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ABSTRACT

We introduce a new data set on over 230,000 monthly prices for 10 goods in 50 Canadian cities over the 40 year period from 1910 to 1950. This coupled with previously published price information from the late twentieth century allows us to present one of the first comprehensive views of nominal rigidities and retail price dispersion over the past 100 years. We find that nominal rigidities have been conditioned upon prevailing rates of inflation with a greater frequency of price changes occurring in the 1920s and the 1970s. Additionally, the process of retail market integration has surprisingly followed a U-shaped trajectory, with many domestic markets being better integrated—as measured by the average dispersion of retail prices—at mid-century than in the 1990s. We also consider the linkages between nominal rigidities and price dispersion, finding results consistent with present-day data.

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1. Introduction

In this paper, we introduce a new data set on over 230,000 monthly prices for 10 goods in 50 Canadian cities over the 40 year period from 1910 to 1950. This coupled with previously published price information from the late twentieth century allows us to present one of the first comprehensive views of nominal rigidities and retail price dispersion over the past 100 years. Thus, we are in a unique position to answer the following questions. Are the patterns of retail price dispersion extensively documented for Canada in the late twentieth century indicative of earlier conditions? Are nominal rigidities as prevalent in deflationary environments such as Canada experienced in the 1920s and early 1930s as they are in settings of low-to-moderate inflation? How are these two phenomena affected by adverse external economic conditions such as the two World Wars or the Great Depression?

As such, the paper draws on two distinct bodies of research in macroeconomics. First, there is the burgeoning literature on using micro-data to detect nominal rigidities. Starting with the work of Carlton (1986) and Ceccheti (1986), the literature has moved beyond the study of specific products or markets. Instead, studies in the genre employ massive datasets on almost the entire range of goods entering into the typical consumption basket. Thus, Bils and Klenow (2004) deploy detailed pricing information underlying the United States' consumer price index, encompassing nearly 80,000 goods and services across 22,000 outlets in 88 geographic areas. Likewise, Dhyne *et al*. (2006) are able to muster an almost equally impressive dataset on the euro area while Ahlin and Shintani (2007) and Gagnon (2009) extend the empirical rigidity literature to the developing world. The common denominator in all the more recent studies is that there is both a higher frequency of price changes and a higher degree of heterogeneity of those price changes over product categories than has been generally appreciated.

At the same time, the behavior of purchasing power parity and its relationship to nominal rigidities remains a central question in macroeconomics. In the past dozen years, there has been an explosion of studies exploring the issues first raised in Engel and Rogers (1996). While Engel and Rogers' study had at its heart the divergence of real exchange rates across national borders and the consequently puzzling nature of the border, another strand of the literature has picked up the issue of purchasing power parity within national borders (cf. O'Connell and Wei, 2002; Parsley and Wei, 2001). However, these two forces of nominal rigidities and retail price dispersion are generally considered in isolation and are marked by a limited temporal scope, so that the patterns which emerge from these studies may be not be able to be generalized. One of the exceptions here is the very recent work of Crucini, Shintani, and Tsuruga (2009) which links the temporal pricing strategy of firms with the pricing behavior of geographically dispersed retail markets. We follow their lead in this regard, but also exploit the panel nature of our data to consider this linkage over time.

In summary, we find that the degree of price stickiness has been conditioned upon prevailing rates of inflation with a greater frequency of price changes occurring in the 1920s and the 1970s. Additionally, we find that the process of retail market integration has surprisingly followed a U-shaped trajectory, with many domestic markets being better integrated—as measured by the average dispersion of retail prices—at mid-century than in the 1990s. We also consider the linkages between price dispersion and nominal rigidities, finding results which are consistent with present-day data. In what follows, Section 2 discusses the data employed in this paper while Section 3 presents our results with respect to nominal rigidities, retail price dispersion, and their linkages in the context of the early twentieth century Canadian macroeconomy. Section 4 concludes with a comparison of results for the late twentieth century as well as suggesting avenues for future research.

2. Data

The sole source of retail price data used in this study is the Canadian Department of Labour's *Labour Gazette*. This periodical was published monthly to maintain a running record of retail prices paid by workers. Local correspondents for the Department of Labour reported city-wide average prices paid in representative retail establishments for a wide range of goods and for all Canadian cities with a population of 10,000 or more inhabitants. The department ensured comparability of price quotes by demanding detailed explanations of any monthly variation (and even in some cases, extended lack of variation) in local retail prices. Publication began in 1910 and ended in 1950. All told, the *Labour Gazette* represents the most comprehensive source for retail prices in the early twentieth century for Canada.[1] The perspective it brings is unique in that detailed price data are not available for the vast majority of countries over this period. We might also add that for the one other country with relatively abundant pricing data—the United

[1] Missing observations constitute less than 1% of the sample and were substituted with estimates from the TRAMO (Time Series Regression with ARIMA Noise, Missing Observations and Outliers) program developed by Gomez and Maravall (1997).

States—government data collection and storage procedures in the early twentieth century obscured the behavior of prices through aggregation, inconsistent use of price indexing principles, and in some cases, the outright destruction of data.

The *Labour Gazette* has also been used by a number of studies which examine the course of real wages in the Canadian economy across the twentieth century. Emery and Levitt (2002) were the first to exploit the potential of this source by combining detailed information on the cost of living and nominal wages for thirteen Canadian cities. They document that regional price levels—which in 1900 diverged by as much as 50% between eastern and western localities—experienced protracted convergence from 1914. This price level convergence was, however, matched by convergence in nominal wages, generating little—if any—convergence in real wages and incomes across provinces. Following up on this study, Coe and Emery (2004) explore the issue of Canadian labor market integration by comparing the behavior of real wages from 1901 to 1950 versus their behavior from 1971 to 2000. What emerges from this study is the view that the Canadian labor market experienced fundamental—but undocumented—structural change in between 1950 and 1970 as the rate of employment and not real wages became the chief means by which regional disparities in the short-run business cycle and long-run growth paths were ameliorated.

What sets this study apart is the decided focus on the dynamics of nominal rigidities and retail price dispersion. To this end, we have collected the full set of monthly observations on retail prices for the period from 1910 to 1950 contained in the *Labour Gazette* rather than the single observation for January of each year used in Emery and Levitt (2002) and Coe and Emery (2004). In order to ensure strict comparability across time, we have narrowed our attention to a set of 10 identical goods which appear consistently from 1910 (or 1916) all the way up to 1950.[2] Likewise, the sample has been further refined by collecting retail price data for only those 50 cities which appear consistently from 1910 to 1950. In total, we exploit less than half of the available retail price data available in the *Labour Gazette*, yet we are still able to compile a data set of over 230,000 monthly price observations.

Figure 1 depicts the 50 cities included in our retail price sample. Obviously, the sample is heavily biased towards eastern Canada with only 13 cities making an appearance west of the

[2] As the *Labour Gazette* data were published to promote labor mobility across Canada, the set of goods for which prices are reported should accurately reflect the typical consumption bundle of the time.

Manitoba/Ontario border. Given historical patterns of settlement, the sample is probably not unduly biased on a population basis.[3] Table 1 also provides information on the commodity composition of the sample, including the mean and standard deviation of retail prices Although limited in size, the goods represented—all dietary staples—undoubtedly contributed a significant, albeit declining, portion of the average Canadian budget of the time. And apart from the late start date of canned goods in the survey (1916), the panel is nearly balanced with only a few missing observations at the beginning and end of the period for each good, totaling 233,025 observations on retail prices.

3. Empirics

3.1. Nominal rigidities through time

In light of the growing empirical literature on nominal rigidities in the present, it comes as somewhat of a surprise that we have very little understanding of how nominal rigidities have evolved over time. Kackmeister (2007) represents an exception. Using matched retail price data in the United States for 1889-1891 and 1997-1999, he finds that price changes in the past were much less frequent, smaller on average, more narrowly distributed, and more permanent. On this basis, he argues that the nineteenth century was marked with a higher frequency of temporary price shocks and higher menu costs. However, the potential role of changes in monetary regimes—that is, from the deflationary world of the classical gold standard to the inflationary world of the post-Bretton Woods era—remains unexplored.

Recent research suggests that this transition might have mattered. Ahlin and Shintani (2007) expands the scope of existing country studies, generally the United States or other OECD members, by considering the Mexican experience with nominal rigidities. Using establishment-level data around the time of the Tequila Crisis in January 1995, they are able to exploit the dramatic and somewhat unexpected change in inflation over the two years of 1994 and 1995. They find results which are compatible with a model in which firms' optimal pricing behavior is state-dependent—where the timing of price changes is endogenous—rather than time-dependent—where the set of firms changing prices is fixed exogenously within a period. Likewise, Gagnon (2009) extends their dataset with highly detailed scanner data from Mexican grocery stores to

[3] In 1911, roughly 24% of the Canadian population resided west of the Manitoba/Ontario border. By 1951, this figure had only increased to slightly over 26%.

shed more light on the applicability of standard pricing models. His implicit argument like that of Ahlin and Shintani (2007) is that there is not sufficient variation in the inflation experiences of most OECD countries to get a firm grasp of which model is most appropriate. Exploiting the high degree of variation in Mexican inflation rates, he finds that for low-inflation environments—with an annual inflation rate below 10-15%—the empirical behavior of prices shares similarities with time-dependent pricing models while for high-inflation environments—with an annual inflation rate above 10-15%—they share similarities with state-dependent pricing models.

In what follows, we borrow from this literature by considering three summary statistics on nominal rigidities: the frequency of price changes, the average size of price changes (in absolute terms), and the share of price increases in price changes. The frequency of price changes is calculated as the proportion of months in which retail prices change over a given time horizon; thus, the reciprocal of this measure informs us on the number of months which pass on average before retail prices change. The average size of price changes is calculated as the mean absolute monthly change in retail prices in percentage terms, irrespective of whether retail prices have changed or not. The share of price increases is calculated as the proportion of retail price changes which are positive in value. We also consider how these measures systematically vary across commodities, provinces, and time in response to the prevailing rate of inflation.

Table 2 reports the first of these exercises by looking at the three metrics of rigidity for goods across time. Thus, the figure for beef in 1910-1915 of 0.2476 suggests that, across provinces, beef changed price roughly once every 4 months on average. With few exceptions, all the commodity series obey the following pattern: starting from a low base, the frequency of price changes dramatically rises in the 1920s, reaching a peak in the late 1920s/early 1930s, and sliding into the 1940s. The only exceptions are milk which from the 1920s was tightly regulated through provincial marketing boards and potatoes which persists with a high frequency of price changes into the 1940s. Also of interest, here, is the wide disparity in the frequency of price changes across commodities. On average, potatoes exhibited the highest frequency of price changes and milk the lowest; this finding tends to be true not only over the entire period, but also for every sub-period. Given the unique characteristics of these products as well as their market structures, this should not come as a surprise. What this disparity in the frequency of price changes does point out is the need for consistent and representative consumption baskets whenever aggregate measures of nominal rigidities are used.

In terms of the average size of price changes, a figure for beef in 1910-1915 of 0.0247 suggests that the unconditional average price change per month was around 2.47%; that is, we calculate the average (absolute) change in price over all months, including those with no changes. The information in the two panels on the frequency of price changes and the average size of price changes can be used to form an approximation of the average conditional on prices having actually changed. In the case of beef in 1910-1915, this conditional average would be (0.0247/0.2476)=0.0998. That is, given a price change has occurred, the average percentage change in the price of beef was nearly 10%. Overall, the unconditional average exhibits a pattern, one strikingly common across commodities: the average size of price changes declines through time with the majority of the fall being concentrated in the 1930s. The size of these changes is also more narrowly distributed than the frequency of price changes reported above as (barring potatoes) the unconditional average figures only range from 0.0138 for milk to 0.0413 for prunes. It is, again, only potatoes which deviates from this pattern: the average size of price changes was 0.1326. The last panel of Table 2 considers the share of price increases in price changes. Here, there seems to be very little disparity across commodities. The majority of price changes were price increases with the average share ranging from 0.5003 for sugar to 0.5782 for milk. At the same time, there seems to be less change across periods although the average share does uniformly dip into the early 1930s and uniformly increase from the late 1930s, corresponding with the deflationary pressures of the post-WWI and Great Depression periods.

We also consider whether these properties of goods across time are somehow affected by commodity-province specific unobservables. Table 3 relates the three measures on nominal rigidity across goods and space rather than across goods and time. There, many of the features of Table 2 are replicated: the relatively anomalous behavior of milk and potatoes for the frequency and average size of price changes; the tight distribution of the frequency and average size of price changes for all other commodities; and the predominant, but not overwhelming role of price increases in the share of price changes. Thus, given these properties, it seems appropriate to think of Canadian patterns in nominal rigidities being driven by changes in provincial rigidities over time, rather than changes in good-specific rigidities across space.

To this end, we consider Table 4 which reports our three measures across provinces and time. In other words, we average the frequency of price changes, the size of price changes, and the share of price increases in price changes *across* all commodities to arrive at "aggregate" measures of nominal rigidities. We employ the term, "aggregate", in the sense that we recognize that the commodity composition of the sample could only account for a small portion of the typical consumption basket of the time, but is the only consistent sample of goods at our disposal. With this caveat in mind, the results on the frequency of price changes in Table 4 demonstrate a remarkable consistency across Canadian provinces. The average value across periods is narrowly distributed with a low of 0.615 in the Maritimes and a high of 0.664 in Alberta, suggesting that the provinces were likely buffeted by common shocks—a possibility we explore below. Over time, the provincial as well as the Canadian (simply, the average of the provincial figures weighted by the number of cities in each province) frequencies all rise up to 1925-1930 and then decline all the way into the 1940s. Likewise, we see little variation in the average size of price changes across provinces as well as little trend in the average size of price changes in Canada until 1930-1935 at which point the average size declines by half. Finally, we see little variation in the share of price increases in price changes. However, there is a persistent decline in this share from 1910-1915 to 1930-1935 at which point this measure reverses trend and begin to rise all the way through the 1940s. All of these results seem to suggest that it makes sense to speak of truly *Canadian* trends in nominal rigidities.

Given the importance of the rate of inflation in determining patterns of price setting and changes in the modern data (Konieczny and Skrzypacz, 2005), it may then pay to relate information on the two in a more explicit fashion. We run the following regression:

1.) $NR_{p,q} = \alpha_p + \beta_1 \Pi_{Canada,q} + \varepsilon_{p,q}$

where $NR_{p,q}$ is one of our three "aggregate" measures of nominal rigidity for province p in quinquennia q, α_p are provincial fixed effects, and $\Pi_{Canada,t}$ is the average monthly inflation rate for Canada in quinquennia q calculated from the Statistics Canada wholesale consumer price index reported in the Global Financial Database.[4] Table 5 provides summary statistics on the

[4] That is, it is independently constructed and is based off wholesale—and not retail—prices. Furthermore, it encompasses a wider range of goods: the Statistics Canada price index aggregates 18 sub-indices ranging from "paints, oil, and glass" to "raw furs". The 10 goods in our sample would presumably fall into only three of these

variables in 1.) along with those for the paper's remaining regressions while Figures 2a through 2c chart the "aggregate" measures of nominal rigidity across time and against the average monthly inflation rate. Regression results are reported in Table 6 below.

Panel A of Table 6 confirms that the rate of inflation did vitally affect the frequency and size of price changes as well as the share of price increases in price changes. However, it should be emphasized that the rate of inflation, while positively associated with the share of price increases in price changes, enters the frequency and size of price change estimating equations with a *negative* sign. What must be borne in mind here is that the period from 1910 to 1950 encompassed times of not only inflation, especially in the war years, but also strong rates of deflation in the period from 1920 to 1935 where the frequency of price changes was on the rise. What the negative coefficients pick up then is the degree to which retail prices were not downwards nominally rigid in face of the deflationary pressures attendant upon the end of the World War I commodity price boom and the Great Depression. This is seen in the results that the share of price increases rises while the frequency and size of price changes falls with the rate of monthly inflation.

We also consider another possibility, namely that the average level of prices might vitally affect nominal rigidities. The concern is that in earlier periods money was not sufficiently divisible to facilitate frequent price changes for certain goods. For instance, in the period from 1910 to 1915, the average price of milk across cities was 8 cents per quart. Thus, a one-cent increase in the average price of milk represented an adjustment in price of 12.5%. In periods of low prices, prices may have only adjusted once accumulated inflation was enough to justify the 12.5% increase. In Panel B of Table 6, we include the average level of prices across commodities but within provinces to control for this effect. We find a statistically significant relationship only for the frequency of price changes, finding that lower average price levels were associated with less frequent price changes. However, this addition is not enough to override the negative relationship between the average inflation rate and the frequency of price changes documented in Panel A.

sub-categories: "animals & meat", "dairy produce", and "other foods". Thus, any correlation between the dependent and independent variables is not automatic by construction.

3.2 Retail price dispersion through time

One of the defining debates in Canadian economic history has been the degree to which one can speak of a truly Canadian market, whether it be for wholesale goods (Minns and MacKinnon (2007), labor (Coe and Emery, 2004), or capital (Keay and Redish, 2004). This paper contributes to this debate through the explicit consideration of the dynamics of retail price convergence across the early half of the twentieth century. To begin, we consider a simple metric of price convergence commonly used in the literature. The coefficient of variation (CV) is simply the standard deviation of retail prices across markets divided by their arithmetic average. In simplest terms, what is expected from increasing market integration is a decline in the value of the CV as the distribution of prices becomes more concentrated around the mean.

Figures 3a through 3d depict the CV on a monthly basis across the 50 cities for each individual good. The goods are grouped across the four categories of animal products, canned goods, dry goods, and the singular potato. Within product categories, there appears to be a fair degree of consistency with correlations ranging from 0.55 to 0.85. Across product categories, we find the highest average level of price variation in potatoes and the lowest average levels in the dry goods category. This accords with our expectations as potatoes were a highly seasonal crop and one which was marked by highly localized markets until the advent of flash freezing while dry goods were non-perishable and of relatively high value. Indeed, in an unreported regression of the average CV for the period from 1916 to 1925 on the average price per pound in the same period and expected shelf-life in years, the coefficients on both variables is negative and highly significant: a one standard deviation increase in average price reduces the average CV by 0.85 standard deviations while a one standard deviation increase in shelf life reduces the average CV by 0.75 standard deviations.

More importantly, Figures 3a through 3d also give us a rough sense of the timing of retail market integration across Canadian markets. All series return their highest values in the years between 1910 and 1916. From these high points, all experience significant declines into the early 1920s—a result which is consistent with the findings of Emery and Levitt (2002) as well as Minns and MacKinnon (2007). Broadly, this was followed by either a slight decline or flat-lining of the CV until the outbreak of the Great Depression which witnessed fairly uniform increases in the CVs. Finally, the outbreak of World War II seems to have spurred the process of integration much as did World War I. Although for certain goods, namely sugar and tea, the effects of wartime rationing seem to be at work as well.

Rather than relying on such ocular econometrics, we can consider a slightly different metric which borrows from the contemporary literature on purchasing power parity and the real exchange rate. Engel and Rogers (1996) is the obvious place to start looking. There, $p^i_{j,k,t}$ is the log of the price of good *i* in location *j* relative to location *k*, or $\ln(\frac{P^i_{j,t}}{P^i_{k,t}})$. They then difference this ratio between time *t* and *t-2* and calculate its standard deviation over the period from 1978 to 1994. Recently, Broda and Weinstein (2008) have pointed out that this standard deviation term only captures what they term "Approximate Relative PPP" in that it only measures changes in the percentage deviation of prices in two locations. This property is generated by the fact that Engel and Rogers used city-specific CPI information which was only available in index form. Broda and Weinstein further suggest that in the case where exact price levels are available a more intuitive measure of price dispersion is simply $\left|p^i_{j,k,t}\right|$, the absolute value of the log of the price of good *i* in location *j* relative to location *k*, itself averaged over an appropriate period of time. Here, we average over non-overlapping 5 year periods as before. In what follows, we utilize this average price dispersion measure as our dependent variable, using the city-wide averages of retail prices for good *i* detailed above.

Rather than using the full set of possible city-pair combinations (50*(50-1)/2 = 1225 per quinquennia), we make do with the set of city-pair combinations formed by using Toronto as the reference city (49 per quinquennia). The idea here is that by using the larger set our estimation strategy will not fully control for cross-sectional correlation in the error terms. Using price data for all city-pairs then will bias downward the standard errors as the relative prices in certain city-pairs are not independent of those in a second city-pair. For example, by using the full set, we would include price information on the city-pairs of Kitchener-Toronto, London-Toronto, and Kitchener-London when it is econometrically sufficient to consider only the first two pairs. That is, the third pair provides no independent information. Finally, given the historical prominence of Toronto as a center of distribution and production in the Canadian economy, the choice is an obvious one.

This methodology yields 49 observations per quinquennia, and with 8 quinquennia in the sample as well as 10 commodities, the final data set on retail price dispersion contains 3,772 observations. Data in hand, we estimate the following:

2.) $\left|p_{jt}^{i}\right| = \alpha + \beta_1 \ln(dist_j) + \varepsilon_{jt}^{i}$

The results are reported in the first column of Table 7. As expected, the coefficient on distance is positive and highly statistically significant: a one standard-deviation rise in (logged) distance is associated with an increase of 0.29 standard deviations in average price dispersion. We also consider variations on the estimating equation above which include fixed effects for commodities, provinces, and quinquennia. The second column reporting the results with commodity fixed effects demonstrates that potatoes were marked with the highest degree of price dispersion while butter displayed the lowest. This evidence is consistent with the evidence above which highlighted the role of unit values and shelf-life in determining the levels of the CV. We also note that the inclusion of commodity fixed effects seems to explain the greatest proportion of the variation in price dispersion, suggesting that changes in relative dispersion were muted over time across commodity classes.[5]

The results for the specification with provincial fixed effects suggest a relatively pronounced V-shaped gradient whereby price dispersion declines as provinces get closer to Toronto. This is perhaps not surprising given the role of distance in shaping the process of retail market integration. However, this attractive force is apparently not uniform: only Manitoba and Saskatchewan are significantly different from the Ontario average reported in column 3.[6] This suggests that the proximity of British Columbia and, to a lesser extent, Alberta to the Pacific may have actually contributed to tighter integration with eastern Canadian markets than with the Prairies. Another possibility is the extent to which individual provinces became or were integrated with retail markets across the border as, on average, cities in the Prairies were further removed from the dominant commercial centers of the United States.

Finally, the inclusion of fixed effects for the eight quinquennia also conforms with the earlier analysis of CVs in that average price dispersion was clearly falling through time. Of

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[5] Appendix I also contains the results from restricting the sample to consider only two cities per province as cities in Ontario are relatively over-represented. The results reported there are materially the same as those presented here. We also consider systematic differences in distance coefficients across commodities.

[6] Here, we are simply comparing the 95% confidence intervals (not reported) around estimated coefficients. If the intervals do not coincide or "overlap", this is taken as evidence of statistically significant difference in average price dispersion.

particular interest here in column 4 are the periods which are significantly different from preceding periods, namely 1915-1920 and 1940-1945. Thus, we argue that the periods of the two world wars constitute the only abrupt breaks in market integration in our sample. This, of course, not only corresponds with earlier research which has pointed to the formative role played by World War I in promoting the integration of the Canadian market (Minns and MacKinnon, 2007) but also suggests a similar role for World War II at mid-century. Confirming and expounding on this result, especially with respect to the very limited evidence for the United States (Cecchetti *et al*., 2002; Chen and Devereux, 2003), is potentially a fruitful area for future research.

It should also be reasonably clear by now that as we concentrate solely on Canadian retail markets we are making a departure from the traditional “border” literature (cf. Engel and Rogers, 2006; Broda and Weinstein, 2008) which exploits differences in domestic and international price differentials to infer the “width” of borders separating countries. For better or worse, one of the few independent variables at our disposal is that of distance as traditional proxies in the border literature such as exchange rate volatility provide us with no useful variation in the intra-national case. However, we would like some sense of the evolution of intra-national trade costs over time. We interact distance with our quinquennial fixed effects and re-run the final specification considered in Table 7. Figure 4 plots the estimated coefficients. It is important to bear in mind here that with the inclusion of both quinquennial fixed effects *and* their interaction with distance what Figure 4 actually depicts are the deviations (and associated 95% confidence intervals) from the pure time effect for the distance interaction term. Thus, as average price dispersion declined over time across Canada, distance-related trade costs actually seem to have been on the rise from the 1920s. It is only in the 1940s that they return to their pre-1920 levels.

3.3 Linking nominal rigidities and retail price dispersion

Additionally, this paper can contribute to the literature on the role of nominal rigidities in generating deviations from the law of one price. Apart from their importance in determining the dynamics of inflation, nominal rigidities could also be thought of as carrying important implications for welfare. To the degree to which the dispersion of prices affects the purchasing and, thus, consumption decisions of representative consumers, tracing any linkage between the dispersion and rigidity of retail prices is an important task. Fortunately, we are not alone in this task; very recent work by Crucini, Shintani, and Tsuruga (2009) provides a framework for analyzing staggered price setting models and their relation to price dispersion.[7]

As mentioned before, the standard staggered price setting model popularized by Taylor (1980) assumes that the set of firms changing prices is fixed exogenously within a period. In another variant, Calvo (1983) assumes that each firm faces a fixed probability of being able to changes its price each period. Consequently, nominal rigidities mechanically generate deviations from the law of one price so that a high frequency of price changes should be related with a low level of price dispersion. The convergence of prices in the face of a shock—whether real or nominal—is non-instantaneous as sellers slowly adjust their prices and a new steady-state equilibrium is reached.

In the context of Crucini, Shintani, and Tsuruga (2009), they incorporate Calvo pricing behavior into a dynamic general equilibrium model of intra-national relative prices which features monopolistically competitive firms and distance-related trade costs. The model's chief implications are that variation in deviations from the law of one price should be:

1.) increasing with the distance separating cities, thus, reflecting the role of trade costs in driving a wedge between intra-national prices; and

2.) decreasing with the level of nominal rigidity exhibited by goods, reflecting the role of pricing-to-market behavior in tempering the effects of idiosyncratic productivity shocks.

On the basis of highly detailed Japanese retail price data for the period from 2000 to 2005, they find strong evidence in support of these propositions.

Their main estimating equation is the following:

3.) $V\left(p_{jt}^{i}\right) = \beta_1 \ln(dist_j) + \beta_2 \lambda_i + \sum_{j=1}^{n} \gamma_j D_j + \varepsilon_{jt}^{i},$

where the dependent variable is the standard deviation of the log of the price of good *i* in location *j* relative to a benchmark city, λ_i is a measure of the nominal rigidity of good *i*, and *D* is a city-pair indicator variable for location *j*. In particular, λ_i is defined as one minus the frequency of price changes of goods as reported in the top panel of Table 2. In what follows, we adopt their empirical strategy, adding time fixed effects for good measure, and report the results in Table 8.

[7] We thank one of referees for drawing our attention to this work and suggesting that we pursue this line of attack.

To say the least, the results are highly consistent with those of Crucini, Shintani, and Tsuruga (2009). First, the dispersion of prices is positively related with the distance separating cities from Toronto: a one standard-deviation increase in the log of distance is associated with an increase in price dispersion of 0.14 standard deviations. Second, and more importantly, the dispersion of prices is negatively related with the infrequency of price changes: a one standard-deviation increase in the infrequency of price changes is associated with a decrease in price dispersion of 0.23 standard deviations. Taken together, this evidence indicates clear linkages between nominal rigidities and price dispersion, suggesting a potentially formative role of sticky prices in ameliorating deviations from the law of one price in the intra-national setting.

3.4 Comparison to previous studies

Here, we might do well to compare our results to previous studies of nominal rigidities and price dispersion. Consistent with the most robust feature of the literature, our data exhibits systematic heterogeneity in the frequency of price changes across commodities. This is a result found in a variety of settings: Israel (Lach, 2002); Japan (Crucini, Shintani, Tsurgua, 2009); Mexico (Ahlin and Shintani, 2006); Norway (Wufsburg, 2009); and the United States (Nakamura and Steinsson, 2008). The common pattern in all of these studies is that more durable products exhibit less frequent price changes and less variance in price changes. In particular, we note that, in our sample, butter and potatoes exhibit by far the most variation in prices. The result that butter and potatoes are at the high end of the distribution with respect to the frequency of price changes distribution was also found in Bils and Klenow (2004) and Kackmeister (2007). However, it is noteworthy that the average frequency of price changes exhibited by potatoes in our sample is almost double that which has been found for the United States in historic and modern day data. We can only speculate as to the reasons for this large difference, whether it can be attributed to differences in storage technologies, differences in the role of home production, or differences in growing conditions.

Drawing further comparisons across studies on nominal rigidities is hampered by both differences in the data itself as well as the treatment of the data by researchers. Studies differ in the treatment of sales and product substitutions as featured in Nakamura and Steinsson (2008) with some studies focusing on posted prices and others on reference prices. Furthermore, not all studies focus on individual goods but rather some aggregation of goods across categories, locations, and time. These differences aside, one robust finding is that there is a positive relationship between inflation and measures of nominal rigidities (for a summary, see Klenow and Malin, 2009). Klenow and Kryvtsov (2008) find that the frequency of price changes is positively correlated with inflation and that the size of price changes is even more highly correlated with inflation. In addition, Wufsburg (2009) in a study of Norwegian data from 1975 and 2004 finds that the relationship between the frequency of price changes and inflation is strongest for food products. This finding is so pervasive that upon calibrating their model to data from low inflation environments Golosov and Lucas (2007) cite their model's ability to generate this feature as a form of empirical validation. That this relationship is not found in our sample of Canadian prices suggests different avenues for modeling nominal rigidities, particularly in deflationary environments.

Finally, Barron, Taylor, and Umbeck (2004) discuss two classes of microeconomic pricing models that can generate price dispersion: monopolistic competition models and search-based models. Each class of models suggests that an increase in the number of sellers is associated with both decreases in prices and measures of price dispersion. Thus, the downward trend in price dispersion in our data is likely at least partially the result of increased competition over this period. Lach (2002) in a study of Israeli retailers finds that price dispersion is persistent and that individual stores are very mobile within the price distribution. Although it is difficult to make further comparisons to firm-level studies using our city-level data, future work on the competitiveness of the retail industry itself may shed light on the underlying causes of the pattern of price dispersion exhibited in the data.

4. By way of conclusion: comparisons between the early and late 20th century

In this paper, we have confronted the separate issues of nominal rigidities and retail price dispersion, both separately and in conjunction with one another. We have documented the simultaneous rise and fall of the frequency and size of price changes—a pattern mirrored in the fall and rise of the share of price increases in price changes over time. We have also documented long-run secular patterns in the decline of retail price dispersion—a pattern, however, which has been punctuated by bursts of market integration most likely associated with the mobilization and rationalization efforts of the two world wars. Finally, we have presented initial results linking the process of spatial retail market integration and the evolution of nominal rigidities, finding results consistent with present-day data.

But is there any further evidence on price dispersion, nominal rigidities, and their links in the more recent past? Ceglowski (2003) investigates the behavior of quarterly retail prices of 45 goods across 25 Canadian cities in the period from 1976 to 1993. The source of her data is Statistics Canada's publication, "Average Retail Price Survey". She finds that the relative price series are generally stationary around zero, suggesting a highly integrated Canadian retail market. This data was generously made available to us by the author, allowing for a few comparisons between the periods to be made.

First, Table 9 compares the frequency, size, and share measures of price changes in 1945-1950 for the three quinquennia bounded by 1978-1993.[8] Across all product categories, there are marked increases in the frequency of price changes from 1945-1950 to 1978-1983. There is less clear-cut evidence on the average size of price changes with some products rising and others falling. Likewise for the share of price increases. However, what is notable in this regard is that the share of price increases noticeably declines in the period from 1978 to 1993. Certainly, this reflects the moderation of Canadian inflation rates, but also may signal subtle changes in the Canadian retail sector. Turning to our across-product "aggregate" measures of nominal rigidities, we document a similar pattern across provinces and Canada in the increase in the frequency of price changes. There is a fairly clear increase in the average size of price changes from 1945-1950 to 1978-1983 while the share of price increases demonstrates the earlier pattern of an initial gain giving way to subsequent declines.

Table 11 replicates the regressions of price dispersion on distance and variously, commodity, provincial, and quinquennial fixed effects. In contrast to the results in Table 7, the estimated coefficient for distance is appreciably smaller and explains about one-fourth as much of the variation in price dispersion as previously, suggesting if not the "death of distance" in the Canadian economy, at least its relative demise. Likewise, most commodities in this later period do not demonstrate any systematic differences from the group average. Only milk , potatoes, and sugar have demonstrably higher averages—again, not a surprising result given the nature of production and, especially, the degree of regulation in these market. Echoing the results on the

[8] In what follows, we have re-calculated the rigidity measures for 1945-1950 reported in Tables 3 and 4 on a quarterly basis to ensure comparability with the data from 1978 to 1993.

diminishing importance of distance, the full set of provincial fixed effects are statistically indistinguishable from one another, suggesting that the time-series evidence presented by Ceglowski is consistent with the emergence of a truly Canadian retail market sometime in the period between 1950 and the late 1970s. Finally, the quinquennial fixed effects point to the fact that if anything the average level of price dispersion in the Canadian economy was increasing through the 1980s. However, (unreported) regressions of price dispersion on quinquennial fixed effects and their interaction with distance yields highly insignificant coefficients for the latter. Thus, any increase in the average dispersion of prices must not have been generated from distance-related trade costs such as transportation and distribution costs. A likely candidate in this regard is increasing market power among producers during this period. Another possibility is the increased north-south (rather than east-west) orientation of the Canadian market as retailers began to integrate—and potentially compete—across the border with the United States.

Table 12 replicates the Crucini-Shishani-Tsuruga regressions for this later period from 1978 to 1993. And again, the results are highly comparable to those they find for Japan for the early 2000s: the dispersion of prices is positively related with the distance separating cities from Toronto and negatively related with the infrequency of price changes. Thus, the pattern which emerged linking nominal rigidities and retail price dispersion in the early twentieth century seems just as relevant for the late twentieth century. However, the results suggest that, if anything, the statistical fit of the regression was better earlier on.

Cumulatively, these findings suggest a few things. First, there is surprising degree of continuity between the results for the early and late twentieth century: there is an appreciable degree of heterogeneity with respect to nominal rigidities across goods and provinces; and retail price dispersion is vitally affected by both the distances separating cities and the degree of nominal rigidity goods display. However, certain features of the Canadian macroeconomy with respect to nominal rigidities and retail price dispersion did change and quite remarkably so over the twentieth century. In this regard, we need simply to point to the dramatic increases in the frequency of price changes across goods and provinces between 1950 and 1978 and the relative decline in the importance of distance in explaining divergences from the law of one price. At a minimum, this suggests that filling in the gap in our knowledge on the obvious structural change in the Canadian economy from 1950 to the late 1970s is an important task for future research—an observation echoed in the work of Coe and Emery (2004).

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Appendix: Sensitivity Analysis

Here, we restrict the sample used in price dispersion regressions of Table 2 to consider only two cities per province as cities in Ontario are relatively over-represented in the original dataset (20 of the 50 cities are located in Ontario). One concern is that if commodity markets were integrated on a provincial—and not national—basis the within Ontario city-pairs may be driving our results. We select cities on the basis of their populations, choosing the two largest cities per province in our dataset. The restricted sample (vis-à-vis Toronto) include the following: Vancouver, Victoria, Calgary, Edmonton, Regina, Saskatoon, Brandon, Winnipeg, Hamilton, Ottawa, Montreal, Quebec City, Halifax, and Moncton. Over the entire period, this still leaves us with 1078 observations as opposed to the 3772 observations in Table 2.

Table A1 reports the results of this exercise. Considering the coefficient on distance first, we find that the price differentials in the cities of the restricted sample are apparently more sensitive to distance than previously estimated. The distance coefficient in three of the four specifications increases from roughly 0.015 to roughly 0.025. We also note that the difference is statistically significant as the confidence intervals around the respective point estimates do not overlap. Otherwise, the fixed effects for commodities, provinces, and periods all point to similar patterns: 1.) controlling for distance, higher value, less perishable items are marked by less price dispersion; 2.) controlling for distance, the prairie provinces demonstrate the highest mean price dispersion; 3,) controlling for distance, mean price dispersion declines through the 1910s and 1920s, pauses in the early 1930s, and continues apace up to 1950.

Finally, we allow the distance coefficients to vary across commodities as in Table A2. There emerge five commodity groups based on the point estimates and associated confidence intervals (in order of the magnitude on distance): 1.) Potatoes; 2.) Beef and Milk; 3.) Corn, Peas, Prunes, and Tomatoes; 4.) Sugar and Tea; 5.) Butter. Again, this exactly corresponds with earlier results on average unit prices and expected shelf-lives. That is, the ability for spatial price differentials to be evened out is dependent upon commodity characteristics.

Table A1: Price Dispersion Regressions, Restricted Sample

	Coefficient	Std Error	p-value	Coefficient	Std Error	p-value	Coefficient	Std Error	p-value	Coefficient	Std Error	p-value
Distance	0.0246	0.0018	0.00	0.0246	0.0017	0.00	0.0130	0.0044	0.00	0.0246	0.0016	0.00
Beef				-0.0541	0.0128	0.00						
Butter				-0.1154	0.0119	0.00						
Corn				-0.0613	0.0126	0.00						
Milk				-0.0739	0.0132	0.00						
Peas				-0.0629	0.0126	0.00						
Potatoes				0.0629	0.0141	0.00						
Prunes				-0.0741	0.0132	0.00						
Sugar				-0.0910	0.0121	0.00						
Tea				-0.0872	0.0130	0.00						
Tomatoes				-0.0616	0.0124	0.00						
Maritimes							0.0066	0.0316	0.83			
Quebec							-0.0016	0.0281	0.96			
Ontario							-0.0037	0.0219	0.87			
Manitoba							0.0412	0.0329	0.21			
Saskatchewan							0.0486	0.0343	0.16			
Alberta							0.0351	0.0355	0.32			
British Columbia							0.0119	0.0364	0.74			
1910-1915										-0.0109	0.0132	0.41
1915-1920										-0.0367	0.0120	0.00
1920-1925										-0.0534	0.0117	0.00
1925-1930										-0.0700	0.0115	0.00
1930-1935										-0.0588	0.0115	0.00
1935-1940										-0.0609	0.0116	0.00
1940-1945										-0.0892	0.0114	0.00
1945-1950										-0.0998	0.0113	0.00
N:		1078			1078			1078			1078	
R-squared:		0.1100			0.8203			0.7209			0.7409	

Table A2: Price Dispersion Regression, Distance-Commodity Interactions

	Coefficient	Std Error	p-value
Beef	0.0177	0.0006	0.00
Butter	0.0085	0.0003	0.00
Corn	0.0144	0.0004	0.00
Milk	0.0203	0.0007	0.00
Peas	0.0150	0.0004	0.00
Potatoes	0.0321	0.0007	0.00
Prunes	0.0155	0.0004	0.00
Sugar	0.0113	0.0004	0.00
Tea	0.0126	0.0005	0.00
Tomatoes	0.0144	0.0004	0.00
N:		3772	
R-squared:		0.7706	

Figure 1: Cities in Retail Price Sample

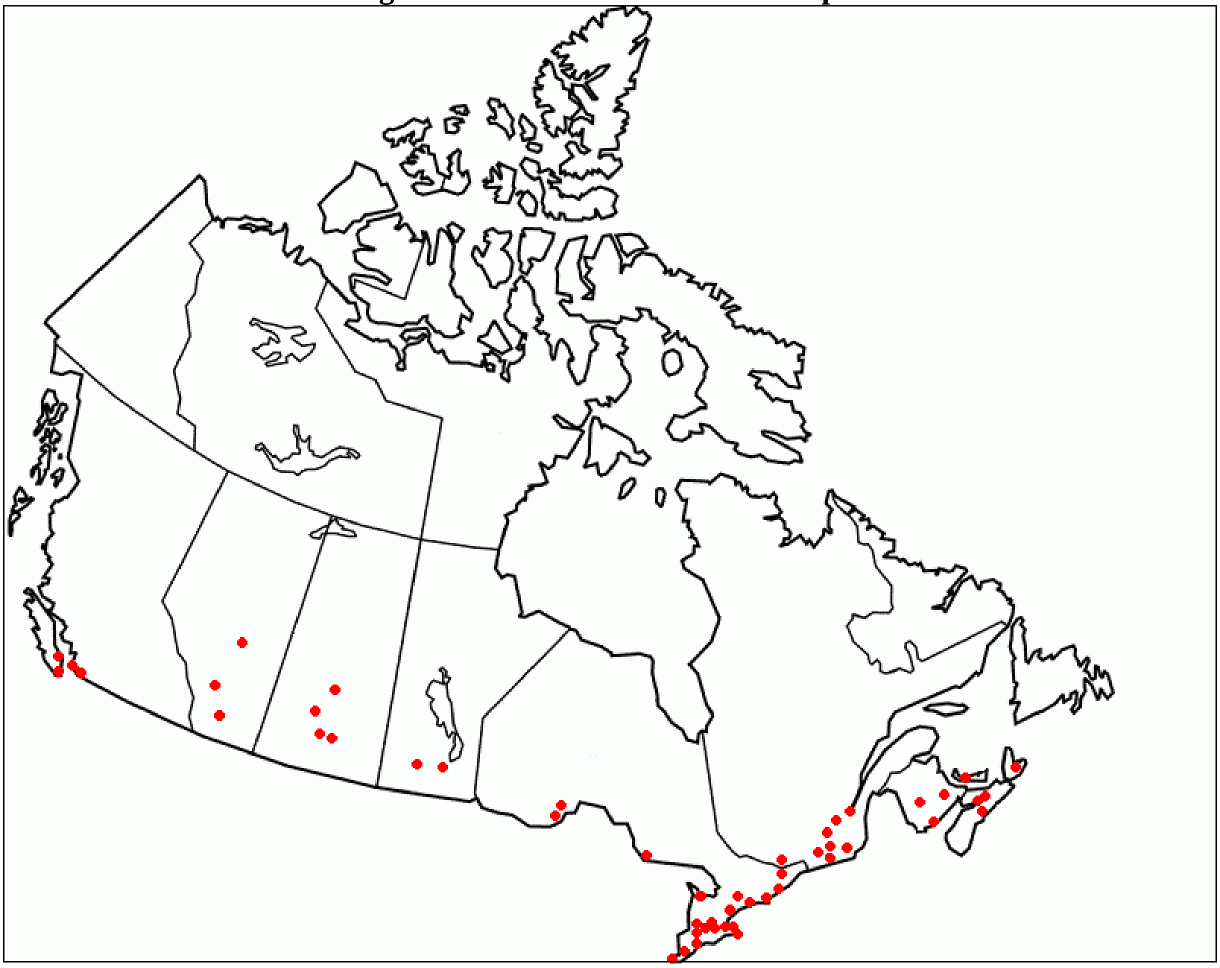


Table 1: Composition of Price Data by Commodity

Commodity:	Description:	Start date:	Observations:	Mean:	St. Dev.:
Beef	Sirloin, cents per pound	02/1910	24,319	33.26	13.61
Butter	Creamery prints, cents per pound	02/1910	24,356	41.47	12.84
Corn	Vegie cans, 2's, cents per can	03/1916	20,844	15.48	3.91
Milk	Cents per quart	02/1910	24,341	11.38	2.81
Peas	Vegie cans, 2's, cents per can	03/1916	20,832	15.04	3.29
Potatoes	Cents per 15 pounds	02/1910	24,440	33.11	15.90
Prunes	Cents per pound	02/1910	24,311	14.95	4.22
Sugar	Granulated, cents per pound	02/1910	24,341	8.44	2.65
Tea	Black, cents per pound	02/1910	24,341	53.55	13.59
Tomatoes	Vegie cans, 3's, cents per can	03/1916	20,900	16.11	4.47

Table 2: Nominal Rigidities of Goods across Time

Frequency of price changes

	Beef	Butter	Corn	Milk	Peas	Potatoes	Prunes	Sugar	Tea	Tomatoes
1910-1915	0.2476	0.5443		0.1485		0.6331	0.2345	0.3995	0.1388	
1915-1920	0.3178	0.5622	0.2389	0.2069	0.2344	0.7089	0.2117	0.4292	0.1967	0.2267
1920-1925	0.8219	0.9056	0.7875	0.2131	0.7781	0.9147	0.8319	0.8686	0.8169	0.7703
1925-1930	0.9022	0.9667	0.9036	0.1642	0.9169	0.9711	0.9350	0.8097	0.9442	0.8897
1930-1935	0.9253	0.9656	0.8961	0.1150	0.9150	0.9575	0.9386	0.7725	0.9647	0.8681
1935-1940	0.9408	0.9611	0.8742	0.0831	0.8794	0.9653	0.9214	0.6794	0.9617	0.8561
1940-1945	0.7319	0.7608	0.6672	0.0636	0.6119	0.9556	0.7219	0.2661	0.5500	0.5783
1945-1950	0.6951	0.7017	0.6673	0.0786	0.6033	0.9578	0.7389	0.2231	0.3403	0.6942
1910-1950	**0.7094**	**0.8011**	**0.7355**	**0.1376**	**0.7233**	**0.8860**	**0.6983**	**0.5505**	**0.6181**	**0.7186**

Average size of price changes

	Beef	Butter	Corn	Milk	Peas	Potatoes	Prunes	Sugar	Tea	Tomatoes
1910-1915	0.0247	0.0498		0.0193		0.1603	0.0379	0.0344	0.0212	
1915-1920	0.0311	0.0410	0.0340	0.0226	0.0342	0.1620	0.0296	0.0373	0.0205	0.0322
1920-1925	0.0520	0.0518	0.0318	0.0204	0.0303	0.1820	0.0583	0.0498	0.0270	0.0265
1925-1930	0.0388	0.0342	0.0278	0.0142	0.0284	0.1392	0.0528	0.0261	0.0238	0.0245
1930-1935	0.0492	0.0589	0.0368	0.0110	0.0417	0.1290	0.0616	0.0316	0.0437	0.0306
1935-1940	0.0481	0.0435	0.0313	0.0046	0.0294	0.1140	0.0474	0.0189	0.0315	0.0247
1940-1945	0.0189	0.0214	0.0166	0.0045	0.0171	0.0860	0.0220	0.0069	0.0182	0.0113
1945-1950	0.0177	0.0186	0.0150	0.0095	0.0092	0.0925	0.0181	0.0070	0.0056	0.0209
1910-1950	**0.0353**	**0.0403**	**0.0275**	**0.0138**	**0.0268**	**0.1326**	**0.0413**	**0.0256**	**0.0242**	**0.0244**

Share of price increases

	Beef	Butter	Corn	Milk	Peas	Potatoes	Prunes	Sugar	Tea	Tomatoes
1910-1915	0.5683	0.5881		0.5462		0.5400	0.4976	0.5059	0.5735	
1915-1920	0.5970	0.6314	0.6535	0.6577	0.6482	0.5517	0.6535	0.6401	0.6540	0.6362
1920-1925	0.4833	0.5675	0.4892	0.4316	0.4859	0.4686	0.4648	0.4141	0.5315	0.4807
1925-1930	0.5240	0.5193	0.4928	0.4704	0.4638	0.4803	0.4902	0.3942	0.4816	0.4593
1930-1935	0.4536	0.4796	0.4622	0.3816	0.4836	0.4331	0.4800	0.4344	0.4757	0.4493
1935-1940	0.5350	0.5260	0.4957	0.8428	0.4867	0.5232	0.4818	0.5331	0.5326	0.5373
1940-1945	0.6057	0.5601	0.5987	0.6769	0.5729	0.5776	0.5375	0.5960	0.6146	0.6158
1945-1950	0.6783	0.6298	0.5146	0.9576	0.5800	0.5487	0.6581	0.7397	0.7396	0.4778
1910-1950	**0.5474**	**0.5599**	**0.5130**	**0.5782**	**0.5176**	**0.5101**	**0.5264**	**0.5003**	**0.5484**	**0.5045**

Table 3: Nominal Rigidities of Goods across Provinces

Frequency of price changes

	Beef	Butter	Corn	Milk	Peas	Potatoes	Prunes	Sugar	Tea	Tomatoes
Maritimes	0.6472	0.8006	0.7233	0.1582	0.7101	0.8721	0.7073	0.5291	0.5807	0.7101
Quebec	0.7360	0.8268	0.7019	0.2182	0.7069	0.8762	0.6413	0.4873	0.6089	0.6658
Ontario	0.7158	0.8170	0.7437	0.1089	0.7303	0.8973	0.7085	0.5630	0.6212	0.7345
Manitoba	0.7092	0.7888	0.7422	0.1265	0.7570	0.8816	0.7082	0.5612	0.6102	0.7014
Saskatchewan	0.6950	0.7577	0.7695	0.1264	0.7223	0.8726	0.7243	0.6099	0.6449	0.7308
Alberta	0.7664	0.7534	0.7426	0.1322	0.7153	0.8760	0.6870	0.6034	0.6575	0.7370
British Columbia	0.7168	0.7520	0.7410	0.1061	0.7362	0.8969	0.7189	0.5505	0.6423	0.7398
Canada	**0.7094**	**0.8011**	**0.7355**	**0.1376**	**0.7233**	**0.8860**	**0.6983**	**0.5505**	**0.6181**	**0.7186**

Average size of price changes

	Beef	Butter	Corn	Milk	Peas	Potatoes	Prunes	Sugar	Tea	Tomatoes
Maritimes	0.0311	0.0382	0.0259	0.0102	0.0228	0.1314	0.0439	0.0242	0.0222	0.0240
Quebec	0.0451	0.0416	0.0349	0.0234	0.0304	0.1223	0.0365	0.0229	0.0289	0.0252
Ontario	0.0322	0.0405	0.0268	0.0121	0.0272	0.1334	0.0415	0.0265	0.0241	0.0253
Manitoba	0.0366	0.0463	0.0245	0.0139	0.0262	0.1552	0.0405	0.0254	0.0206	0.0215
Saskatchewan	0.0366	0.0416	0.0250	0.0122	0.0256	0.1457	0.0440	0.0273	0.0230	0.0228
Alberta	0.0425	0.0411	0.0248	0.0145	0.0260	0.1469	0.0381	0.0279	0.0235	0.0222
British Columbia	0.0328	0.0357	0.0259	0.0109	0.0280	0.1162	0.0450	0.0258	0.0226	0.0234
Canada	**0.0353**	**0.0403**	**0.0275**	**0.0138**	**0.0268**	**0.1326**	**0.0413**	**0.0256**	**0.0242**	**0.0244**

Share of price increases

	Beef	Butter	Corn	Milk	Peas	Potatoes	Prunes	Sugar	Tea	Tomatoes
Maritimes	0.5498	0.5500	0.5201	0.5221	0.5328	0.4972	0.5269	0.4953	0.5651	0.4960
Quebec	0.5407	0.5764	0.5102	0.6202	0.5205	0.5218	0.5357	0.4835	0.5349	0.5119
Ontario	0.5516	0.5735	0.5044	0.5890	0.5142	0.4961	0.5228	0.5057	0.5461	0.4992
Manitoba	0.5540	0.5589	0.5186	0.5726	0.5265	0.5162	0.5159	0.5200	0.5518	0.5197
Saskatchewan	0.5465	0.5227	0.5318	0.5623	0.5117	0.5359	0.5314	0.5080	0.5501	0.4988
Alberta	0.5505	0.5245	0.5199	0.5492	0.5096	0.5379	0.5254	0.5040	0.5458	0.5239
British Columbia	0.5302	0.5319	0.5227	0.5625	0.5073	0.5370	0.5280	0.4893	0.5544	0.5186
Canada	**0.5474**	**0.5599**	**0.5130**	**0.5782**	**0.5176**	**0.5101**	**0.5264**	**0.5003**	**0.5484**	**0.5045**

Table 4: "Aggregate" Nominal Rigidities across Provinces and Time

Frequency of price changes

	Maritimes	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	**Canada**
1910-1915	0.324	0.319	0.327	0.322	0.342	0.374	0.396	**0.3346**
1915-1920	0.291	0.338	0.362	0.306	0.329	0.350	0.347	**0.3400**
1920-1925	0.768	0.766	0.781	0.777	0.751	0.770	0.750	**0.7709**
1925-1930	0.830	0.841	0.839	0.858	0.834	0.862	0.848	**0.8403**
1930-1935	0.822	0.827	0.833	0.847	0.838	0.841	0.831	**0.8318**
1935-1940	0.814	0.821	0.810	0.808	0.816	0.817	0.795	**0.8123**
1940-1945	0.576	0.569	0.598	0.594	0.605	0.598	0.602	**0.5908**
1945-1950	0.544	0.544	0.580	0.570	0.607	0.571	0.576	**0.5696**
1910-1950	**0.615**	**0.645**	**0.661**	**0.655**	**0.662**	**0.664**	**0.656**	**0.6507**

Average size of price changes

	Maritimes	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	**Canada**
1910-1915	0.053	0.047	0.046	0.051	0.049	0.050	0.056	**0.0485**
1915-1920	0.044	0.044	0.047	0.040	0.039	0.044	0.044	**0.0448**
1920-1925	0.047	0.057	0.055	0.054	0.054	0.051	0.046	**0.0528**
1925-1930	0.038	0.046	0.041	0.044	0.044	0.043	0.038	**0.0416**
1930-1935	0.048	0.052	0.048	0.055	0.052	0.051	0.041	**0.0487**
1935-1940	0.035	0.046	0.036	0.040	0.041	0.042	0.036	**0.0384**
1940-1945	0.020	0.021	0.022	0.025	0.027	0.027	0.022	**0.0225**
1945-1950	0.022	0.020	0.022	0.023	0.024	0.022	0.020	**0.0218**
1910-1950	**0.037**	**0.042**	**0.039**	**0.042**	**0.041**	**0.041**	**0.037**	**0.0361**

Share of price increases

	Maritimes	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	**Canada**
1910-1915	0.555	0.556	0.557	0.532	0.497	0.538	0.524	**0.5468**
1915-1920	0.628	0.609	0.615	0.639	0.629	0.623	0.619	**0.6190**
1920-1925	0.485	0.493	0.486	0.492	0.488	0.485	0.469	**0.4859**
1925-1930	0.471	0.482	0.481	0.488	0.490	0.476	0.474	**0.4795**
1930-1935	0.457	0.466	0.461	0.456	0.455	0.458	0.466	**0.4608**
1935-1940	0.532	0.529	0.517	0.500	0.499	0.515	0.529	**0.5200**
1940-1945	0.596	0.599	0.581	0.592	0.580	0.574	0.568	**0.5851**
1945-1950	0.597	0.609	0.589	0.643	0.627	0.641	0.614	**0.6040**
1910-1950	**0.535**	**0.532**	**0.526**	**0.532**	**0.528**	**0.528**	**0.526**	**0.5449**

Table 5: Summary Statistics for Regressions

Variable:	*Observations:*	*Mean:*	*St. Dev.:*
Frequency of price changes	56	0.6367	0.2009
Average size of absolute price changes	56	0.0402	0.0114
Share of price increases in price changes	56	0.5380	0.0613
Average inflation rate	56	0.0018	0.0035
Average price level	56	24.6648	4.0766
Price dispersion	3,772	0.1032	0.0772
Distance (log)	3,772	6.3697	1.2908
Infrequency of price changes	3,772	0.3526	0.2972

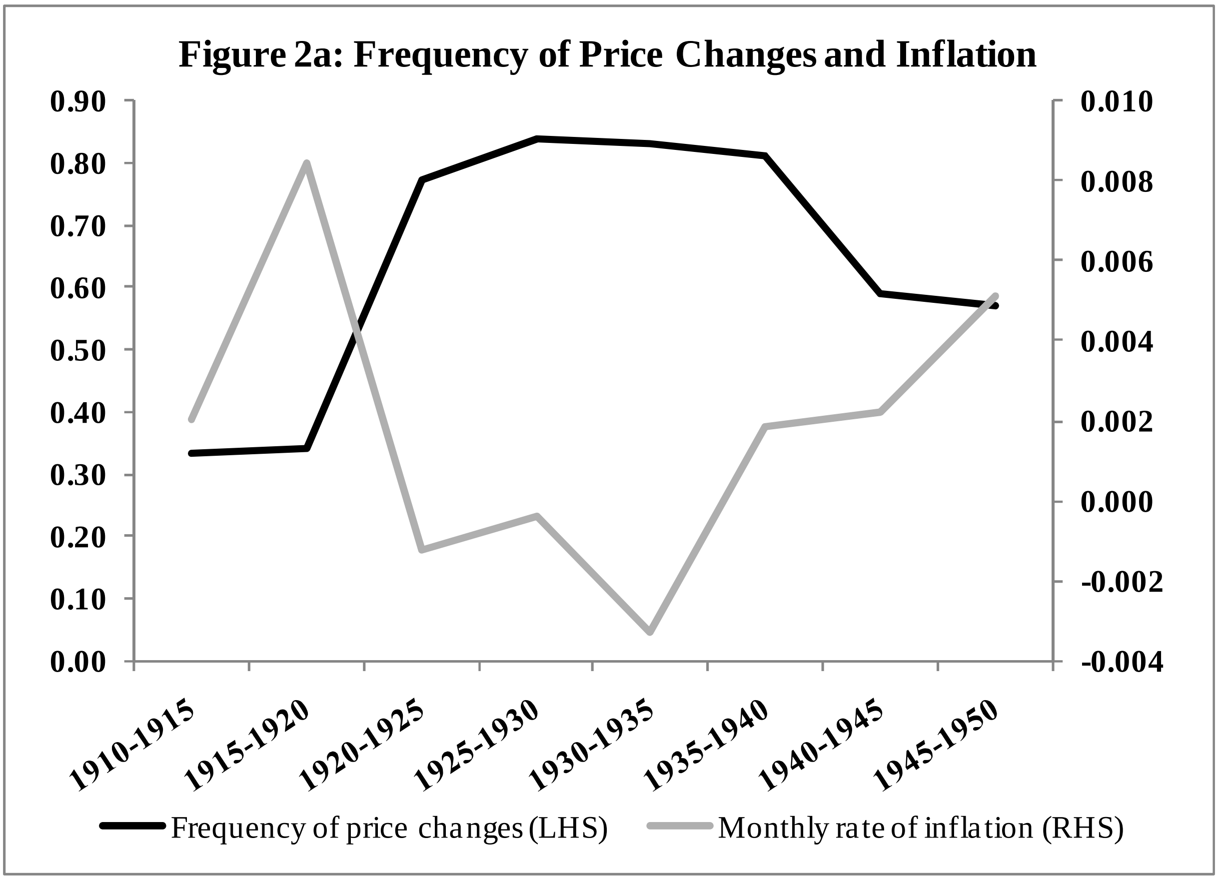


Figure 2a: Frequency of Price Changes and Inflation
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.010
0.008
0.006
0.004
0.002
0.000
-0.002
-0.004
1910-1915
1915-1920
1920-1925
1925-1930
1930-1935
1935-1940
1940-1945
1945-1950
Frequency of price changes (LHS)
Monthly rate of inflation (RHS)

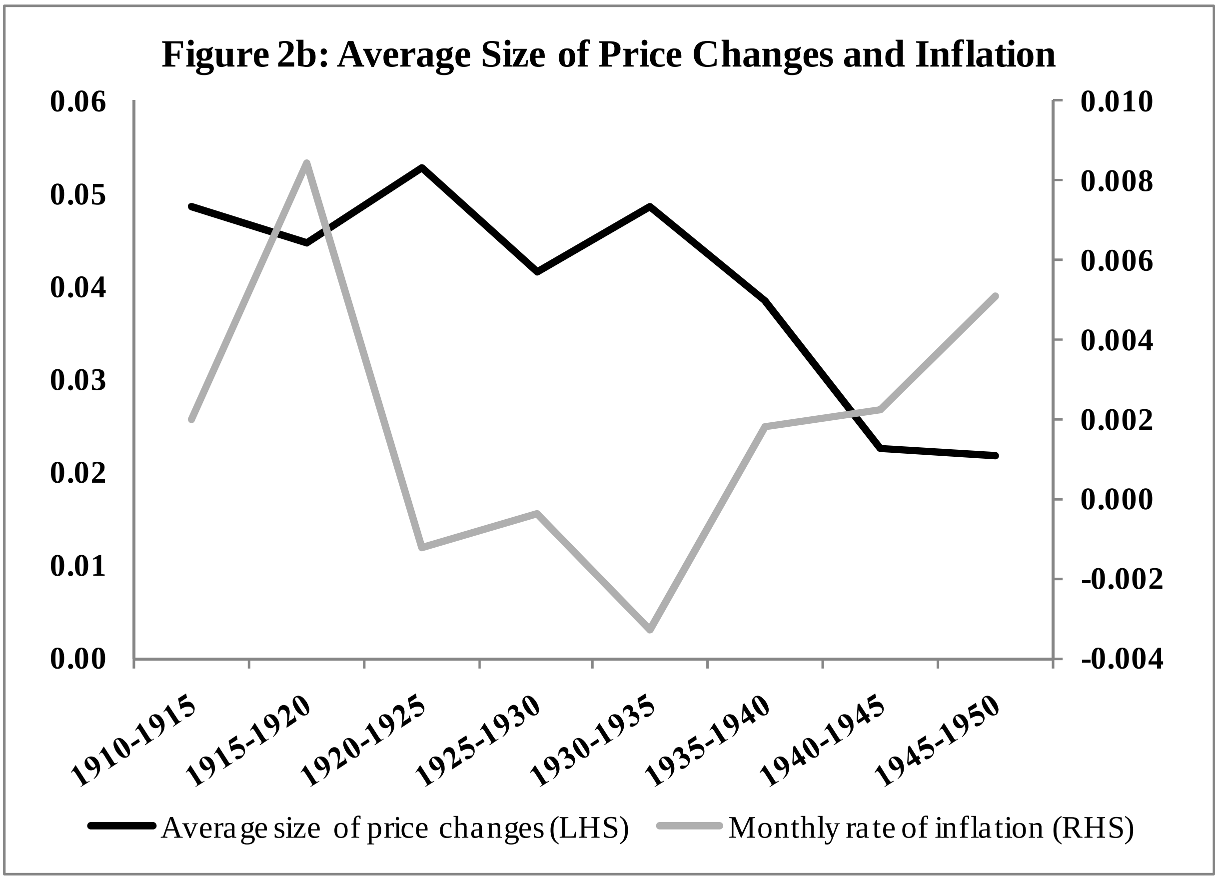


Figure 2b: Average Size of Price Changes and Inflation
0.06
0.05
0.04
0.03
0.02
0.01
0.00
0.010
0.008
0.006
0.004
0.002
0.000
-0.002
-0.004
1910-1915
1915-1920
1920-1925
1925-1930
1930-1935
1935-1940
1940-1945
1945-1950
Average size of price changes (LHS)
Monthly rate of inflation (RHS)

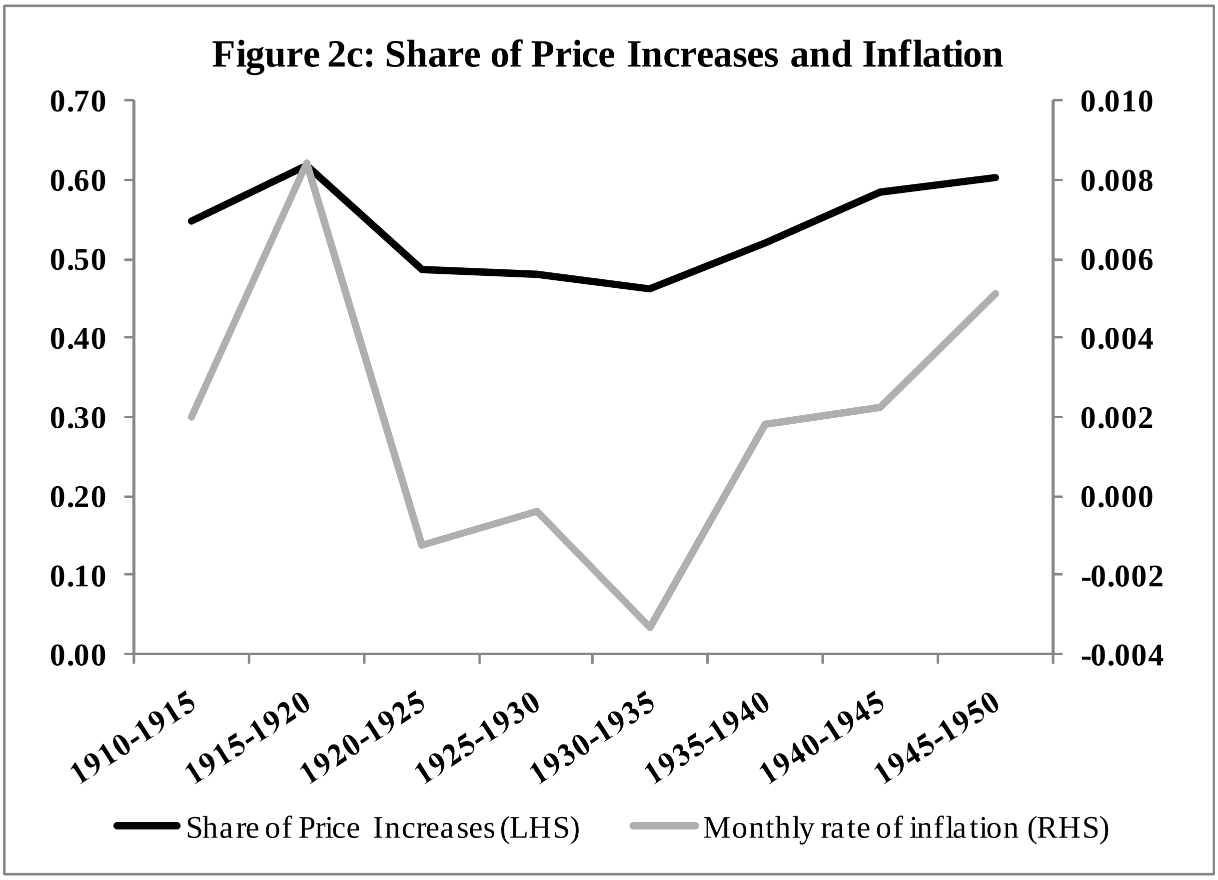


Figure 2c: Share of Price Increases and Inflation
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.010
0.008
0.006
0.004
0.002
0.000
-0.002
-0.004
1910-1915
1915-1920
1920-1925
1925-1930
1930-1935
1935-1940
1940-1945
1945-1950
Share of Price Increases (LHS)
Monthly rate of inflation (RHS)

Table 6: Nominal Rigidities and Inflation

Panel A

Dependent variable:	Frequency of price changes			Average size of price changes			Share of price increases		
	Coefficient	Std Error	p-value	Coefficient	Std Error	p-value	Coefficient	Std Error	p-value
Average inflation rate	-44.0293	1.8278	0.00	-1.3912	0.4304	0.00	16.1429	0.8553	0.00
Maritimes	0.7015	0.0507	0.00	0.0409	0.0040	0.00	0.5107	0.0088	0.00
Quebec	0.7087	0.0519	0.00	0.0443	0.0042	0.00	0.5134	0.0094	0.00
Ontario	0.7218	0.0507	0.00	0.0421	0.0039	0.00	0.5063	0.0077	0.00
Manitoba	0.7157	0.0517	0.00	0.0440	0.0036	0.00	0.5133	0.0107	0.00
Saskatchewan	0.7205	0.0502	0.00	0.0437	0.0032	0.00	0.5037	0.0105	0.00
Alberta	0.7281	0.0468	0.00	0.0438	0.0035	0.00	0.5092	0.0093	0.00
British Columbia	0.7235	0.0430	0.00	0.0405	0.0041	0.00	0.5036	0.0077	0.00
N:		56			56			56	
R-squared:		0.5793			0.1952			0.8365	

Panel B

Dependent variable:	Frequency of price changes			Average size of price changes			Share of price increases		
	Coefficient	Std Error	p-value	Coefficient	Std Error	p-value	Coefficient	Std Error	p-value
Average inflation rate	-49.2024	3.5878	0.00	-1.1354	0.4620	0.02	15.7849	0.9029	0.00
Average price level	0.0107	0.0062	0.09	-0.0005	0.0003	0.13	0.0007	0.0008	0.37
Maritimes	0.4475	0.1683	0.01	0.0535	0.0091	0.00	0.4931	0.0208	0.00
Quebec	0.4650	0.1630	0.01	0.0563	0.0078	0.00	0.4965	0.0209	0.00
Ontario	0.4670	0.1683	0.01	0.0547	0.0084	0.00	0.4887	0.0217	0.00
Manitoba	0.4638	0.1671	0.01	0.0565	0.0085	0.00	0.4958	0.0222	0.00
Saskatchewan	0.4586	0.1712	0.01	0.0566	0.0086	0.00	0.4855	0.0240	0.00
Alberta	0.4721	0.1659	0.01	0.0565	0.0085	0.00	0.4915	0.0198	0.00
British Columbia	0.4586	0.1671	0.01	0.0536	0.0096	0.00	0.4853	0.0206	0.00
N:		56			56			56	
R-squared:		0.6177			0.2247			0.8385	

Figure 3a: CVs for Animal Products

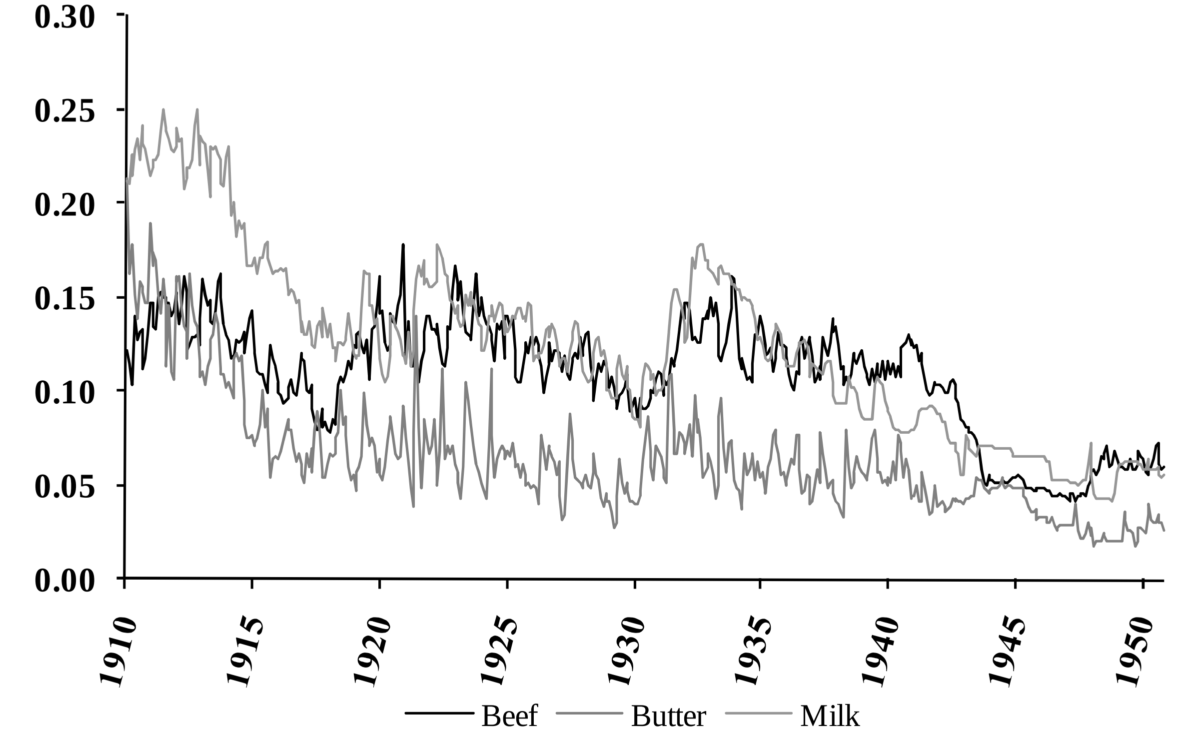


Figure 3b: CVs for Canned Goods

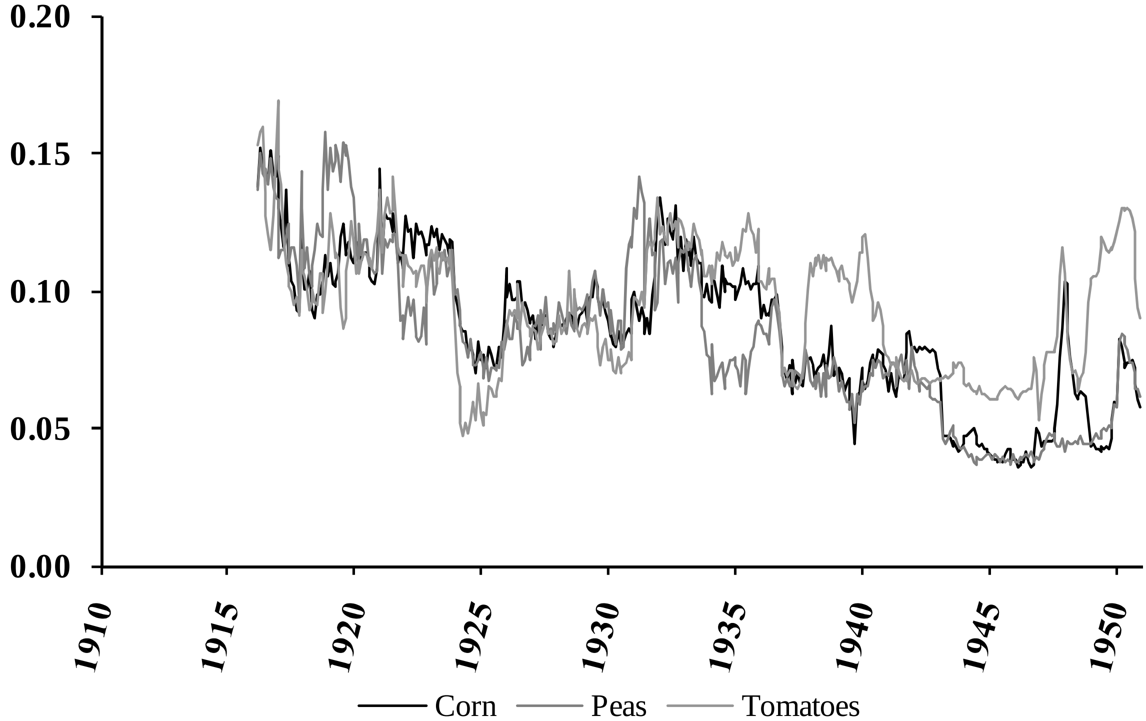
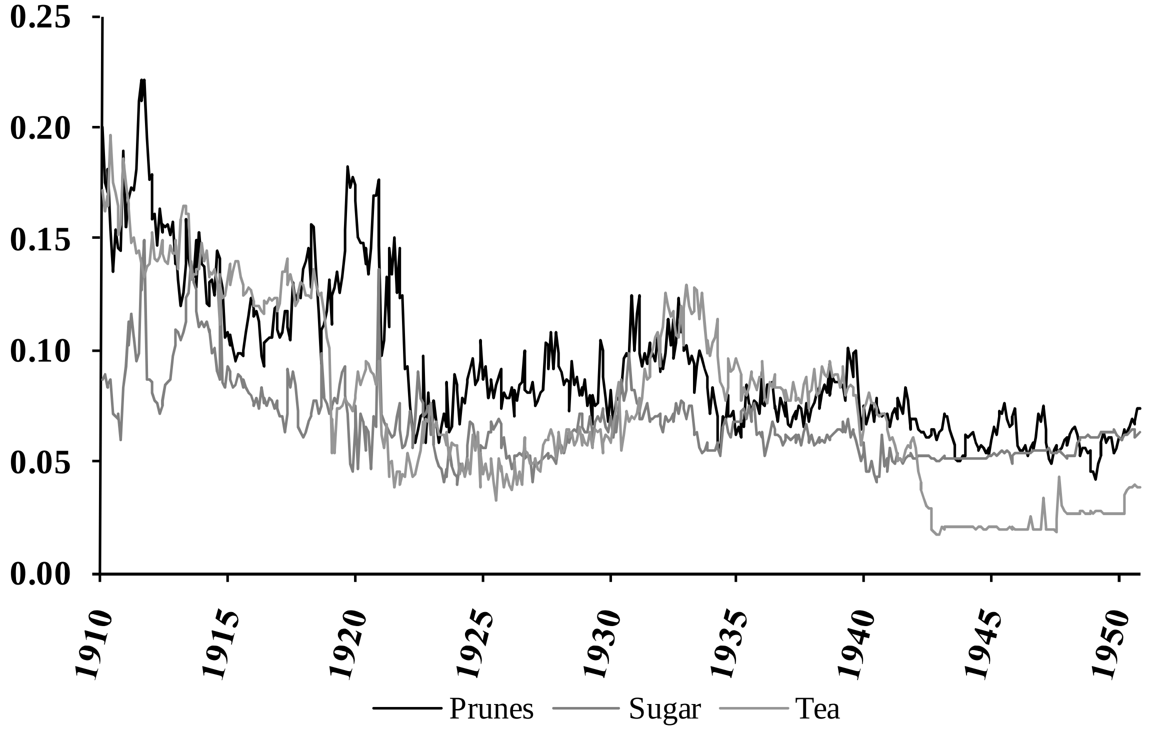


Figure 3c: CVs for Dry Goods



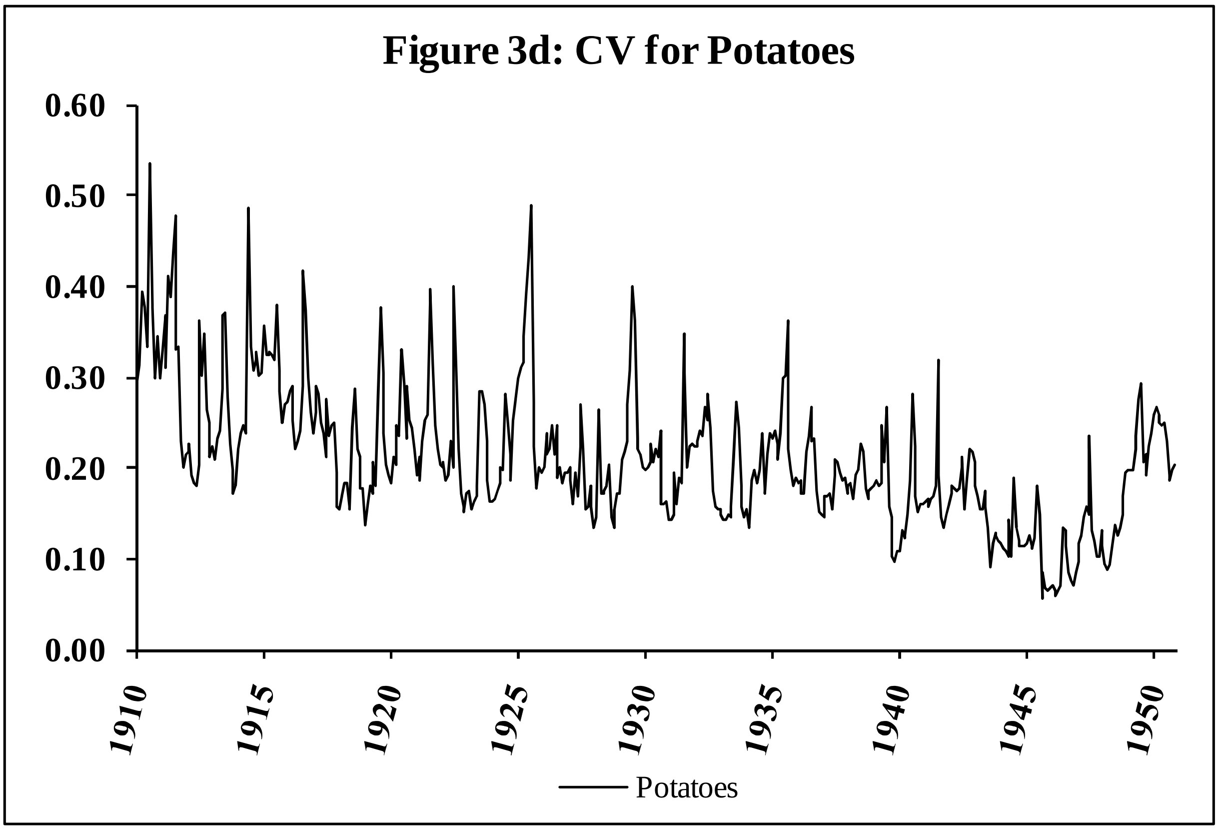


Figure 3d: CV for Potatoes
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1910
1915
1920
1925
1930
1935
1940
1945
1950
Potatoes

Table 7: Price Dispersion Regressions

	(1) Coefficient	(1) Std Error	(1) p-value	(2) Coefficient	(2) Std Error	(2) p-value	(3) Coefficient	(3) Std Error	(3) p-value	(4) Coefficient	(4) Std Error	(4) p-value
Distance (log)	0.0174	0.0009	0.00	0.0174	0.0008	0.00	0.0067	0.0018	0.00	0.0175	0.0008	0.00
Beef				0.0034	0.0059	0.56						
Butter				-0.0575	0.0050	0.00						
Corn				-0.0223	0.0051	0.00						
Milk				0.0244	0.0071	0.00						
Peas				-0.0177	0.0052	0.00						
Potatoes				0.0875	0.0060	0.00						
Prunes				-0.0085	0.0054	0.12						
Sugar				-0.0400	0.0051	0.00						
Tea				-0.0308	0.0056	0.00						
Tomatoes				-0.0226	0.0051	0.00						
Maritimes							0.0599	0.0013	0.00			
Quebec							0.0647	0.0012	0.00			
Ontario							0.0429	0.0090	0.00			
Manitoba							0.0878	0.0146	0.00			
Saskatchewan							0.1020	0.0146	0.00			
Alberta							0.0843	0.0151	0.00			
British Columbia							0.0667	0.0152	0.00			
1910-1915										0.0551	0.0068	0.00
1915-1920										0.0220	0.0056	0.00
1920-1925										-0.0003	0.0055	0.96
1925-1930										-0.0172	0.0055	0.00
1930-1935										-0.0060	0.0056	0.29
1935-1940										-0.0122	0.0055	0.03
1940-1945										-0.0377	0.0052	0.00
1945-1950										-0.0483	0.0052	0.00
N:		3772			3772			3772			3772	
R-squared:		0.0852			0.3426			0.1099			0.2239	

Notes: Dependent variable in all regressions is the average of the absolute value of logged relative prices; robust standard errors reported.

Figure 4: Distance Coefficients through Time

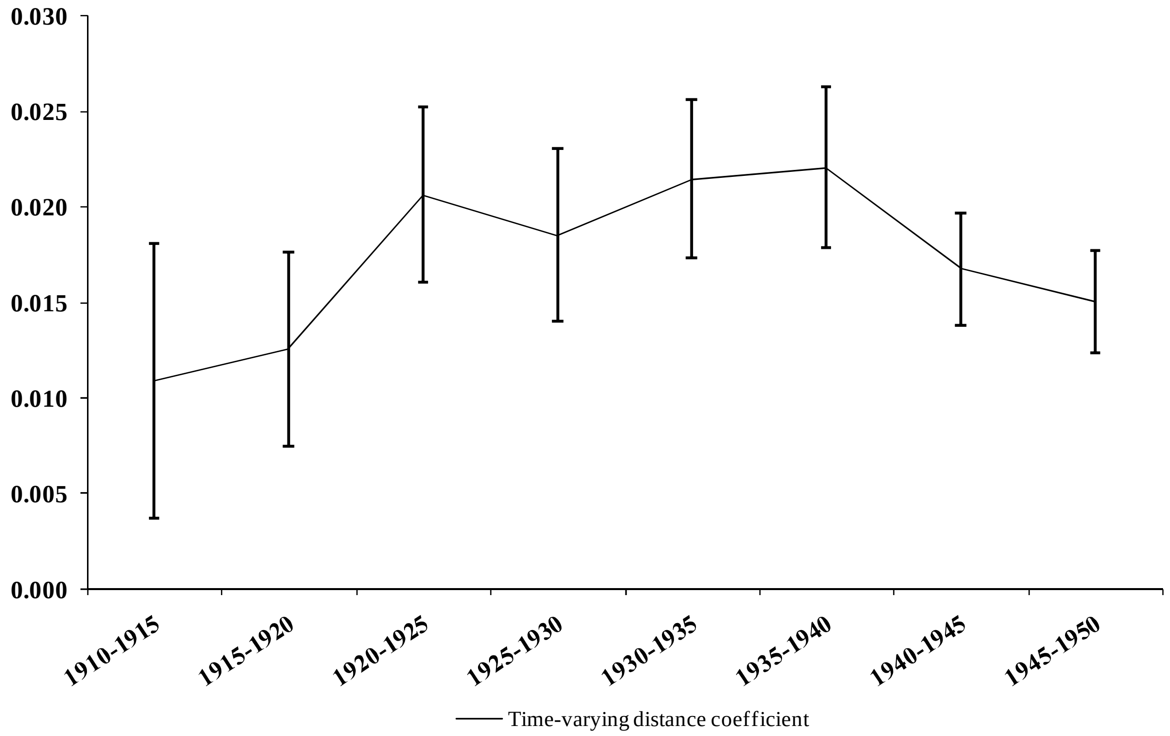


Table 8: Price Dispersion and Nominal Rigidities

Dependent variable: Standard deviation of price dispersion

	Coefficient	Std Error	p-value
Distance (log)	0.0082	0.0021	0.00
Infrequency of price changes	-0.0608	0.0046	0.00
N:		3772	
R-squared:		0.3123	

Notes: Dependent variable is the standard deviation of logged relative prices; robust standard errors reported; city-pair and quinquennia fixed effects suppressed.

Table 9: Nominal Rigidities of Goods across Time

Frequency of price changes

	Beef	Butter	Milk	Potatoes	Sugar	Tea	Tomatoes
1945-1950	0.8883	0.8617	0.2121	0.9640	0.3333	0.6510	0.8433
1978-1983	0.9960	0.9702	0.8052	1.0000	0.9935	0.9583	0.9762
1983-1988	0.9960	0.8611	0.4782	0.9901	0.9107	0.9922	0.9167
1988-1993	0.9980	0.8651	0.4167	0.9921	0.8730	0.9740	0.9306
1978-1993	**0.9963**	**0.9033**	**0.5714**	**0.9933**	**0.9232**	**0.9746**	**0.9390**

Average size of price changes

	Beef	Butter	Milk	Potatoes	Sugar	Tea	Tomatoes
1945-1950	0.0440	0.0447	0.0259	0.1452	0.0170	0.0158	0.0530
1978-1983	0.1007	0.0266	0.0243	0.1388	0.1157	0.0167	0.0352
1983-1988	0.1191	0.0208	0.0134	0.2638	0.0765	0.0512	0.0530
1988-1993	0.1178	0.0229	0.0092	0.3079	0.0704	0.0392	0.0529
1978-1993	**0.1007**	**0.0239**	**0.0160**	**0.2450**	**0.0874**	**0.0366**	**0.0477**

Share of price increases

	Beef	Butter	Milk	Potatoes	Sugar	Tea	Tomatoes
1945-1950	0.7164	0.6989	0.9821	0.5599	0.7273	0.7440	0.4706
1978-1983	0.6594	0.9611	0.9113	0.6151	0.6122	0.5734	0.8293
1983-1988	0.5657	0.7074	0.8133	0.6413	0.4902	0.5591	0.5065
1988-1993	0.5268	0.6009	0.7257	0.5660	0.5886	0.4866	0.5757
1978-1993	**0.5818**	**0.7636**	**0.8347**	**0.6045**	**0.5424**	**0.5441**	**0.6664**

Table 10: "Aggregate" Nominal Rigidities across Provinces and Time

Frequency of price changes

	Maritimes	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	**Canada**
1945-1950	0.6278	0.6728	0.6970	0.6904	0.7292	0.7054	0.6845	**0.6791**
1978-1983	0.9686	0.9305	0.9604	0.9695	0.9787	0.9543	0.9817	**0.9588**
1983-1988	0.8681	0.8595	0.9063	0.8810	0.8214	0.8750	0.9018	**0.8733**
1988-1993	0.8389	0.8560	0.8854	0.8690	0.8304	0.9048	0.9077	**0.8653**
1978-1993	**0.8905**	**0.8833**	**0.9172**	**0.9077**	**0.8750**	**0.9099**	**0.9268**	**0.8985**

Average size of price changes

	Maritimes	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	**Canada**
1945-1950	0.0452	0.0474	0.0562	0.0358	0.0624	0.0523	0.0474	**0.0507**
1978-1983	0.0707	0.0694	0.0722	0.0606	0.0616	0.0596	0.0591	**0.0672**
1983-1988	0.0750	0.0934	0.1040	0.0751	0.0980	0.0835	0.0569	**0.0862**
1988-1993	0.1031	0.0895	0.0966	0.0901	0.0880	0.0760	0.0717	**0.0910**
1978-1993	**0.0824**	**0.0847**	**0.0908**	**0.0759**	**0.0821**	**0.0730**	**0.0626**	**0.0814**

Share of price increases

	Maritimes	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	**Canada**
1945-1950	0.6481	0.6529	0.6521	0.6638	0.6572	0.6456	0.6522	**0.6523**
1978-1983	0.7522	0.7248	0.7206	0.6981	0.7414	0.7508	0.7733	**0.7379**
1983-1988	0.6048	0.5997	0.5911	0.5743	0.5761	0.5952	0.6238	**0.5977**
1988-1993	0.5646	0.5605	0.5597	0.6233	0.5806	0.5888	0.5770	**0.5705**
1978-1993	**0.6454**	**0.6344**	**0.6249**	**0.6328**	**0.6448**	**0.6485**	**0.6513**	**0.6391**

Table 11: Price Dispersion Regressions

	(1)			(2)			(3)			(4)		
	Coefficient	Std Error	p-value	Coefficient	Std Error	p-value	Coefficient	Std Error	p-value	Coefficient	Std Error	p-value
Distance (log)	0.0101	0.0043	0.02	0.0096	0.0041	0.02	0.0337	0.0150	0.03	0.0101	0.0040	0.01
Beef				0.0452	0.0292	0.12						
Butter				-0.0126	0.0287	0.66						
Milk				0.1470	0.0348	0.00						
Potatoes				0.0867	0.0293	0.00						
Sugar				0.0762	0.0347	0.03						
Tea				0.0049	0.0290	0.87						
Tomatoes				0.0156	0.0298	0.60						
Maritimes							-0.1215	0.1076	0.26			
Quebec							-0.0794	0.0962	0.41			
Ontario							-0.0831	0.0688	0.23			
Manitoba							-0.1053	0.1124	0.35			
Saskatchewan							-0.1294	0.1164	0.27			
Alberta							-0.1474	0.1200	0.22			
British Columbia							-0.1634	0.1228	0.18			
1978-1983										0.0083	0.0272	0.76
1983-1988										0.0529	0.0281	0.06
1988-1993										0.0895	0.0295	0.00
N:		405			405			405			405	
R-squared:		0.0115			0.2912			0.0392			0.1270	

Notes: Dependent variable in all regressions is the average of the absolute value of logged relative prices; robust standard errors reported.

Table 12: Price Dispersion and Nominal Rigidities

Dependent variable: Standard deviation of price dispersion

	Coefficient	Std Error	p-value
Distance (log)	0.0108	0.0040	0.01
Infrequency of price changes	-0.0955	0.0125	0.00
N:		405	
R-squared:		0.1850	

Notes: Dependent variable is the standard deviation of logged relative prices; robust standard errors reported; city-pair and quinquennia fixed effects suppressed.