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A Comparison of Upward and Downward Intergenerational Mobility in Canada, Sweden and the United States

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Abstract

We use new estimators developed by Bhattacharya and Mazumder (2010) to compare rates of upward and downward intergenerational mobility across three countries: Canada, Sweden and the United States. These measures overcome some of the limitations of traditional measures of intergenerational mobility such as the intergenerational elasticity, which are not well suited for analyzing directional movements or for examining differences in mobility across the income distribution. Data for each country include administrative data sources containing sufficiently long time spans of earnings. We find that the simplest measures of directional mobility that simply compare whether sons moved or up or down the distribution relative to their parents do not differ much across the countries. However, we do find that there are clear differences in the *extent* of the movement. We find larger cross-country differences in downward mobility from the top of the distribution than upward mobility from the bottom. Canada has the most downward mobility while the U.S. has the least, with Sweden in the middle. In future drafts we plan to further investigate the possible sources and implications of these differences in downward mobility. We find some differences in upward mobility but these are somewhat smaller in magnitude. This raises the question of the extent to which cross-country differences in intergenerational mobility truly reflect differences in "equality of opportunity". An important caveat is that our analysis may be sensitive to the concept of income we use and broader measures such as family income could lead to different conclusions.

1. Introduction

A question of long standing interest among social scientists is the degree to which an individual's status in society is determined by the position of one's parents in the prior generation. This line of inquiry has been primarily motivated by an interest in understanding the degree of equality of opportunity in a society. The sharp rise in inequality in recent decades in some industrialized countries has brought this issue to the forefront as it is sometimes argued that rising inequality may be tolerable from a societal perspective, if there is ample room for families to move up and down the income distribution across generations.

A vast literature has emerged in recent years that has used various measures of intergenerational mobility to try to quantify the persistence of economic advantage or disadvantage across generations. We contribute to a strand of the literature that has attempted to compare rates of intergenerational mobility across countries. We introduce new measures and utilize large samples from administrative data to study mobility in Canada, Sweden and the United States. In addition to providing new descriptive evidence our analysis can potentially offer some insight into the underlying factors behind the cross-country differences. The analysis of these three countries may be particularly useful because they cover the scale of welfare state policies from low (United States) to moderate (Canada) to large (Sweden).

Economists have focused primarily on the intergenerational elasticity (IGE) in earnings or income between fathers and sons. Previous surveys of the literature (e.g. Solon, 2002; Corak, 2006; Black and Devereux, 2010) report similar results concerning the IGE in Canada, Sweden and the US. Canada and Sweden appear to have the same level of relatively high income mobility, while mobility in the US by this measure is significantly lower.

While the IGE is useful for summarizing intergenerational mobility in a single parameter, it has some drawbacks. First, it does not differentiate between upward mobility and downward mobility. In the US, for example, much of the popular interest in intergenerational mobility has been motivated by concerns about the potential for upward mobility from the bottom. Indeed, the concern about equality of opportunity is really about the opportunity to move up. Second, the IGE is not informative about nonlinearities in mobility. For example, it could be the case that mobility is high in certain parts of the income distribution but not others. Third, the IGE is known to be sensitive to the length of time averages used and the age at which income is measured in each generation. Some have also raised concerns about selection rules concerning instances of non-positive income given the reliance on the log-log specification.[1]

In this paper we use a set of measures that are designed to measure mobility by simply comparing the relative ranks of fathers and sons in the income distribution of each respective generation. We refer to these as measures of "directional rank mobility" (DRM). For example, if the child's percentile in the distribution is higher than the parents' percentile in the prior generation then this could be classified as upward mobility.[2] We believe that these measures correspond much more closely to what a typical person thinks of as upward mobility compared to the IGE. Simple statistics that calculate the percent of individuals who experience upward or downward mobility at various points of the income distribution in each country can easily be calculated. Bhattacharya and Mazumder (2010) introduced these measures and discuss some of their key properties along with applying them to U.S. data from the NLSY.[3] Mazumder (2010) also uses these methods and find that they can be useful in characterizing interracial differences in intergenerational mobility in the U.S.

As far as we are aware, no previous study has utilized the directional rank mobility measures on data outside of the United States. The study closest to ours is by Jantti et al (2006) who in addition to examining differences in the IGE, also examine four specific transition probabilities using data from the United States, the United Kingdom, Denmark, Finland, Norway and Sweden. They find significantly lower rates of both upward mobility from the bottom of the distribution, and downward mobility from the

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[1] The IGE is also poorly suited for studying group differences in intergenerational mobility (e.g. immigrants vs. natives) because it is only informative about rates of persistence *within* groups as opposed to differences relative to the entire distribution. However, this is not relevant for our study since we look only at aggregate rates at the national level.

[2] These measures are similar to transition probabilities that have been used in prior studies of mobility to measure movements across particular quantiles of the distribution, except rather than using arbitrarily chosen quantiles, comparisons are made between the actual ranks of the parent and the child.

[3] Mazumder (2010) has also applied these measures to studying black-white differences in intergenerational mobility.

top of the distribution in the United States compared to the Nordic countries. They generally found the United Kingdom to fall somewhere between the United States and the Nordic countries.

We also utilize administrative data on earnings of fathers and sons for all three countries, including the United States. This provides us with some degree of consistency in both the concept of income we are using and arguably with the reliability of the data. Nevertheless, we fully acknowledge that some differences in the data remain that could present issues.

Our most basic measures of directional mobility that simply compare whether sons moved or up or down relative to their fathers at different points in the distribution, are similar across the countries. There are however, notable differences in the *amount* of movement. We find larger cross-country differences in downward mobility from the top of the distribution than upward mobility from the bottom. Canada has the most downward mobility while the U.S. has the least, with Sweden in the middle. We find some differences in upward mobility but these are somewhat smaller in magnitude. This raises the question of the extent to which cross-country differences in intergenerational mobility truly reflect differences in "equality of opportunity". An important caveat is that our analysis may be sensitive to the concept of income we use and broader measures such as family income could lead to different conclusions.

2. Measures

Transition Probabilities

Before describing the new measures of directional rank mobility, we first define transition probabilities. These serve as a useful base for comparison for the new measures as well as to earlier studies. The upward transition probability (hereafter "UTP") is the probability that the child's income percentile (Y_1) exceeds a given percentile s, in the child's income distribution by an amount τ, conditional on the parent's income percentile (Y_0) being at or below s in the parent's income distribution.[4]

[4] Bhattacharya and Mazumder (2010) use a more general notation that allows for a less restricted set of transition probabilities. For example, transition probabilities can be estimated conditional on parent income lying within any specific percentile interval.

$$(1)\quad UTP_{\tau,s} = \Pr(Y_1 > s + \tau \mid Y_0 \le s)$$

For example, in a simple case where $\tau = 0$ and $s = 0.2$, the upward transition probability ($UTP_{0,s}$) would represent the probability that the child exceeded the bottom quintile in the child's generation, conditional on parent income being in the bottom quintile of the parent generation.[5] The empirical analysis of upward transition probabilities will vary s in increments of 5 percentiles throughout the bottom half of the distribution (i.e. 5, 10,…,50). Using this approach implies that the samples will overlap as progressively more families are added to the sample as s increases. We will also show results that use non overlapping percentile *intervals* of the parent income distribution (e.g. $s <= 5^{th}$ percentile, 5^{th} percentile $> s <= 10^{th}$ percentile,..., 45^{th} percentile $> s <= 50^{th}$ percentile).

It is straightforward to see that this estimator can be modified to measure downward transition probabilities by altering the inequality signs:

$$(2)\quad DTP_{\tau,s} = \Pr(Y_1 <= s + \tau \mid Y_0 > s)$$

In this case we vary s from 50 to 95. We also consider intervals such as the 95^{th} percentile $< s <= 100^{th}$ percentile, 90^{th} percentile $< s <= 95^{th}$ percentile,…, 50^{th} percentile $< s <= 55^{th}$ percentile.

Directional Rank Mobility (DRM)

Following Bhattacharya and Mazumder (2010), we use a new measure of upward directional rank mobility ("UP") which estimates the likelihood that an individual will surpass their parent's place in the distribution by a given amount, conditional on their parents being at or below a given percentile.

$$(3)\quad UP_{\tau,s} = \Pr(Y_1 - Y_0 > \tau \mid Y_0 \le s)$$

In the simple case where $\tau = 0$, this is simply the probability that the child exceeds the parents place in the distribution. As with the TP measure, positive values of τ enable one to measure the *amount* of the gain in percentiles across generations. Results will be shown for a range of values for τ and also as

[5] If one were to set up a traditional transition matrix using quintiles of the income distribution this example would measure 1 minus the probability of remaining in the bottom quintile. The introduction of τ is useful to parallel variations on the UP estimator that are introduced later.

s is progressively increased.[6] Similarly one can construct a measure of downward mobility ("DOWN") using an analogous approach:

$$(4)\quad DOWN_{\tau,s} = \Pr(Y_0 - Y_1 > \tau \mid Y_0 \geq s)$$

Bhattacharya and Mazumder (2010) develop the distribution theory for both transition probabilities and the directional rank mobility estimators and justify why the bootstrap can be used to calculate standard errors.

Finally, we also consider a set of more continuous measures that avoids having to specify a specific value for τ. We will also show values of the mean percentile gain for each of our samples conditional on the son's percentile being higher than the fathers' and an analogously defined measure of the mean loss conditional on sons' being below their fathers.[7]

$$(5)\quad MN\_GAIN_s = \frac{1}{N}\sum (Y_1 - Y_0) \mid Y_1 - Y_0 > 0, Y_0 \geq s)$$

$$(6)\quad MN\_LOSS_s = \frac{1}{N}\sum (Y_0 - Y_1) \mid Y_0 - Y_1 > 0, Y_0 \geq s)$$

Comparison of transition probabilities and directional rank mobility

Since there are an infinite number of possible transition probabilities, depending on the specific quantiles that are chosen, a criticism of transition probabilities is that they require using arbitrarily chosen yardsticks. In contrast, the DRM measures simply compare the child's rank to the parent's rank rather than to an arbitrarily chosen quantile. When making comparisons between population subgroups this is an unambiguous advantage to using the DRM. However, when using the full sample (i.e. pooling all subgroups), the DRM measures are only meaningful if there is some cutoff, s used to condition the sample. The choice of s of course, is likely to be arbitrary. Even in this case, however, children's ranks are still directly compared to their parents' rank as opposed to an arbitrary yardstick.

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[6] Bhattacharya and Mazumder show that the UP measure can also be calculated conditional on continuous covariates and nonparametric regressions can be used to estimate the effects of changing a covariate on upward mobility.

[7] We have also calculated these measures "unconditional" and these are available from the authors. The general cross-country patterns in the data are not altered by whether we look at these unconditionally or not.

Measurement issues

A focal point of research on intergenerational mobility has concerned measurement. In particular, studies have emphasized the importance of having many years of data to better capture "permanent income" (Solon 1992, Zimmerman 1992, Mazumder 2005) and to measure income at an age at which bias due to heterogeneous lifecycle profiles is minimized (Jenkins 1987, Reville 1995, Grawe 2006, Haider & Solon 2006). Some studies have also addressed the issue of how to handle years of zero earnings given the log-log specification (Couch and Lillard 1998, Mazumder 2005). Unlike the regression context, where familiar analytical formulas can be derived to demonstrate how transitory fluctuations or measurement error can affect estimates, it is unclear how the DRM estimates are affected.[8] In practice, we generally find that these issues do not appear to have much of an effect on our findings. This may be due to the fact that we are using sufficiently long time averages and appropriate ages so as to minimize the scope for such bias. However, we leave it to future research to address this issue more thoroughly.

3. Data

Canada

The Canadian data are based upon administrative information on individual income tax returns that have been grouped into families. Canadians file their income tax returns (officially referred to as T1 Forms) on an individual basis, and Statistics Canada has grouped these into families using a variety of matching strategies that are described in Harris and Lucaciu (1994). The resulting file is the basic building block for the creation of an inter-generationally linked set of T1 Forms for a series of cohorts of young men and women, and their mothers and fathers. This represents not quite four million individuals and their parents, and in particular 1.9 million men who are the starting point for our research. These individuals are linked to their fathers—not necessarily their biological fathers—if they filed an income tax return between 1982 and 1986 while still living at home. This is required to ensure that a parent-child match is made, and

[8] O'Neill et al (2007) consider the effect of classical measurement error on transition probabilities and show through simulations that classical measurement error can lead transition probabilities to overstate mobility as in the regression context.

also that the child has an observed Social Insurance Number (SIN), a unique individual identifier that can then be used to link all subsequent T1 Forms which contain information on earnings. These T1 Forms are available for all years between 1978 and 1996.[9]

Sweden

The Swedish data are based on a 25 percent random sample of sons born between 1960 and 1967. This sample was drawn from Statistic Sweden's multigenerational register. The identification rate of fathers for these cohorts of sons is approximately 98 percent. The multigenerational register also includes information on the year of birth and death (when applicable) of each individual as well as information concerning immigration and emigration. The sample of sons was then matched with data from the official Swedish tax register. We use data on pre-tax, labor market income, which is available from 1974 to 2007 to construct our earnings measure for fathers and sons.[10]

For our fathers, Böhlmark and Lindquist (2006) suggest that income measured after age 33 may act as a good proxy of permanent income. For sons born in 1950, they tell us to look at a specific age, namely age 34. But since our sons are born between 1960 and 1967 and have (on average) more education than those studied by Böhlmark and Lindquist (2006), we choose to shift this age upwards by one year to age 35.

Our proxy for permanent earnings of sons is calculated as follows. We use 11 years of earnings data for each son centered on age 35, i.e., from age 30 to age 40. Nominal earnings are deflated using the Swedish consumer price index. We use the natural logarithm of an average of real earnings taken across these periods. A similar procedure is used to calculate the permanent income of fathers. The only difference is that fathers earnings are measured between age 30 and 60. We argue that this proxy of

[9] The algorithm used to create the data leads to an under-representation of children from lower income backgrounds, and from the major metropolitan areas: Montreal, Toronto, and Vancouver. Corak and Heisz (1999), Oreopoulos (2003), and Oreopoulos, Page and Stevens (2008) all explore the nature of this under-reporting and find that it does not play a role in biasing their analytical results. We note that weights based upon Census data have been created to account for the under-reporting, and our analysis uses them throughout even though they make no difference to the results.

[10] This measure of earnings includes all taxable labor market insurance benefits such as sickness insurance, parental leave benefits and unemployment insurance.

fathers' permanent earnings is a high quality measure of permanent earnings that is largely free from both life-cycle bias and attenuation bias. Before estimating our mobility measures, both fathers' and sons' earnings are regressed on birth year dummies.

Sons that have died or emigrated from Sweden before 2007 are dropped from the sample. Sons that immigrated to Sweden after age 30 have been dropped from the sample.[11] The Swedish fathers in our sample are born between 1938 and 1947. This restriction is necessary in order to have earnings for 31 years, from ages 30-60. This is the key sample restriction. When imposed, we lose X% of our father-son pairs. It also means that our fathers tend to be matched (primarily) to their first born sons and that the average father-son age difference is smaller (by X years) than what we find in a random sample. Fathers are dropped from the sample if they die or emigrate before age 60.

United States

The sample for the United States is based on pooling the 1984, 1990, 1991, 1992 and 1993 panels of the Survey of Income and Program Participation ("SIPP") matched to administrative earnings records maintained by the Social Security Administration (SSA).[12] The Census Bureau attempted to collect the social security numbers (SSN) of all individuals in the surveys and they were subsequently matched to SSA administrative data bases of Summary Earnings Records (SER) and Detailed Earnings Records (DER). Mazumder (2005) shows that the match rate between the 1984 SIPP and the SER data is extremely high and that selection does not appear to be a serious concern.[13] The SER data covers annual earnings over the period from 1951 to 2007, while the DER data is only available since 1978.

There are two aspects to using SER records that raise potential issues. The first is that some individuals who are working are not covered by the social security system and their earnings will be

[11] Note, however, that most of these sons have already been dropped, since they cannot be matched to their fathers who are (typically) living outside of Sweden. Also, our requirement of 10 years of earnings data between the ages of 30 and 40 also limit the number of dropped observations due to late immigration to Sweden.

[12] This data source is not publicly available. Researchers must apply to obtain the data through the Center for Economic Studies at the US Census Bureau (http://www.ces.census.gov/)

[13] Mazumder (2005) only had access to the SER data and focused on children in the 1984 SIPP who were between the ages of 15 and 20, the vast majority of whom had social security numbers. We find similar match rates to Mazumder (2005) between the SIPP and the DER.

recorded as zero. Second, earnings in the SER data are censored at the maximum level of earnings subject to the social security tax. While in principle the DER data is not subject to either of these problems an examination of the data shows that the DER data actually shows higher rates of non-coverage than the SER data. Since the non-coverage patterns are different in the two datasets we take the maximum of earnings in a year between the SER and DER to minimize the bias due to non-coverage. The SER data is first imputed based on CPS data from each year starting in 1978.[14]

We start with a sample of males who were living with their parents at the time of the SIPP and who were no older than 20 years old. We require that the adult earnings of these men are observed when they are at least 28 years old. Sons' average earnings are taken over the five years spanning 2003 through 2007. Years of zero earnings are included in the average, however, sons must have positive income in at least two years to be included. Fathers' must have positive earnings in all 9 years between 1978 and 1986 and the average earnings over this span are used to construct a measure of permanent income. Fathers also must have been between the ages of 30 and 60 to be included. This produces a sample of 3251 men who could have been born anytime between 1964 and 1975 and who are observed as adults between the ages of 28 and 43.

Comparison of Samples

Summary statistics for each sample are shown in Table 1. Our samples are reasonably comparable along several dimensions. For example, the mean age of sons in the data ranges from 32 in Canada to 34 in the US to 35 in Sweden. Similarly fathers' mean age is in a relatively small range of between 40 and 45. One notable difference is that we use just a five year average of fathers' earnings in Canada, a nine year average in the US and a 30 year average in Sweden. Another large difference is that we have virtually the universe of observations for Canada, a very large intergenerational sample for Sweden and a small sample for the U.S.

[14] This is done in the following manner. First the March CPS data is itself adjusted for topcoding based on the cell means by race and sex reported in Tables 3 and 7 of Larrimore et al (2008) who used the internal version of the CPS files. After making this adjustment, then mean values of CPS earnings of those above the SER topcode are calculated and are used to impute the SER data by cells based on race and education level (less than 16 years, 16 years, greater than 16 years) for individuals between the ages of 30 and 55.

4. Results

Estimates of the Intergenerational Earnings Elasticity (IGE)

We begin this section by presenting estimates of the commonly used IGE that are produced using our samples. For Canada, our estimate is 0.22.[15] This is extremely close to the estimate of Corak and Heisz (1999) when using a similar concept and similar selection rules. The estimate for Sweden is 0.26 which is identical to the estimate produced by Jantti et al (2006) and in between the estimates of 0.22 and 0.28 reported in Bjorklund and Jantti (1997).[16] For the U.S., the estimate is 0.40.[17] Although this is similar to the estimates in landmark studies by Solon (1992) and Zimmerman (1992) it is probably a bit lower than what might be expected given the 9 year time average and the use of the SIPP-SSA data. For example, Mazumder (2005) reports estimates of 0.50 to 0.55 when using 9 year average of fathers' earnings.[18]

Upward Mobility Using Transition Probabilities and Rank Directional Mobility

We present our main estimates of upward mobility using cumulative samples in Table 2. Several measures are presented for each country. The first column shows the transition probability out of the fathers' percentile range. So for example, we find that the transition probability out of the bottom quintile is 71 percent in Canada and roughly 68 percent in both Sweden and the U.S. It is worth noting that this particular statistic is equal to 1 minus the probability of staying in the bottom quintile, which is commonly presented as an entry in a transition matrix (defined by quintiles). In Figure 1 we show how the upward transition probabilities differ across the countries along with 95 percent confidence bands.[19] It appears

[15] Corak (2006) reports 7 estimates which range from 0.13 to 0.26. The preferred estimate is 0.19.
[16] Corak (2006) reports 4 estimates which range from 0.13 to 0.30 with a preferred estimate of 0.27.
[17] Corak (2006) reports 41 estimates which range from 0.09 to 0.61 with a preferred estimate of 0.47.
[18] One important difference between the data used here and that used by Mazumder (2005) is the availability of the non-topcoded DER data based on W-2 records. Mazumder (2005) relied on only the topcoded SER data and imputed topcoded earnings based on observable characteristics. When Mazumder (2001) drops fathers with *any* years of topcoded data and uses a 9 year average the estimate is 0.45. A second important difference is that Mazumder (2005) only used the 1984 SIPP whereas we have added samples with fewer of the older cohorts who have reached the age of 40 by 2007. In any case, if we use our sample and estimate the IGE using longer time averages such as 16 years, we find estimates similar to those reported in Mazumder (2005)
[19] We don't present confidence bands for Canada since we have virtually the population.

that throughout the bottom half of the distribution that Canada has slightly higher rates of upward mobility. We actually find very little difference in upward mobility between Sweden and the U.S.

This pattern of results is somewhat surprising given the previous literature and the fact that we find large differences in the IGE. Our reading of the literature suggests that this is mainly driven by the fact that we find higher rates of upward transition probabilities for the U.S. than previous studies. Specifically, a few previous studies using survey data like the PSID and NLSY (e.g. Isaacs et al, 2008; Jantti et al 2006) have found greater stickiness in the bottom quintile in the US with around 60 percent of individuals transitioning out of the bottom. We have done some extensive experimentation with our U.S. data and believe that much of the greater observed mobility out of the bottom quintile in the US is due to a difference in the concept of income being used.[20] On the one hand, this suggests that the larger differences in cross-country upward mobility observed in prior studies may be somewhat sensitive to the concept of income being used. Put differently, it may be that we are underestimating the cross-country differences that would be observed if one were to use family income. In any event, this suggests that some caution must be exercised in drawing conclusions from any one dataset or set of measures.

In the next set of columns we present our DRM measures for values of tau equal to 0, 10 and 20. Not surprisingly, we find that very large fractions of sons who start at the very bottom of the distribution surpass their fathers even if they do not surpass their parents' percentile range.[21] Our estimates range from 92 to 94 percent for those who start in percentiles 1 through 5. As we successively cumulate the sample by adding more 5 percentile groups, this fraction gradually falls as fewer sons surpass their fathers. In Figure 2, we plot the UP-0 series for each of the three countries along with 95 percent confidence bands for Sweden and the U.S. using the same scaling as in Figure 1. What is surprising is how similar the rates of upward mobility are across the three countries by using this measure. For all three countries, roughly

[20] Most previous studies have used family income as the outcome in either one or both generations. Although we cannot measure the family income of the sons with the SSA data, we can try to better capture family income in the parent generation by including mothers' earnings when available. This also alters the selection of our sample to include many children from single mother families. Making these changes significantly lowers our estimated transition probability. Unfortunately we cannot consistently use family income across the three countries

[21] For example, a case where the father is at the 2nd percentile and the son is at the 4th percentile will have a value of UP-0=1 even though the son did not surpass the 5the percentile. In this case the transition probability indicator will be 0.

40 percent of those who start in the bottom half of the income distribution will move to the top half of the distribution.

Figure 3 plots the patterns of the UP-20 measure that shows the probability that a son will exceed his father by at least 20 percentiles. By this measure we now see a noticeably lower rate of upward mobility for the US. For example, 54 percent of sons in the US who start in percentiles 1 to 15 surpass their parents by 20 or more percentiles compared to 59 percent in Canada. This suggests that while the likelihood of surpassing one's parents is similar across the countries the extent of mobility may differ. This is perhaps a bit clearer in Figure 4, where we plot differences in the average percentile gains across the three countries. The chart illustrates that conditional on surpassing their fathers, sons in the US rise by 2 to 4 percentiles less than those in Canada. The gains of Swedish sons are only slightly lower than those in Canada.

We find broadly similar patterns if we use interval samples. The raw results are shown in Table 2. however, since the samples for the U.S. are relatively small, the estimates bounce around quite a bit, so we chose to plot the results using the cumulative samples.

Downward Mobility Using Transition Probabilities and Rank Directional Mobility

In this section we turn to comparisons of downward mobility across the three countries. Tables 3 and 4 present the full set of results using cumulative and intervalled samples. In Figure 5, we plot the differences in the downward transition probabilities. Unlike what we saw in Figure 1, there is a more striking cross-country pattern that is evident with Canada exhibiting the highest rates of downward mobility from the top. The US and Sweden in contrast, have virtually identical rates of downward mobility. For example, among Canadian men who start in the top quintile, 69 percent will fall below the top quintile. This compares to about 62 percent in the US and 61 percent in Sweden.

Using the simplest DRM measure of downward mobility, DN-0, we again see little difference across the countries. This is shown in Figure 6. However, we again find more striking differences when we shift to the DN-20 measure that looks at the rate at which sons fall 20 percentiles or more below their fathers. Figure 7 illustrates that downward mobility in earnings is particularly large in Canada at the very top of the distribution (96th percentile and higher) where 59 percent fall 20 percentiles below their fathers. The comparable estimate is 46 percent for Sweden and 44 percent for the US. This metric also appears to show the most consistent ordering across the three countries with Canada having the highest degree of downward mobility followed by Sweden and then the US. We find that this point generalizes beyond just setting tau equal to 0.2. In Figure 8, we look at the mean percentile loss among those whose rank falls below their fathers and find a similar pattern. Indeed comparing Figure 8 to Figure 4, it appears that thecross-country differences are larger with respect to downward mobility than with upward mobility.

5. Discussion and Conclusion

The current literature on cross-country differences in intergenerational mobility has noted the large difference in the intergenerational elasticity between the US on the one hand and most other industrialized countries. Our approach potentially can add more richness to comparisons of this one summary statistic. By using recently developed measures of directional rank mobility we are able to examine differences in upward vs. downward mobility and look for differences at different points of the distribution. Rather than describing the rate at which earnings regress to the mean over generations we are able to describe the likelihood of a son surpassing his father's rank in the earnings distribution. In that way, our measures are arguably more easily understood by the general public.

Our findings thus far, show some moderately sized differences in rates of mobility across the distribution between Canada, Sweden and the United States. There appears to be a clear ordering in the amount of downward earnings mobility from the top of the income distribution, with Canada having the greatest declines in percentiles across generations followed by Sweden and then the US. Interestingly, we find smaller differences when we look at upward mobility from the bottom despite the well known concern that that perhaps there are poorer prospects for upward mobility in the US. An important caveat to our analysis is that by using only fathers earnings and by relying exclusively on administrative earnings data that we may be overstating upward mobility in the US relative to what would be found using sons from single parent families and combining all sources of family income.

A more fundamental question is whether these measures of rank movement and the amount of rank movement mean the same thing in all three countries. It may be the case that moving 10 percentiles from the bottom of the US distribution is significantly more meaningful in the US in terms standard of living then a comparable move in say Sweden.

In future drafts we plan to address some of these lingering questions. In particular, we hope to offer some possible hypotheses for why downward mobility appears to be greater in Canada. We also plan to consider more carefully how differences in our choice of income concept may influence our findings. We may experiment with other datasets particularly for the US where survey-based intergenerational data is more readily available. We also wish to consider how placing individuals on a common distribution may affect our findings. Nevertheless, we think our analysis is at least a useful first step in adding a little more nuance and richness to cross-country comparisons.

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Table 1: Summary statistics for intergenerational samples

Country	Variable	Mean	S.D.	Minimum	Maximum
Canada					
	Sons' Age (1995)	31.7	1.1	30	33
	Fathers' Age (1980)	45.7	6.3	28	72
	Sons' earnings	10.3	0.6	8.2	14.8
	Fathers' Earnings	10.6	0.5	8.4	15
	N	236210			
Sweden					
	Sons' Age	35.0	--	30	40
	Fathers' Age	45.0	--	30	60
	Sons' earnings	--	--	--	--
	Fathers' Earnings	--	--	--	--
	N	31007			
United States					
	Sons' Age (2005)	34.1	3.4	28	43
	Fathers' Age (1982)	39.9	6.3	30	60
	Sons' earnings	10.6	0.8	--	--
	Fathers' Earnings	10.9	0.6	--	--
	N	3251			

Table 2: Upward Mobility Using Cumulative Samples

	Canada					*Sweden*					*United States*				
Father's Pctile Range	Trans. Prob.	Directional Rank Mobility			Mean gain if UP	Trans. Prob.	Directional Rank Mobility			Mean gain if UP	Trans. Prob.	Directional Rank Mobility			Mean gain if UP
		UP-0	*UP-10*	*UP-20*			*UP-0*	*UP-10*	*UP-20*			*UP-0*	*UP-10*	*UP-20*	
1 to 5	89.5	94	75.9	61.5	37.9	86	92	73	57	36	91.4	93.8	75.9	58.6	34.4
						(0.90)	(0.70)	(1.10)	(1.20)	(0.70)	(2.2)	(1.6)	(3.4)	(3.8)	(2.1)
1 to 10	82.4	90.8	74.6	60.6	38	78	88	71	57	36	79.7	90.2	72.3	57.5	35.9
						(0.70)	(0.50)	(0.80)	(0.90)	(0.50)	(3.8)	(1.7)	(2.3)	(2.7)	(1.5)
1 to 15	76.7	88	72.9	59.1	37.9	73	86	70	57	36	74.5	87.7	69.8	54.2	34.4
						(0.60)	(0.50)	(0.70)	(0.80)	(0.40)	(3.7)	(1.6)	(2.0)	(2.3)	(1.1)
1 to 20	71.1	85.5	71.1	57.9	37.5	68	83	69	56	36	67.8	85.2	69.1	54.5	34.3
						(0.60)	(0.50)	(0.60)	(0.60)	(0.40)	(3.7)	(1.5)	(1.6)	(1.8)	(1.0)
1 to 25	65.9	83	69	56.2	36.9	63	81	67	55	36	64.4	83.6	68.3	53.2	34.1
						(0.50)	(0.40)	(0.60)	(0.60)	(0.30)	(3.6)	(1.1)	(1.4)	(1.6)	(0.9)
1 to 30	60.8	80.6	67.1	54.5	36.4	58	79	66	53	35	59.0	81.0	66.7	52.1	33.8
						(0.50)	(0.40)	(0.50)	(0.50)	(0.30)	(3.3)	(1.2)	(1.2)	(1.3)	(0.7)
1 to 35	55.8	78.1	64.9	52.6	35.7	54	77	64	52	35	54.4	78.4	64.6	50.6	33.4
						(0.50)	(0.40)	(0.50)	(0.50)	(0.30)	(2.0)	(1.0)	(1.3)	(1.2)	(0.7)
1 to 40	51	76	63	50.8	35.1	50	75	62	50	34	48.9	75.4	62.3	48.8	33.3
						(0.50)	(0.40)	(0.50)	(0.40)	(0.30)	(2.5)	(1.0)	(1.2)	(1.2)	(0.6)
1 to 45	46.6	73.8	61.1	49.1	34.4	45	72	60	48	33	43.4	72.3	59.2	46.4	32.6
						(0.40)	(0.40)	(0.40)	(0.50)	(0.20)	(2.8)	(0.9)	(1.1)	(1.1)	(0.6)
1 to 50	42.1	71.5	59	47.1	33.8	41	70	58	46	33	39.4	70.5	57.6	45.0	32.0
						(0.40)	(0.30)	(0.40)	(0.40)	(0.20)	(2.9)	(0.8)	(0.9)	(1.1)	(0.6)

Table 3: Upward Mobility Using Intervalled Samples

	Canada					*Sweden*					*United States*				
Father's Pctile Range	Trans. Prob.	Directional Rank Mobility *UP-0*	*UP-10*	*UP-20*	Mean gain if UP	Trans. Prob.	Directional Rank Mobility *UP-0*	*UP-10*	*UP-20*	Mean gain if UP	Trans. Prob.	Directional Rank Mobility *UP-0*	*UP-10*	*UP-20*	Mean gain if UP
1 to 5	89.5	94	75.9	61.5		86	92	73	57	36	91.4	93.8	75.9	58.6	34.4
						(0.90)	(0.60)	(1.10)	(1.10)	(0.70)	(2.2)	(1.6)	(3.4)	(3.8)	(2.1)
6 to 10	84.5	87.6	73.3	59.7		80	85	70	57	37	78.5	86.5	68.7	56.4	37.6
						(1.10)	(0.90)	(1.10)	(1.30)	(0.70)	(3.8)	(2.9)	(3.6)	(4.3)	(2.5)
11 to 15	79.7	82.5	70	57.3		78	81	67	56	36	79.0	82.7	64.8	47.5	31.1
						(1.00)	(1.00)	(1.10)	(1.30)	(0.70)	(3.7)	(3.5)	(3.7)	(4.7)	(2.3)
16 to 20	75.4	77.9	65.8	53.3		74	76	65	53	36	74.8	77.9	66.9	55.2	34.0
						(1.10)	(1.10)	(1.20)	(1.30)	(0.70)	(3.7)	(3.7)	(3.6)	(4.0)	(2.1)
21 to 25	70.4	72.9	60.7	49.4		69	71	62	50	35	74.7	77.2	65.4	48.1	33.0
						(1.20)	(1.10)	(1.10)	(1.20)	(0.60)	(3.6)	(3.6)	(3.9)	(3.9)	(1.9)
26 to 30	66.5	68.8	57.3	46		66	68	57	46	32	64.4	68.1	58.3	46.6	32.2
						(1.10)	(1.20)	(1.30)	(1.20)	(0.60)	(3.3)	(3.6)	(3.8)	(3.7)	(2.0)
31 to 35	61.1	63.5	52.1	41.1		61	63	53	42	30	60.5	62.3	51.9	41.4	30.3
						(1.20)	(1.20)	(1.40)	(1.20)	(0.60)	(3.2)	(4.1)	(4.5)	(4.1)	(1.7)
36 to 40	58.3	60.6	49.7	38.5		58	60	51	40	29	52.8	54.6	46.6	36.8	32.3
						(1.20)	(1.30)	(1.10)	(1.30)	(0.60)	(3.9)	(4.4)	(4.5)	(4.1)	(2.2)
41 to 45	53.9	56.2	45.5	34.8		53	55	44	32	25	45.7	47.5	34.6	26.5	23.8
						(1.30)	(1.10)	(1.20)	(1.20)	(0.50)	(3.7)	(3.9)	(4.0)	(3.5)	(1.9)
46 to 50	48.9	51.1	40.4	30		49	51	41	29	24	52.8	54.0	42.9	32.5	25.3
						(1.30)	(1.20)	(1.20)	(1.30)	(0.50)	(3.9)	(4.2)	(4.5)	(3.9)	(1.7)

Table 4: Downward Mobility Using Cumulative Samples

	Canada					*Sweden*					*United States*				
Father's Pctile Range	Trans. Prob.	Directional Rank Mobility			Mean loss if DN	Trans. Prob.	Directional Rank Mobility			Mean loss if DN	Trans. Prob.	Directional Rank Mobility			Mean loss if DN
		DN-0	*DN-10*	*DN-20*			*DN-0*	*DN-10*	*DN-20*			*DN-0*	*DN-10*	*DN-20*	
96 to 100	84.8	90	71.9	59.3	39.2	79	88	62	46	34	81.0	86.5	59.5	44.2	33.7
						(1.00)	(0.80)	(1.30)	(1.30)	(0.80)	(3.1)	(2.6)	(3.8)	(4.1)	(2.4)
91 to 100	79.4	87.6	71.5	59.1	39.6	72	85	63	49	35	71.5	85.3	60.7	44.2	33.3
						(0.80)	(0.60)	(0.90)	(0.90)	(0.50)	(3.4)	(2.0)	(2.5)	(2.4)	(1.7)
86 to 100	73.8	85.1	69.8	57.7	39.3	66	82	63	50	35	65.8	83.4	63.1	45.7	34.3
						(0.70)	(0.60)	(0.70)	(0.70)	(0.50)	(4.1)	(1.6)	(1.9)	(2.2)	(1.3)
81 to 100	68.5	82.7	68.2	56.3	38.9	61	80	62	50	35	62.2	81.4	63.0	47.5	35.1
						(0.60)	(0.50)	(0.60)	(0.60)	(0.40)	(4.0)	(1.4)	(1.7)	(1.8)	(1.1)
76 to 100	63.8	80.4	66.5	54.8	38.3	57	78	62	49	35	57.3	79.8	62.1	47.5	34.5
						(0.50)	(0.50)	(0.60)	(0.60)	(0.30)	(3.7)	(1.2)	(1.4)	(1.5)	(0.9)
71 to 100	59.1	78.1	64.8	53.3	37.7	55	77	61	49	35	52.8	77.6	60.8	46.3	33.7
						(0.50)	(0.50)	(0.50)	(0.50)	(0.30)	(3.3)	(1.1)	(1.3)	(1.4)	(0.8)
66 to 100	54.7	75.9	62.9	51.6	37.1	51	75	60	48	35	50.5	76.6	60.5	46.5	33.2
						(0.50)	(0.40)	(0.50)	(0.50)	(0.30)	(2.4)	(1.1)	(1.3)	(1.3)	(0.7)
61 to 100	50.4	73.8	61.1	49.9	36.4	48	73	60	47	34	47.3	75.2	58.8	45.3	32.4
						(0.40)	(0.40)	(0.50)	(0.50)	(0.20)	(2.5)	(1.1)	(1.3)	(1.2)	(0.7)
56 to 100	46.2	71.7	59.2	48.1	35.6	45	72	58	46	33	43.7	73.5	57.6	44.3	32.0
						(0.40)	(0.40)	(0.50)	(0.40)	(0.30)	(2.5)	(1.0)	(1.1)	(1.2)	(0.7)
51 to 100	42.1	69.6	57.3	46.44	34.9	41	70	57	45	33	39.4	70.5	55.7	42.7	31.7
						(0.40)	(0.40)	(0.40)	(0.40)	(0.20)	(2.6)	(0.9)	(1.0)	(1.0)	(0.5)

Table 5: Downward Mobility Using Intervalled Samples

	Canada					*Sweden*					*United States*				
Father's Pctile Range	Trans. Prob.	Directional Rank Mobility			Mean loss if DN	Trans. Prob.	Directional Rank Mobility			Mean loss if DN	Trans. Prob.	Directional Rank Mobility			Mean loss if DN
		DN-0	*DN-10*	*DN-20*			*DN-0*	*DN-10*	*DN-20*			*DN-0*	*DN-10*	*DN-20*	
96 to 100	84.8	90	71.9	59.3		79	88	62	46	34	81.0	86.5	59.5	44.2	33.7
						(1.00)	(0.80)	(1.10)	(1.30)	(0.80)	(3.1)	(2.7)	(3.8)	(4.2)	(2.4)
91 to 95	82.2	85.2	71	59		78	82	65	51	36	76.7	84.0	62.0	44.2	32.9
						(1.10)	(1.00)	(1.20)	(1.20)	(0.70)	(3.4)	(3.3)	(4.3)	(3.8)	(2.3)
86 to 90	77.1	80	66.6	54.8		74	77	64	51	37	75.9	79.6	67.9	48.8	36.5
						(1.20)	(1.10)	(1.20)	(1.30)	(0.80)	(4.1)	(4.0)	(3.9)	(4.1)	(2.4)
81 to 85	72.8	75.4	63.2	52.1		70	73	60	49	36	71.8	75.5	62.6	52.8	37.8
						(1.20)	(1.10)	(1.10)	(1.20)	(0.70)	(4.0)	(3.4)	(3.9)	(3.9)	(2.3)
76 to 80	68.8	71.3	59.7	48.7		68	70	60	49	35	67.3	73.5	58.6	47.5	31.7
						(1.00)	(1.10)	(1.10)	(1.30)	(0.70)	(3.7)	(3.7)	(4.2)	(4.0)	(2.3)
71 to 75	64.3	66.7	56.2	45.7		67	69	58	48	33	60.7	66.3	54.0	40.5	28.6
						(1.20)	(1.10)	(1.20)	(1.30)	(0.60)	(3.3)	(3.7)	(4.4)	(4.1)	(2.0)
66 to 70	60.5	62.6	51.4	41.4		61	63	55	43	32	69.1	71.0	58.6	47.5	30.5
						(1.20)	(1.20)	(1.20)	(1.20)	(0.60)	(3.8)	(3.8)	(4.0)	(4.3)	(1.8)
61 to 65	56.7	58.9	48.5	37.9		62	64	54	42	29	59.5	65.6	47.2	37.4	25.9
						(1.20)	(1.20)	(1.20)	(1.30)	(0.50)	(3.7)	(4.7)	(4.4)	(4.1)	(2.0)
56 to 60	52.6	54.8	44.2	34.2		55	58	47	36	27	56.2	59.3	48.1	35.8	27.5
						(1.10)	(1.20)	(1.30)	(1.20)	(0.50)	(3.6)	(4.8)	(4.4)	(4.1)	(1.8)
51 to 100	48.5	50.7	40.2	30.7		51	54	43	30	24	42.3	43.6	38.7	28.8	26.9
						(1.40)	(1.30)	(1.20)	(1.20)	(0.50)	(3.8)	(3.9)	(4.2)	(3.5)	(1.6)

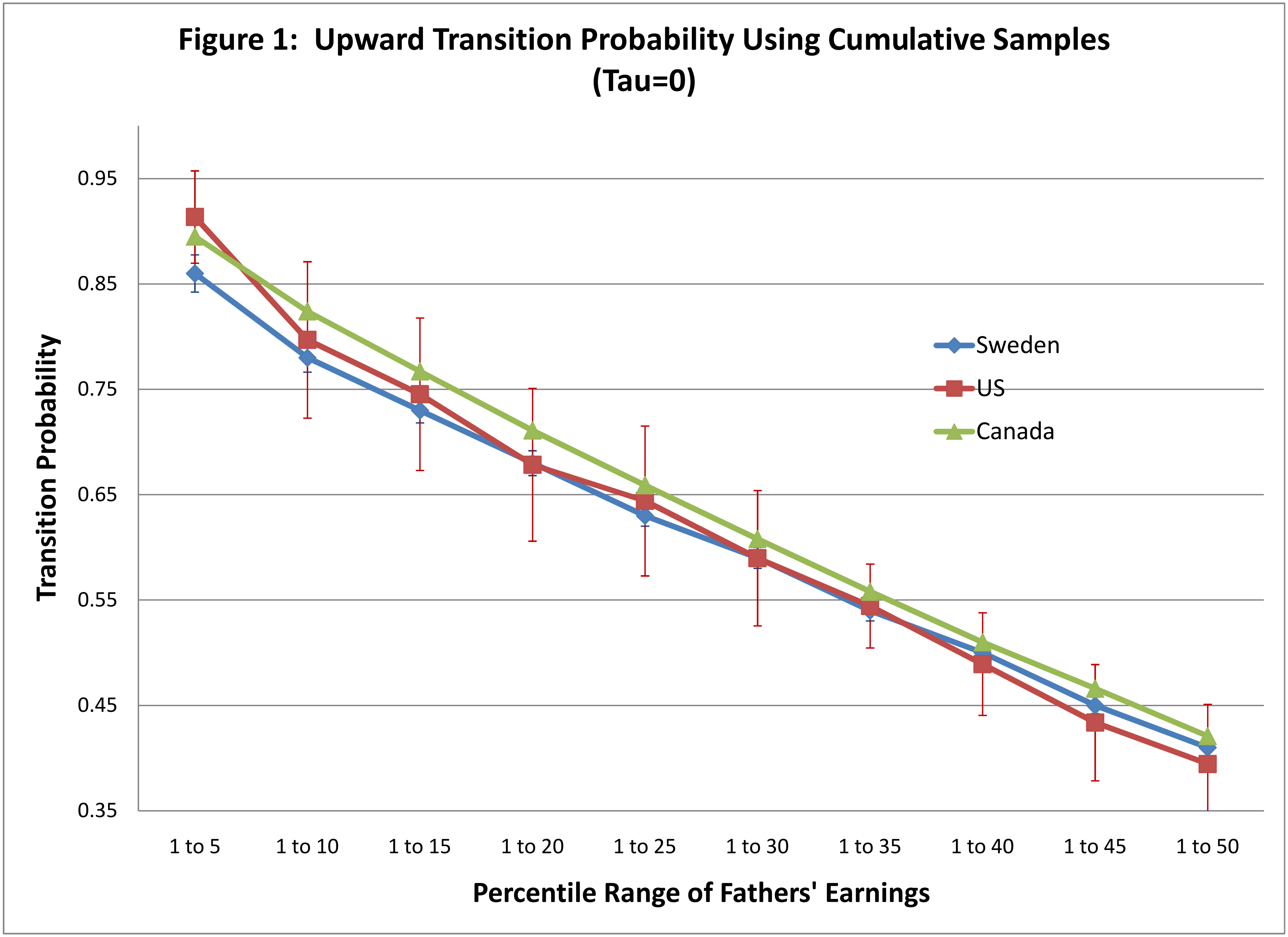


Figure 1: Upward Transition Probability Using Cumulative Samples
(Tau=0)
Transition Probability
0.95
0.85
0.75
0.65
0.55
0.45
0.35
Sweden
US
Canada
1 to 5
1 to 10
1 to 15
1 to 20
1 to 25
1 to 30
1 to 35
1 to 40
1 to 45
1 to 50
Percentile Range of Fathers' Earnings

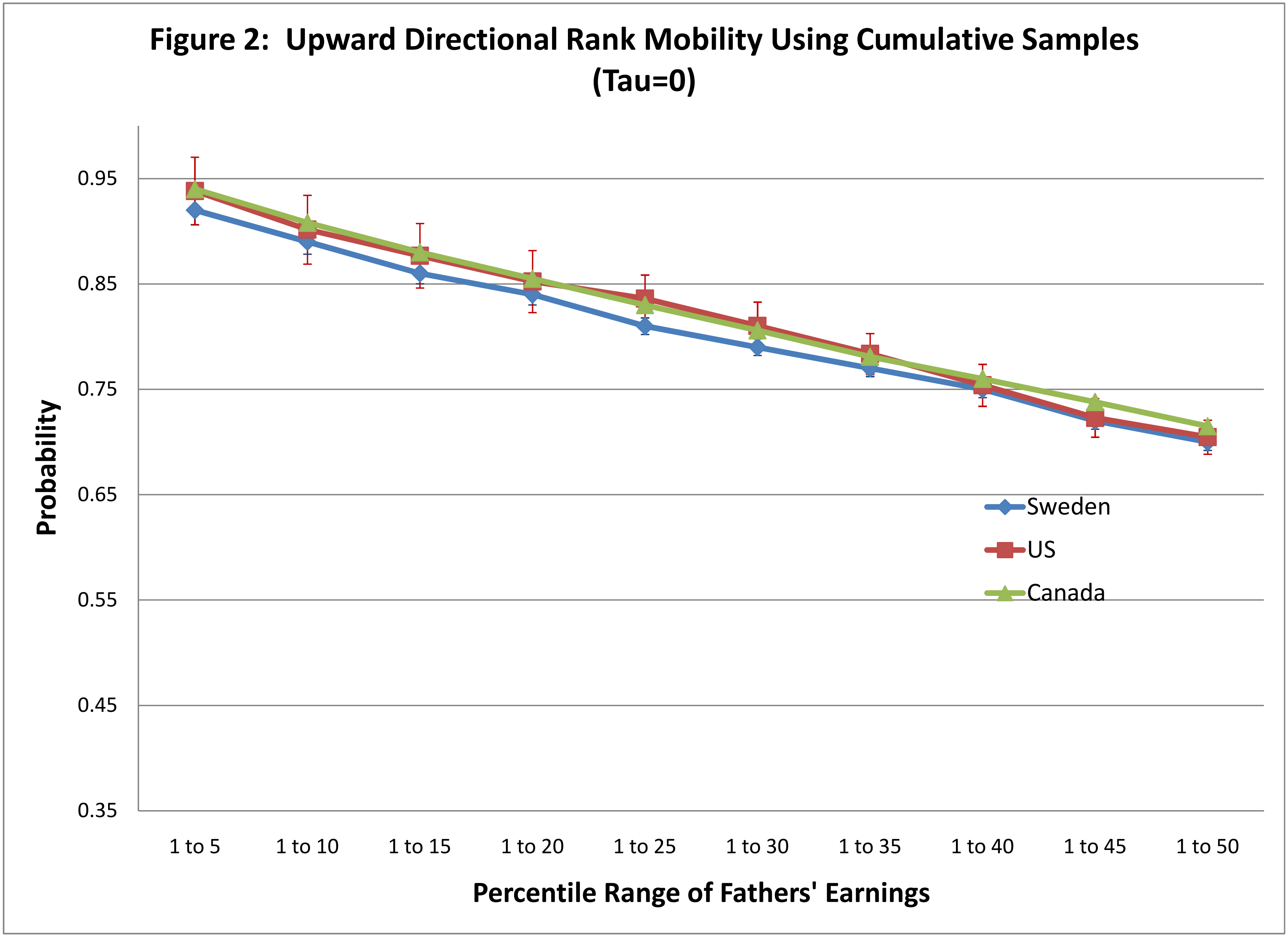


Figure 2: Upward Directional Rank Mobility Using Cumulative Samples
(Tau=0)
Probability
0.95
0.85
0.75
0.65
0.55
0.45
0.35
1 to 5
1 to 10
1 to 15
1 to 20
1 to 25
1 to 30
1 to 35
1 to 40
1 to 45
1 to 50
Percentile Range of Fathers' Earnings
Sweden
US
Canada

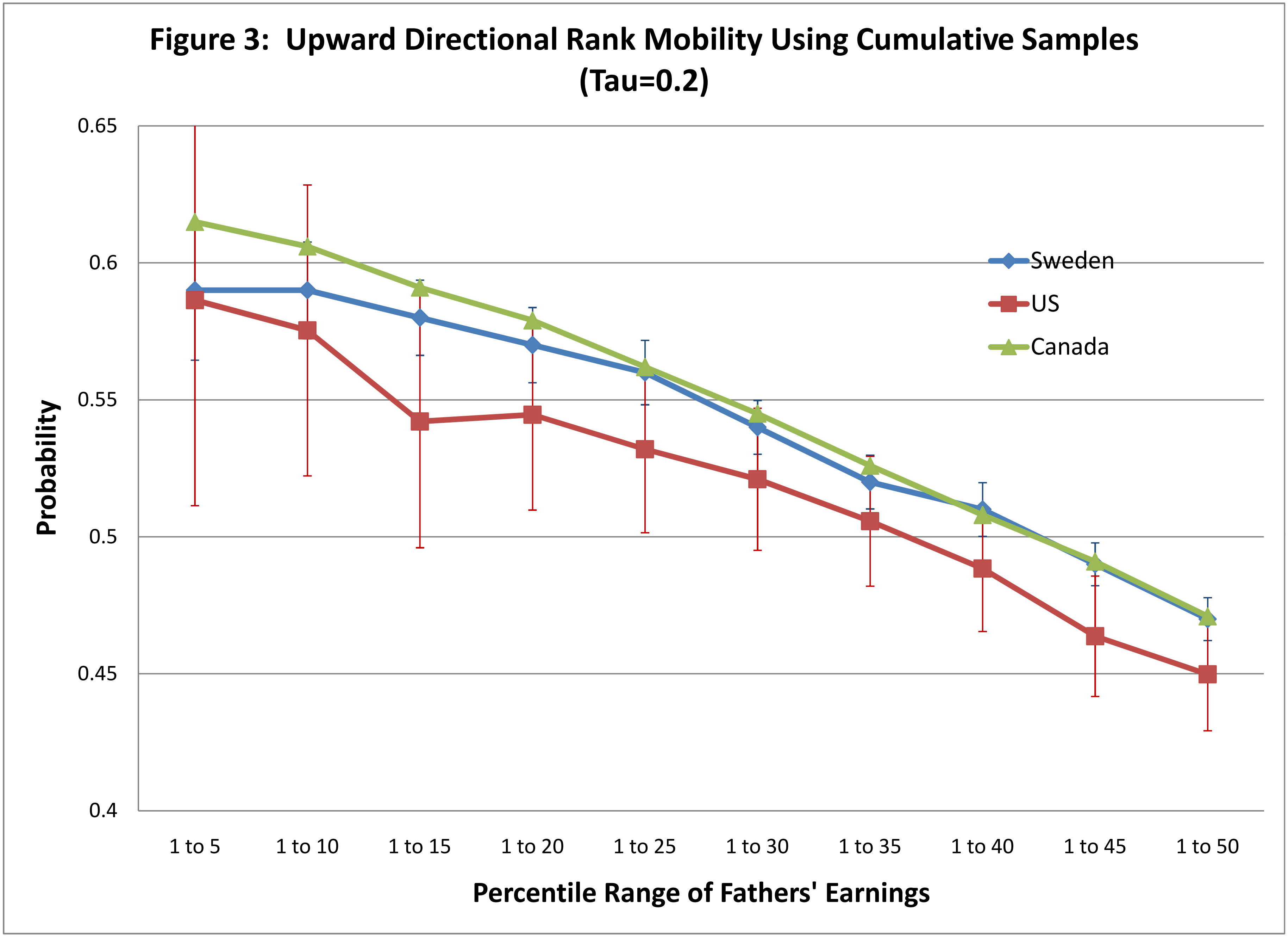


Figure 3: Upward Directional Rank Mobility Using Cumulative Samples
(Tau=0.2)
0.65
0.6
0.55
0.5
0.45
0.4
Probability
Sweden
US
Canada
1 to 5
1 to 10
1 to 15
1 to 20
1 to 25
1 to 30
1 to 35
1 to 40
1 to 45
1 to 50
Percentile Range of Fathers' Earnings

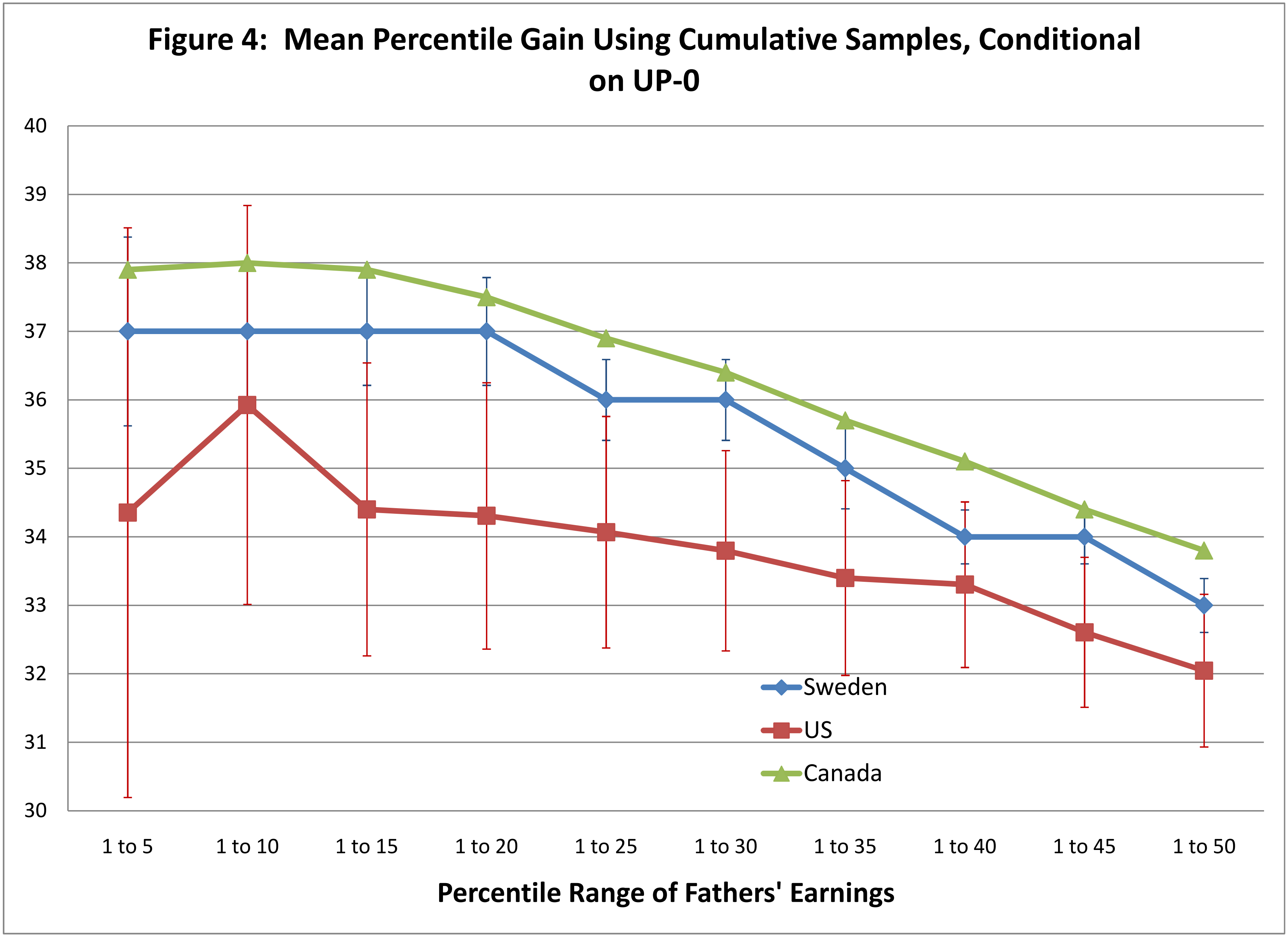


Figure 4: Mean Percentile Gain Using Cumulative Samples, Conditional on UP-0
40
39
38
37
36
35
34
33
32
31
30
Sweden
US
Canada
1 to 5
1 to 10
1 to 15
1 to 20
1 to 25
1 to 30
1 to 35
1 to 40
1 to 45
1 to 50
Percentile Range of Fathers' Earnings

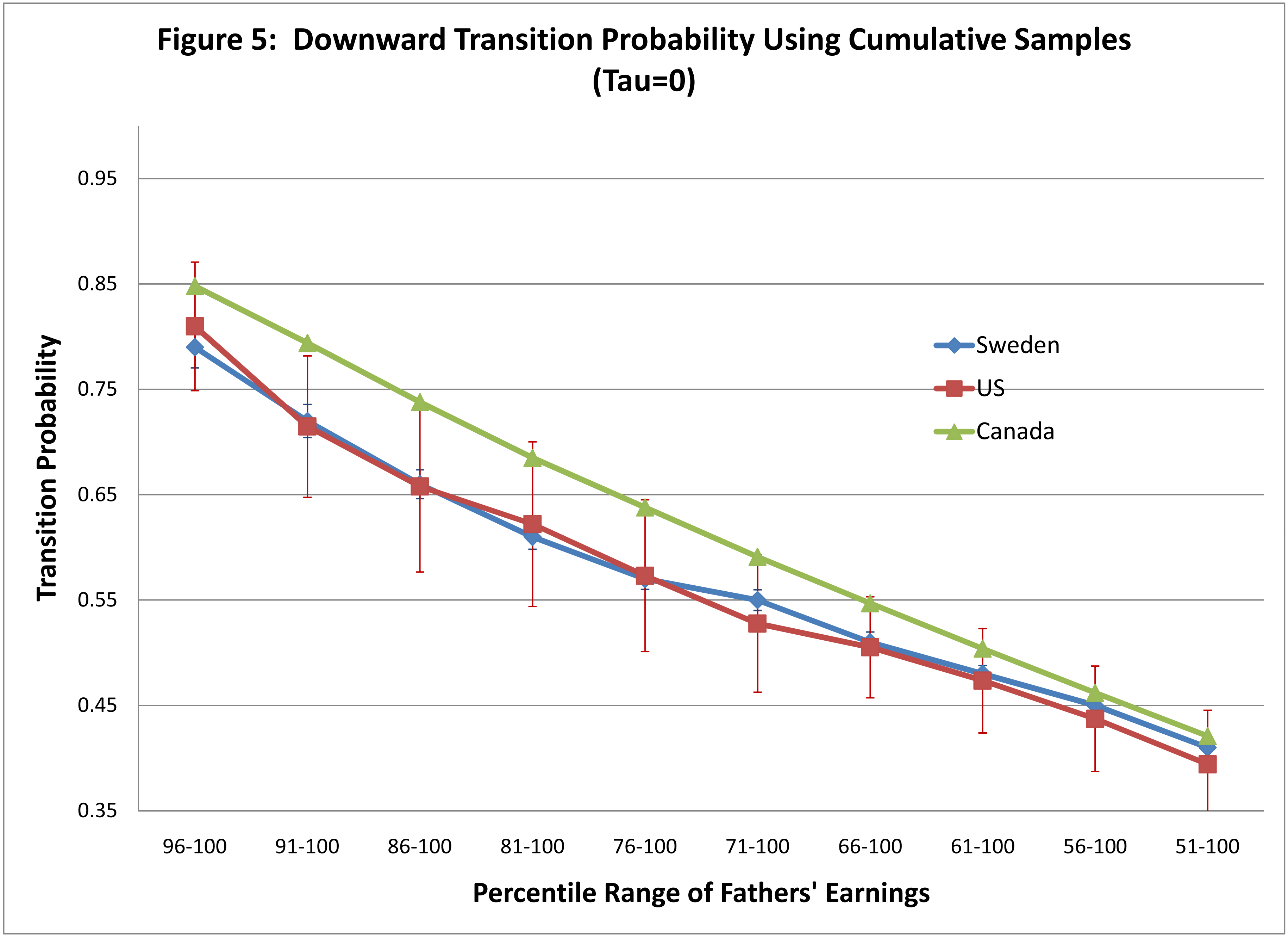
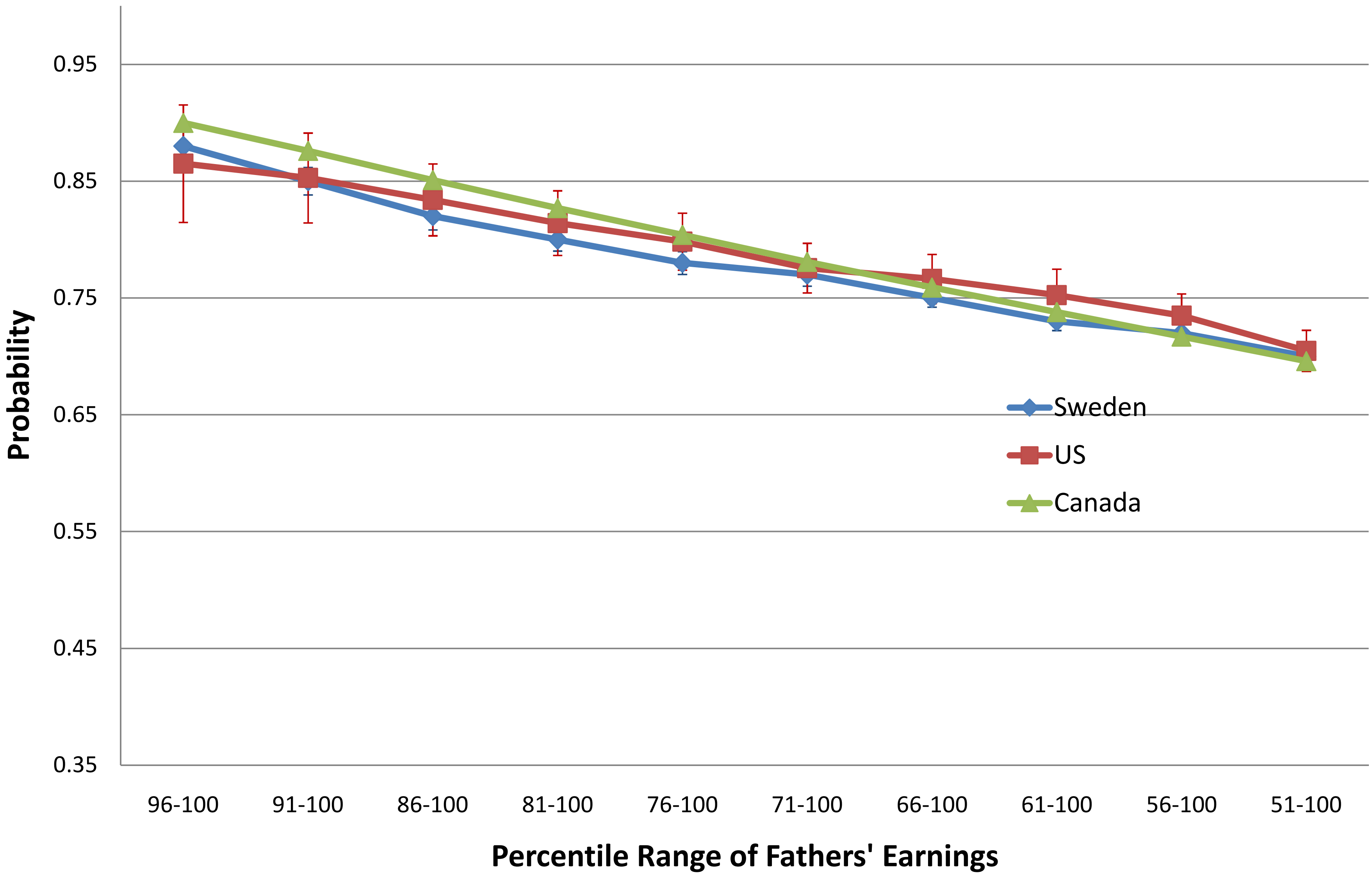


Figure 5: Downward Transition Probability Using Cumulative Samples
(Tau=0)
Transition Probability
0.95
0.85
0.75
0.65
0.55
0.45
0.35
Sweden
US
Canada
96-100
91-100
86-100
81-100
76-100
71-100
66-100
61-100
56-100
51-100
Percentile Range of Fathers' Earnings

Figure 6: Downward Directional Rank Mobility Using Cumulative Samples (Tau=0)



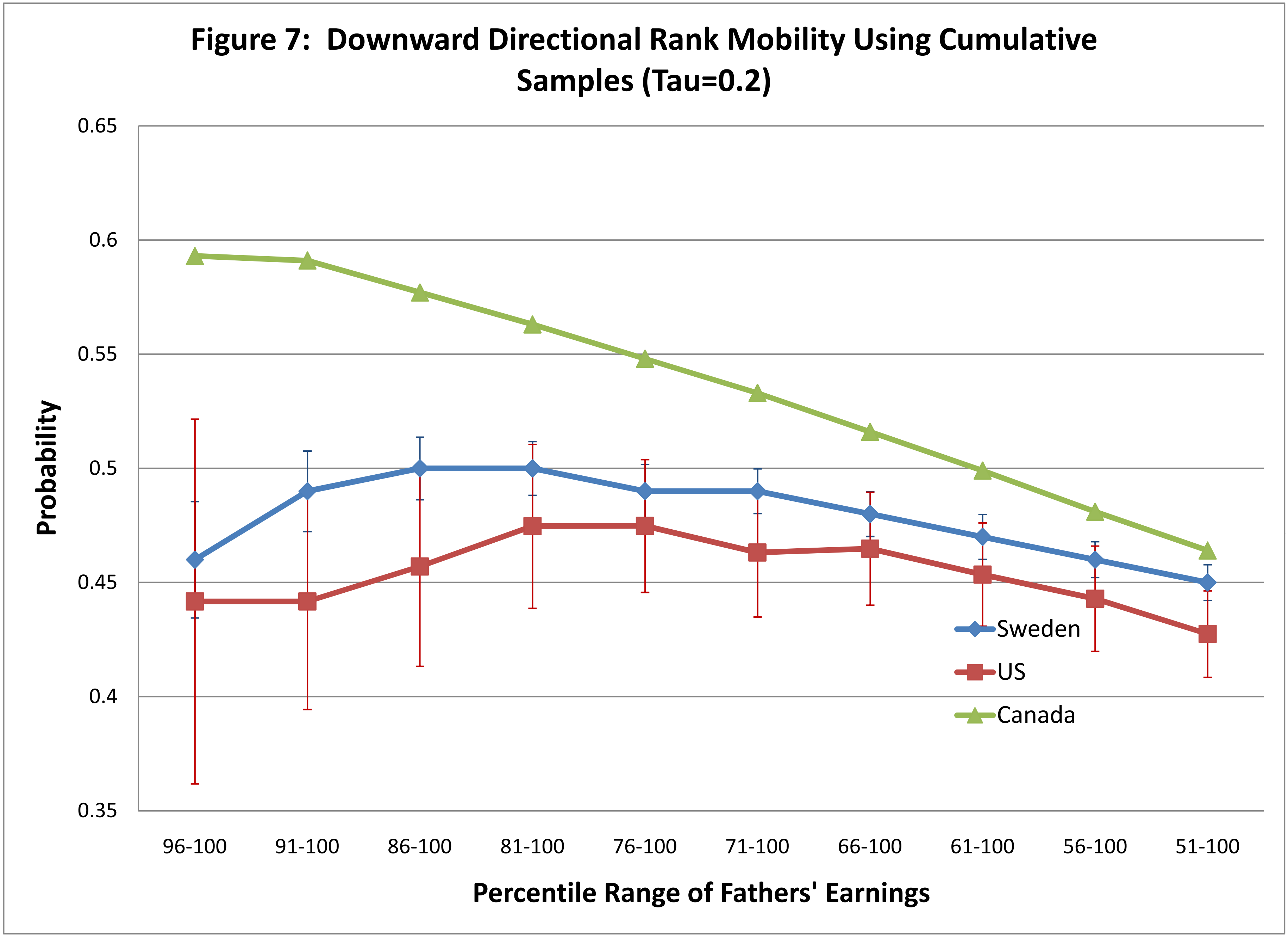


Figure 7: Downward Directional Rank Mobility Using Cumulative Samples (Tau=0.2)
Probability
0.65
0.6
0.55
0.5
0.45
0.4
0.35
96-100
91-100
86-100
81-100
76-100
71-100
66-100
61-100
56-100
51-100
Percentile Range of Fathers' Earnings
Sweden
US
Canada

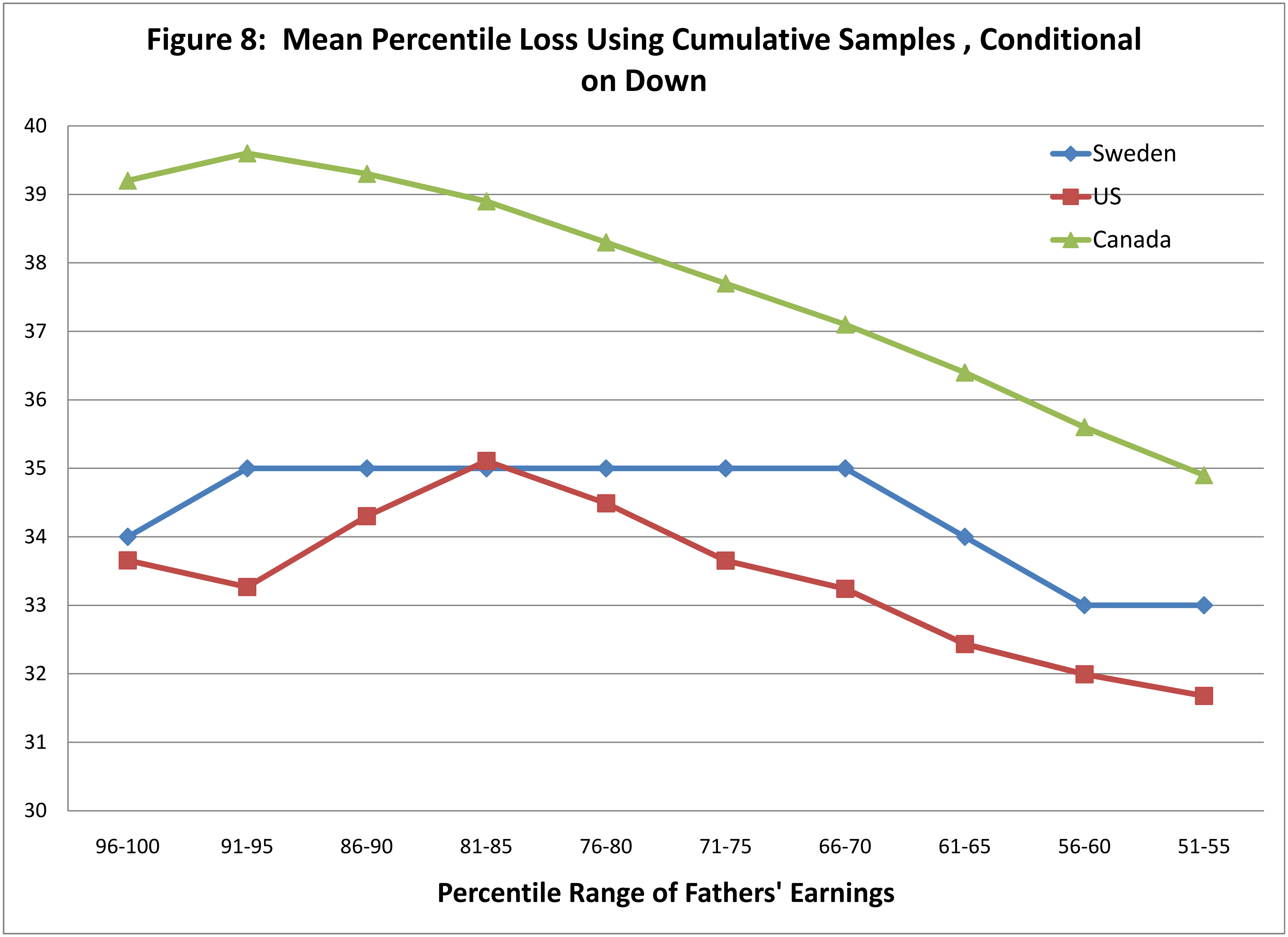


Figure 8: Mean Percentile Loss Using Cumulative Samples , Conditional on Down
40
39
38
37
36
35
34
33
32
31
30
Sweden
US
Canada
96-100
91-95
86-90
81-85
76-80
71-75
66-70
61-65
56-60
51-55
Percentile Range of Fathers' Earnings