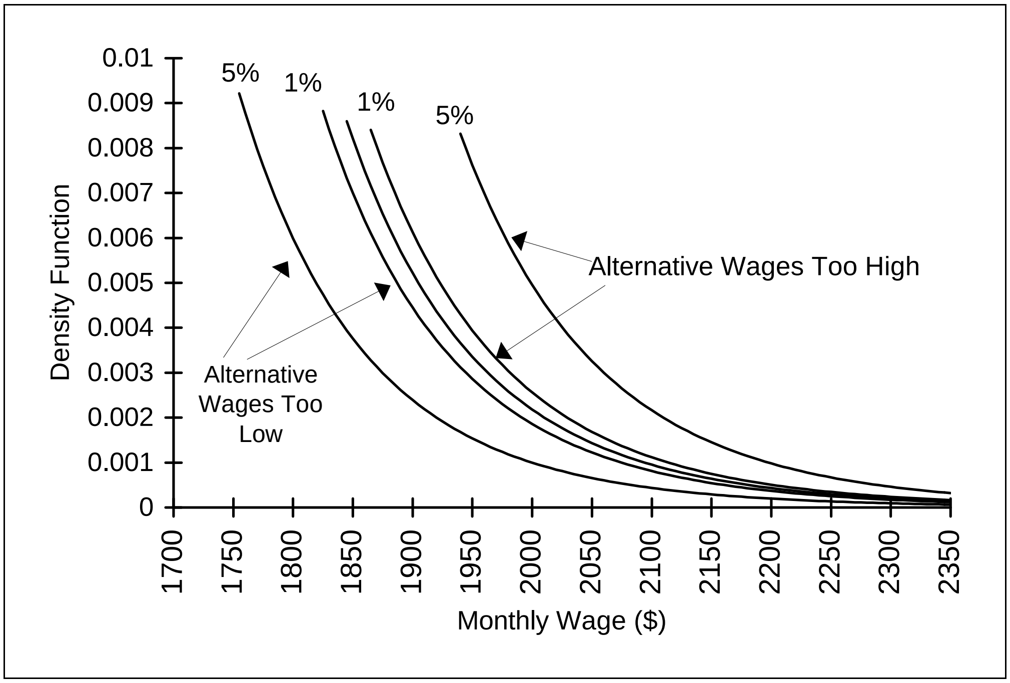
Given that job offer acceptance and rejection errors are both plausible and potentially costly, we next determine how large wage distribution errors have to be for acceptance rates to diverge significantly from the optimal level. We specify shifted versions of the true nominal wage distribution in which the perceived distribution of alternative wages is either too high or too low. Figure 4 graphs the true density function along with possible distributions which result when workers think that wages are either higher or lower than is the case in the true distribution of alternative job offers.

Following Björklund and Holmlund, we assume that errors in anticipating changes in the overall level of wages, rather than prices, create the possibility of non-optimal job rejection or acceptance. There are two ways in which individual-level inflation errors could affect unemployment. First, it is possible to adopt the "detection lag" approach of Björklund and Holmlund (1981) and assume that all labour market participants make the same errors because of unexpected changes in the rate of inflation. In this case, if wages rose at a faster rate than expected the perceived wage distribution would be lower than the true distribution of nominal

[2] This result is reasonably robust to the parameterization. In particular, if the distribution of wages is modified so as to create a higher variance of wage offers, the critical arrival rate at which offers begin to be refused falls. Given that the variance of the wage distribution used here is slightly lower than that reported by Jones and Lancaster and Chesher, this indicates that pushing the model in the direction of these results makes it even more likely that inflation errors will affect reservation wages.

wages. Conversely, if the inflation rate was lower than expected searchers would be using a wage distribution shifted too far to the right. In the first case, some offers would be incorrectly accepted while in the second case acceptable offers might actually be rejected. In this scenario, periods of unexpected rising inflation would be associated with lower unemployment and periods of unexpected falling inflation with rising unemployment.

Figure 4: The Perceived Distribution of Nominal Wages with Errors



A second effect of inflation is more subtle and is closely related to the “sand” argument of Groshen and Schwietzer. Some workers will over-estimate the position of wages while others will under-estimate it. Like Tommasi, Groshen and Schweitzer cite evidence that shows that the variability of relative prices rises with the inflation rate. If this is the case, in an inflationary period some workers will set reservation wages that are too high while other workers will make the opposite error. The net effect of these two types of error will not be zero, however, because persons who incorrectly accept a job can correct their error more quickly than those who turn down an offer that they should have accepted. Also, and perhaps more importantly, there is a range of offer arrival rates for which symmetric wage-distribution errors have a negative impact upon the average re-employment probability in the economy.

The remainder of this section considers how inflation errors of various magnitudes will affect individual reservation wages and re-employment probabilities. The effects of these various errors are summarized in Table 2 which shows the re-employment probabilities corresponding to errors of -5 percent, -1 percent, -0.5 percent, +0.5 percent, +1 percent and +5 percent. This table reveals a great deal of variation of re-employment probabilities due to errors. For example, with an offer-arrival rate of 0.5 per month, the re-employment probability ranges from 9.6 percent per month when wages are perceived to be 5 percent higher than they really are to 20.9 percent with no expectational error and through to 43.9 percent when wages are perceived to be 5 percent lower than is truly the case. Similar effects are found for all arrival rates which produce non-zero rejection rates.

Figures 5 and 6 show the impact of 1 percent and 5 percent wage errors upon re-employment probabilities. The full nature of the interactions between arrival rates, wage errors and search outcomes is revealed by the three dimensional graphs in Figures 7 and 8.

Figure 5: The Effect of a 1% Wage Error on Re-employment Probabilities

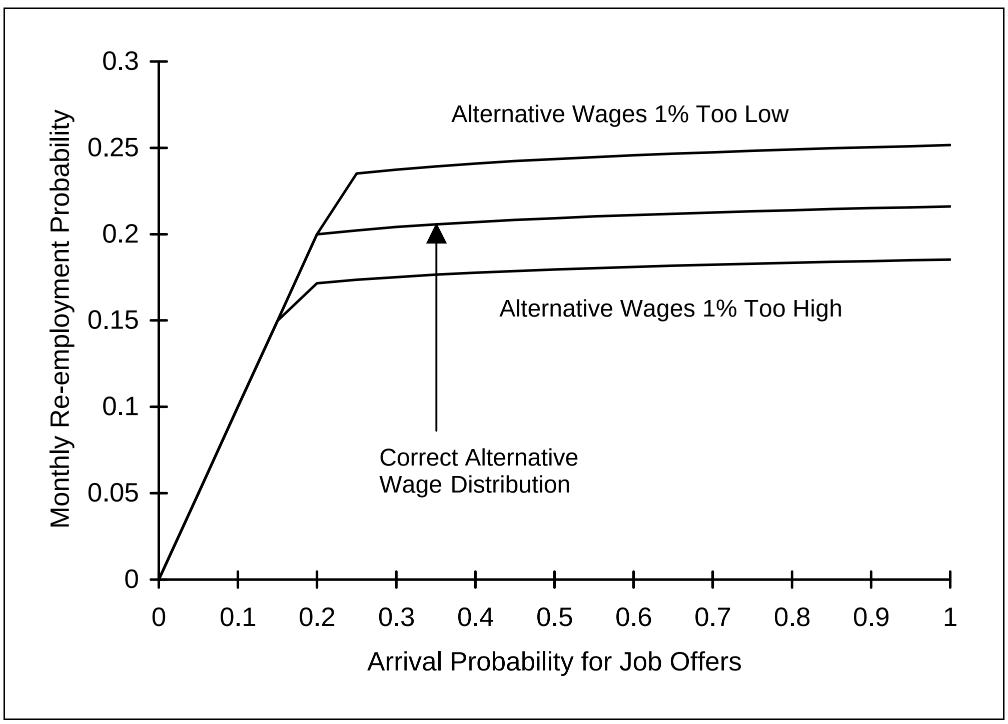
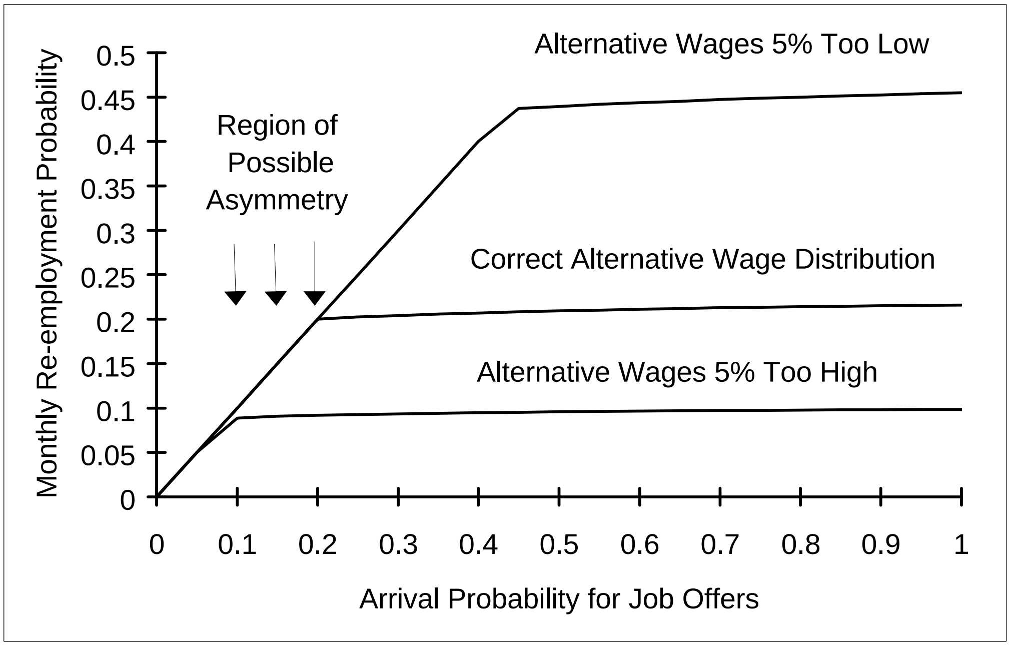


Figure 6: The Effect of a 5% Wage Error on Re-employment Probabilities



Asymmetries in the effects of over-versus under-estimation of wages are important. When the wage distribution is perceived as being farther to the left than is the case, the current wage offer is judged to be better than it really is. In this case, offers are accepted that would be refused with complete information. Such errors can be rectified almost immediately by quitting or by continuing to search on the job. Jobs that are rejected in error, on the other hand, are gone and it may be necessary to wait some time before another offer arrives. Moreover, future offers may not be acceptable. Errors involving the incorrect rejection of offers are thus likely to be more costly over time than the incorrect acceptance of a job.

A less obvious element of asymmetry is that *for certain offer arrival rates,* over-estimation of alternative wages will lower re-employment probabilities while under-estimation of wage alternatives will have no impact on the probability of becoming re-employed. This is because if it was initially optimal to accept any offers, this continues to be the case when wages are under-estimated but may cease to be true when alternative wages are perceived to be too high. Taking the case of a 20 percent arrival rate, for example, over-estimating wages by 1 percent lowers the re-employment probability from 20 percent to 17.2 percent while a 1 percent under-estimation of the alternative wage would have no effect on re-employment probabilities.

Table 2: Re-employment Probabilities When Alternative Wages Are Misperceived

Offer Arrival Rate	Perceived Alternative Wages Too *High* By:			Wages Perceived Correctly	Perceived Alternative Wages Too *Low* By:		
	5%	1%	0.5%		0.5%	1%	5%
0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.05	0.050	0.050	0.050	0.050	0.050	0.050	0.050
0.10	0.089	0.100	0.100	0.100	0.100	0.100	0.100
0.15	0.090	0.150	0.150	0.150	0.150	0.150	0.150
0.20	0.092	0.172	0.185	0.200	0.200	0.200	0.200
0.25	0.093	0.174	0.187	0.202	0.218	0.235	0.250
0.30	0.093	0.175	0.189	0.204	0.220	0.237	0.300
0.35	0.094	0.177	0.191	0.206	0.222	0.239	0.350
0.40	0.095	0.178	0.192	0.207	0.223	0.241	0.400
0.45	0.095	0.179	0.193	0.208	0.225	0.242	0.437
0.50	0.096	0.180	0.194	0.209	0.226	0.244	0.439
0.55	0.096	0.180	0.195	0.210	0.227	0.245	0.442
0.60	0.096	0.181	0.196	0.211	0.228	0.246	0.444
0.65	0.097	0.182	0.196	0.212	0.229	0.247	0.445
0.70	0.097	0.182	0.197	0.213	0.229	0.247	0.447
0.75	0.097	0.183	0.198	0.213	0.230	0.248	0.449
0.80	0.098	0.183	0.198	0.214	0.231	0.249	0.450
0.85	0.098	0.184	0.199	0.214	0.231	0.250	0.451
0.90	0.098	0.184	0.199	0.215	0.232	0.250	0.453
0.95	0.098	0.185	0.200	0.216	0.233	0.251	0.454
1.00	0.098	0.185	0.200	0.216	0.233	0.252	0.455

In Table 2, the shaded area in the upper right of the table shows combinations of arrival rates and errors for which all jobs are accepted. For any given arrival rate, if there are some cells in the shaded area and some cells outside of it, then it is possible to have a drop in the average re-employment probability even if the errors themselves sum to zero. This is illustrated for a 5 percent error in Figure 6. The region of possible asymmetry in this graph shows a range of offer arrival rates within which over-estimating alternative wages by 5 percent will lower the re-employment probability while under-estimating them by 5 percent has no effect because all offers are already accepted.

Figure 7: Arrival Rates, Wage Errors and the Reservation Wage

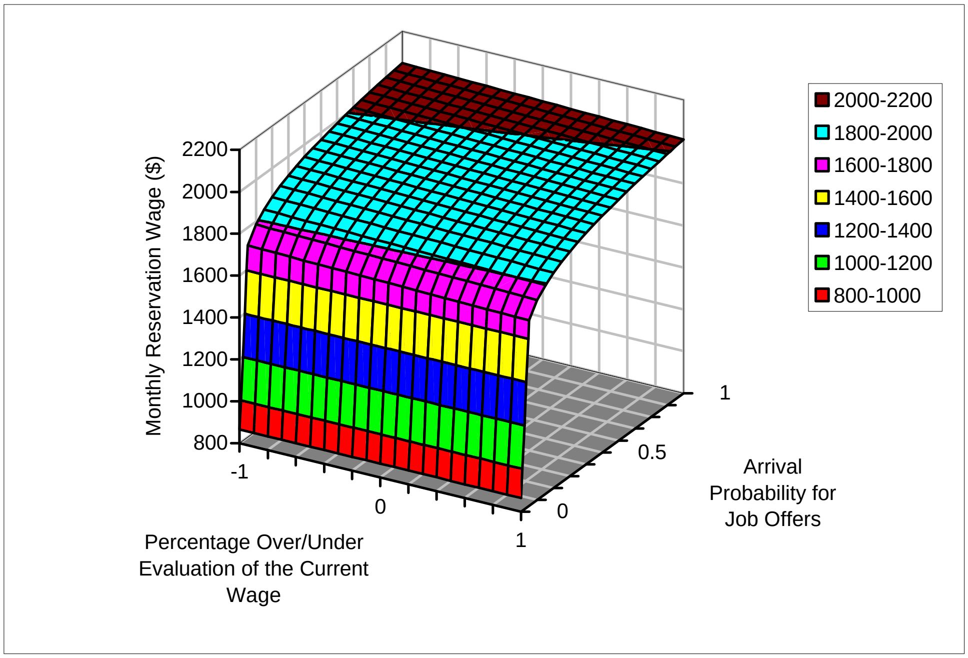
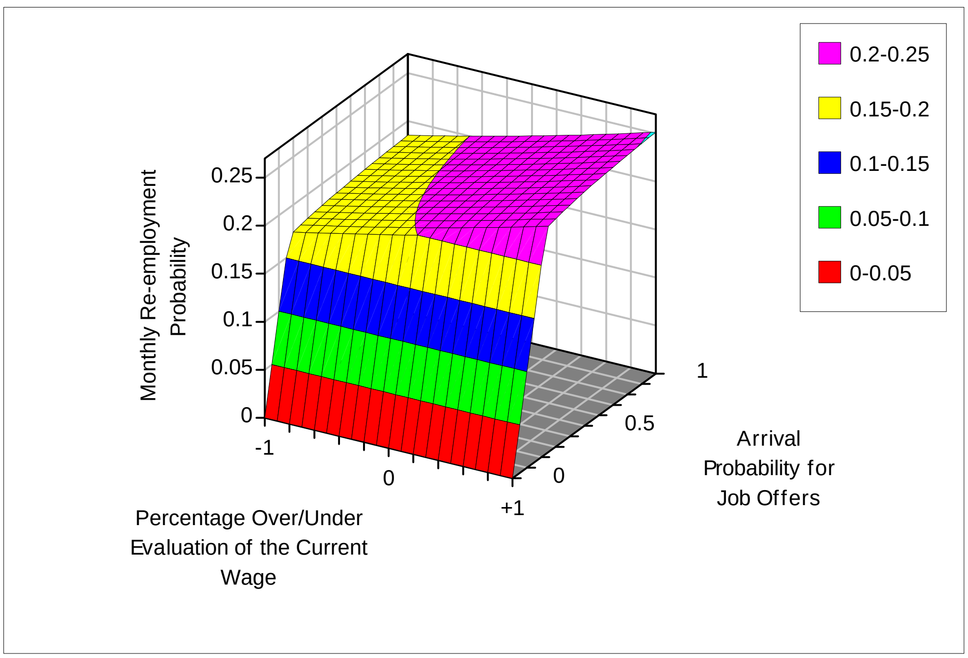


Figure 8: Arrival Rates, Wage Errors and Re-employment Probabilities



7. The Quantitative Significance of Inflation Errors

To determine the economic implications of these results it is useful to consider certain facts of the Canadian labour market. Based on Labour Force Survey data from Statistics Canada, between 1976 and 1998 average monthly employment was 12.16 million persons in Canada while average unemployment was 1.25 million persons. Given this stock of unemployed persons, and an average transition rate from employment to unemployment of 2.1 percent per month,[3] it is possible to calculate the effect of changes in re-employment probabilities due to price changes. This can be done for two scenarios: a detection lag scenario in which all searchers make the same error and a situation with zero average inflation errors but non-zero errors for individual searchers. These two will be considered in turn.

7.1 The Cost of Slow Detection of a Changed Wage Distribution

Given the process described above, if the offer arrival rate equals 30 percent, then the re-employment probability would be 20.4 percent and employment to unemployment flows of 254,698 persons are balanced by unemployment to employment flows of 254,698 persons. If the re-employment probability fell to 18.9 percent because wages were viewed as 0.5 percent higher than was the case, 235,970 persons would leave unemployment (18,728 fewer than without the error). This increase in the number of unemployed would be 36,207 persons with wages 1 percent too high and 138,586 persons with a 5 percent over-perception of the distribution of wages.

These numbers of unemployed persons are large, representing respectively 1.5 percent, 2.9 percent and 11 percent of the existing numbers of unemployed persons. If inflation errors can increase the number of unemployed persons by between 1.5 percent and 11 percent then there seems to be substantial costs of inflation, at least for some individuals. Moreover, these people who incorrectly refuse a job offer will likely remain unemployed for a non-negligible time since even if they learn that they made an error it may be some time before another acceptable offer arrives. On the other hand, the effect of inflation errors on the unemployment rate is less striking. If the labour force were to remain constant at 13.4 million persons, then the increases in the number of unemployed persons produced by price level errors would translate into increases of

[3] This 2.1 percent figure was chosen to yield a steady state with employment to unemployment flows balancing flows in the reverse direction. It is also very close to the average transition rate of 2 percent found in LFS gross flow data.

0.14, 0.27 and 1.03 percentage points (from 9.31 percent to 10.34 percent, for example, in the case of a 5 percent price error).

An increase in the magnitude of 1 percentage point in the unemployment rate is significant. As the unemployed become relatively more numerous within the labour force, the effect of a fall in the job-finding probability is amplified. Furthermore, it is clear that there is also an impact of price-level errors upon the separation rate. Persons currently employed might find their job less interesting if they over-estimated real wages elsewhere. This might produce on-the-job search or, in the extreme, quits in order to search. Perhaps more realistic is the possibility that these errors will lead to time lost through strikes and other labour disputes. This is consistent with the finding illustrated in Harrison and Stewart (1994) that the frequency of strikes in Canada increased significantly in the early 1970s when inflation first began to rise. On the other hand, while Canadian inflation was low by G-7 standards in the 1990s, strike activity in Canada was relatively high. It would be interesting to relate the variability of inflation to the frequency of strikes in a future empirical analysis.

7.2 The Cost of Symmetric but Non-Zero Errors

If errors made by some searchers offset those made by others, the impact of reservation wage errors depends upon offer arrival rates. For searchers facing arrival rates within the critical range of possible asymmetry in Figure 6, searchers who correctly perceive the wage distribution accept all offers. Those persons who perceive wages to be lower than they really are have no change in their behavior because the acceptance probability cannot exceed one. A searcher who thinks that wages are higher than the truth may (incorrectly) decide to reject some offers.

If half of the population makes a positive error and the other half makes a negative error but all are within the critical arrival rate region, then the effect on unemployment is roughly half the effect described above for the detection lag case. To see this, suppose that 625,000 of the unemployed over-estimate alternative wages by 1 percent while the other 625,000 under-estimate them by 1 percent. If the arrival rate is 0.20, the job finding rate falls to 0.172 for persons over-estimating the alternatives but remains at 0.20 for those under-estimating the alternative. This would raise unemployment by 17,500 persons or 1.4 percent of the existing stock of unemployed persons.

Of course, it is unlikely that all searchers have arrival rates in the critical region and the total effect depends upon the fraction of searchers inside this region. In this sense, the figure here is an upper bound on the impact of stable but non-zero inflation on unemployment. It is also not clear how large the errors made by individuals will be. Some persons may make errors significantly larger than 1 percent while others will make no errors. To quantify this further we need more information about the distribution of wage distribution errors.

8. Conclusions

The results of this paper suggest that reducing inflation could set in motion a process that lowers steady-state unemployment due to the effect of wage-level errors upon reservation wage strategies in an environment of costly job search. Higher inflation, particularly if it is variable, creates problems of over- and under-estimation of alternative wages that translate into non-optimal rejection of job offers. As stated above, there is some debate about the link between the level of inflation and the variability of inflation or relative prices but both Groschen and Schweitzer and Tommasi cite empirical evidence supporting the existence of such links.

For reasonable parameterizations of the search environment, price errors of a plausible magnitude have significant effects upon individual probabilities of finding a job. These changes in re-employment probabilities translate into increases in the number of persons unemployed and therefore in the unemployment rate. The effect upon the unemployment rate is less dramatic than that upon individual re-employment probabilities, but is nonetheless appreciable. Also, these effects on unemployment will diminish over time as searchers are able to adjust their strategies. It is nevertheless, true, though that some workers in particular could suffer fairly severe consequences of their search errors. These individual-level effects will be most severe for persons with low arrival rates of job offers. Finally, there are also suggestions that other factors, such as strike behaviour driven by reservation wage strategies, will amplify the costs of inflation.

An important element of these results is that even if inflation errors cancel out at the aggregate level, non-linearities in the relationship between offer arrival rates and re-employment probabilities imply that the steady-state unemployment rate could be higher in an inflationary environment. This suggests that policy-makers should include the benefits of fewer job search errors when determining how well the economy functions in a period of low inflation. Of course, these non-linearities will only impact the aggregate unemployment rate if there are unemployed persons with offer arrival rates in the region of asymmetry shown in Table 2 and Figure Six. While it is unlikely that no workers will be in this region, we need more information to determine just how many workers would actually contribute to this non-linear asymmetric effect in the Canadian economy.

Another important implication of this paper is that it may be possible to lower the natural rate of unemployment by using labour market policies designed to minimize misperceptions of the rate of change of overall wages. Employment counseling should focus on both job search methods and providing unemployed workers with information on the wage distributions of relevant jobs. If the unemployed can be shown convincing information about comparable salaries, they may be able to avoid costly periods of unemployment due to excessive wage demands. These types of policies would be particularly relevant for micro-level policy objectives of helping the least fortunate workers with low offer arrival rates since they are most likely to suffer long-lasting consequences of an incorrect job search decision.

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