The Micro and Macro of Downward Nominal Wage Rigidity

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- Evidence indicates that employers and employees are, in general, reluctant to reduce nominal wages when economic conditions would normally imply such an adjustment. In such a context, one solution that might be desirable would be a higher inflation target, which would lower real wages without necessitating nominal wage cuts. While the decision to change the inflation target is affected by many other considerations, this article focuses on downward nominal wage rigidity (DNWR) as an argument in favour of a higher inflation target, given its prominence in the literature.
- This article presents new evidence suggesting that in recent years the extent of downward nominal wage rigidity and its influence on average wage growth have increased in the Canadian labour market.
- Even if DNWR is important in the Canadian labour market, its presence alone is not sufficient to argue for a higher inflation target as long as the current target adequately addresses concerns that policy-makers have regarding the effective lower bound.

Some economists have long conjectured that, for a variety of reasons, employees and some employers are unwilling to decrease their nominal wage even when economic conditions justify a reduction. As a reason for their reluctance, employers often cite the impact that a cut in the nominal wage could have on worker morale and, hence, productivity. More-formal analysis of individual-level wage changes suggests that there are a large number of zero nominal wage changes and few nominal wage cuts relative to increases. Keynes (1936) and Tobin (1972) argue that the downward nominal wage rigidity (DNWR) demonstrated by employees and employers plays an important role in labour market dynamics and therefore has significant implications for macroeconomic policy. One implication central to monetary policy is that the presence of DNWR can lead to a long-run trade-off between inflation and unemployment when inflation is low.

The intuition for this trade-off starts with the notion that, in a low-inflation environment, the reductions in real wages that are required to offset the effects of a negative shock can only be achieved through nominal wage cuts. If employers are unwilling or unable to reduce nominal wages, their only recourse is to lay off workers, leading to an increase in the number of unemployed. One way to mitigate the adverse effects of DNWR on employment is higher inflation, which can lower real wages without a corresponding reduction in the nominal wage. When the inflation target is higher, DNWR

is less likely to prevent a decline in the real wage necessary to facilitate economic adjustment over a given time horizon. In other words, workers are assumed to suffer from "money illusion"; that is, they do not recognize the effect that inflation has in reducing the real value of their wages and so accept real wage cuts that they would not accept otherwise.[1] Proponents of this view, such as Akerlof, Dickens and Perry (1996) and Fortin (2013) regard inflation as "grease" that can aid labour market adjustments.

In the Canadian labour market, the extent of downward nominal wage rigidity and its influence on average wage growth have increased in recent years

Since one of the core questions associated with the 2016 renewal of the inflation-control target is whether to change the target, the Bank of Canada undertook work to examine the prevalence and implications of DNWR for Canada.[2] Brouillette, Kostyshyna and Kyui (forthcoming), extending Crawford and Wright's earlier analyses (2001 and 2004), re-examine whether DNWR is present in the Canadian labour market using two sources of Canadian micro-data representing the firm and worker levels and find evidence consistent with the presence of DNWR. They find that the extent of downward nominal wage rigidity and its influence on average wage growth have increased in recent years. Studies for other countries, such as the United States and Europe, also find evidence of the presence of DNWR in labour markets (Fallick, Lettau and Wascher 2016; Deelen and Verbeek 2015; Babecký et al. 2010; Dickens et al. 2007; and Fehr and Goette 2005).

At the same time, Amano and Gnocchi (forthcoming) take DNWR as a given and explore its implications for monetary policy in a macroeconomic model that includes an effective lower bound (ELB) on nominal interest rates. Preliminary results from their model support the finding that when DNWR and the ELB are each considered in isolation, they tend to favour a higher inflation target, in line with previous results from the literature. In fact, and similar to the case of DNWR, the ELB also provides a rationale for a positive inflation target, as discussed by Witmer and Yang (2016). At first glance, this might create expectations that introducing both frictions into a common framework would lead to an even higher optimal inflation target. However, the authors find that this is not the case. More specifically, adding DNWR to a model that already incorporates the ELB does not raise the optimal inflation target because firms' anticipation of DNWR dampens declines in prices, wages and, ultimately, interest rates. This effect, in turn, reduces both the frequency and the severity of ELB episodes for any given level of the inflation target.

Results by Amano and Gnocchi (forthcoming) and Brouillette, Kostyshyna and Kyui (forthcoming) exclude several factors that would be considered in a decision to change the inflation target. First, a higher inflation target may not help in the presence of downward real wage rigidity, which may even increase with inflation. Second, other real labour market frictions, such as a lack of flexibility in adjusting hours or the level of employment, might amplify the costs of DNWR and result in a higher inflation target than found in this article. Third, the findings hinge on the assumption that monetary policy follows a simple interest rate rule. However, unconventional monetary policy, such as quantitative easing, forward guidance and negative nominal interest rates, might completely eliminate the occurrence of ELB episodes

1 The assumption of money illusion is not essential for our argument. As an alternative, and to the extent that debt obligations are not indexed to inflation, workers might value DNWR because it reduces uncertainty about their future nominal income. If this is the case, they would accept a real wage cut triggered by a rise in inflation that would also reduce their real debt burden.

2 As part of its mandate to promote the economic and financial welfare of Canada, the Bank uses monetary policy to achieve a 2 per cent inflation-control target, within a target range of 1 to 3 per cent. This target is renewed every five years by the Government and the Bank of Canada. The next renewal is scheduled for the end of 2016.

and restore the traditional argument by Keynes (1936) and Tobin (1972) regarding the role of DNWR in labour market dynamics and macroeconomic policy (see page 15). Moreover, labour market policies implemented by the government may be more effective in addressing labour market frictions and may eliminate the need to grease the wheels of the economy through higher inflation. Finally, since the theoretical model is calibrated, the quantitative results should be taken as suggestive, although they seem qualitatively robust to changes in the calibration of key variables. With all these caveats in mind, the findings still qualify Tobin's conclusions and emphasize that DNWR is not sufficient by itself to justify an increase in the inflation target.

Evidence for Canada Based on Firm and Worker Data

To assess the extent of DNWR, changes in wages over time are usually examined, either at the job level (for a given position) or at the worker level (for persons keeping the same job). Recent work by Brouillette, Kostyshyna and Kyui (forthcoming) combines both types of microdata. The authors analyze changes in hourly wages using the Major Wage Settlement (MWS) data set and the Survey of Labour and Income Dynamics (SLID) data for Canadian employees.[3] The MWS data set contains reliable administrative data and covers a long period (January 1978 to May 2015) but only for unionized firms with more than 500 employees.[4, 5] The SLID data set consists of a representative sample of the entire Canadian working-age population from 1993 to 2011 but includes self-reported information, which may likely be subject to reporting errors. With MWS, the first-year change in the base pay is analyzed in a period when a wage negotiation took place; therefore, changes in wages that occur in a particular year but that were negotiated in previous years are not included in the sample.[6] With SLID, the individual hourly wage used in the analysis is derived from self-reported total hours worked and wage income, which includes tips, commissions and bonuses. Combining both sources of information allows for a more extensive analysis of DNWR in the Canadian labour market.

Measuring downward nominal wage rigidity

One way to measure DNWR is to analyze the distribution of the changes in hourly wages from one period to another (e.g., annually). For example, firms adjust wages following changes in the demand for their products or in the face of technological or productivity shocks. In the case of a negative demand shock, firms may need to reduce wages and may even lay off workers. But wage reductions could be prevented by DNWR. How would this be reflected in the distribution of the observed wage changes? **Chart 1** shows two possible wage distributions—with and without DNWR. Assume, for example, that 25 per cent of firms experience a negative demand shock following an adverse commodity price shock and want to reduce wages. Firms in other sectors are much less affected and either freeze wages (40 per cent) or increase wages (35 per cent).[7] In the absence of DNWR, wages are fully flexible and all firms wanting to reduce wages (25 per cent)

3 SLID was a survey conducted by Statistics Canada. MWS data are collected by the Labour Program at Employment and Social Development Canada.

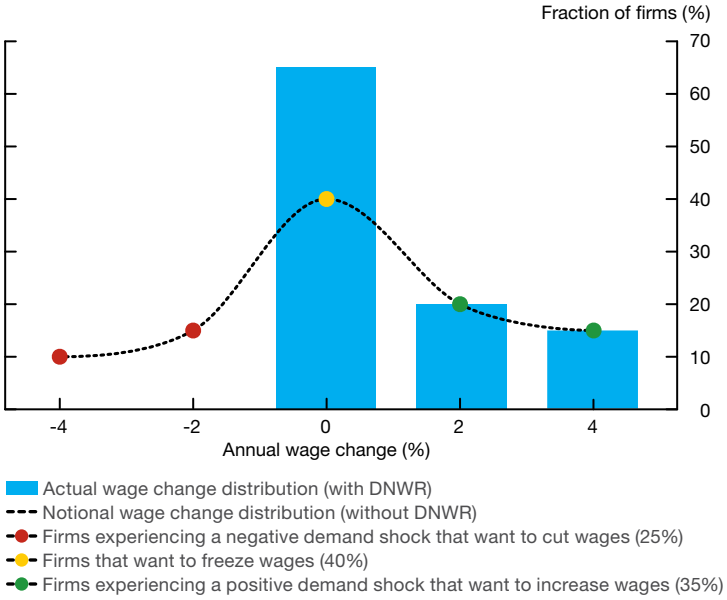
4 The term "firms" here refers to both public sector organizations and private sector firms.

5 According to Crawford and Harrison (1998), the wage distribution of the MWS data is not significantly different from some other data sources (e.g., the annual compensation survey of Sobeco Ernst and Young for 1989–96).

6 An important caveat here is that the resulting data set covers only those large unionized firms that negotiate a wage change in a reference year.

7 All the numbers cited in the example are hypothetical.

Chart 1: Hypothetical example of the distribution of wage changes with and without downward nominal wage rigidity (DNWR)



Note: All numbers are hypothetical.
Source: Authors' calculations

can do so. The distribution of wage changes without DNWR—the notional wage change distribution—is depicted in **Chart 1** by coloured dots on the dotted line. In the presence of DNWR, however, desired wage cuts turn partially or fully into wage freezes. In this simple example, assuming that all wage cuts are turned into wage freezes, 65 per cent of firms overall would freeze wages, compared with 40 per cent when DNWR is not present. The actual, or observed, wage distribution in the presence of DNWR is shown by the blue bars. An increase in the percentage of freezes in hourly wages may therefore be an indicator of the growing importance of DNWR. Estimates of the impact of DNWR can then be derived by comparing the notional and observed distributions of changes in hourly wages.

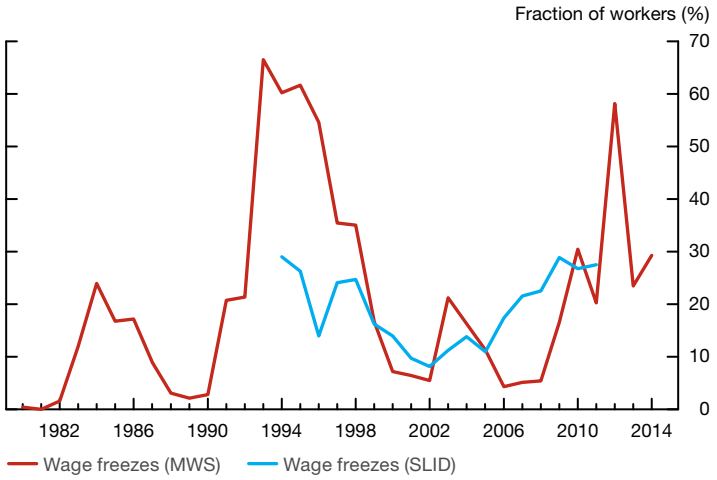
Downward nominal wage rigidity in Canada

The increase in the share of workers experiencing wage freezes is driven not only by lower inflation but also by the weakness in aggregate demand

Data from both MWS and SLID provide evidence that the effect of DNWR may have increased in recent years. **Chart 2** depicts the proportion of wage freezes observed in both the MWS and SLID data (red and blue lines, respectively).[8] As suggested by the MWS data, the proportion of freezes in hourly wages increased from 5 per cent in 2008 to almost 58 per cent in 2012. The percentage of wage freezes, however, dropped to about 25 per cent in 2013 and 2014. SLID data also show an increase in the percentage of wage freezes from 2008 to 2011, although this increase was smaller. Interestingly, a similar level of wage freezes was observed in the MWS data in the early 1990s, when the inflation level and the inflation-control target were higher. This suggests that the increase in the share of workers experiencing wage freezes is driven not only by lower inflation but also by the weakness in aggregate demand.

8 In the SLID data, the analysis is restricted to job-stayers, defined as workers having a job tenure of at least 24 months, who had only one paid job (self-employed workers and those working at non-paid jobs are excluded from the analysis). The change in average annual wage in the SLID data is taken into account here. In the MWS data, the unit of observation is a firm negotiating a change in the base pay in a given year.

Chart 2: Observed wage freezes in Canada



Sources: Major Wage Settlement database, Survey of Labour and Income Dynamics data and Bank of Canada calculations

Last observations: MWS, 2014; SLID, 2011

The average wage change decreased substantially over the entire period, from about 13 per cent in the early 1980s to 1.5 per cent in 2014, in line with the lower level of inflation observed in Canada after the introduction of the inflation-control target. The variance of wage changes also declined after the early 1980s. Following the Great Recession, over the period from 2008 to 2012, the average wage change decreased from 3.4 per cent to 1.6 per cent.

The percentage of hourly wage freezes cannot by itself identify the extent of DNWR because some workers might have experienced hourly wage freezes even in the absence of DNWR, as discussed in the simple example described above. More extensive empirical analysis is necessary to identify the percentage of hourly wage freezes driven by DNWR. The main hurdle is the estimation of the notional distribution of hourly wage changes, which, by definition, is not observed. Assumptions need to be made on the properties of the distribution, and results may be sensitive to these assumptions.

Extending the analytical framework of Crawford and Wright (2001), Brouillette, Kostyshyna and Kyui (forthcoming) estimate the underlying notional distribution of changes in hourly wages. The authors then quantify the impact of DNWR on average wage growth (i.e., by how much DNWR inflated average wage growth because its presence prevented some wage cuts). Their empirical analysis using MWS data suggests that the effects of DNWR have become slightly more important since the Great Recession. For example, annual wage growth of workers in large unionized firms was inflated by about 0.2 percentage points (pp), on average, during the 2010–15 period because of the presence of DNWR, while the average impact between 2006 and 2008 was less than 0.1 pp.[9] Estimates using MWS data are presented here because MWS was the main source of data historically used to study DNWR in Canada, despite its limited coverage. Estimation results using the SLID data are qualitatively similar in the sense that these data also suggest that the effects of DNWR have increased since the 2009 recession. Quantitatively, the results from the SLID data also suggest that the effects of DNWR might be larger for smaller firms than for bigger firms.

9 It is noteworthy that the impact of DNWR also increased in the wake of the 1991 recession, although to a larger extent, from less than 0.1 pp (1986–91) to 0.7 pp (1992–97).

Our results are in line with the findings in the empirical literature for Canada and other countries—that DNWR is present. We should be cautious, however, before concluding that our results imply that DNWR has real macroeconomic effects on, for example, long-run employment. This is especially true considering that the analysis excludes other types of labour market frictions that could affect unemployment in the absence of DNWR.[10] Some previous studies analyzing DNWR in Canada (e.g., Fortin 2013; Simpson, Cameron and Hum 1998) find that the combination of DNWR and low inflation pushed unemployment above the level it would have been in the absence of DNWR, suggesting that real wage erosion through inflation takes more time when inflation is low. In contrast, Farès and Lemieux (2001), Faruqui (2000) and Farès and Hogan (2000) find that DNWR had no long-term effect on unemployment. Overall, the presence of DNWR is not by itself sufficient to support the inference that the natural rate of unemployment may be higher than it would be in the absence of DNWR.

The presence of downward nominal wage rigidity (DNWR) is not by itself sufficient to support the inference that the natural rate of unemployment may be higher than it would in the absence of DNWR

The Macroeconomics of Downward Nominal Wage Rigidity

Modelling downward nominal wage rigidity and the effective lower bound

In addition to DNWR, the recent experiences of central banks operating at or near the ELB have also raised the question of whether a higher inflation target would provide policy-makers with a potentially useful buffer against this lower bound (see Blanchard, Dell'Ariccia and Mauro 2010). While these two issues have been studied separately with respect to their implications for the inflation target, relatively little work has been done on their interaction. In an effort to fill this important gap, Amano and Gnocchi (forthcoming) construct several variants of a standard New Keynesian model with different combinations of DNWR and the ELB.[11] In particular, they start with a standard New Keynesian model in which price and wage adjustment entails costs that increase disproportionately to the size of the adjustments. The model is calibrated such that nominal prices and wages adjust every two and four quarters, respectively. Nominal price rigidity generates a New Keynesian Phillips curve that positively links price inflation to the unit labour cost. Monetary policy is represented by a Taylor rule, with a 1.2 weight on inflation's deviations from target, a 0.07 weight on GDP fluctuations and a 0.4 weight on the lagged interest rate.[12] Conditional on this rule and a set of demand and supply shocks, the model is simulated over a series of inflation targets that range from zero to five. The optimal rate of inflation is then computed as the one that maximizes households' welfare.[13] The quantitative results should only be taken as suggestive. However, these results are qualitatively robust to changes in the calibration of key variables, including the length of nominal contracts, the sensitivity of monetary policy to deviations

10 An issue not investigated in this analysis is the presence of downward real wage rigidity (DRWR). A higher inflation target may not be desirable if it generates more DRWR, making the real wage adjustment even more difficult. In such a case, other labour market policy (e.g., a policy introducing more flexibility in hours worked) may be needed to facilitate the labour market adjustment.

11 In this article, we focus on the case of a zero lower bound for both the nominal interest rate and nominal wage growth.

12 The calibration of the Taylor rule is borrowed from Kim and Ruge-Murcia (2009), who study optimal monetary policy in the presence of DNWR without taking into account the ELB constraint.

13 The theoretical model assumes that the economy is closed to international trade and thus does not account for the loss of competitiveness that DNWR would impose on exporters in the event of an adverse productivity or foreign demand shock. However, the model captures these costs in an ad hoc fashion through domestic supply shocks. In fact, these shocks harm the economy if prices and nominal wages are not perfectly flexible and call for a positive inflation target, even in this setup, as in Tobin's original argument.

in inflation and output, the relative size of the demand and supply shocks, the interest rate elasticity of consumption demand, and the level at which the ELB is imposed.

The results are summarized in **Table 1**. In the model, a positive inflation target increases relative price dispersion because of price and wage rigidity and leads to an inefficient allocation of resources (Woodford 2003), making fluctuations in inflation costlier as the trend level of inflation rises (Coibion, Gorodnichenko and Wieland 2012). In fact, as relative price dispersion grows larger, households and firms increasingly dislike uncertainty about the level of price dispersion and inflation. For the baseline case with no DNWR or ELB, inflation does not have any benefit but only entails welfare costs, and the optimal inflation target is found to be zero, consistent with previous literature (Woodford 2003).

Table 1: The impact of the effective lower bound and downward nominal wage rigidity on the optimal inflation target

Version of model	Optimal inflation target (per cent)
No ELB or DNWR	0.0
ELB	4.5
DNWR	1.0
ELB and DNWR	1.5

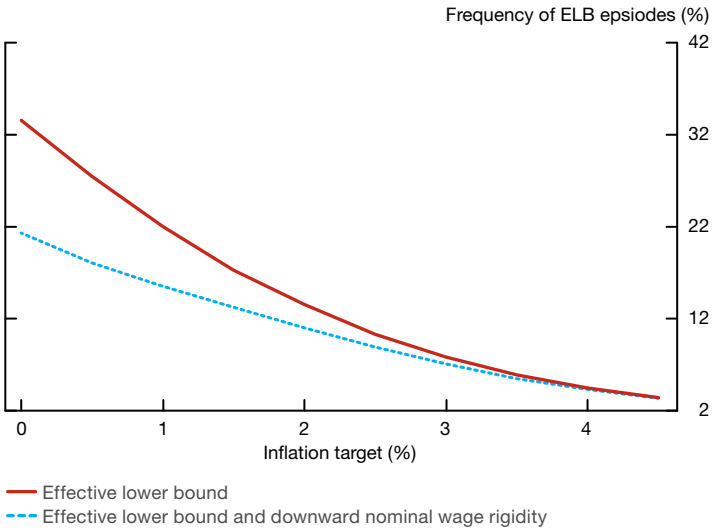
Source: Authors' calculations

In a second version of the model (the ELB model), the ELB is imposed at 0 basis points, and the model is simulated using the same calibration as for the baseline case. As shown in **Table 1**, this causes the optimal inflation target to rise from 0 to 4.5 per cent. Positive trend inflation provides the economy with a buffer against ELB episodes, during which volatility in inflation and output spikes. On the other hand, a higher inflation target magnifies inflation volatility in normal times, generating larger inefficiencies. This trade-off explains why the optimal level of the inflation target is not large enough to eliminate ELB episodes completely, which occur with a frequency of roughly 3.5 per cent in the case of a 4.5 per cent inflation target (**Chart 3**), as opposed to a frequency of 33 per cent in the case of a zero inflation target.

A third version includes DNWR but not the ELB. DNWR is modelled by placing a zero lower bound on the growth of nominal wages, thus capturing the notion that firms may face greater frictions when contemplating nominal wage decreases relative to increases of the same magnitude. This allows the model to capture the effects of DNWR without appealing to the traditional assumption of money illusion. As shown in **Table 1**, this version of the model places the optimal inflation target at 1 per cent, given that higher inflation helps to "grease the wheels" of real wage and labour market adjustments.

Chart 4 provides a comparison of the dynamic responses of the DNWR model with the baseline model (with no DNWR or ELB), when the models are perturbed by a negative demand shock and the inflation target is set at 2 per cent. Wage inflation, which is initially at its 2 per cent trend level, decreases by 2 pp after the shock and hits its lower bound in the DNWR model. Since DNWR prevents nominal wages from falling further than in the baseline model, inflation and nominal interest rates also tend to react by less. Hence, for a given interest rate rule, DNWR diminishes the accommodation provided by monetary policy and causes employment to decline by more than it would otherwise, depressing consumption.

Chart 3: The effect of downward nominal wage rigidity on the frequency of effective lower bound episodes



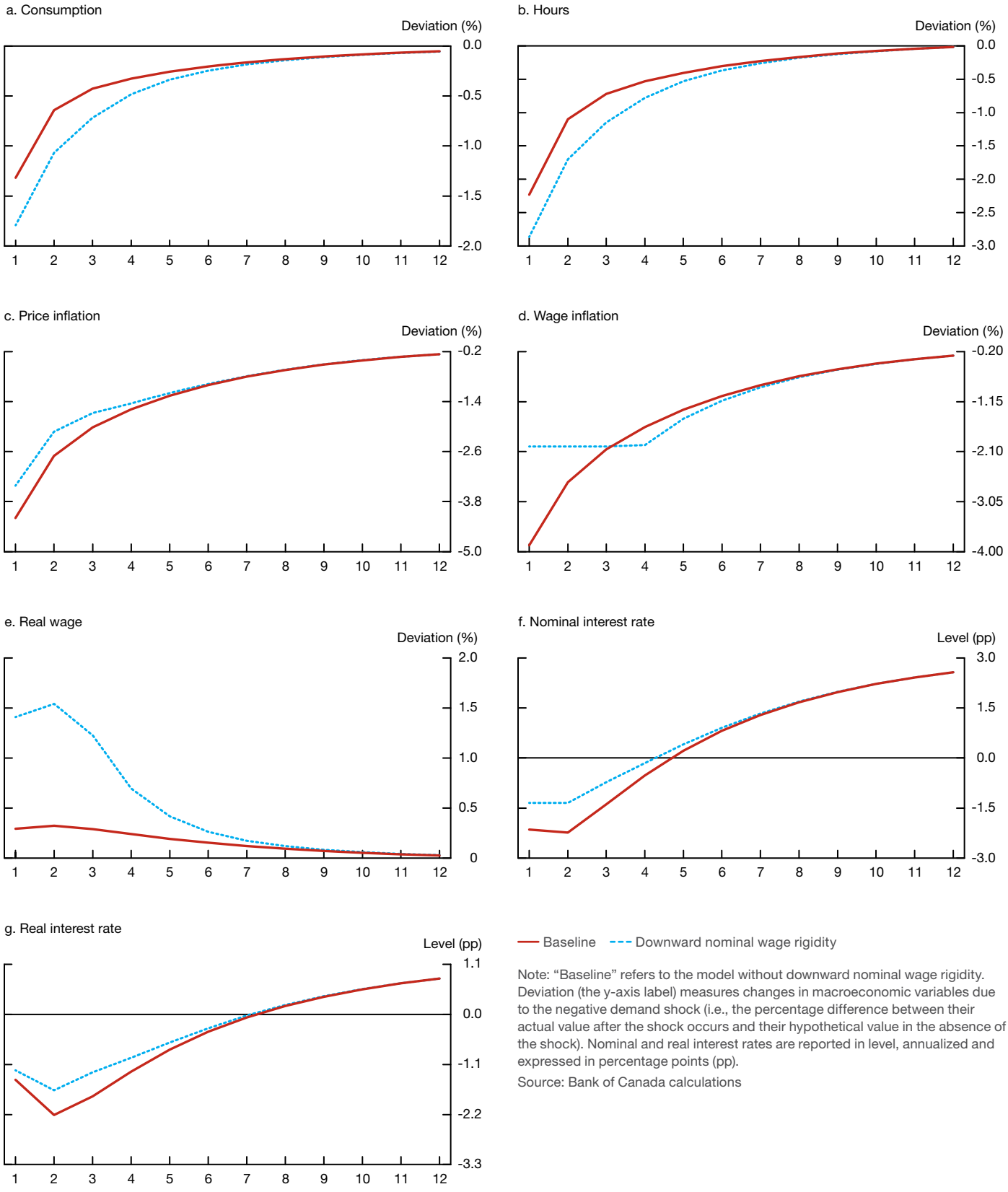
Source: Bank of Canada calculations

Downward nominal wage rigidity moderates declines in nominal wages and, subsequently, in prices and interest rates. This dampening effect then reduces the frequency of episodes of the effective lower bound for any given inflation target

The final version of the model incorporates DNWR and the ELB simultaneously (the ELB-DNWR model). As mentioned above, one might initially think that these two frictions would jointly drive the optimal inflation target above the 4.5 per cent prescription delivered by the ELB-only version. However, our results suggest otherwise. Indeed, relative to the ELB-only model, the optimal inflation target when DNWR is included falls to 1.5 per cent. The principal reason for this drop is that DNWR moderates declines in nominal wages and, subsequently, in prices and interest rates. This dampening effect then reduces the frequency of ELB episodes for any given inflation target. **Chart 3** illustrates the magnitude of this effect. In this chart, the frequency of ELB episodes (vertical axis) is plotted against the inflation target (horizontal axis). The solid line corresponds to the ELB-only model, while the dashed line corresponds to the model with both frictions. When policymakers target zero inflation, we see that the introduction of DNWR causes the frequency of ELB episodes to fall from 33 per cent to 20 per cent, approximately. However, as the inflation target rises, the effect of DNWR on the frequency of ELB episodes weakens, especially once the inflation target exceeds 3 per cent. A similar picture emerges with respect to the average duration of ELB episodes. For example, our baseline calibration predicts that the introduction of DNWR should reduce the average duration of ELB episodes by 40 per cent when the inflation target is at zero, but by only 20 per cent when the inflation target is at 2 per cent.

Chart 5 demonstrates these effects by comparing the response of the ELB-only model (solid line) with that of the ELB-DNWR model (dashed line) following a demand shock that forces the nominal interest rate to its ELB. From this chart, we see that DNWR has the conventional effect of placing upward pressure on real wages. In isolation, this effect would tend to favour lower employment. However, **Chart 5** also makes it clear that the response of price inflation in the ELB-DNWR model is substantially diminished relative to that in the ELB model. In particular, price inflation falls by only 4 per cent in the ELB-DNWR model, whereas inflation in the ELB model declines by more than 8 per cent and remains lower for more than one year. Since

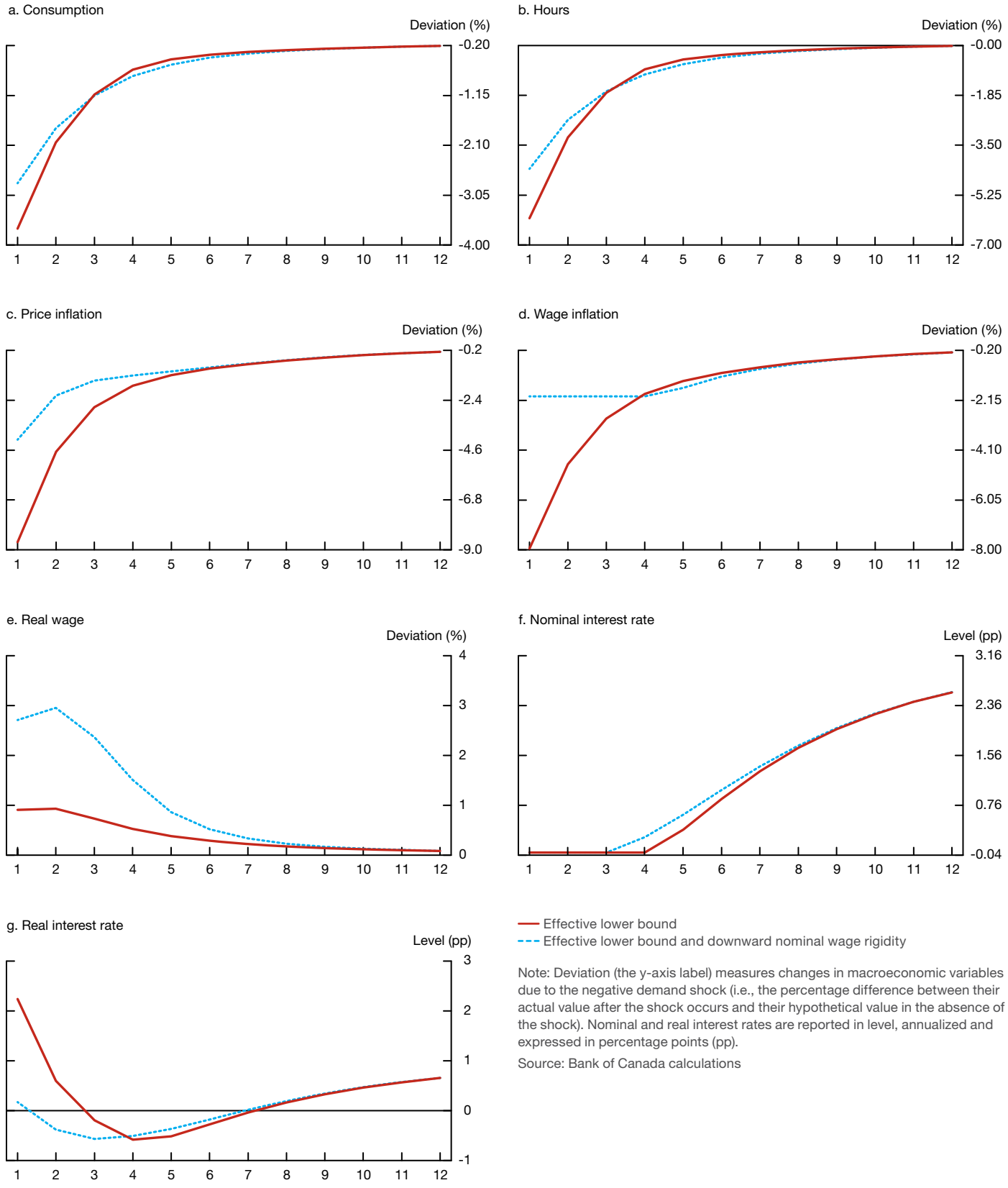
Chart 4: Effect of a negative demand shock on macroeconomic variables in the absence of the effective lower bound
Quarters after the shock



Note: "Baseline" refers to the model without downward nominal wage rigidity. Deviation (the y-axis label) measures changes in macroeconomic variables due to the negative demand shock (i.e., the percentage difference between their actual value after the shock occurs and their hypothetical value in the absence of the shock). Nominal and real interest rates are reported in level, annualized and expressed in percentage points (pp).

Source: Bank of Canada calculations

Chart 5: Effect of a negative demand shock on macroeconomic variables when the effective lower bound is taken into account
Quarters after the shock



Note: Deviation (the y-axis label) measures changes in macroeconomic variables due to the negative demand shock (i.e., the percentage difference between their actual value after the shock occurs and their hypothetical value in the absence of the shock). Nominal and real interest rates are reported in level, annualized and expressed in percentage points (pp).

Source: Bank of Canada calculations

higher inflation translates into lower real interest rates due to the ELB, the ELB-DNWR model thus delivers lower real rates in response to the demand shock. In isolation, these lower real rates would tend to favour higher aggregate demand and, in turn, higher employment. The net impact of DNWR on employment thus depends on how the benefits associated with lower real rates balance against the costs associated with higher real wages. From **Chart 5**, we see that the former dominates, with the ELB-DNWR model ultimately delivering higher employment, higher consumption and a lower duration for the ELB episode.[14]

Overall, combining DNWR with the ELB reduces the frequency, duration and welfare cost of ELB episodes relative to the ELB-only case. This suggests that previous literature focusing exclusively on the ELB may have overestimated the optimal inflation target.

Theory of the second best

The result that the ELB and DNWR combined does not lead to a higher inflation target than the ELB alone may, at first, seem a little surprising. However, the result has an analogy in the public finance literature and the theory of the "second best." The ELB and DNWR are both undesirable constraints because each of them considered in isolation prevents the economy from efficiently responding to aggregate shocks. Combined, however, they partially offset each other so that DNWR is desirable when the ELB is binding, similar to a fiscal subsidy that counteracts the negative effects of a distortionary tax, a case often discussed in the literature of public finance. For example, Bénabou (2002) and Bovenberg and Jacobs (2005) show that subsidizing education improves welfare because progressive income taxation discourages the accumulation of human capital by lowering expected returns from schooling. This example, like our finding, is an application of the theory of the second best, first formalized by Lipsey and Lancaster (1956–57): in economies where it is impossible to perfectly correct a particular distortion, introducing a second distortion may mitigate the first one and lead to a more efficient outcome. As a result, the second best might counterintuitively differ from efficiency.

According to the findings by Amano and Gnocchi (forthcoming), DNWR acts as both a complement and a substitute for monetary policy when the ELB is taken into account. On the one hand, DNWR works with a positive inflation target in reducing the risk of monetary policy becoming constrained by the ELB. On the other hand, when such a risk materializes, DNWR takes over the role of the policy rate—which cannot be further decreased—in supporting aggregate demand.

Downward nominal wage rigidity acts as both a complement and a substitute for monetary policy when the effective lower bound is taken into account

Conclusion

This article discusses two recent studies, Brouillette, Kostyshyna and Kyui (forthcoming) and Amano and Gnocchi (forthcoming), which analyze the extent of DNWR in the Canadian labour market and its implications for the conduct of monetary policy. One manifestation of DNWR should be an increase in the incidence of wage freezes in the distribution of wage changes as wage cuts become more difficult to implement. Microdata evidence shows that this has been the case in Canada since the mid-2000s,

14 Consumption is equal to the sum of wage income and firms' profits, net of price and wage adjustment costs. In the ELB-DNWR model, inflation is lower than in the ELB model and adjustment costs are smaller. As a result, percentage differences in consumption across models cannot be explained entirely by percentage differences in labour income.

which suggests that the effect of DNWR has increased. This conclusion is supported by the results of Brouillette, Kostyshyna and Kyui's empirical analysis that finds that the effects of DNWR on average wage growth have become stronger in recent years. For example, average wage growth was about 0.2 percentage points higher between 2010 and 2015, owing to the presence of DNWR among large unionized firms that negotiated wage changes during this period.

The results described in this article have a number of potential implications. First, DNWR may be an important piece of the "missing disinflation" puzzle of why advanced economies did not experience disinflations of the magnitude normally associated with the large output gaps witnessed during the Great Recession. That is, DNWR may play a role in stabilizing prices during periods of persistently high unemployment. Second, the presence of DNWR may suggest that nominal wages will lag the economic recovery because firms were unable to reduce their wages as much as they would have liked during the recession. Third, and perhaps most significant from the perspective of the 2016 renewal of the inflation-control target, the results suggest that DNWR is no reason to increase the Bank's inflation target if policy-makers are satisfied that the current target adequately accommodates their concerns about the ELB.

Downward nominal wage rigidity is no reason to increase the Bank's inflation target if policy-makers are satisfied that the current target adequately accommodates their concerns about the effective lower bound

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