
Cyclical Changes in Short-Run Earnings Mobility in Canada, 1982 to 1996

Charles M. Beach and Ross Finnie¹

Introduction

This paper uses longitudinal income tax-based data for Canada to examine the cyclical pattern of changes in the earnings distribution and earnings mobility in Canada over the period 1982 to 1996, an interval that includes considerable variation in labour market conditions. Numerous recent studies have noted increasing degrees of inequality and polarization of workers' earnings, especially for men; broad distributional shifts in earnings, especially for women; and changing degrees of earnings mobility for both men and women in Canada over the 1980s and up to the middle 1990s (Picot, 1997; Beach and Slotsve, 1996; Beach and Finnie, 1998). Here we want to focus on the cyclical pattern in these changes.

This paper examines basic evidence on how polarization, distributional shifts and measures of the short-run mobility of workers' earnings vary over the business cycle. This can be viewed as updating the C.D. Howe study by Beach and Slotsve (1996), but with much more extensive data and with a data set that has an explicit longitudinal dimension — indeed the LAD file on which this study is based was pioneered by the former Economic Council of Canada of which David Slater was the chair for a number of years. As one

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may expect, there are evidently major trends on-going in these various aspects of distributional change (Beach and Finnie, 2000). In the present paper, we analyze cyclical patterns in the above distributional features. Alternatively viewed, to what extent are distributional changes in workers' earnings and the related pattern of earnings mobility in Canada concentrated in periods of economic recession, and what effects do strengthening or weakening labour markets have on these different dimensions of distributional change in earnings in Canada?

The study focuses on earnings rather than total income because widening inequality and polarization and declining real incomes over the period have been principally attributes of labour markets, and we wish to abstract from government transfers and other sources of income. By short-run distributional change, we mean year-to-year changes in order to be comparable to conventional studies of annual cross-sectional data (such as the SCF in Canada or CPS in the United States). Much of the discussion also focuses on the mobility of workers' earnings because this is a relatively novel concept on which to have data for Canada and because longitudinal-based mobility measures do a better job at indicating how individual workers' earnings actually change over time than cross-sectional-based estimates.

Cyclical variation in earnings mobility is of interest for several reasons. Mobility and inequality can be viewed as distributional complements. For a given degree of inequality of earnings, more earnings mobility corresponds to securing greater labour market opportunity (Shorrocks, 1978). Cyclical variation in earnings mobility thus shows how changes in labour market opportunity vary over the business cycle. Numerous studies have analyzed cyclical changes in inequality; this is the first to focus on cyclical variation of income or earnings mobility for Canada. This will be useful for better understanding how earnings mobility may be expected to be affected by the current economic slowdown in Canada. Identifying cyclical variation in workers' earnings is also critical to the formal statistical modelling of individuals' earnings changes (e.g., Abowd and Card, 1989) and to the econometric analysis of changes in wage structure and earnings inequality (Katz and Autor, 1999). For example, to identify possible labour market and distributional effects of a Free Trade Agreement of the Americas in 2005 requires us to understand underlying cyclical effects already present in workers' earnings mobility and their labour market opportunities. Finally, macro aggregates such as consumption and housing expenditures likely depend on workers' expectations of labour markets and income changes, so that earnings mobility measures may provide input to cyclical fluctuation in household expenditure expectations.

Major non-Canadian studies that provide excellent treatment of mobility in terms of underlying basic issues and policy relevance include Atkinson, Bourguignon and Morrison (1992); Duncan, Smeeding and Rodgers (1994); Gottschalk and Moffitt (1994); OECD (1993, 1996); Buchinsky and Hunt (1996); and Burkhauser, Holtz-Eakin and Rhody (1997). The one early Canadian study we are aware of is Kennedy (1989) which uses a Canada Pension Plan administrative file on earnings of middle-aged men over the period 1966–83. Baker and Solon (1999) study earnings dynamics of men over the 1976–92 interval using regression-based variance-decomposition techniques. And several papers by Finnie (1997a, b, c, d) all use the LAD file, but employ a narrow definition of earnings (essentially wage and salary income) and look at earnings quintile shares (rather than median-based population shares).

The main findings of this paper are as follows. First, there have indeed been major cyclical changes in earnings polarization and distributional shifts, and these have been most markedly concentrated in the recessions, particularly the 1990–92 interval, and show relative stasis during the observed periods of expansion. Second, the general distributional pattern observed for men as a whole holds across all age groups, and the general pattern for women as a whole also holds across all age groups (except for entry-age workers), but the strength of these effects differs considerably across age groups. Third, earnings mobility significantly decreases for men during recessions by reducing the probability of moving up the distribution and increasing the probability of moving down about equally, thus markedly decreasing the net probability of moving up. Fourth, for men, the cyclical sensitivity of transition probabilities decreases monotonically with age, so that cross-sectional age-earnings profiles become steeper in recessions and flatter over economic expansions as the earnings of entry-age and younger workers show the greatest cyclical variation.

The paper is organized as follows. The next section describes the main features of the LAD data set used in this study and defines the estimation sample generating the results. The following two sections look at distributional changes from a cross-sectional perspective treating each year as if it were a separate cross-section. This allows one to look at the cyclical fluctuations in the distribution of workers, the polarization of earnings, and the degree of upward or downward shift in the earnings distribution by sex and age group. The fifth section then exploits the longitudinal aspect of the LAD file more fully by examining various measures of earnings mobility, again by sex and age group, and analyzing their cyclical sensitivity. The final section summarizes and concludes.

The LAD Data Set and the Analysis Sample

The master LAD file is a 10 per cent representative sample of all Canadian tax-filers. In order to be as inclusive as possible, we look at total employment income (henceforth “earnings”) consisting of all wage and salary income and net self-employment income of all earners (men and women) aged 20 to 64 who were not identified as full-time students in the income year and who received at least \$1,000 in earnings (in 1996 constant dollars) as reported on T-1 forms.¹ The intention is to approximate Statistics Canada’s concept of “All Earners” while excluding those who have only a limited attachment to the labour market. The resulting sample in 1996 is thus 1.218 million observations or 56 per cent of the full LAD file of 2.167 million observations that year. The biggest exclusions were for those over age 64 (17 per cent in 1996) and under the \$1,000 earnings cut-off (20 per cent). The sample sizes vary from 1.033 million observations in 1982 to 1.218 million observations in 1996.

The LAD’s coverage (and representativeness) of the adult population is very good since the rate of tax filings is very high in Canada: high-income recipients are required to do so, while low-income individuals have incentives to file in order to recover income tax and other payroll tax deductions made throughout the year, and since 1986 to recover various tax credits. The full set of tax files from which the LAD is constructed are estimated to cover from 91 to 95 per cent of the target adult population (Finnie, 1997d). There has been an increase in the proportion of individuals filing tax forms over time due to the introduction of the federal sales tax credit in 1986, the goods and services tax (GST) credit in 1990, and various other federal and provincial benefits. While this improved coverage means that the LAD has become increasingly representative of the underlying adult population, it also poses potential problems for comparisons of earlier and later years, since the “new” filers are more likely to have low earnings in any given year and hence bias estimates towards slower average growth and stronger net downward mobility. The comparison problem does not, however, appear to be very great and is, in any case, attenuated by the age, student and low-earnings exclusions imposed on the sample (Beach and Finnie, 2001).

The estimation sample is divided into eight separate age/sex population subgroups. Women and men are treated separately because of their different

¹We have also put in place special procedures to deal with individuals who have changed their SINS, who have multiple SINS, and other non-standard cases — see Finnie (1997c) — which comprise of the order of 4 per cent of the file in any given year. Designation of full-time student is based on the tuition and education tax credit responses on T-1 forms.

earnings experience since the early 1980s. Each gender is also divided into four age groups: entry workers (age 20–24), younger workers (age 25–34), prime age workers (age 35–54), and older workers (age 55–64). This allows one to see how mobility patterns vary across the life cycle and how these dynamics vary over the business cycle for the different age groups. The 1996 age breakdown is as follows (in thousands of observations):

	Women	Men
Entry (20–24)	49.3 (8.8%)	57.7 (8.7%)
Younger (25–34)	152.6 (27.3%)	174.2 (26.4%)
Prime (35–54)	305.8 (54.8%)	354.1 (53.7%)
Older (55–64)	50.4 (9.0%)	73.8 (11.2%)

The subsamples in 1996 vary from 49,310 to 354,110 observations each. The numbers in earlier years reflect demographic change with larger numbers of younger workers and smaller numbers of prime age workers than in 1996.

In dividing the earnings distribution into lower, middle and upper regions (henceforth “earnings intervals” or EIs), various cut-off levels are used:

- Below 25% of median (“Very low”)
- 25-50% of median (“Low”)
- 50-100% of median (“Low middle”)
- 100-150% of median (“High middle”)
- 150-200% of median (“High”)
- Above 200% of median (“Very high”).

Following the convention in the polarization literature, the cut-offs are expressed in terms of the median earnings level (rather than in terms of quantiles such as earnings quintiles). In order to address the questions of where various individuals lie in the overall distribution of earnings, or how well women and men are doing in the overall earnings distribution, all cut-offs are computed from a common median earnings level for the earnings distribution as a whole each year. Note that the median was virtually the same (in real terms) in 1982 as in 1996 (\$25.3 and \$25.2 thousand, respectively, in 1996 dollars). So cut-off levels between the earnings intervals were also essentially the same between the two end years. Median earnings also varied remarkably little over the period — from a low of \$24.7 thousand in 1984 to a peak of \$26 thousand in 1989. This reflects conflicting patterns for men and women as men’s (higher) median earnings declined over the period since 1989 while women’s (lower) median earnings increased.

Polarization Rates, Distributional Shifts, and the Economic Cycle

This section looks at the basic distributions of male and female workers across earnings intervals, how these have changed over the 1982–96 period, and the evidence for any cyclical variation in these changes.

Table 1 shows the distribution of men and women workers across earnings intervals for the two end years of the sample and for peak (1989)

Table 1: Distribution of Workers across Earnings Intervals for Men and Women, Selected Years, 1982-1996 (percentages)

	<i>Very Low</i>	<i>Low</i>	<i>Low Middle</i>	<i>High Middle</i>	<i>High</i>	<i>Very High</i>
All Workers						
1982	11.2	13.4	25.4	22.1	14.8	13.1
1983	12.0	13.9	24.2	21.3	14.8	13.9
1989	11.0	13.5	25.5	22.0	14.2	13.7
1992	12.4	14.0	23.6	21.0	14.0	15.0
1996	12.4	13.9	23.7	20.8	13.5	15.7
Mean	11.77	13.80	24.41	21.29	14.24	14.47
Men						
1982	7.4	9.6	19.8	23.1	20.0	20.1
1983	8.2	10.5	19.1	21.2	19.7	21.3
1989	7.0	9.8	20.2	22.8	19.0	21.3
1992	9.4	11.3	19.5	20.2	17.5	22.1
1996	9.3	11.1	20.1	20.1	16.4	23.0
Mean	8.17	10.52	19.75	21.25	18.41	21.91
Women						
1982	16.7	18.7	33.3	20.6	7.5	3.2
1983	17.2	18.5	31.3	21.4	8.1	3.5
1989	16.2	18.4	32.1	20.8	8.3	4.2
1992	16.0	17.3	28.5	21.9	9.7	6.5
1996	16.0	17.3	27.9	21.6	10.1	7.1
Mean	16.37	17.98	30.38	21.31	8.91	5.03

and trough (1983, 1992) years within the 1982–1996 period.^{2,3} Average percentages of workers in each earnings interval over the full sample period appear in the last row of each panel. That men on average have higher earnings than women shows up in men being much more prevalent in the upper two earnings intervals, while women occur more frequently in the lower three intervals.

For men as a whole, the major change was an increasing polarization of workers, characterized by movements from the high and high-middle regions of the distribution (which include many manufacturing and unionized jobs) towards the lower and top ends of the distribution. For women as a whole, the most notable change was the general upward shift of the entire earnings distribution from the lower three regions to the upper three regions of the distribution (due to increases in both wage rates and hours worked).

Cyclical patterns in these shifts are also apparent, particularly for males (who tend to work more in manufacturing and primary-goods sectors than women who are concentrated more in services and public sector jobs which are less cyclically volatile). Between 1989 and 1992, for example, the percentage of men within the lowest two earnings intervals rose from 16.8 to 20.7 per cent. During the preceding 1983–89 expansion, the share had declined from 18.7 to 16.8 per cent. Cyclical changes thus appear to occur most markedly during periods of economic recession and slack labour market performance. For women, however, general downward trends in the bottom three shares and upward trends in the upper three shares appear more predominant. These cyclical patterns are illustrated in Figures 1 and 2.

Now consider the cyclical patterns of earnings polarization and distributional shift in more detail. Polarization of earnings refers to a growing proportion of workers at the two ends of the earnings distribution and a corresponding reduction in the proportion of workers around the middle of the distribution. This has been found by Beach and Slotsve (1996) to characterize the male earnings distribution in Canada based on grouped histograms of cross-sectional SCF data published by Statistics Canada. It would be worthwhile to examine this issue further with the large LAD

²In 1996, the five earnings cut-offs dividing the distribution into six earnings groups were \$6.3 (thousand), \$12.6, \$25.2, \$37.8 and \$50.4.

³Standard errors could be calculated for these earnings interval shares as these are multinomially distributed, but the underlying sample sizes are so large they were judged not worth reporting.

microdata set. From a cross-sectional perspective, this could be examined by looking at year-to-year changes in

$$(P_{VL} + P_L) + (P_H + P_{VH}) \quad (1)$$

where P_{VL} is the percentage of workers within the very low (VL) earnings interval and the remaining percentages are defined accordingly. (Middle percentages do not enter the formula as the percentages all sum to a 100 per cent and an increase in the lower and upper interval shares implies a corresponding reduction in the middle interval percentages.) Alternatively, one could also look at the more extreme measure

$$P_{VL} + P_{VH} \quad (2)$$

concentrating on just the two end interval shares. These are called cross-sectional measures because they do not exploit the panel nature of the data.

Table 2 presents estimates of changes in both these measures of polarization (in the first two rows of each panel). Also presented are the breakdowns of these measures into the portions contributed by the upper and lower ends separately (in the bottom four rows of each panel). Three features are most noticeable from these results. First, a substantial degree of increased polarization is evident in the last column of the table. Among all workers, the interval share of individuals with earnings in the bottom two and top two intervals increased by three percentage points between 1982 and 1996 (a 5.7 per cent increase), while the proportion of workers in just the two extreme intervals rose by 3.8 points (or by 15.6 per cent). The corresponding increases for men were 2.7 and 4.8 percentage points, respectively, and for women 4.4 and 3.2 percentage points. Evidently, the shift is strongest in percentage terms in the two extreme earnings intervals.

Second, the increased polarization for men occurs at both ends of the earnings distribution with increasing shares of workers at both the very low and very high intervals. (Estimates of what fraction of the increased polarization is attributable to increases at one end or the other, however, are not at all robust as they vary greatly with exactly what polarization measure is used.) For women, though, this is not the case as the increased polarization measures really reflect a shift up of the entire distribution such that the increased share in the high and very high intervals (6.5 percentage points) completely swamps the reduced share of workers in the low and very low intervals (-2.1 percentage points). Thus what is going on in the distribution of female earnings is not really well characterized by the term polarization. This will be revisited below.

**Figure 1: Change in the Earnings Distribution for Men
1989 to 1992**

**Figure 2: Change in the Earnings Distribution for Women
1989 to 1992**

Third, the most marked changes in the degree of polarization among men's earnings occurred during the two major recessions and particularly over the recession period of 1989–92. In general, earnings polarization increased during recessions (with the biggest increases occurring among low earners) and attenuated during economic expansions (with again the biggest adjustments occurring among low earners) with high earners relatively insulated from such cyclical fluctuations (see Figure 1). But over the full

Table 2: Cross-Sectional Polarization Changes for Men and Women, Selected Years, 1982-1996 (percentage point changes)

	1982- 1983	1983- 1989	1989- 1992	1992- 1996	1982- 1996
All Workers					
- Beyond 50% of median ¹	2.1	-2.2	3.0	0.1	3.0 (5.7%)
- Change in VL and VH ²	1.6	-1.2	2.7	0.7	3.8 (15.6%)
- Change in VL and L ³	1.3	-1.4	1.9	-0.1	1.7
- Change in VL ⁵	0.8	-1.0	1.4	0.0	1.2
- Change in VH and H ⁴	0.8	-0.8	1.1	0.2	1.3
- Change in VH ⁶	0.8	-0.2	1.3	0.7	2.6
Men					
- Beyond 50% of median	2.6	-2.6	3.2	-0.5	2.7 (4.7%)
- Change in VL and VH	2.0	-1.2	3.2	0.8	4.8 (17.5%)
- Change in VL and L	1.7	-1.9	3.9	-0.3	3.4
- Change in VL	0.8	-1.2	2.4	-0.1	1.9
- Change in VH and H	0.9	-0.7	-0.7	-0.2	-0.7
- Change in VH	1.2	0.0	0.8	0.9	2.9
Women					
- Beyond 50% of median	1.2	-0.2	2.4	1.0	4.4 (9.5%)
- Change in VL and VH	0.8	-0.3	2.1	0.6	3.2 (16.1%)
- Change in VL and L	0.3	-1.1	-1.3	0.0	-2.1
- Change in VL	0.5	-1.0	-0.2	0.0	-0.7
- Change in VH and H	0.9	0.9	3.7	1.0	6.5
- Change in VH	0.3	0.7	2.3	0.6	3.9

Notes: ¹ $\Delta(P_{VL}+P_L)+\Delta(P_H+P_{VH})$

$$\begin{aligned}
&^2\Delta P_{VL} + \Delta P_{VH} \\
&^3\Delta P_{VL} + \Delta P_L \\
&^4\Delta P_{VH} + \Delta P_H \\
&^5\Delta P_{VL} \\
&^6\Delta P_{VH}
\end{aligned}$$

where P_i represents the percentages of workers in earnings interval i .

period 1982–96, the latter attenuation has not recovered all the polarization increases that occurred during the recessions — and this is especially so over the 1990s. As a result, the increases in earnings polarization for men have tended to follow a ratchet pattern over the period covered, notching up significantly during recessions and then easing off relatively little over the ensuing expansion. This does not bode well for when the next recession hits the labour market.

It has been noted above that the earnings distribution for women has generally shifted upward over the sample period, especially over the 1990s. We now look at this more formally. Again from a cross-sectional perspective, this idea could be examined by looking at year-to-year changes in

$$(P_{VH} + P_H + P_{HM}) - (P_{LM} + P_L + P_{VL}) \quad (3)$$

where again P_{VH} is the percentage of workers within the very high (VH) earnings interval and the remaining percentages are defined accordingly. Intuitively, a shift up of a distribution would show up as generally positive changes in the upper set of interval shares and negative changes in the lower set of interval shares. (Recall that the sum of all six shares is always 100 per cent.) So an upward shift will typically be captured by a positive change in the share formula (3), while a downward shift will tend to show up as a negative change. Alternatively, since the biggest changes appear to have occurred in the lower and upper interval shares, one could also look at the more extreme measure of distributional shift

$$(P_{VH} + P_H) - (P_L + P_{VL}) \quad (4)$$

which concentrates on shifts at the two ends of the distribution. Since the polarization measures may be dominated by shifts at only one end of a distribution, it is useful to complement them by further measures of distributional shift per se to see whether a distribution is more appropriately characterized as generally moving up or moving down.

Table 3 presents estimates of changes in both these measures of upward/downward distributional shift. One notices first the virtual absence of

distributional shift for all workers (men and women together, first panel). But this hides strong opposite shifts in fact going on within the overall distribution between men and women. The earnings distribution for men shifted down strongly over the 1982–96 period as a whole (right-hand column), while the distribution for women workers shifted even more strongly upward

Table 3: Cross-Sectional Upward/Downward Shift for Men and Women, Selected Years, 1982-1996 (percentage point changes)

	1982- 1983	1983- 1989	1989- 1992	1992- 1996	1982- 1996
All Workers					
- Change in Top Three to Bottom Three EIs ¹	-0.1	0.0	0.1	0.0	0.0
- Change in Top Two to Bottom Two EIs ²	-0.5	0.6	-0.8	0.3	-0.4
Men					
- Change in Top Three to Bottom Three EIs	-2.0	1.7	-6.5	-0.6	-7.4
- Change in Top Two to Bottom Two EIs	-0.8	1.2	-4.6	0.1	-4.1
Women					
- Change in Top Three to Bottom Three EIs	3.4	0.6	9.7	1.3	15.0
- Change in Top Two to Bottom Two EIs	0.6	2.0	5.0	1.0	8.6

Notes: ¹ $\ddot{A}(P_{VH}+P_H+P_{HM}) - \ddot{A}(P_{LM} + P_L + P_{VL})$

² $\ddot{A}(P_{VH}+P_H) - \ddot{A}(P_L + P_{VL})$

where P_i represents the percentage of workers in earnings interval i .

(see Figure 2). So the two earnings distributions have strongly converged over the sample period. Also note that the period of most marked distributional shifts occurred over the 1989–92 period of major recession in Canada. Indeed, more than half the shifting occurred over this brief interval — between 58 and 65 per cent of the entire 1982–96 shift for women and 88–112 per cent for men. By contrast, the recessionary period 1982–83

accounted for only 7–23 per cent of the full period shift for women and 20–27 per cent for men. In terms of distributional shift, the early recession and subsequent recovery of the 1990s were a period of quite dramatic and likely historic adjustment.

In an extended version of the current paper (Beach and Finnie, 2001), we also examine whether these cyclical patterns are statistically significant once one nets out underlying trends. This is done by running regressions of earnings interval shares (the proportions in expressions (1) - (4)) as dependent variables on a time trend and the adult male (age 25 and over) unemployment rate (as a proxy for business-cycle effects). The unemployment rate coefficients are referred to as *net* cyclical effects or net responsiveness to unemployment changes. Results in Table 4 show that weak labour markets increase earnings polarization significantly for both men and women with generally much stronger effects for men than for women (see rows one and two). Among men, the action driving the greater polarization of earnings occurs towards the bottom end of the distribution as lower-earnings workers slip down the distribution. Among women, however, the action occurs towards the top end of the distribution as higher-earnings women move up relatively in the distribution. In Table 5, highly significant opposite distributional shifts for men and women stand out clearly. Weak labour markets shift the earnings distribution for men down significantly, but the higher unemployment shifts the women's distribution up significantly in relative terms as women's earnings are relatively less sensitive to weakened labour markets. Both sets of net cyclical effects mirror the gross results already observed in the raw data of Tables 2 and 3.

Patterns across Age Groups

The recent literature (e.g., Beaudry and Green, 2000; or Beach and Finnie, 1998) has found considerable differences in earnings experiences for different age groups in Canada. This is worth exploring further. Table 6 presents earnings interval shares for each of four age groups, entry workers (age 20–24), younger (25–34), prime (35–54), and older workers (55–64). To save clutter, the table focuses on just the 1989–92 recessionary period as well as mean earnings interval shares (P_i 's) over the full 1982–96 period.

As can be seen from the latter figures, entry workers are concentrated more towards the lower end of the distribution, and prime age male workers appear predominantly towards the upper end (since the EI cutoffs are based on the overall median earnings level). The general cyclical pattern for men as a whole previously seen in Table 1 (and illustrated in Figure 1) holds

Table 4: Net Cross-Sectional Polarization Responsiveness to Unemployment for Men and Women, 1982-1996

	<i>Men</i>	<i>Women</i>
Beyond 50% of median marginal UR effect	0.687 (4.51)	0.432 (4.75)
Change in VL and VH marginal UR effect	0.611 (4.66)	0.363 (6.14)
Change in VL and L marginal UR effect	0.789 (17.5)	-0.035 (0.43)
Change in VL marginal UR effect	0.496 (16.4)	0.078 (1.37)
Change in VH and H marginal UR effect	-0.102 (0.73)	0.467 (17.8)
Change in VH marginal UR effect	0.115 (0.93)	0.285 (13.4)

Note: See notes to Table 2. Figures in parentheses are absolute values of “t-ratios”. Coefficients are marginal effects as defined in the text.

Table 5: Net Cross-Sectional Upward/Downward Responsiveness to Unemployment in Earnings Distributions for Men and Women, 1982-1996

	<i>Men</i>	<i>Women</i>
Change in top three to bottom three EIs	-1.195 (12.6)	1.286 (15.2)
Change in top two to bottom two EIs	-0.892 (6.32)	0.502 (6.37)

Note: See notes to Table 3. Coefficients are marginal effects as defined in the text. Figures in parentheses are absolute values of “t-ratios”.

Table 6: Distribution of Workers across Earnings Intervals by Age, 1989 and 1992, and Mean over 1982-1996 (percentages)

Men						
	<i>Very Low</i>	<i>Low</i>	<i>Low Middle</i>	<i>High Middle</i>	<i>High</i>	<i>Very High</i>
Entry						
1989	17.9	20.9	36.0	18.8	5.2	1.1
1992	26.6	24.1	31.0	13.6	3.9	0.9
Mean	21.86	22.63	33.19	16.04	5.05	1.25
Younger						
1989	6.4	9.7	22.9	27.8	20.1	13.1
1992	9.0	11.7	22.8	24.9	18.5	13.0
Mean	7.56	10.54	22.28	25.59	19.81	14.23
Prime						
1989	4.3	7.0	14.8	20.7	21.8	31.4
1992	6.1	8.5	15.4	18.9	19.9	31.3
Mean	5.07	7.53	15.07	19.71	20.97	31.64
Older						
1989	8.8	10.6	19.7	21.3	17.5	22.0
1992	11.1	12.5	19.9	18.9	15.6	22.1
Mean	9.51	11.11	19.22	20.72	17.12	22.33
Women						
	<i>Very Low</i>	<i>Low</i>	<i>Low Middle</i>	<i>High Middle</i>	<i>High</i>	<i>Very High</i>
Entry						
1989	26.1	24.7	37.0	10.7	1.3	0.2
1992	31.6	25.6	30.8	10.4	1.4	0.2
Mean	28.64	25.33	34.03	10.39	1.45	0.16
Younger						
1989	16.1	17.4	33.0	23.0	7.9	2.7
1992	15.9	17.1	30.3	23.1	9.7	3.8
Mean	16.09	17.13	31.20	23.25	9.15	3.16
Prime						
1989	13.1	16.5	30.6	22.7	10.6	6.5
1992	12.7	15.3	26.9	23.7	11.8	9.5
Mean	13.35	16.39	28.88	22.87	10.99	7.51
Older						
1989	17.9	20.5	31.2	19.5	6.7	4.1
1992	18.0	20.0	28.2	20.4	7.4	6.1
Mean	17.69	19.96	29.71	20.51	7.18	4.91

across all age groups, and the general cyclical pattern for women as a whole (in Table 1 and illustrated in Figure 2) also holds across all age groups, except for entry age women whose pattern resembles more that of entry age men. The strength of the cyclical effects, though, differs across age groups, with the strongest shifts generally occurring among entry and younger workers.

Cyclical patterns in polarization rates and distributional shifts by age group are examined in Beach and Finnie (2001). Polarization rates increase in recessions across all age/sex groups. Entry and younger workers of both sex show the strongest sensitivity to unemployment rate changes, while older workers show generally the weakest effects. The cyclical pattern of distributional shifts (both in the raw data and the net unemployment rate effects) across all age groups for each gender mirrors that for the gender as a whole (with the one exception of entry-age women workers). But the strength of the cyclical effects differs across age groups with typically the strongest effects occurring among entry and younger workers.

Cyclical Effects on Earnings Mobility

So far the analysis in this paper has operated as if we simply had a series of large annual cross-sections of data. We now exploit the longitudinal aspect of the LAD file in order to see how workers move about the earnings distribution from one year to the next. This allows us to see better where workers were coming from or went when changes occurred in earnings interval shares and how these earnings dynamics are related to the business cycle. As Beach and Finnie (2000) show, the underlying earnings transition probabilities can be viewed as the basic primitives driving the observed changes in the cross-sectional distribution of workers in the earnings distribution.

Transition Matrices and Earnings Mobility Measures

The principal tool of analysis underlying the dynamic work in this paper is the transition matrix. This provides a general, flexible, data-based approach to the study of earnings mobility (Atkinson *et al.*, 1992). This is a two-dimensional array of earnings intervals (EIs) for an initial year down the left-hand side and of earnings intervals for a subsequent year along the top, and whose elements indicate the percentages of individuals moving from earnings interval i in the

initial year to earnings interval j in the subsequent year. These percentages sum to 100 across each row. In order to analyze the cyclical aspects of these dynamics, one-year or short-run transition matrices for the cyclical peak (1988–89) and cyclical trough (1991–92) years are presented in Table 7.⁴⁵ In the top row of the 1991–92 panel for women, the figures indicate that 83.9 per cent of the women who were in the very high earnings interval in 1991 stayed in that top interval in 1992, while only 3.6 per cent of the top 1991 female earners fell as far as two categories into the high-middle earnings interval. Numbers (in bold) on the principal diagonal running from bottom left to top right are the “staying probabilities” (expressed in percentages). Numbers above this diagonal indicate probabilities of moving down one or more earnings intervals (“moving down probabilities”). Numbers below the principal diagonal represent probabilities of moving up one or more intervals (“moving up probabilities”).

The transition matrices thus show that the probability of staying in the same earnings interval is the largest item in each row and that the probabilities decline as one moves further away from the initiating interval. That is, it is much less likely for a worker’s earnings to change dramatically from one year to the next than to stay in the same or move to an adjacent interval. Recall, however, that the intervals are fairly wide — either 25 or 50 per cent of the median. This leaves quite a wide range for year-to-year earnings variation (see footnote 2) without workers slipping out of their current earnings intervals.

In all of the transition matrices in Table 7, the probability of staying in the same earnings interval generally rises with the level of earnings. That is, high earners are more likely to continue with their high earnings levels from

⁴Again, standard errors could also be calculated for the estimated transition probabilities (Amemiya, 1985, ch. 11), but the underlying sample sizes in this paper are so large they were judged not worth reporting.

⁵We focus on the 1990–92 recession because the data completely cover the period (compared to the early eighties recession where our data only begin in 1982 and hence the transition 1982–83) and because the labour market following the early nineties recession did not really show significant tightening until 1997 (which is beyond the end year of our sample).

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Table 7: One-Year Transition Matrices for Men and Women, Earners, 1988–89 and 1991-92

Men						
<i>1988-89 (Peak)</i>						
1988/1989	VL	L	LM	HM	H	VH
Very High	0.29	0.43	1.28	2.59	11.64	83.77
High	0.55	0.96	3.26	16.21	64.56	14.46
High Middle	1.50	2.59	13.72	63.68	15.87	2.65
Low Middle	4.91	11.53	56.65	22.00	3.74	1.16
Low	16.54	39.59	33.82	7.74	1.62	0.69
Very Low	40.25	30.61	22.47	5.08	1.11	0.49
<i>1991-92 (Trough)</i>						
1991/1992	VL	L	LM	HM	H	VH
Very High	0.40	0.62	1.66	2.85	8.97	85.49
High	0.85	1.35	4.12	13.25	65.32	15.12
High Middle	2.14	3.45	14.23	62.12	15.94	2.13
Low Middle	7.06	14.11	56.54	18.54	2.83	0.93
Low	19.63	42.54	29.85	6.19	1.29	0.49
Very Low	46.14	29.58	19.07	3.99	0.84	0.38
Women						
<i>1988-89 (Peak)</i>						
1988/1989	VL	L	LM	HM	H	VH
Very High	0.39	0.49	1.68	4.44	14.17	78.83
High	0.52	0.94	4.21	17.80	66.96	9.58
High Middle	1.34	2.25	15.76	70.45	9.20	1.00
Low Middle	4.64	11.04	68.38	14.62	1.09	0.23
Low	17.73	48.57	29.99	3.19	0.41	0.11
Very Low	52.21	31.19	14.74	1.53	0.27	0.07
<i>1991-92 (Trough)</i>						
1991/1992	VL	L	LM	HM	H	VH
Very High	0.34	0.54	1.69	3.55	10.00	83.89
High	0.62	0.96	4.41	12.85	67.10	14.06
High Middle	1.40	2.67	13.26	71.08	10.50	1.09
Low Middle	5.60	12.18	65.61	14.96	1.35	0.30
Low	20.18	49.78	26.23	3.32	0.37	0.11
Very Low	55.68	29.38	12.98	1.66	0.22	0.09

one year to the next than are low earners to continue at their low earnings levels. High earners thus have much greater year-to-year stability of earnings than do low earners on average.

Note also that the transition matrices are not symmetric. The elements below the principal diagonal are typically larger than the corresponding elements above, indicating that the probabilities of moving up the earnings distribution are generally greater than the probabilities of moving down. Also, the probability of moving up generally declines as one moves from lower earnings levels to higher ones, while the probability of moving down changes remarkably little over the different regions of the distribution. Thus the net probability of moving up also declines as one moves up the distribution. These patterns are consistent with younger workers being initially concentrated in the lower portion of the distribution and then moving up relatively rapidly early in their careers with individuals' earnings then becoming more stable once they have reached middle age. Note also that the width of the second earnings interval is only 0.25 of the median, while higher interior intervals are twice as wide, so it takes a bigger change in earnings to move out of these intervals, thus reducing mobility across intervals.

A further point of interest is that, except at the top earnings interval, the staying probabilities are higher for women than for men, most markedly so at the bottom end of the distribution. That is, women's earnings are generally less mobile or more stable from one year to the next than men's. This pattern is consistent with women typically having flatter age-earnings profiles than men and with women's earnings being less sensitive to business-cycle unemployment rate variations. The average probability of moving up one or more earnings intervals from 1995 to 1996 was 26.4 per cent for men versus 19.6 per cent for women, and the average probability of moving down was 13.2 per cent for men as compared to 14 per cent for women. Men are thus much more likely to advance their earnings by one or more earnings intervals in a year and are also about as likely to experience year-to-year earnings losses of one or more intervals as women.

The figures in Table 7 also show evidence of cyclical sensitivity. Comparison of the 1991–92 (cyclical trough) transition probabilities with the 1988–89 (cyclical peak) probabilities shows, first, that the staying probabilities (or earnings immobility) towards the lower and upper ends of the distribution increase during recessions — more so for men among lower earnings intervals and for women among the top earnings interval. The probabilities of moving up across earnings intervals — figures below the principal diagonal — generally decline in periods of recession, while the probabilities of slipping down one or more intervals — figures above the principal diagonal — generally rise in recession, though this latter effect is

largely restricted to the lower three earnings intervals. That is, over the bottom two earnings intervals it appears that an economic recession is associated with a higher probability of staying (or reduced degree of earnings mobility), a lower probability of moving up, and an enhanced probability of moving down the distribution. The opposite occurs during an economic expansion. This cyclical pattern is also more clear-cut for men's earnings than for women's.

To better see the more salient patterns of dynamic distributional change, however, it is useful to summarize some of the main features of the transition matrices to a smaller and more manageable set of mobility statistics. This is done in Table 8. Here the detailed probabilities of moving up or moving down are summed across each row in the transition matrix. Then the Avg. Prob. of Moving Up is the (simple) average of the six probabilities of moving up across all six earnings intervals in a distribution. Similarly, the Avg. Prob. of Moving Down is the average of the probabilities of moving down across all the earnings intervals. The Avg. Net Prob. of Moving Up is the difference between the former and the latter. Finally, if avg. Pr(S) is the average of the probabilities of staying (expressed as percentages) across all six earnings intervals in a distribution, then

$$\text{Avg. Mobility} = 100 - \text{avg. Pr(S)}.$$

Figures on these average probabilities (all expressed as percentages) are presented in Table 8 for the full sample period as well as for the transition between 1987 and 1988 (years of strong economic expansion) and between 1990 and 1991 (years of relatively severe recession). Looking at the average one-year transitions over the full sample period, one sees that average mobility of earnings is substantially higher for men than for women by about seven percentage points. The average probability of moving up is also substantially higher for men than for women — by 7.5 percentage points. The average probability of moving down is only slightly lower for men than for women — by less than one percentage point. But all the average moving down probabilities are less than the average moving up probabilities — indeed about half the size in the case of men and three-quarters the size for women. So the average net probabilities of moving up are also all positive — about 12–13 per cent over the sample period for men and about 4 per cent for women. So the average net probability of moving up is also substantially

**Table 8: Average Mobility Measures by Cyclical Phase
for Men and Women, 1987–88 and 1990–91**

	<i>All Workers</i>	<i>Men</i>	<i>Women</i>
Average Mobility			
1987–88	38.40	42.43	36.08
1990–91	37.80	40.95	35.41
Average across years	37.36	41.25	34.56
Avg. Prob. of Moving Up			
1987–88	23.56	28.24	19.60
1990–91	22.29	24.58	20.48
Average across years	22.95	26.94	19.41
Avg. Prob. of Moving Down			
1987–88	14.83	14.18	16.48
1990–91	15.52	16.36	14.93
Average across years	14.41	14.31	15.14
Avg. Net Prob. of Moving Up			
1987–88	8.73	14.06	3.12
1990–91	6.77	8.22	5.54
Average across years	8.55	12.63	4.27

higher for men than for women — by over eight percentage points — again consistent with lower and flatter age-earnings profiles for women than for men.

There also appears to be a marked cyclical pattern in the net upward probabilities for men being driven by a corresponding cyclical pattern in the average probability of moving up. The probabilities rise in expansionary periods and decline in recessions. The average mobility of earnings declined with the onset of the early 1990s recession — by about 1.5 percentage points for men, but by only about 0.5 of a point for women. So again, the cyclical effect shows up much stronger for men than for women. For men, the average probability of moving up declines by over 3.5 points and the average probability of moving down rises by about two percentage points. Consequently, the average net probability of moving up falls by almost six percentage points. Over the ensuing expansion, these three probabilities

moved in the reverse direction. For women, however, the change in earnings mobility between 1987–88 and 1990–91 was weaker, but in the opposite direction from men: a less than one percentage point rise in the probability of moving up, a 1.5 point decline in the probability of moving down, and a resulting 2.5 point increase in the net probability of moving up. The latter probability did not change between 1990–91 and 1995–96, suggesting that the cyclical earnings transition pattern for women is not clearly revealed by the raw data.

Net Cyclical Effects in Earnings Mobility

Just as we earlier looked at how earnings interval shares show significant net cyclical effects after controlling for underlying trends in the data, we now do the same for the summary earnings mobility measures. This will allow a more formal identification of underlying cyclical effects. In this case, the transition probabilities are the dependent variables in a regression analysis (see Beach and Finnie, 2001).

The unemployment responsiveness of the initial-year transition probabilities is illustrated in Figure 3. Periods of high unemployment reduce upward mobility over the lower earnings intervals for both men and women, though more strongly for men than for women, again perhaps because of the relatively greater concentration of males in the more cyclically sensitive manufacturing and primary sectors of the economy, whereas females are concentrated relatively more in the service and public sectors. More generally, weaker labour markets tend to reduce the degree of upward earnings mobility for almost all regions of the earnings distribution for men. But for women, earnings mobility increases over the middle and upper regions of the earnings distribution, again because of the relatively stronger decline in overall median earnings levels in recessions. Thus among men, the biggest (negative) unemployment rate effects occur over the bottom three earnings intervals, while among women they show up (positively) in the high and high-middle regions of the earnings distribution.

Net cyclical effects on the summary mobility measures appear in Table 9. Higher unemployment decreases net earnings mobility significantly for men by reducing the probability of moving up the earnings distribution and increasing the probability of moving down about equally, so that the average net probability of moving up is significantly decreased. For every percentage

**Figure 3: Unemployment Responsiveness of Earnings Mobility
across Earnings Intervals for Men and Women**

Table 9: Net Responsiveness to Unemployment in the Average Summary Mobility Measures for Men and Women, 1982-1996

	<i>Men</i>		<i>Women</i>	
Average Mobility				
Marg. effect	0.096	(0.67)	0.344	(1.34)
Elasticity	0.024		0.34	
Avg. Prob. of Moving Up				
Marg. effect	-0.768	(4.12)	0.447	(2.62)
Elasticity	-0.211		0.102	
Avg. Prob. of Moving Down				
Marg. effect	0.865	(5.07)	-0.103	(0.53)
Elasticity	0.302		-0.072	
Avg. Net Prob. of Moving Up				
Marg. effect	-1.634	(4.99)	0.550	(2.11)
Elasticity	-0.513		0.074	

Note: The unemployment responsiveness coefficients for the average net probability of moving up, Avg Pr (Net), are obtained as the respective coefficients in an OLS time-series regression on Avg Pr (Net) as the dependent variable with the time trend and the change in the (adult male) unemployment rate as independent variables. The "Elasticity" figures for Avg Pr (Net) are obtained as the respective coefficients in an OLS time-series regression on ln (Avg Pr (Net)) as the dependent variable with the time trend and the change in the log of the (adult male) unemployment rate as independent variables. Figures in parentheses are (absolute values of) coefficient "t-ratios".

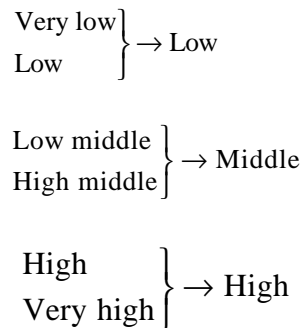
point increase in the unemployment rate, the average net probability of moving up is estimated to fall by 1.63 percentage points. Expressed differently, if the unemployment rate doubles in a recession (say, from 7 to 14 per cent), the opportunity rate of (annual) advancement in the earnings distribution (i.e., the net probability of moving up) is estimated to be cut in half. Recessions inhibit labour market opportunities while economic expansions promote them. For women, the net cyclical effects are again generally opposite in sign and much weaker, so the unemployment rate effect on the net probability of moving up is positive but only about a third as strong as that of men, reflecting the relative weaker responsiveness of their earnings to the

business cycle. Once again, the net cyclical effects largely mirror the gross cyclical patterns observed in the raw data (in Table 8), except perhaps for the stronger net estimated moving down effect among men compared to what was observed in the data.

Earnings Mobility across Age Groups

The analysis in the fourth section revealed quite substantial distributional changes going on for different age groups. It would be useful to follow this up by looking at age-group differences in the underlying earnings mobility as well. As already noted, the underlying transition probabilities can be viewed as the more basic primitives driving the observed changes in the cross-sectional distribution of workers.

When one breaks down populations into separate age groups, the numbers of observations per age group in the samples are obviously reduced, especially among entry (age 20–24) and older (age 55–64) workers. We thus reduce the fineness of the earnings interval breakdown for each age group by collapsing the previous six intervals into three:



So the earnings cut-offs now are 50 per cent and 150 per cent of the median. The year-to-year transition matrices underlying this section are correspondingly three-by-three.

The resulting average probabilities by age group are presented in Table 10. Here it can be seen that average mobility is highest for younger workers and thereafter declines with age. Again, earnings mobility is higher every-

Table 10: Average Mobility Measures by Cyclical Phase by Age for Men and Women, 1987–88 and 1990–91

Men				
	<i>Entry</i>	<i>Younger</i>	<i>Prime</i>	<i>Older</i>
Average Mobility				
1987–88	26.60	26.60	24.73	22.70
1990–91	26.23	24.70	22.93	22.10
Average across years	25.42	25.59	23.76	22.03
Avg. Prob. of Moving Up				
1987–88	16.27	19.57	18.33	11.67
1990–91	12.07	16.23	15.43	9.93
Average across years	14.45	18.45	17.18	11.08
Avg. Prob. of Moving Down				
1987–88	10.33	7.03	6.40	11.03
1990–91	14.17	8.43	7.50	12.20
Average across years	10.98	7.14	6.58	10.95
Avg. Net Prob. of Moving Up				
1987–88	5.93	12.53	11.93	0.64
1990–91	-2.10	7.80	7.93	-2.27
Average across years	3.47	11.32	10.60	0.13
Women				
	<i>Entry</i>	<i>Younger</i>	<i>Prime</i>	<i>Older</i>
Average Mobility				
1987–88	24.50	23.13	17.97	17.57
1990–91	22.27	23.20	17.13	16.80
Average across years	22.63	22.80	16.79	16.53
Avg. Prob. of Moving Up				
1987–88	11.20	11.90	10.10	5.30
1990–91	9.23	11.97	10.00	5.43
Average across years	10.05	11.95	9.66	5.26
Avg. Prob. of Moving Down				
1987–88	13.27	11.23	7.90	12.27
1990–91	13.07	11.23	7.13	11.37
Average across years	12.58	10.85	7.13	11.26
Avg. Net Prob. of Moving Up				
1987–88	-2.07	0.67	2.20	-6.97
1990–91	-3.83	0.74	2.87	-5.94
Average across years	-2.53	1.10	2.53	-6.00

where for men than for women. The average probability of moving up is also highest among younger workers and thereafter declines with age for both men and women. The average probability of moving down is highest for entry and older workers and lowest for prime age workers, again for both sexes. The average net probability of moving up for men is highest for younger workers and thereafter declines with age, but for women is highest among prime age workers. The average net probability is everywhere greater for men than for women across all age groups, but the differential is greatest among younger and prime age workers (8.1 – 10.2 points) and lower among entry and older workers (6.0 – 6.1 points). Again, this is consistent with men having generally higher and more concave career earnings trajectories than women.

Net responsiveness of the summary mobility measures by age group is examined in Beach and Finnie (2001). For men, the sensitivity of earnings mobility measures to changes in unemployment decreases monotonically with age. The average probability of moving up is fairly cyclically responsive for all ages attenuating from a marginal unemployment rate effect of -0.82 for entry workers to -0.28 for older workers. When the unemployment rate rises, the probability of moving up falls. The probability of moving down also shows significant cyclical responsiveness declining from 0.62 for entry workers to 0.27 for older workers — it rises along with the unemployment rate. But its strength is generally less than that of the upward mobility. As a result, the net probability of moving up shows significant cyclical variation among all age groups of male workers moderating from -1.44 for entry workers (-0.99 for younger workers and -0.81 for prime age workers) to -0.55 for older workers. Between 50 and 60 per cent of the net upward mobility cyclical effect arises from changes in the probability of moving up across the four age groups of male workers. But perhaps most interestingly, since the shift downward in net upward mobility decreases with age, the earnings advances of entry and young workers will be dampened much more than those of prime age and older workers, thus widening the gap between relatively low earners early in their careers and higher earners later in their careers. The result is that men's *cross-sectional* age-earnings profiles swivel down during recessions and their steepness and concavity are accentuated — as illustrated in Figure 4. In periods of economic expansion, the reverse occurs. For female workers, the net cyclical earnings shifts are far smaller and show no such statistically significant pattern. For example, the unemployment rate effects on the net probability of moving up vary from -0.19 for entry workers to 0.17 for older workers (none of which are statistically significant). Consequently, women's *cross-sectional* age-earnings profiles do not show any significant change in shape over the business cycle.

**Figure 4: Cyclical Shift in Men's Life-Cycle Earnings
Cross-Sectional Profile**

Conclusions and Review

This study has used income tax longitudinal data over the period 1982–96 to look at business-cycle effects on short-run earnings mobility patterns of workers in the Canadian labour market. The approach has involved looking at the proportion of workers in six earnings intervals over time and at dynamic one-year transition matrix summary measures of earnings mobility over time. Four major results have been found.

First, there are major cyclical effects in changes in the degree of earnings polarization and in general upward or downward shifts of the earnings distribution over the 1982–96 period, and these effects are most markedly concentrated in the two recessions over this period, particularly between 1990 and 1992. Weak labour markets increase earnings polarization significantly with generally much stronger effects for men than for women. In terms of general distributional shift, quite opposite cyclical patterns are observed. Weak labour markets shift the earnings distribution for men down significantly, but the higher unemployment shifts the women's earnings distribution up relative to the men's as women's earnings are relatively less sensitive to weakened labour markets.

Second, when these cyclical patterns are observed across age groups, the cyclical effects across all age groups for each gender generally mirror that for the gender as a whole, but the strength of the effects differs across age groups with the strongest effects typically occurring among entry and younger workers. Higher unemployment increases polarization rates across all age/sex groups. Among males, it is the cyclical sensitivity of the earnings of workers at the lower end of the distribution which is driving the results. Among female workers, it is generally the upper end of the earnings distribution where the greatest cyclical sensitivity occurs. Entry and younger workers of both gender show far the greatest sensitivity to unemployment rate changes, while older workers show generally the weakest effects.

Third, year-to-year dynamics of workers' earnings are summarized in terms of measures of earnings mobility, the probability of moving up the distribution across earnings intervals, the probability of moving down the distribution across earnings intervals, and the net probability of moving up across earnings intervals. It is found that higher unemployment decreases net earnings mobility significantly for men by reducing the probability of moving up the earnings distribution and increasing the probability of moving down about equally, so that the average net probability of moving up is significantly decreased. For every percentage point increase in the (adult male) unemployment rate, the average net probability of moving up is estimated to

fall by 1.63 percentage points. The unemployment rate effect on the average net probability of moving up for women is only about a third that of men.

Fourth, it is found for men that the cyclical sensitivity of earnings mobility decreases monotonically with age — strongest among entry age workers and weakest for older workers. So the cross-sectional, age-earnings profiles swivel downward and become steeper in recessions and swivel upward and become flatter over economic expansions. For women workers, the net cyclical effects on earnings mobility are far smaller showing no such statistically significant pattern.

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