Intergenerational Mobility Between and Within Canada and the United States

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Intergenerational income mobility is lower in the United States than in Canada but varies significantly within each country. Our subnational analysis finds that the national border only partially distinguishes the approximately 1,000 regions we analyze within these countries. The Canada-US border divides central and eastern Canada from the US Great Lakes and northeastern regions. Simultaneously, some Canadian regions have more in common with the low-mobility southern parts of the United States than with the rest of Canada; that these areas represent a much larger fraction of the US population also explains why mobility is lower in the United States.

I. Introduction

The degree to which inequality is passed on across generations has been a long-standing issue studied by labor economists and other social scientists

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at least since the late 1800s, when Francis Galton famously conceptualized the process as "regression to the mean." But the issue has also risen to the top of the public policy agenda in many countries, particularly in the United States. In part, this reflects the fact that the influence of family background on child outcomes relates to one of the country's defining metaphors, the American Dream. But in part it also reflects growing labor market inequality and the increasing awareness that economic opportunity—the capacity of children to move up the economic ladder—may be more limited for those from relatively less advantaged families when inequalities of outcomes are greater.

The empirical literature addressing intergenerational mobility naturally looks to time-series variation to highlight potential causal forces and appreciate the influence of public policy. Our analysis begins with a brief review of economic theory to suggest that comparative analysis between countries may also have particular value. One of the implications to be drawn from a series of papers by Raj Chetty, Nathan Hendren, and their coauthors, how-

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ever, is that the tone of comparative research has changed. In particular, a lesson from Chetty et al. (2014) is that a within-country analysis of the United States is more relevant than many between-country comparisons because the variation—or lack of it—within national borders more appropriately highlights the driving forces and feasible policy options. Social choices in many other countries may be motivated by underlying values that Americans may not share and therefore have little relevance to the conduct of public policy. Having documented considerable variation within the United States leads the authors to naturally explore the important causal role geographic mobility may play in promoting intergenerational mobility (Chetty, Hendren, and Katz 2016; Chetty and Hendren 2018a, 2018b).

We begin with the premise that cross-country comparisons can complement within-country analyses. A Canada-US comparison is particularly judicious, and in Sections II and III of the paper we draw lessons from theory and highlight public opinion data to appreciate the underlying determinants of intergenerational mobility and how they are perceived by the citizens of these two countries. Public opinion polls suggest that Canadians and Americans share basic attitudes toward inequality and opportunity and toward the underlying drivers of upward mobility. If there is such a thing as the Canadian Dream, it would look very much like what Americans say the American Dream is. Differences in Canada-US outcomes need not reflect different values, and this raises the possibility of learning more about the causes of economic opportunity and appreciating the role played by institutions and policies.

Our objective is to offer a between- and within-country analysis of Canada and the United States by examining a menu of intergenerational mobility indicators estimated for each of about 1,000 small areas. The Canadian data we construct are described in Section IV of the paper, and like the administrative data source used by Chetty et al. (2014), they are based on intergenerationally linked income tax files for a group of young men and women born in the early 1980s whose adult incomes are captured when they are in their early 30s. We place these Canadians in the US income distribution and describe the landscape of economic opportunity over census divisions and commuting zones that completely tile these two countries. We should stress that our analytical sample is intended not to be the best possible data for the analysis of intergenerational mobility in Canada but rather the best possible data for a comparison with the United States. The Canadian data we construct and use probably allow a more accurate comparison with the United States than any countrywide comparison that has been made in the literature to date: tax-based administrative data, used to define similar measures of income and coming close to covering the total population of similarly defined birth cohorts.

The analysis and findings are described in Sections V–VII of the paper. We confirm the existing impressions from the cross-country literature that

Canada is characterized by more intergenerational mobility than the United States, whether in terms of intergenerational income mobility, intergenerational rank mobility, or particularly relevant elements of the intergenerational transition matrix, like rags-to-riches movement and intergenerational cycles of low income. The border partially demarcates the most populous region of Canada—the Quebec City–Windsor corridor—from the northeastern seaboard and the Great Lakes region of the United States. In part, this reflects a greater degree of labor market inequality in these parts of the United States. But the other reason the national statistics suggest that Canada is more mobile has to do with the fact that there is a high concentration of low mobility in the southern United States. While certain regions of northern Canada share this limited mobility and are more accurately grouped with these regions of the United States than with other parts of Canada, they make up a much smaller share of the Canadian population and do not influence the national statistics to the same degree. Our findings suggest that inequalities between whites and blacks likely play an important role in understanding why the United States has lower rates of intergenerational mobility than other countries, in spite of public opinion polls showing that many Americans feel that race is not an important driver of upward mobility.

II. Theoretical Background

Alan Krueger (2012), in his role as chairman of the Council of Economic Advisers, cited the positive correlation between income inequality and the intergenerational earnings elasticity across the rich countries—a relationship he christened the "Great Gatsby Curve"—to motivate the possibility that rising income inequality in the United States will in the coming decades move the country in the direction of less social mobility. There is a case to be made that among the possible cross-country comparisons in the literature, the Canada-US comparison may be particularly apt. There are "small differences" in the way Canadians and Americans value and understand intergenerational mobility, and this may help to bring into relief important differences in the nature of labor markets and public policies.

Theory shows that differences in intergenerational mobility between countries may reflect differences in any number of structural parameters, some of which may be more open to policy influence in some national contexts than others. Solon (2004, 2018) adapts the workhorse model of Becker and Tomes (1979, 1986) and Loury (1981) to illustrate the challenges of making comparisons across time and space. A simplified version of the model in Solon (2004)—one that puts aside an explicit utility function reflecting the influence of parental altruism on child investments as well as the influence of the progressivity of government investment—is captured in the following equations:

$$y_t = \rho h_t, \tag{1}$$

$$h_t = \theta y_{t-1} + e_t, \tag{2}$$

$$e_t = \lambda e_{t-1} + \epsilon_t, \tag{3}$$

where t indexes generations within a family dynasty, y refers to the logarithm of permanent income, and h refers to human capital, which determines income (having a return ρ) and in turn may be determined by parental income if there are credit constraints in human capital investment but is otherwise determined by e, an unobserved endowment not influenced by family investment decisions and mechanically transmitted across generations according to a first-order autoregression governed by parameter λ, the inheritability of endowments, with ϵ being a random variable representing luck.[1] Solon (2004) shows that in a steady state the population regression of earnings across generations has an elasticity $\beta = (\rho\theta + \lambda)/(1 + \rho\theta\lambda)$.

With perfect capital markets—that is, $\theta = 0$—the structure of labor markets and the institutions that determine human capital investment do not come into play, and differences in earnings mobility over time or across space reflect, in some loosely defined way, differences in populations and environments that imply differences in the nature and transmission of endowments. But if capital markets are not perfect, then differences in the returns to human capital—and the causal role of parental income determining the amount of human capital—must also be part of the story. Inequality may be higher in some places, as reflected in higher values of ρ, but individual behavior or public investments easing θ may be countervailing forces. Becker et al. (2018) and specifically Solon (2004) add other dimensions relevant to cross-country comparisons, permitting parental altruism (i.e., tastes and values), the progres-

[1] Clearly, this is a very simplified framework, but it can be easily extended. A child's adult income may be influenced not just by his or her human capital and endowment but possibly directly by parental income, which might proxy for nepotism or the role of social networks, with the children of higher-income parents earning more than equally skilled children of lower-income parents. See Mulligan (1997) and the application and interpretation of this formulation by Corak and Piraino (2016), who add parental income to eq. (1). This simplified model also probably encourages us to think of e—and its evolution between generations—as a genetic endowment. But the literature on epigenetics cautions against making a sharp distinction between "nature" and "nurture," and it might be more constructive to view e as embodying a host of inherent and environmental factors. Becker and Tomes (1986) think in these terms. Heckman and Mosso (2014) recognize this by generalizing eq. (2) to reflect the recursive process that more accurately models child development, the multifaceted nature of skills, and the role and complementarities of human capital investments within and across the successive stages through which development occurs.

sivity of government spending, and substitutability between private and public investments to also influence the intergenerational elasticity.

Countries may occupy different positions on the Great Gatsby Curve for a whole host of reasons associated with the inheritability of endowments, access to education and other sources of human capital, and differences in labor markets as well as for the simple reason that they make different choices reflecting different social objectives or different perspectives on the role of private versus public investments in children. This underscores the fact that not all cross-country comparisons are relevant, with some comparisons more likely to reveal the impact of policy and institutions than they are to reflect differences in social priorities.

III. Values toward Inequality and Economic Opportunity

Simply put, values and institutions differ, and this fact has long played a role in understanding differences in the nature and size of the welfare state, particularly between continental Europe and North America (Alesina and Glaeser 2004). In a similar way, the priority societies place on equality of opportunity–enhancing policies will reflect underlying values. Arguably, these are more similar across the Canada-US border than elsewhere.

Public opinion polls find that Americans and Canadians define the American Dream in virtually the same way. The Pew Charitable Trusts conducted a number of public opinion polls asking Americans what meaning they attach to the phrase "the American Dream." The responses have been stable through time, and a poll conducted in late January and early February 2009 was adapted and conducted in Canada in August and September of the same year (Corak 2010). Figure 1 summarizes one of the major findings by indicating the percentage of respondents in each country answering 8 or higher on a 10-point scale for each of the possible definitions of the American Dream presented to them.[2]

The point estimates are very similar, particularly so with respect to the options most closely related to intergenerational mobility. Sixty percent of US respondents ranked being able to succeed regardless of family back-

[2] The poll was conducted under the sponsorship of the Pew Charitable Trusts by Greenberg Quinlan Rosner Research and Public Opinion Strategies using a sample of 2,119 US adults 18 years and older and by EKOS Research Associates using sample of 1,035 Canadians falling in the same age group. The specific question referring to the American Dream asked to Canadians was directly adapted from the US poll and read as follows: "Americans often talk about attaining the American Dream to describe what it means to have a good life in their country. This means different things to different people. Here are some ways some Americans have described what the American Dream means to them. On a scale of one to ten, please tell me how accurately each statement describes what you would consider the Canadian Dream to be. One would mean the statement does not describe what it means at all. A ten would mean the statement describes it perfectly."

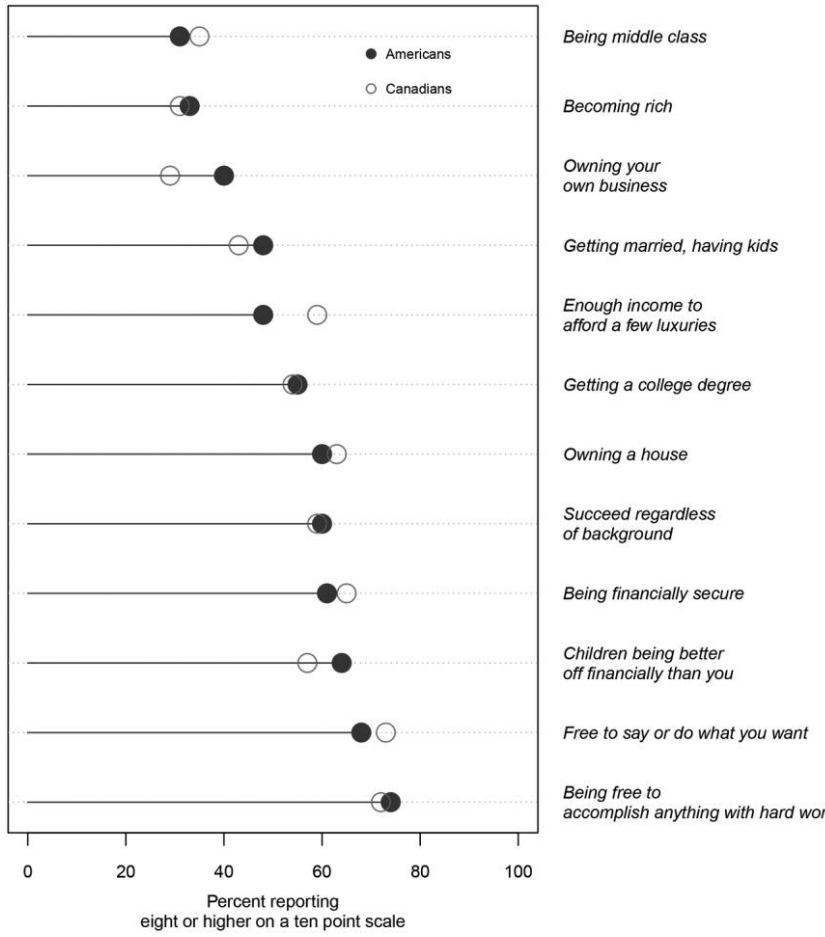

FIG. 1.—Percentage of respondents in comparable public opinion polls indicating 8 or higher on a 10-point scale to alternative descriptions of the American Dream. A color version of this figure is available online.

ground 8 or higher on the 10-point scale, while 59% of Canadians did so.[3] The percentage indicating that the statement "your children being better off financially than you" represents the American Dream was 64% in the United States and 57% in Canada. While these two options relate most directly to intergenerational mobility, they do not offer clear guidance on the appropriate way to measure it statistically. The reference to children being financially better off most clearly refers to absolute mobility using an intra-

[3] The exact wording of the option presented to respondents was as follows: "Being able to succeed regardless of the economic circumstances in which you were born."

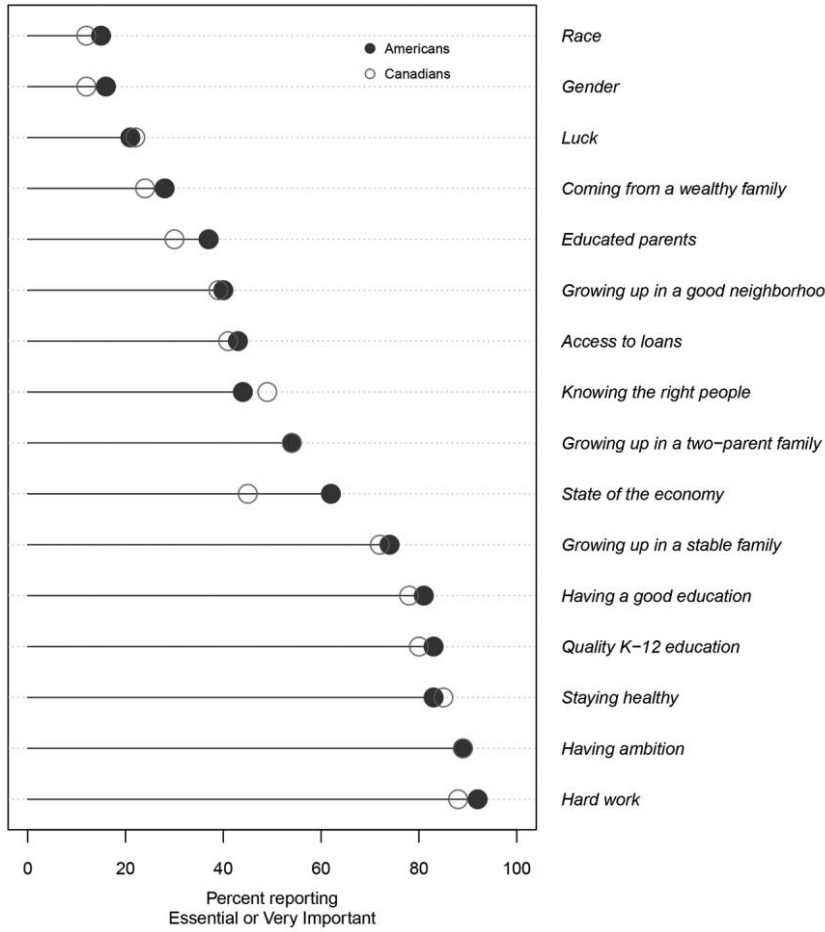

FIG. 2.—Percentage of respondents in comparable public opinion polls stating that a factor is "essential" or "very important" to upward mobility. A color version of this figure is available online.

family reference point, but "being able to succeed regardless of family background" leaves the reference point undefined and may be interpreted in a relative or an absolute sense. The differences between these responses and to those to all but one of the other options listed in the figure are not statistically significant. The only exception is that 40% of Americans suggested that "owning your own business" is a strong marker of the meaning of the American Dream, but at 29% significantly fewer Canadians reported feeling the same way.

Americans and Canadians also have a similar view of the factors determining upward economic mobility. Figure 2, drawn from information in

the same source, lists a host of determinants of upward mobility, ranging from factors that are not subject to individual choice or responsibility—like race, gender, and luck—to others entirely within an individual's locus of control—like hard work and having ambition—as well as a number of others that may reflect both extremes in addition to public policy choices.

Representative samples in both countries tend to see factors associated with individual choice and responsibility as the prime drivers of economic mobility. Ninety-two percent of Americans and 88% of Canadians reported that "hard work" was either essential or very important in determining upward mobility, and 89% of respondents in both countries also felt this way about "having ambition." On the other hand, small minorities in both countries cited race, gender, or luck as being essential or very important, with luck being the most cited, with 21% of Americans and 22% of Canadians thinking of it in these terms. The responses across all 16 factors presented to respondents are very similar across the two countries; often they are essentially the same, with the only notable exception being that Americans were somewhat more likely to view the state of the economy as important.[4] That said, Americans tend to view family background more importantly than Canadians. Twenty-eight percent of US respondents versus 24% of Canadians said that "coming from a wealthy family" was essential or very important, and 37% versus 30% viewed having "educated parents" in the same way. On the other hand, Canadians were more likely to cite "knowing the right people" as an essential or very important driver of mobility.[5]

But if Americans and Canadians have a similar meaning of the good life and similar views on how to attain it, they have significantly different views on the role of collective action through public policy. McCall (2017) uses 2000 data from the International Social Survey Programme to point out that while 35% of Americans "strongly agree" or "agree" with the statement "Government's responsibility is to reduce the gap between high and low incomes," a significantly larger proportion (47%) of Canadians have this view. Even if this issue is not supported by a plurality of Canadians, the difference is significant. However, these two countries are much more similar than respondents in European countries, where the majority—and often the strong

[4] This likely reflects the fact that the survey was, as mentioned, conducted in January and February 2009, during the height of the Great Recession. The recession was notably more severe in the United States. In addition, the Canadian survey was conducted about 6 months later.

[5] The 2000 round of the International Social Survey Programme also found similar responses to similar questions. Forty-seven percent of Americans vs. 49% of Canadians felt that knowing the right people is essential or very important for "getting ahead." (The percentages associated with this question in fig. 2 are, at 44% and 49%, essentially the same.) In addition, 20% of Americans but only 13% of Canadians felt that "coming from a wealthy family" was essential or very important for getting ahead. See McCall (2017).

majority—in Great Britain, Sweden, Norway, western Germany, and France feel that redistribution is an important government responsibility.

Findings from Corak (2010) also suggest that Americans and Canadians share a preference for equality of opportunities over equality of outcomes: 71% of Americans and 68% of Canadians felt it was more important "to ensure everyone has a fair chance of improving their economic standing" than "to reduce inequality." That said, Canadians are more likely to offer a more "activist" role for their governments.

> A notable difference between the two countries concerns the role of government as a means to influence economic mobility. When asked if the government does more to help or more to hurt people trying to move up the economic ladder, respondents in both countries lacked strong proclivities. However, 46 percent of Canadians feel that government does more to help than to hurt, compared to 36 percent of Americans. On the other hand, 46 percent of Americans feel government does more to hurt versus 39 percent of Canadians. The difference in the responses to this question was among the largest of all questions asked. (Corak 2010, 17)

This is as much a statement about differences in beliefs about the efficacy and efficiency of public policy as it is about ideological differences concerning the role of the state, and it has a clear echo in the public opinion research conducted by Alesina, Stantcheva, and Teso (2018). They focus on the relationship between perceptions of intergenerational mobility and preferences for redistribution in the United States and four European countries. Canada is not part of their analysis, and their purpose is not the same as ours, focusing on intergenerational mobility to understand the strength of preferences for equality of outcomes. But they underscore the point that beliefs about the role of government intervention are at the core of political polarization and lead to different views on what to do about intergenerational mobility even if the lack of it is perceived as a problem.

For example, in the Pew-EKOS polls a slight majority of Americans (51%) feels that cutting taxes would be a "very effective" government action to improve mobility, but only 38% of Canadians feel the same way (Corak 2010, fig. 7). These differences imply different public policy capacities. Hoynes and Stabile (2017) document the very dramatic differences in income support for lower income families in the two countries, with the safety net being drawn much more tightly in Canada. Even if underlying values are the same in these two countries, perceptions about the role of public policy—and ultimately the range and design of policy—may be very different.

This relates directly to the emphasis Solon (2004) puts on the "progressivity" of public investment in human capital. His model also suggests that cross-country differences in the design of public policies—in addition to

differences in the inheritability of endowments, the returns to human capital investment, and the capacity of family income to influence a child's human capital—play a role in determining differences in intergenerational mobility. All of these factors may come into play in understanding Canada-US differences. But since these two countries define and value mobility in the same way, comparing them may help place a sharper focus on differing beliefs about the role of public policy. In other words, a Canada-US comparison might open up a wider menu of choices in US public debate than if the comparison was just over time within the country or, for that matter, to European public policy, which can be more easily dismissed as not relevant to US values.

IV. Data and Measurement

The economics literature on intergenerational income mobility has grown significantly since the early 1990s, when the maturing of the Panel Study of Income Dynamics offered Solon (1992) the opportunity to estimate intergenerational income elasticities with nationally representative data spanning two generations.[6] The surveys of this research by Björklund and Jäntti (2011), Black and Devereux (2011), Blanden (2013), Corak (2006, 2013), Mulligan (1997), Solon (1999, 2002), and Stuhler (2018) reveal the important role that the construction and availability of new data plays in offering opportunities to both revisit long-standing issues and imagine new possibilities. In Canada this took the form of the development of intergenerationally linked income tax data by Corak and Heisz (1999), which were used to estimate an intergenerational elasticity of about 0.2—a finding similar to that of Fortin and Lefebvre (1998), who use census data, and at least half the magnitude of the best available estimate for the United States (Solon 1992; Zimmerman 1992; Mazumder 2005a, 2005b).[7] The most important recent advance in the US literature has been the development and use of similar tax-based data from the Internal Revenue Service by Chetty et al. (2014) and Mitnik et al. (2015), confirming intergenerational income elasticities of about 0.4 and likely approaching 0.6. Mazumder (2018) incorporates these findings in his literature review to suggest that the consensus estimate of the father-son intergenerational elasticity of incomes should be considered to be about 0.6. Analyses with tax-based data also suggest the use of a wider variety of intergenerational statistics and, as illustrated by Chetty et al. (2014), subnational analysis as an important new research possibility.

[6] Zimmerman (1992) offered a contemporaneous analysis that did not use the Panel Study of Income Dynamics.

[7] The Canadian data, called the Intergenerational Income Database, have also been used by Chen, Ostrovsky, and Piraino (2017), Corak (2001), Corak, Gustafsson, and Osterberg (2004), Corak and Heisz (1998), Corak and Piraino (2011, 2016), Grawe (2004, 2006), Oreopoulos (2003), and Oreopoulos, Page, and Stevens (2008) to study a host of issues and in some cases offer causal analysis.

We update and reconstruct the Canadian data to permit a direct comparison with the regional analysis of the United States offered by Chetty et al. (2014). This involves examining labor market outcomes in 2011 and 2012, but for a younger cohort born in 1980 and 1982. Our development of these data is meant to line up as closely as possible to the US equivalent, and as such we are not in a position to examine intergenerational income mobility at the most appropriate stage in the life cycle, when the children are in their late 30s to mid-40s.[8] As such, we follow Chetty et al. (2014) in focusing on different measures of rank mobility, which tend to be stable by the time individuals reach their early 30s (Nybom and Stuhler 2017; Corak 2018, table 5).

Canadians file income taxes as individuals, but the tax form—referred to as the T1 form—requires identifying information about a spouse or common-law partner to be provided. We are able to construct a "family income" variable for both parents and children (in adulthood) and their spouses in the manner of Chetty et al. (2014): the total (before-tax) income of both partners in the household using the Canada Revenue Agency definition of total income (all market sources of income plus all government transfers).[9] Parent total income is averaged over the tax years 1996–2000, a potential of up to 5 years for each parent. If a parent's T1 record is not found for a particular year, income is assigned a value of zero. This framework is comprehensive in not only using a wide definition of income but also including both sons and daughters as well as children raised by single parents.

The intergenerational link of tax returns between parents and children requires that the child has a social insurance number while living at home.

[8] Chen, Ostrovsky, and Piraino (2017) offer an analysis of cohorts born in the mid-1960s who are followed up to 2008 in a manner that takes full account of the life-cycle biases discussed by Grawe (2006), Jenkins (1987), and Haider and Solon (2006). They estimate the father-son elasticity to be 0.32 and offer a Canada-US comparison from this perspective. Corak (2018) uses the data on this older cohort in the same manner we do, offering regional estimates for the 266 census divisions defined in the 1986 Canadian census, with the more appropriate point in the life cycle allowing estimates of the regression to the mean model in incomes.

[9] More specifically, this consists of earnings from an employer-employee relationship as indicated on the T4 form, including commissions, interest and investment income, other employment income, other income, pension and superannuity income, rental income, and self-employment net income (from business, commissions, farming, fishing, or professional activities), as well as capital gains and losses and dividends (taxable and appropriately grossed up to reflect changes in tax treatment). It also includes Old Age Security pensions payments, Canada/Quebec Pension Plan benefits, and employment insurance benefits. In addition, for the years from 1986 onward total income is defined to include tax credits associated with the Goods and Services Tax and the Harmonized Sales Tax; from 1992, net federal supplements, social assistance payments, and workers' compensation payments; from 1996, Guaranteed Income Supplement benefits; and from 1998, limited partnership income and Registered Retirement Savings Plan income.

Some parents obtain a social insurance number for their children early in their lives, but others do not and for the birth cohorts we study it is usually obtained when the child enters the labor market, whether part time as a teenager or later. The link between parent and child social insurance numbers is made with the algorithm described by Corak and Heisz (1999). The appendix offers a detailed explanation of the structure of the data and the creation of our analytical sample. Chetty et al. (2014) use children born between 1980 and 1982 whose parents are identified and have a positive mean income between 1996 and 2000. A small difference is that our analysis uses only those children born in 1980 and 1982, the 1981 birth cohort not being part of underlying data created from income tax files by Statistics Canada.

The adult income of these children is defined in a similar way, on the basis of the average total income during 2011 and 2012, including any spousal income if a spouse is present. The US data considers only partners who are married, putting aside common-law relationships. Our use of the Canadian data treats common-law partnerships as married, since for the most part they are recognized in the Canadian income tax system as such and form a very important fraction of many long-term stable relationships in some provinces, particularly Quebec. The proportion of the relationships that are identified as either married or common law in these tax files is about 50%, just below the 55% recorded as married in the United States.

Children not filing a T1 form in 2011 or 2012 (or in both years) are assigned an income of zero. We add the income from the child's spouse, if a spouse is present, to own income in calculating the child's "family" income. All dollar amounts are adjusted to 2012 Canadian dollars using the national consumer price index and then to US dollars using the purchasing power parity rate for 2012 produced by the Organization for Economic Cooperation and Development (1.28 Canadian dollars per US dollar).

A child's geographic location is based on the postal code provided on the T1 form in the year the child is linked to his or her parents. This is consistent with Chetty et al. (2014), who use the 1996 location for 96% of their sample. The postal code is converted to census geography codes using Statistics Canada's Postal Code Conversion File. The analysis is based on the census division, which roughly corresponds to a county or municipality, the subprovincial level of government used to deliver provincial and municipal services. Not all provinces have such a level of government, and in these cases Statistics Canada, in consultation with provincial counterparts, defines an equivalent geographic area so that the entire country is covered. In the 1996 census there are 288 census divisions. Conceptually, this geographic unit is somewhat narrower than the commuting zones used in the US data, but practically they are similar as some census divisions cover a significant geographic area (although in some cases they are much wider than would be suggested by commuting patterns). This implies that our subnational analysis involves, together with the 741 commuting zones in the US data, more than 1,000 regions.

In the manner of Chetty et al. (2014), we also use census data to derive a host of economic and demographic variables profiling the census divisions. This is mostly based on the one-in-five micro data associated with the 1996 Canadian census, the data from the so-called long form that roughly 20% of Canadians are required to complete. In this way, we are able to explore the community-level correlates of intergenerational mobility statistics we derive from the tax data for each region.

Theory offers only a partial guide to the choice of statistics to measure intergenerational mobility, and to some degree research is increasingly informed not just by the limitations and opportunities of available data but also by public policy discussion. Becker and Tomes (1979, 1986) focus empirical attention on the regression to the mean model of incomes: $y_{i,t} = \alpha + \beta y_{i,t-1} + \varepsilon_i$, where once again $y_{i,t}$ represents the natural logarithm of permanent income of a member of family i in generation t and α and β are the parameters usually estimated by least squares that respectively measure absolute and relative income mobility. As stressed, only under very specific circumstances is β a structural parameter, and it should more accurately be understood to be a broad summary indicator of intergenerational income mobility reflecting both the correlation of standardized incomes and differences in the variance of incomes between generations. That said, even as a descriptive statistic it does not capture all dimensions of the process, as rank mobility is not explicitly measured and the linearity assumption implies that the rate of mobility is the same across the entire parental income distribution. As such, we are agnostic as to the appropriate measure of mobility. Like Chetty et al. (2014), we downplay the intergenerational elasticity in large measure because of the potential for life-cycle biases.[10]

We focus on summary indicators of rank mobility derived from a rank-rank regression: $R_{i,j,t} = a_j + b_j R_{i,j,t-1} + e_{i,j}$, where $R_{i,j,t}$ refers to the percentile rank in the national income distribution of an individual in family i belonging to generation t from region j when the analysis is subnational. To be clear, we are following Chetty et al. (2014) in defining a child's geography on the basis of where he or she lived as a teenager, but our measure of permanent income is determined without regard to where the child may be living as an adult, a little more than a decade later. Geographic mobility is embodied in this analysis, and children and parents—regardless of where they live—are placed in the national income distributions to determine their rank, not in the local income distribution. The parameters of this model are estimated using least squares, with a_j offering a measure of absolute mobility—the expected rank of a child raised by bottom-percentile parents—and b_j a measure of relative rank mobility—the increase in a child's rank for every percentile increase in the parents' rank.

[10] That said, we do characterize our communities by the average parental income, an important correlate of the expected adult income of children.

Our focus is also on certain cells of the quintile transition matrix, in particular the chances that a child born to bottom-quintile parents will rise to the top quintile—so-called rags-to-riches mobility—and the chances that he or she will grow up to in turn be a bottom-quintile adult—the intergenerational cycle of low income. These are referred to, respectively, as $P_{1,5} = \Pr\{Y_t \in \text{top} | Y_{t-1} \in \text{bottom}\}$ and $P_{1,1} = \Pr\{Y_t \in \text{bottom} | Y_{t-1} \in \text{bottom}\}$, where Yt and Y_{t-1} refer, respectively, to child and parent permanent income. We calculate these statistics for the country as a whole and for each subnational unit.

Canadian incomes are placed both in the Canadian income distribution and in the US income distribution. The subnational analysis is based entirely on the latter ranking. In this case, the assigned ranks refer to the percentile rank in the United States, and the transition matrices derived from this ranking are not strictly transition matrices, as the rows are not constrained to add to one. The online appendix to Chetty et al. (2014) lists the national marginal income distributions by percentile.[11]

Table 1 shows average parent and child incomes for selected percentiles of the income distributions, based on the national cutoffs. The average income in the bottom percentile of the child's income distribution in the analytical file Chetty et al. (2014) use is −$43,800, and all percentiles up to the sixth have an average income of zero. This may appear odd, as the objective is to estimate permanent income, and it is hard to rationalize how anyone can have a negative or even zero permanent income. But Chetty et al. (2014) motivate the decision to keep these very low incomes because of high incarceration rates among some groups of the US population in this cohort. Excluding these groups would likely induce a more severe sample-selection bias at the low end of the income distribution.[12] This is appropriate, since the 2-year window relatively early in the child's life span places an even greater limitation on estimating permanent income. As mentioned, the Canadian data are also constructed to include observations with low incomes, although this is not common in the existing literature, which generally imposes a cutoff of $500 or more on incomes averaged over 5 years.

Table 1 also shows that while Canadian parents tend to have lower average income within almost all percentiles other than the very bottom percentiles, this is markedly so higher up in the income distribution. To be in the top 20%—and certainly to be in the top 5% and the top 1% or 2%—implies

[11] Specifically, we use table 2 retrieved at https://opportunityinsights.org/paper/land-of-opportunity/, which offers the average parent and child incomes for each percentile of the respective income distributions, rounded to the nearest $100. We define the percentile cutoffs to be the midpoint between two means.

[12] Correspondence with Raj Chetty. The analytical files are based both on the 1040 forms Americans are required to complete when filing their income taxes and on the W-2 forms submitted by employers. The later allow the authors to capture individuals who did not file their tax returns.

Table 1
Selected Percentiles of the Parent and Child Income Distributions in Canada and the United States: US (2012) Dollars

	Parents		Children	
Percentile	Canada	US	Canada	US
1	1,593	1,700	−10,456	−43,800
5	8,379	9,200	0	0
10	12,944	15,000	179	2,300
20	22,194	24,900	13,575	11,000
50	52,122	59,500	44,663	34,600
80	87,972	107,900	81,703	74,400
90	111,475	144,500	102,852	99,900
95	137,335	194,300	122,165	125,300
99	242,279	420,100	169,247	193,300
100	586,026	1,408,800	277,608	408,400

SOURCE.—Authors' calculations, Chetty et al. (2014) online tables.

having a good deal more income in the United States than in Canada. Children in the United States are raised in a context of greater top-end income inequality. At the same time, the adult incomes of Canadian children are higher in the middle of the income distribution than in the United States. That said, child top incomes are also higher in the United States.[13] When Canadian parents are placed in the US income distribution, 29.7% fall into the bottom quintile, and only 5.2% fall in the top. The patterns are not as extreme for Canadian children, but they are similar: 20.7% of Canadian children in adulthood fall into the bottom fifth of the US income distribution, and 12.5% fall into the top fifth.[14]

V. Between-Country Comparisons

We confirm the general notion in the literature viewing Canada as more intergenerationally mobile than the United States, but in motivating the remainder of our analysis, note that this finding may be complemented and nuanced in an important way with subnational comparisons.

[13] Research based on survey data for the 1990s finds that when Canadian children are placed in the US income distribution they are much less likely to be in the bottom decile of the US income distribution than their US counterparts, reflecting differences in the polarization of labor markets, the structure of families, and the more generous Canadian system of income support. To be clear, however, this result does not account for in-kind support—in particular, Supplemental Nutrition Assistance Program (SNAP) benefits (food stamps)—which tend to be greater in the United States. This limitation also applies to analyses based on income tax data. See Corak, Curtis, and Phipps (2011).

[14] For parents, 28.3%, 24.9%, and 11.9% place in the second, third, and next to top quintile, respectively; for children, these percentages are 18.8%, 22.8%, and 25.1%.

Table 2
Least-Squares Estimates of Relative Intergenerational Income and Rank Mobility, Canada and United States

	Income Definition			
	Child	Parent	US	Canada
	A. Intergenerational Income Elasticities			
1	Logarithm of family income	Logarithm of family income	.344	.310
2	Excluding incomes below $500	Logarithm of family income		.226
3	Recoding incomes below $500 to $500	Logarithm of family income		.313
4	Recoding zero incomes to $1	Logarithm of family income	.618	.474
5	Recoding incomes below $1,000 to $1,000	Logarithm of family income	.413	.294
	B. Relative Rank Mobility			
6	Percentile in US	Percentile in US	.341	.229
7	Percentile in US (excluding missing)	Percentile in US		.226
8	Percentile in own country	Percentile in own country	.341	.212
9	Percentile in own country (excluding missing)	Percentile in own country		.228
10	Percentile in own country	Percentile in own country 1999 to 2003	.339	.216
11	Percentile in own country	Percentile of top parent own country	.312	.219

NOTE.—All estimates are statistically significant, with the maximum standard error being 0.006.

Least-squares estimates of relative income and rank mobility—the estimates of the parameters β and b—are presented in table 2 for a number of different sample selection rules in a way that follows some of the findings of Chetty et al. (2014, table 1), from which the estimates for the United States are drawn. Panel A offers intergenerational elasticities, and the panel B offers rank-rank slope estimates, where ranks are determined both by the within-country percentile distribution and by placing Canadians in the US income distribution.

The Canadian intergenerational income elasticity is lower. All of the coefficients and all of the differences between the countries are statistically significant—the largest standard error in the table is 0.006 (that for the Canadian estimate in row 4)—with most being about 0.001 for Canada and in the range of 0.0003–0.0004 for the United States. The Canadian estimates of the elasticities are similar to those in the existing literature but not directly comparable to them: our income definition is unique, the samples include both men and women, and they are, at least for a comparison with the best current estimates in Chen, Ostrovsky, and Piraino (2017), early in the life cycle.[15] The estimates of relative rank mobility in table 2 imply that a child

[15] The exception is a comparison to Corak (2018), who uses the same administrative data source and income definitions but with an older cohort of Canadians born in the mid-1960s, whose outcomes are measured over a 5-year period ending in

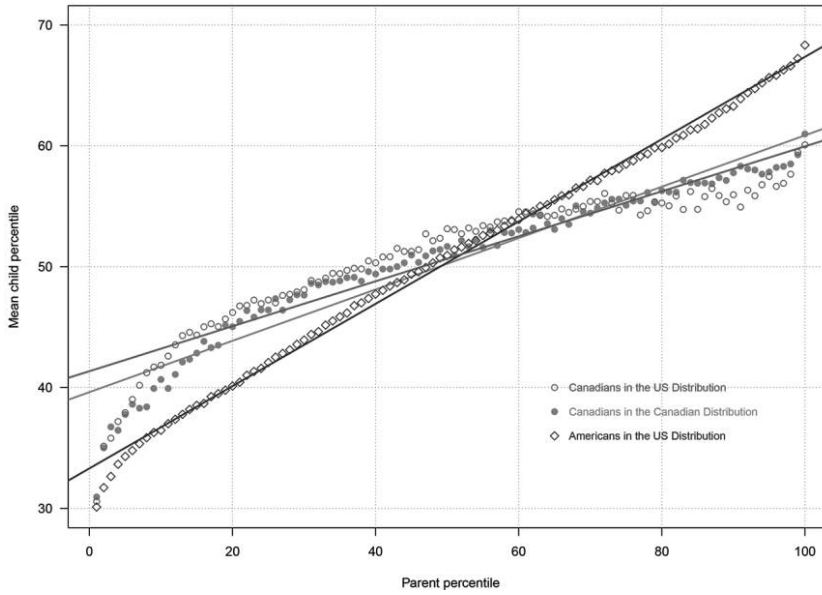

FIG. 3.—Intergenerational rank mobility in Canada and the United States. A color version of this figure is available online.

raised by top percentile parents in the United States will rank about 31–34 percentiles higher in the income distribution than a bottom-percentile child, but in Canada this difference would, at 21–23 percentiles, be a full decile lower.[16]

Figure 3 contrasts rank mobility between the two countries in a way that permits a comparison of both absolute and relative mobility. The slope is flatter in Canada and the intercept is higher, the combination implying that Canadian children will rank higher than their US counterparts until about the median of parent income is reached. The expected rank of a Canadian child raised by bottom-quintile parents is somewhat above the 40th percentile, but for an American child the expected rank is significantly below it. To

2008. Interestingly, he reports a Canada-wide elasticity that, at 0.20, is actually a bit lower than the lowest estimate offered in panel A of table 2. Both of these sets of estimates are much lower than those offered by Chen, Ostrovsky, and Piraino (2017), but these authors also suggest that their results should be understood to be about half as great as comparable US estimates.

[16] Corak (2018, table 5) reports a rank-rank slope for Canada of 0.242 when child outcomes are measured at 35–48 years of age and of 0.240 when measured for the same cohort at 31 and 32 years of age. This is in the range of our estimates, suggesting that percentile ranks are established by the time children reach the early 30s, as Chetty et al. (2014) suggest with US data and as Nybom and Stuhler (2017) show with Swedish data.

Table 3
Quintile Transition Matrices: Americans in the US Income Distribution, Canadians in the Canadian Income Distribution, and Canadians in the US Income Distribution

	Parent's Quintile				
Child's Quintile	Bottom	Second	Third	Fourth	Top
	A. United States				
Bottom	33.7	24.2	17.8	13.4	10.9
Second	28.0	24.2	19.8	16.0	11.9
Third	18.4	21.7	22.1	20.9	17.0
Fourth	12.3	17.6	22.0	24.4	23.6
Top	7.5	12.3	18.3	25.4	36.5
	B. Canada in the Canadian Income Distribution				
Bottom	32.0	20.3	17.0	15.3	15.5
Second	24.0	23.2	20.7	18.0	14.8
Third	18.2	21.3	21.6	20.6	18.8
Fourth	14.6	19.3	21.8	22.8	21.4
Top	11.2	15.9	18.9	23.3	29.5
	C. Canada in the US Income Distribution				
Bottom	29.1	18.1	15.6	15.4	17.0
Second	22.5	20.1	16.7	14.1	12.1
Third	21.7	24.7	23.5	22.0	19.6
Fourth	19.0	26.1	29.5	29.3	26.8
Top	7.7	10.9	14.8	19.3	24.6

SOURCE.—Authors' calculations and Chetty et al. (2014, table 2).

reach a similar point on the US income ladder a US child would have to have parents who ranked as high as the 30th percentile. The US "middle class" is within easier reach for low-income Canadian children than it is for low-income Americans.

That said, the information in figure 3 also implies that US children raised by top-quintile parents are more likely to rank higher than their Canadian counterparts. The rank-rank relationship tends to show more nonlinearity in Canada, but top-percentile Canadians still cannot expect to see their children attain the same rank as top-percentile Americans. There also seems to be more pronounced nonlinearities at the bottom of the Canadian income distribution, certainly over the course of the bottom decile of the parent distribution. To some degree the linear rank-rank model is a less accurate summary indicator of rank mobility in Canada than Chetty et al. (2014) find it is for the United States.

Table 3 presents another perspective on these movements by offering estimates of the quintile transition matrices for the two countries, including two estimates for Canada: panel B based on the Canadian quintile cutoffs and panel C based on the ranks that would be ascribed to Canadian parents and children if they were placed in their respective US income distributions.

Panels A and B show that there is a good deal of intergenerational mobility for a large segment of the population in these two countries for children raised in families from the 20th to the 80th percentiles. Family income in these middle quintiles seems rather loosely related to child outcomes, the quintile transition probabilities hovering a bit above and a bit below 0.20. In this sense, intergenerational mobility may actually contribute to middle-class anxiety, with parents not being able to greatly influence their child's station in life. There certainly are distinct gradients between the 20th and 80th percentiles—and somewhat more so in the United States—but these are notably sharper for children from bottom-quintile and top-quintile parents.

The children of top-quintile parents in the United States have an almost 37% chance of staying in the top quintile as adults and face about a one in 10 chance of falling to the bottom fifth of the income distribution. Panel B shows that this tilt is also present in Canada but not as extreme: just less than a 30% chance of remaining in the top and more than a 15% chance of falling to the bottom.[17] A similar pattern is displayed at the other extreme of the income distribution. In both the United States and Canada, bottom-quintile children face about a one in three chance of an intergenerational cycle of bottom income, but a rags-to-riches movement is more likely for Canadians than Americans, the odds being less than one in 10 in the United States but higher in Canada. The 7.5% chance of moving from a bottom-quintile to a top-quintile family in the United States is the lowest probability listed in panels A and B.

The mobility of low-income Canadian children is even greater when they and their parents are ranked according to the US income distribution. Panel C of the table shows that they are somewhat less likely to stay in the bottom relative to their US counterparts (29.1% vs. 33.7%) and much more likely to rise to the top half of the income distribution, although not necessarily more likely to rise to the top fifth.

All three dimensions of this cross-country comparison, but in particular this last result related to the prospects of low-income children, put the so-called American Dream in sharp relief and offer stronger evidence to support the growing perception in the literature that this dream—if it is defined in terms of income mobility and the opportunity to, in terms of figure 1, "succeed regardless of family background"—is more of a reality in Canada than

[17] Nybom and Stuhler (2017) and O'Neill, Sweetman, and Van de gaer (2007) note that measurement error in both parent and child incomes influences transition matrices in a nonclassical way, leading to an overstatement of mobility in middle parts of the distribution and an understatement at the extremes. While our correction for measurement error in child incomes is imperfect—an averaging of only 2 years of child incomes—we do not expect this to influence quintile transition matrices, but for this reason we put aside a detailed look at the extremes of the percentile transition matrices.

in the United States. But the subnational research documented by Chetty et al. (2014) presents a challenge: the degree of intergenerational mobility varies significantly within the United States, with some regions showing much more mobility than that recorded even for the most mobile countries. Between-country comparisons have more relevance when they are also accompanied by within-country comparisons.

VI. Between-Country and Within-Country Comparisons

In fact, these markers of intergenerational mobility have somewhat more variation across the 288 Canadian census divisions than across the 709 US commuting zones for which we are able to calculate rank mobility estimates. The unweighted standard deviation of the rank-rank intercept is 6.82 in Canada and at 6.89 is about the same in the United States. But the standard deviation of the rank-rank slope is notably higher in Canada: 0.113 versus 0.0648. This suggests a certain overlap in these statistics across regions. The two countries, in other words, may not be perfectly distinguished by the border between them.

Figure 4 maps Canada and the United States according to the value of $P_{1,1}$, defined by the quintile cutoffs of the US income distribution. The roughly 1,000 regions of the two countries are categorized into five groups, with the most mobile cutoff placed at 0.2 and the upper cutoff placed at 0.35. There is a clear border effect between some parts of the two countries. An important exception involves the most mobile areas, extending from eastern parts of Alberta and the southern parts of Saskatchewan to neighboring North Dakota through the adjoining regions between Manitoba and Minnesota. But the national border is clearly distinguished further east, particularly between the lower Great Lakes region all the way through to the eastern seaboard. Most of the regions in the eastern part of the United States are characterized by a transition probability of 0.3 or higher. This part of Canada has only a few pockets with a greater than 0.35 chance of intergenerational poverty that are shared with regions scattered throughout the United States. For the most part, the highest probabilities of intergenerational cycles of low income are found in northern parts of Canada. Indigenous populations are significant in these areas, and many are sparsely populated.

Rags-to-riches mobility, $P_{1,5}$, is not as sharply distinguished between the two countries with one important exception. Figure 5 maps this probability. Southern Ontario—the most populous part of Canada lying north of Lake Ontario and Lake Erie—displays a similar bottom- to top-quintile mobility as adjacent regions in Michigan, Ohio, and New York State, with most regions being categorized in the 0.05–0.10 range. That said, some areas of Quebec adjacent to New York State, Vermont, and New Hampshire display a lower probability than their counterparts in Ontario and New England. Regions with rather high chances of escaping low income and rising

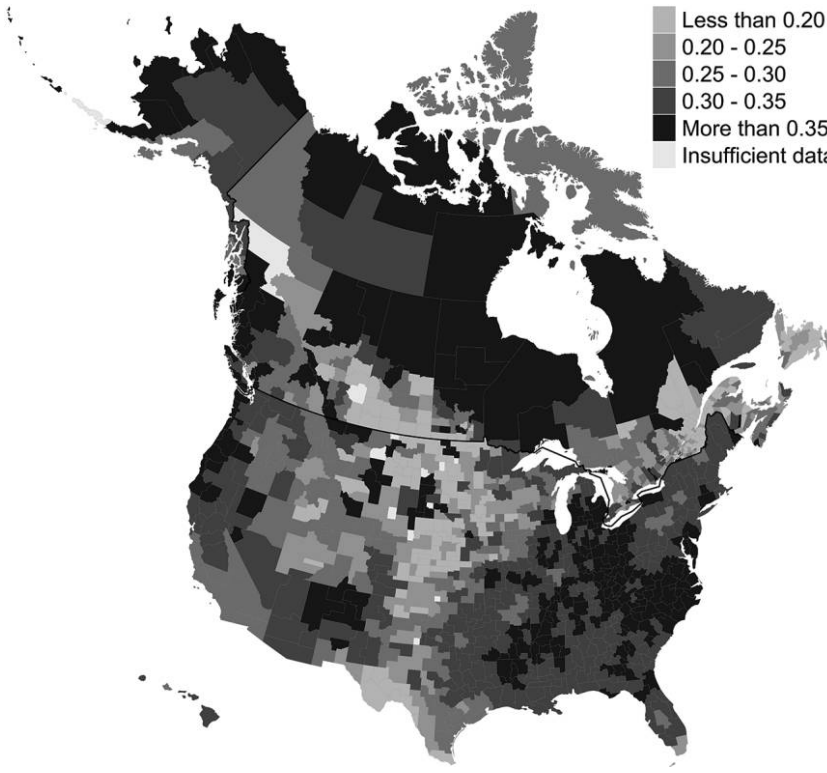

FIG. 4.—The intergenerational cycle of low income. Bottom quintile to bottom quintile transition probabilities in Canada and the United States show distinct patterns on either side of the national border. A color version of this figure is available online.

to the very top quintile cover the US Midwest, where in most commuting zones the probability is more than 20%, with similar probabilities being experienced in the adjacent regions of western Canada. Similarities also extend, roughly speaking, across the border into Canada from the northwest of the United States. The distinct difference between the countries is the significant pockets of very low bottom- to top-quintile mobility in parts of the southern states. This is a concentrated area of low upward mobility covering a significant proportion of the population that does not have a parallel in Canada, or at least to the extent that it does covers a rather small proportion of the Canadian population.

These comparisons are hard to generalize for at least two reasons. First, they are only two possible measures of intergenerational mobility. As policy relevant as they may be, they do not embody all dimensions of mobility. Second, while the maps are striking illustrations leaving strong impressions,

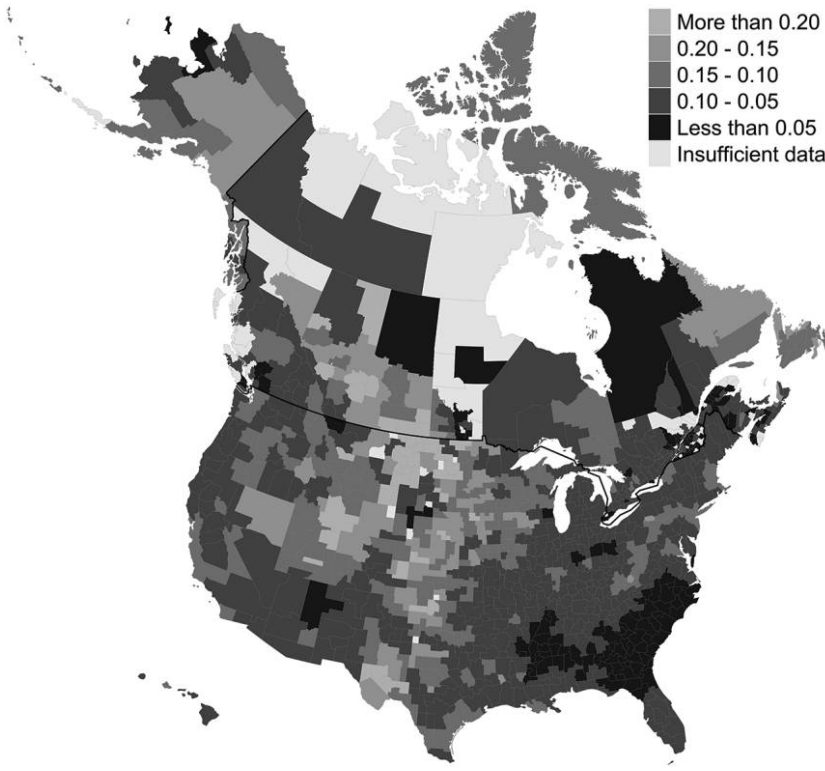

FIG. 5.—Rags-to-riches mobility. Bottom quintile to top quintile transition probabilities are not sharply distinguished on either side of the national border. A color version of this figure is available online.

they are based on arbitrary—although intuitively appealing—probability cutoffs. For these reasons we focus on an alternative descriptive approach that allows us to simultaneously use a total of five available indicators. We cluster the regions with *K*-means, an unsupervised machine-learning algorithm. To be clear, this is not an exercise in prediction, but rather one of clustering units into a predetermined number of groups according to a metric of all available mobility indicators. We chose the number of groupings according to our purpose. This is an exercise in description, intended to serve a communication purpose and set directions for more detailed analysis. It permits us to be agnostic about the choice of indicator in order to highlight which regions of Canada and the United States are more similar to each other than to other parts of the country. In this way we assess more rigorously whether and to what extent the national border falls out as the aftermath of the categorization.

In brief, *K*-means partition observations into groups that minimize the within-cluster variation, defined as the sum of all of the pairwise squared Euclidean distances. The optimization problem involves

$$\underset{C_1,\ldots,C_K}{\text{minimize}} \left\{ \sum_{k=1}^{K} \frac{1}{|C_k|} \sum_{i,i' \in C_k} \sum_{j=1}^{p} \left(x_{ij} - x_{i'j}\right)^2 \right\}, \tag{4}$$

where K is the number of predefined clusters, C_k denotes a cluster, i and j represent particular observations within a cluster, and x_j is one of the p features of the data. We use five such features: relative rank mobility as measured by the least-squares estimate of the rank-rank slope (b_j), absolute mobility as measured by the least-squares estimate of the intercept of the rank-rank regression (a_j), the mean of parent incomes in the region, and the two-quintile transition probabilities highlighted in figures 4 and 5, $P_{1,1}$ and $P_{1,5}$. It is in this sense that we claim to be agnostic as to the appropriate statistic measuring intergenerational mobility. The algorithm solving equation (4) is described in James et al. (2013) and Hastie, Tibshirani, and Friedman (2009).[18]

Figure 6 maps the US commuting zones and the Canadian census divisions when they are forced to belong to only two clusters. In other words, with this map we seek to determine whether the *K*-means algorithm would classify these regions into two groups according to the international border. It does so only partially, and in a way hinted at by the previous maps: large parts of Canada are grouped with the more mobile regions of the United States, but other parts are grouped with the less mobile US regions. The vast majority of Canadian census divisions covering the most populated parts of the country have a degree of intergenerational mobility more in common with each other than with neighboring regions of the northeastern United States. But these areas would also be grouped with regions in the midwestern parts of both countries. There are also regions in the north of the country that have more in common with a large swath of the US South and eastern seaboard than they do with the rest of Canada.

Panel A of table 4 offers the total number of regions and populations of these two clusters, with the population estimates coming from the 2001 Canadian and 2000 US censuses and the number of children from the tax-based

[18] We use the Stata package Cluster and the command "cluster kmeans" with 500 random restarts and present the results that maximize the Calinski-Harabasz pseudo *F*-statistic, which is the ratio of between-cluster variance to within-cluster variance. This is a top-down approach to clustering requiring the number of clusters to be predetermined. We employed up to 2,000 restarts and found no significant change in the results. We examined up to 10 predetermined clusters in deciding on the results in the text. An alternative approach would be to use agglomerative (bottom-up) clustering, which does not require the number of clusters to be prespecified.

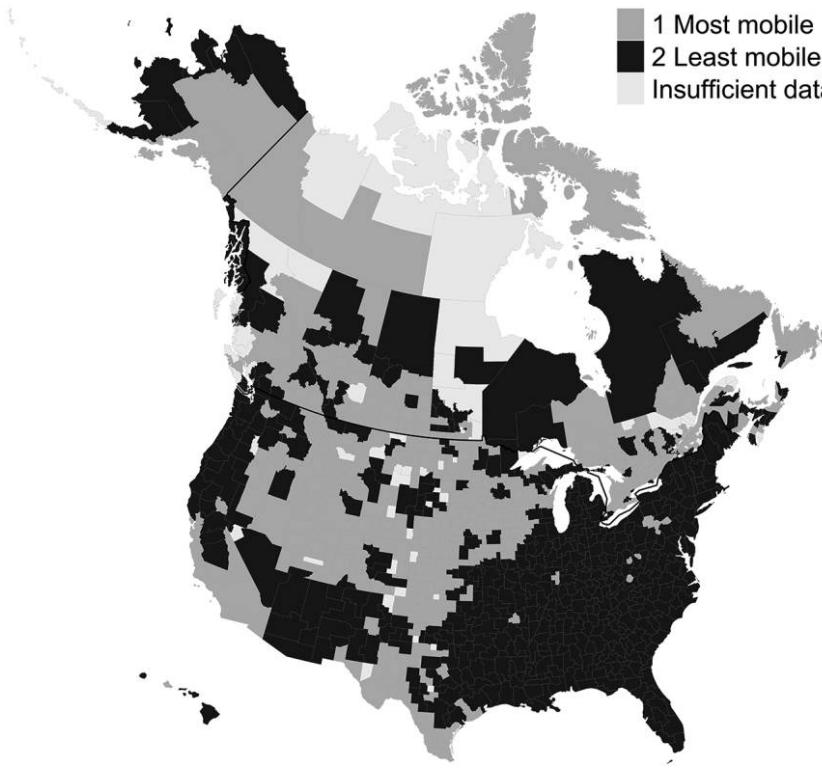

FIG. 6.—The Canada-US border would not be chosen by a machine learning algorithm minimizing within-cluster variance of five indicators of intergenerational mobility. A color version of this figure is available online.

analytical files. The table also offers population-weighted values of the five mobility indicators. The most populous cluster includes almost 246 million people and four-fifths of our sample, but as the accompanying table 5 shows it does not cover the most populous regions of Canada, which are included in the cluster that is more mobile according to the absolute and relative rank indicators and the two transition probabilities. About two-thirds of our sample—and 60% of Canadians according to the 2001 census—lived in the areas covered by cluster 1. This cluster is also a cluster of regions with lower average parent incomes.

This is not our preferred number of clusters and does not accurately capture the variance in the data. But that, in part, is the point. When subnational indicators of mobility are available for analysis they do not naturally support the conclusion that a simple between-country analysis is an appropriate way to view intergenerational mobility. We conduct the analysis repeat-

Table 4
Summary Statistics of Intergenerational Mobility Measures for Clusters of Canadian Census Divisions and US Community Zones, as Determined by *K*-means

Cluster Identifier	Number of Regions	Population (Thousands)		Rank Mobility		Transition Probability		Average Parent Income (US Dollars)
		Children	Total	Absolute (a)	Relative (b)	$P_{1,5}$	$P_{1,1}$	
				A. Two Clusters				
1	402	2,137	65,750	40.1	.239	10.7	27.0	83,508
2	556	8,411	245,948	32.3	.345	7.4	34.1	87,246
				B. Four Clusters				
1	153	350	9,021	46.3	.237	16.0	22.2	72,841
2	342	1,421	44,988	38.3	.253	8.1	28.0	64,745
3	149	5,822	178,081	34.1	.321	8.6	32.8	100,457
4	314	2,956	79,608	29.6	.376	5.9	36.0	68,953

NOTE.—Total population refers to populations estimates from the 2001 and 2000 censuses.

edly with up to 10 clusters being prespecified and judge that a four-cluster mapping is the best way to communicate the regional variation in mobility.

This is mapped in figure 7 and shows that the clustering continues to occur on either side of the international border, for the most part a line drawn along the Great Lakes and Saint Lawrence River regions, one that continues to distinguish the New England states from the Atlantic provinces. The clusters associated with the most and the least mobility span the border, one running through the Midwest of the United States and into Saskatchewan and most of Alberta, another grouping the southern United States with northern parts of Canada. Panel B of table 4 summarizes the mobility measures in this

Table 5
Distribution of the Number of Regions and Sample Sizes across Clusters for Canada and the United States: Two- and Four-Cluster Analyses

Cluster	Canada		United States	
	Number of Census Divisions	Number of Children (Thousands)	Number of Commuting Zones	Number of Children (Thousands)
	A. Two Clusters			
1	171	489	231	1,648
2	78	284	478	8,128
	B. Four Clusters			
1	40	103	113	246
2	175	552	167	869
3	5	88	144	5,733
4	29	28	285	2,928

NOTE.—Number of children refers to the size of the analytical sample.

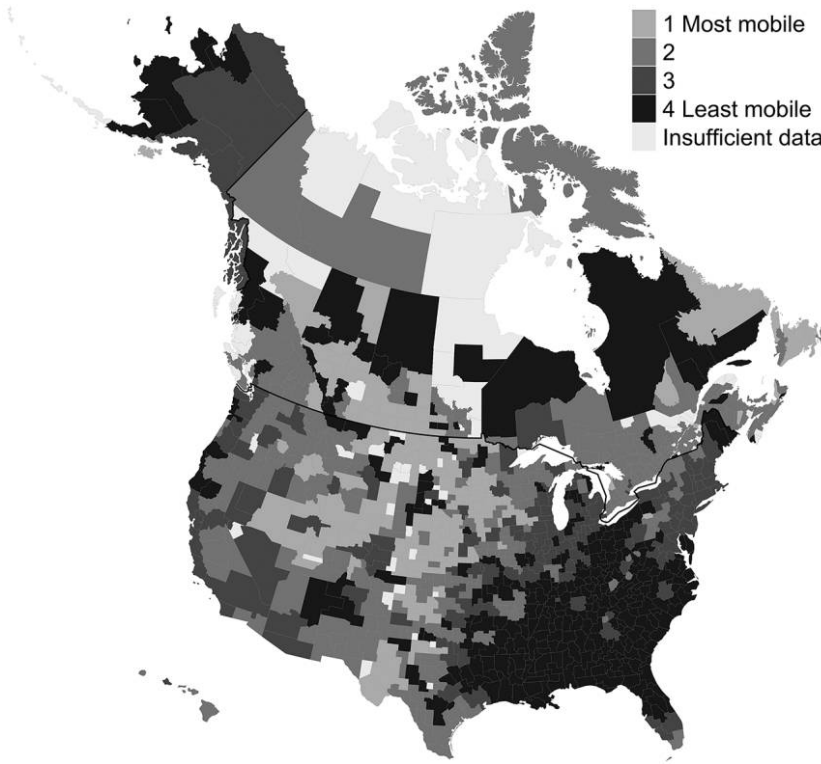

FIG. 7.—A four-cluster mapping shows that some regions lie largely on either side of the Canada-US border but that others are not confined to one country. A color version of this figure is available online.

four-cluster map. Cluster 3 contains the largest fraction of the population, and table 5 documents that it is almost exclusively based in the United States, covering significant portions of the northeastern, midwestern, and western coastal areas. Only five Canadian census divisions are grouped into this cluster. Cluster 3 is distinguished from clusters 1 and 2, which together geographically cover most of Canada and 85% of our sample. Mobility is generally lower in the US-dominant cluster 3, while average parental income is higher. A top percentile parent in cluster 3 has children who can expect to rank about 32 percentiles higher than a bottom percentile parent, almost a decile more than in cluster 2. The probability of an intergenerational cycle of low income is also significantly higher in cluster 3, on average about one-third.

The three clusters spanning the border are higher and lower mobility areas. Cluster 1 running through Alberta and Saskatchewan into the midwestern US states is the highest mobility area of these two countries, with absolute rank mobility of more than 45 percentiles and probabilities of rags-

to-riches movement and intergenerational low income in the neighborhood of 20%. This cluster includes significant parts of the provinces of Alberta and Saskatchewan as well as of Newfoundland and Labrador, a province traditionally considered a low-income/low-mobility region. These regions experienced robust labor markets during the period we are measuring child outcomes as a result of a boom in oil, potash, and other commodity prices. Rising wage rates and labor supply led to significant increases in median incomes during the first decade of the twenty-first century.[19] This highlights the fact that our measure of permanent income for children may be less than perfect in a way that has differential national impacts. Measurement error in child incomes is often not considered to imply an attenuation bias in the estimation of the intergenerational income elasticity, leading only to a loss of efficiency. But this is not the case with rank-based statistics, which require both parent and child incomes to be corrected for measurement (Nybom and Stuhler 2017). We average child incomes over only a 2-year period during the height of this boom and as such do not take the period of lower prices after 2014 into account. In this sense, these time-specific events likely lead us to overstate the permanent incomes of children in these Canadian regions.

This would also apply to regions of the United States experiencing a commodity boom at the same time. It is interesting to note that Corak (2018) averages child incomes over a 5-year period ending in 2008, and while Newfoundland and Labrador do not appear as a particularly high-mobility region, at least for a cohort of Canadians who as adults were 38–45 years of age, Saskatchewan and Alberta continue to represent the most mobile regions of the country. This suggests that something other than a transitory shock is at play in determining our results. Even to the extent that our findings are related to commodity price movements, this would reflect a clear lesson from theory: that relatively more equal and inclusive labor markets lead to more generational mobility. The commodity boom should not be understood as the sole driver of mobility in this cluster, which also includes communities that have other advantages. As theory and Chetty et al. (2014) stress, these relate to family structure, community resources associated with social capital, and an ethic of geographic mobility.

Average parent income is not noticeably different across the three clusters spanning the border. The most mobile cluster, labeled cluster 1, is significantly less populated than the low-mobility cluster, labeled cluster 4 in figure 7 and table 4. Cluster 4 is most notably distinguished from the others by a very low rags-to-riches movement and has the highest chance of intergenerational low income. The chances that a child born to bottom-quintile parents will also be a bottom-quintile adult averages 36%. Escaping low in-

[19] See Corak (2016), fig. 15, and more detailed analyses by Fortin and Lemieux (2016) and by Marchand (2012, 2015).

come is a challenge not only in the southern United States but also in some northern parts of Canada.

We examined an alternate specification that undertook the clustering not on the standardized values of the five features but on the standardized residuals of least-squares estimates in which each feature is regressed against a set of variables that the literature suggests are correlated with mobility. These are described in the next section and include the Gini coefficient, the unionization rate, variables related to family structure, the racial and ethnic composition of the population, the educational qualifications of the adult population, the labor force participation rate of teenagers, and employment shares by industry. Using the residuals from these models removes part of the observed variation in mobility across regions. This analysis continues to find that Canada's population share located in the cluster with the highest mobility is larger than that for the United States, 24% versus 21%. In addition, 30% of Americans live in low-mobility areas, compared with 20% of Canadians. The implication is that our major findings continue to hold even when accounting for a host of observable characteristics.

Another check on our findings focuses the analysis on the border regions. We reexamined the original clustering analysis by using only regions close to the border, defined as the straight-line distance from the centroid of each census division and commuting zone to the international border. We examined regions defined by distances ranging from 100 to 600 kilometers. Sixty-one percent of Canadians live in the 107 census divisions within 100 kilometers to the border, but only 4.7% of Americans live in the adjacent 39 commuting zones. These proportions rise to 78% and 11% when we use a 200-kilometer limit and to 96.6% and 46.5% when we use a 600-kilometer limit. A two-cluster map using only the regions falling within a 600-kilometer straight-line distance looks essentially like figure 6, with the Great Lakes and northeastern regions of the United States continuing to be clearly distinguished from the central and eastern parts of Canada.[20] Table 6 offers the same summary information as table 4 for these regions, yielding similar results.

The grouping of these regions into four clusters is also presented in panel B of the table, with figure 8 offering the equivalent four-cluster map. These results echo those described in table 4, allowing us to summarize by suggesting that Canada and the United States share regions of both high and low mobility but are distinguished by the fact that on average Americans live in regions of less mobility, parental income ranks being more strongly related to child ranks and the chances of escaping low income being lower. What also drives the cross-national differences in mobility indicators is the fact that the low-mobility regions the two countries have in common

[20] The most notable difference is that a few more regions in central New Brunswick and Nova Scotia are classified as parts of the second cluster.

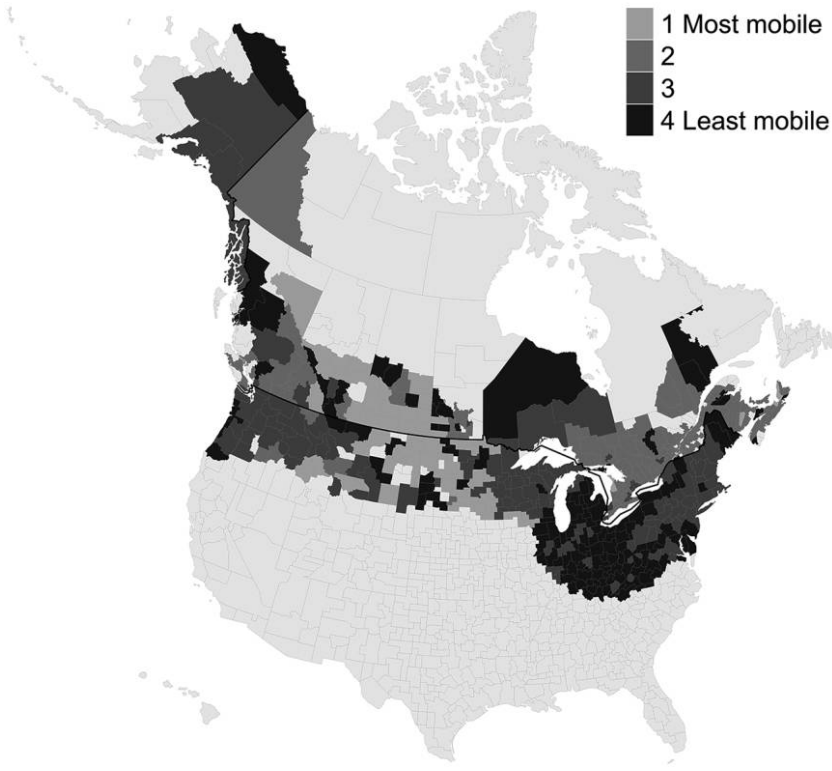

FIG. 8.—Four-cluster mapping using only regions within 600 kilometers of the border. A color version of this figure is available online.

Table 6
Summary Statistics of Intergenerational Mobility Measures for Clusters of Canadian Census Divisions and US Community Zones within 600 Kilometers of the Border, as Determined by *K*-means

Cluster Identifier	Number of Regions	Population (Thousands)		Rank Mobility		Transition Probability		Average Parent Income (US Dollars)
		Children	Total	Absolute (*a*)	Relative (*b*)	$P_{1,5}$	$P_{1,1}$	
				A. Two Clusters				
1	217	623	20,020	42.7	.224	10.5	24.6	70,183
2	286	4,663	140,088	33.4	.342	8.0	34.4	94,447
				B. Four Clusters				
1	68	146	4,031	47.5	.234	16.9	21.3	67,499
2	161	430	16,233	39.7	.227	6.2	26.5	61,316
3	129	2,386	76,191	36.3	.308	9.8	32.1	100,962
4	145	2,323	63,653	30.4	.381	6.5	37.0	89,172

NOTE.—Total population refers to population totals from the 2001 and 2000 censuses.

carry different weights in the overall national populations. The low-mobility regions of the United States weigh more heavily in determining country-wide mobility than they do in Canada. For example, the weighted average of the absolute rank mobility statistic is 35.8 in the United States and would rise to 39.6 if the regions in cluster 4 were excluded from the calculation. A similar calculation in Canada sees the statistic moving up less dramatically, from 40.6 to only 41.4. The rags-to-riches probability increases from 10% to 12.4% in the United States but only from 8.54% to 8.59% in Canada.[21]

VII. Correlates of Intergenerational Mobility

Our analysis makes no pretense of offering causal explanations, either of the intergenerational mobility process or of the role of the national border. That said, there are clear and well-documented differences between and within these two countries, which our review of theory suggests all play a role in determining child outcomes, including differences in labor markets, demographics, and public policies associated with income support and investments in children. The most notable of these is the level of posttransfer income inequality that has been stressed in the literature on cross-country comparisons, including, among others, Solon (2004) and Corak (2013). Figure 9 offers a version of the Great Gatsby Curve using our estimates of the slope of the parent-child rank-rank regression for each region, our data not providing the basis for deriving the covariate generally used in this literature, the intergenerational income elasticity. As such, this is likely an attenuated version of the curve, not being influenced by differences in the variance of incomes between generations. The positive relationship between inequality, as measured by the Gini coefficient for the parent incomes, and relative rank mobility is clear.[22] Chetty et al. (2014) point out that the Great Gatsby Curve is present within the United States, and figure 9 suggests that it also exists within Canada as well as across the joint landscape of the two countries.

It is also clear from the picture that the strong majority of Canadian census divisions have a level of inequality that is comparatively lower than many of the US commuting zones. The median value of the Canadian Gini is 36.4, and three-quarters of the observations have a coefficient of less than 39.2. The US median is 39.8, with three-quarters of the observations falling below

[21] The changes in the bottom quintile to bottom quintile transition probability are more similar, going from 30.7% to 27.3% in the United States and from 26.6% to 24.8% in Canada. There would be a substantial jump in average community income in the United States amounting to more than $5,000, but just a $700 increase in Canada.

[22] A small number of communities with a Gini coefficient of 65 or greater are dropped from the picture for the sake of exposition. They are not used in deriving the least-squares line also drawn in the picture, which is based on an unweighted regression.

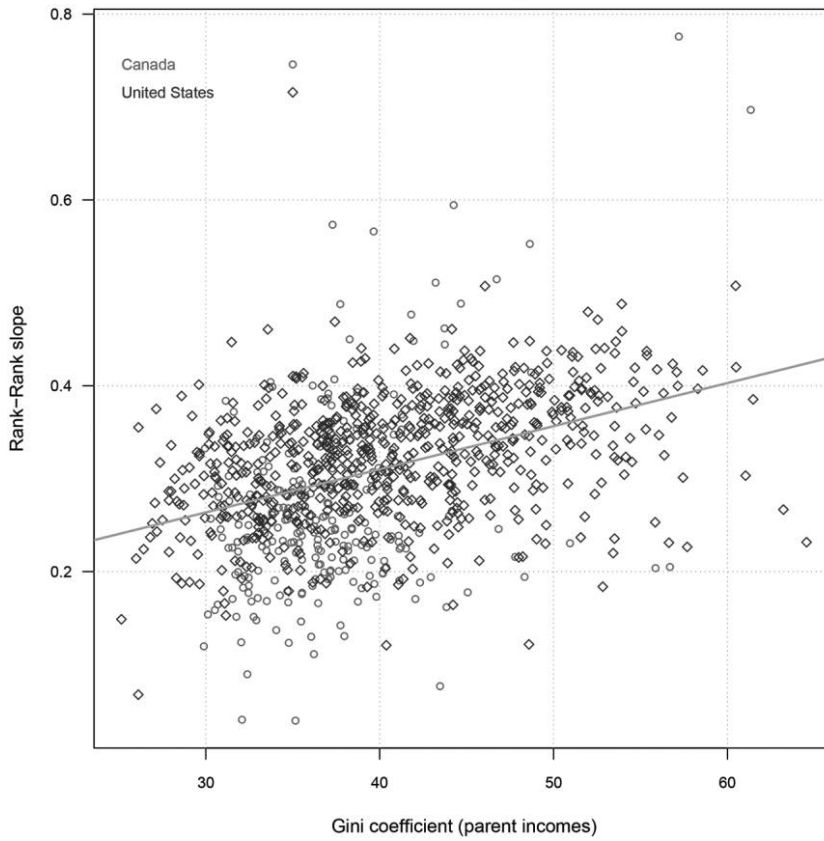

FIG. 9.—Great Gatsby Curve for Canada and the United States: intergenerational rank mobility and inequality. A color version of this figure is available online.

45.7. It also appears from the picture that the relationship between these two variables is stronger in the Canadian data. These impressions are clear in the first row of panel A of table 7, which presents correlation coefficients between relative rank mobility and inequality. The correlations with a number of other community characteristics are also offered. Panel B presents the correlations with absolute rank mobility.[23]

The correlation coefficient between relative rank mobility and the Gini is 0.381, but it is 0.425 for the Canadian data. The other factors most strongly correlated with relative rank mobility have to do with demographics: 0.498 with the fraction of single mothers in the community and 0.473 with the

[23] The country-specific estimates in this table are based on a within-country standardization of the data to have mean 0 and standard deviation 1, while the entries for both countries are based on all of the regions from both countries.

Table 7
Correlation Coefficients between Mobility Indicators and Community Characteristics: Canada, United States, and Both Countries Together

	Canada		United States		Both Countries	
Community Characteristic	Estimate	SE	Estimate	SE	Estimate	SE
	A. Relative Rank Mobility					
Gini coefficient	.425	.054	.345	.035	.381	.029
Fraction single mothers	.142	.059	.641	.029	.498	.028
Fraction divorced	−.200	.058	.158	.037	.175	.031
Fraction married	−.190	.058	−.370	.035	−.122	.032
Fraction black	−.140	.059	.631	.029	.473	.028
Fraction visible minority	−.102	.059	−.260	.036	−.078	.032
Fraction Indigenous	.520	.051	.022	.038	.215	.031
Fraction white	−.475	.052	−.225	.037	−.357	.030
Fraction foreign born	−.202	.058	−.247	.036	−.260	.031
Fraction high school dropout	.417	.054	.378	.035	.009	.032
Fraction university degree	−.263	.057	−.263	.036	−.012	.032
Teenage labor force participation	−.061	.059	−.516	.032	−.199	.031
Unionization rate	.091	.061	−.138	.037	−.293	.031
Manufacturing employment share	−.194	.058	.393	.035	.165	.031
Resource employment share	.207	.058	−.354	.035	−.157	.031
	B. Absolute Rank Mobility					
Gini coefficient	−.563	.049	−.557	.031	−.583	.026
Fraction single mothers	−.421	.054	−.780	.024	−.727	.022
Fraction divorced	−.090	.059	−.438	.034	−.426	.029
Fraction married	.311	.056	.557	.031	.285	.030
Fraction black	−.081	.059	−.627	.029	−.576	.026
Fraction visible minority	−.118	.059	.084	.037	−.035	.032
Fraction Indigenous	−.567	.049	−.157	.037	−.241	.031
Fraction white	.588	.048	.427	.034	.511	.027
Fraction foreign born	−.122	.059	.036	.038	.031	.032
Fraction high school dropout	−.087	.059	−.431	.034	.032	.032
Fraction university degree	−.060	.059	.126	.037	−.106	.032
Teenage labor force participation	.032	.059	.642	.029	.336	.030
Unionization rate	−.087	.061	.079	.037	.285	.031
Manufacturing employment share	.012	.059	−.307	.036	−.227	.031
Resource employment share	.291	.057	.584	.030	.511	.027

SOURCE.—Authors' calculations based on least-squares estimates of standardized data.

fraction who are black. But these two variables also show different patterns between the countries, both correlations being higher than 0.6 in the United States and much smaller in Canada. In fact, while the correlation with the black fraction of the population is statistically significant in the Canadian-only data, it is estimated to have a negative sign. This contrasts with the fraction of Indigenous peoples in the population, which has a much larger coefficient in Canada, the positive correlation with relative rank estimate indicating lower mobility. These patterns hold when the focus is on the relationship with absolute rank mobility in panel B of the table, with the addition of

the fraction of divorced parents also being significant in the United States but not in Canada. Both absolute and relative rank mobility are lower in Canadian communities with a higher Indigenous population share and lower in US communities with a higher black share.

These patterns continue to hold in multivariate regressions with important nuances. The Indigenous population share is a particularly strong correlate of less mobility in Canada, and though not as large in the United States it is nonetheless significant both in magnitude and statistically when the focus is on absolute rank mobility. The black share of the community population is associated with lower absolute mobility in the multivariate US results, while the fractions of divorced and of single parents become more important. These results are available on request and are used to derive a Blinder-Oaxaca decomposition of the mean differences in relative and absolute mobility between the two countries. This suggests that these factors "explain" 5.9% of the relative mobility difference and 89.1% of the absolute difference. While these decompositions and correlations only hint at suggestions for future causal analysis, in combination with our cluster analysis they offer a clearer picture of the descriptive differences between the countries. We suggest three broad themes calling for more analysis.

The first difference that merits study concerns the fact that race plays out differently in the two countries: being black matters for intergenerational mobility in the United States. To the extent that the communities we highlight as part of cluster 4, the low-mobility cluster dominated by the southern US states, have a higher black population, then this must be part of the explanation for the cross-country differences. This suggestion fits well with both Hertz (2005) and Bhattacharya and Mazumder (2011), who find that intergenerational mobility—particularly absolute mobility—among the black population is a good deal lower than that among the general population. It also meshes with Chetty et al. (2018), who offer a detailed geographic analysis of mobility by race, documenting the significantly lower rates of mobility among black men, and with Berger (2018), who associates US regions having low chances of upward mobility with a higher prevalence of slavery at the time of the Civil War, documenting a negative correlation between upward mobility measured by $P_{1,5}$ and prior slavery. It may be that the Canadian communities in this cluster also have significant challenges associated with minority status, but this is more likely reflected in the Indigenous status of their populations and in this way has more in common with the low-mobility commuting zones in the midwestern United States also falling into cluster 4, which Chetty et al. (2014) identify as native reservations.

The second difference requiring further study concerns the nature and role of inequality—both labor market inequality and after tax-transfer inequality—reflecting the role of income support. Inequality is a strong correlate of intergenerational mobility, and the other distinguishing feature of the Canada-US landscape is that virtually all communities belonging to clus-

ter 3 fall on the US side of the border. The Gini coefficient in these areas is notably higher than cluster 2, the cluster grouping the dominant proportion of the Canadian population. The mean Gini coefficient in cluster 3 is 42.6, compared with 37.5 in cluster 2, and the cutoffs for the third quartiles are 47.7 and 40.1, respectively. Top-end inequality is much higher in these regions of the United States than in Canada, but as both Chetty et al. (2014) and Corak (2018) point out in separate analyses of the two countries, it is bottom-end inequality and the share of the middle-income population that matters for regional variation of intergenerational mobility. This may be a reason why cluster 3 does not cross onto the Canadian side of the border. Derenoncourt (2018) examines the hypothesis that inequality in the lower end of the distribution may also be related to race, suggesting that cities and neighborhoods changed in ways that discriminated against blacks who moved northward during the Great Migration. Her results suggest that access to public goods and schooling became more restrictive, with "white flight" depriving these migrants and their children of public investments that in turn had long-term negative consequences that continued across generations. If this is the case, then the country differences in mobility processes reflecting the dominant position of cluster 3 in the United States may be interrelated with the differences reflected in cluster 4 and in this way also associated with the distinct racial patterns on the US side of the border.

The third issue meriting study concerns how these two themes, both related to the inequalities embedded in labor markets, interact with family structure and the support and investments families are able to make in their children. Marriage, divorce, and single motherhood seem to play out differently in the two countries, the intergenerational consequences being more detrimental in the United States. We have no basis for disentangling demographic influences on intergenerational mobility from labor market and public policy influences, but it is clear that these three broad factors interact in different ways across the border and that the underlying causal directions—whether from labor market outcomes to family structure or the opposite—will in part inform the role and design of public policy.

VIII. Conclusion

Intergenerational income mobility is lower in the United States than in Canada, even when Canadians are placed in the US income distribution. This is the case almost without regard to the statistic used to gauge intergenerational dynamics: income mobility, rank mobility, or directional mobility measured by transition matrices. For example, our analysis of rank mobility shows that Canadian children raised by parents in the bottom fifth of the income distribution can on average aspire to rise more than 30 percentiles, approaching the median income in their generation. This is almost 10 percentiles higher than the expected rank of their US counterparts. These dif-

ferences in rank mobility reflect a combination of differences in absolute mobility, the expected rise in the income distribution of a child raised by bottom-ranking parents, and differences in relative mobility, the transmission of an additional percentile rank among parents to their children.

We document public opinion research that we interpret as suggesting that a comparison between these two countries may be particularly apt. Canadians and Americans share values associated with their personal aspirations and the aspirations they hold for their children. The American Dream has a very similar meaning on both sides of this international border, and citizens seem to have a common perspective on the importance of individual initiative and responsibility and on the value associated with equality of outcomes versus equality of opportunity as social goals. As such, a pairing of these two countries may offer insights into the drivers of intergenerational mobility. Comparisons of the United States with many other countries might be interpreted as being policy irrelevant because the results may reflect differences in underlying values and social choices. A Canada-US comparison cannot be as easily dismissed.

The most important difference between Canadians and Americans has to do with their perspectives on the role of the government in supporting individuals and families in striving to realize their aspirations, with Canadians being significantly more inclined to see government as a help rather than a hindrance. Progressive public policies are one factor promoting intergenerational mobility, but there are many others. These have to do with the strength and capacities of families to invest in the human capital of their children and to support them in all of the transitions they must make from infancy to adulthood and with the structure of labor markets that reflect the economic returns to skills and education. Public policy, families, and labor markets all interact to determine differences in intergenerational mobility across space.

Our analysis of administrative data associated with the income tax records of the labor market outcomes of a cohort of Canadian men and women born in the early 1980s, a data set we construct to resemble that used by Chetty et al. (2014) for the United States, allows us to document the level and variation of intergenerational mobility across about 1,000 small areas that completely cover these two countries. This between- and within-country description shows considerable variation in outcomes within both countries, and we use unsupervised machine learning to cluster regions that are most similar across a battery of five related measures of mobility.

The findings support two broad descriptive conclusions that call for more detailed study. The first conclusion is that it is too simplistic to suggest that the international border is the most accurate way to understand the variation across these regions. Many areas in Canada share very high levels of intergenerational mobility with many areas in the United States. At the same time, some of the least mobile Canadian regions have more in common with the least mobile parts of the United States than they do with other parts of

Canada. The second conclusion is that the Canada-US landscape can be best summarized as consisting of four broad regions, three that the countries share and one that is almost entirely American.

These findings in turn raise at least two issues that may help in understanding the underlying drivers of intergenerational mobility. One important reason that there is less intergenerational mobility in the United States has to do with the very low levels of mobility in the US South. While some parts of northern Canada share these challenges, they represent a much smaller fraction of the Canadian population. The US challenge may have to do with the long-standing issue of fully integrating the black population into the economic mainstream of cities and regions that have a long history of exclusion. As such, our findings echo existing research suggesting that there is a much lower degree of mobility among the black population in the United States. The Canadian challenges may be just as important, but they are different in nature, more likely being associated with the Indigenous populations in some geographically more isolated areas of the country. There is no parallel in Canada for the magnitude of the experiences in the US South, which as Alesina and Glaeser (2004) stress is a central factor in understanding US-European differences in the nature and size of the welfare state. We suggest that these same issues may be playing out in understanding the relatively low level of intergenerational mobility in the United States and by implication the greater capacity for the Canadian welfare state to reduce poverty rates and lower inequality in the lower half of the income distribution.

Another reason there is more intergenerational mobility in Canada concerns a region of affluence but of low mobility that is distinct to the United States. Many regions along the Great Lakes and northeastern seaboard of the United States are characterized by a relatively lower degree of mobility. They are not part of the Canadian landscape, with the great bulk of the Canadian population living in adjacent yet relatively more mobile communities. These Canadian communities are on average less affluent, but they are also characterized by less income inequality. This finding suggests that the search for causal explanations place less emphasis on inequalities in family life and private and public investments in education and look more carefully at the structure of labor markets, at the returns to human capital, and at income support to the least advantaged, an insight offered on one level by the Great Gatsby Curve. For example, Rothstein (2018) carefully mines the commuting zone data on relative rank mobility produced by Chetty et al. (2014) to show that parental influences on the educational attainment of their children may be second order in determining the degree of intergenerational mobility. His results emphasize the relatively strong role that variations in the returns to human capital across regions play in determining the degree to which income is transmitted across generations. Our findings also lean in this direction, suggesting an important role for labor market institutions—

and the inequalities embedded in them—as a potential factor in understanding Canada-US differences.

Appendix

The Nature of the Canadian Intergenerational Data

The Intergenerational Income Database (IID) consists of Canadian income tax records in which parent-child pairs are identified and followed over time, allowing for the study of the intergenerational transmission of income. The algorithm used to create the data, which is housed at Statistics Canada, is described in Corak and Heisz (1999). The data are based on the tax filings—the T1 forms Canadians are required to submit to the tax authorities—for selected cohorts of 16–19-year-olds. The original version of these data uses children who fell into this age group in 1982 and 1986, as analyzed by Chen, Ostrovsky, and Piraino (2017) and Corak (2018).

One contribution of our research is the updating of the data to include parent and child records for more recent birth cohorts, those born between 1972 and 1985, and who are linked to their parents in 1991, 1996, or 2001. The following table summarizes the population counts and compares them to the census totals.

Cohort	Birth Years	IID Count	IID Weighted	Census	Ratio
1982	1963–66	1,183,614	1,517,127	1,723,720	.880
1984	1965–68	1,124,849	1,517,126	1,563,105	.971
1986	1967–70	1,155,248	1,517,127	1,520,745	.998
1991	1972–75	1,102,855	1,484,566	1,495,750	.993
1996	1977–80	1,166,879	1,558,393	1,570,605	.992
2001	1982–85	1,350,222	1,634,646	1,642,535	.995

Statistics Canada uses a variety of mechanisms to link parent and child T1 forms. In part, this relies on the Family Allowance, a demogrant to families with children, and in part through an algorithm created and described by Corak and Heisz (1999) relying on the tax-filing behavior of children while living at home. The linkage is based on the T1 Family File, an administrative database of the universe of T1 records from the Canada Revenue Agency that Statistics Canada has developed to identify family members, some of whom are imputed. The process involves using the reported spousal social insurance number on the T1 form—which covers both married and common-law partners—to identify couples as well as the names and addresses of tax-filing children.

The coverage rate, as measured by the number of children in the tax files divided by the relevant population from the census, ranges from 59% to 82% and, as the above table shows, from 88% to 99.8% when weighted. A parent-child match requires the child to file a tax return in at least one year while living at home. The algorithm first attempts to find a match when the children

are 16–19 years of age, and if it is not found it then proceeds to successive attempts in up to each of the five following years. While the universe of all tax filers is available, not all children born in the relevant years for the cohort are part of the final data. Weights are provided to correct for possible undercoverage, as described by Cook and Demnati (2000) and Statistics Canada (n.d.). For the original cohorts, the weights take into account gender, the first two characters of the postal code, and the parents' total market income split into 11 income classes. For the update, an additional step is added to deal with adult tax filers who could be linked to their parents in the 3 years preceding the cohort year (and who end up not being linked in the IID).

The covariates available in the data are limited to information reported for tax purposes and include current marital status, language in which the tax filer completed his or her T1 form, the six-character alphanumeric postal code (in the year the child was linked to the parent), and a unique and confidential identifier for the partner. The T1 files also include all of the income information available on the tax return: various income sources, such as earnings, self-employment net income, interest and investment income, dividends, other employment income, rental income, and different government benefits. Detailed geographic information based on census geographic coding is added to the individual records by Statistics Canada for the census year closest to the year the parents and children are linked. For example, the postal codes from tax years 1997 through 2001 can be linked to files containing information based on the 1996 census geography; for the years 2002–6, they can be linked based on the 2001 census geography. Individuals who immigrated to Canada after the age of 19 are not in scope, even if their later tax records are part of the T1 Family File. Also, while our analysis makes reference to "children and their parents," no biological link can be established, and "parent" should be understood in this sense.

Analytical Sample and Variable Definitions

Our analysis is based on an analytical file we create in order to make the data as comparable as possible to the core data sample used by Chetty et al. (2014), defined as all children born in the 1980–82 birth cohorts for whom parents can be identified and whose mean parent income between 1996 and 2000 is no less than 500 US dollars. We select all children born in 1980 (coming from the 1996 cohort) and 1982 (coming from the 2001 cohort). Due to the age at which the children are matched to their parents (16–19 in the first year the match is attempted) and the tax years that are used to conduct the initial match (1996 and 2001), the Canadian data do not contain individuals born in 1981.[24] Our sample consists of 556,949 unweighted observations for

[24] We drop a handful of observations for which a longitudinally consistent year of birth is not equal to the year of birth from the T1 Family File, which is taken from the T1 form of the year linked and which is the basis of our chosen age group. We also exclude children who were linked to their parents at age 20 or more, al-

analyses at the national level, 294,462 children born in 1980 and 262,487 in 1982.

Selection Rule	1996 Cohort	2001 Cohort	Total
Full sample	1,166,879	1,350,222	2,517,101
Birth year 1980 and 1982	297,662	322,210	619,872
Birth year matches longitudinal birth year	297,647	322,049	619,696
Matched at age 19 or less (2001 cohort only)	297,647	266,904	564,551
Postal code present	296,508	266,253	562,761
Parental income US$500 or higher	294,462	262,487	556,949

Parent income is defined as the 5-year average of the total household income before taxes but after transfers, using the Canada Revenue Agency definition of total income. From 1982 onward this includes Canada/Quebec Pension Plan benefits, capital gains/losses calculated, dividends (taxable grossed up), earnings from T4 slips including commissions, interest, and investment income, Old Age Security pension, other employment income, other income, pension and superannuity income, rental income, self-employment net income (from business, commission, farming, fishing, or professional activities), and employment insurance benefits. We use each parent's total income for the tax years 1996–2000, a potential of up to 5 years for each parent. If we cannot find a parent's tax record in a particular year, we assign a value of zero. We sum the father's and mother's total income and take the mean; that is, we add up all of the income and divide by five.

Note that if the child is recorded as having two parents in the year linked but the parents separate or divorce at a later date, we continue combining the individual incomes of the mother and father as defined in the year linked. Also, since the children born in 1982 are from the 2001 cohort, two "parents" can be identified in the year linked (2001 or later) but traced back in time even if they had not yet formed a household. Suppose a 2001 cohort child's mother and stepfather start filing taxes using the same address in 2000; then in 2001 they would both be considered the child's parents. This implies that in computing the mean parental income from 1996 to 2000, the mother and stepfather were actually not in the same household from 1996 to 1999.

though sensitivity analyses (not reported here) show that this exclusion does not change the results in a significant way.

Descriptive Statistics for Parents	Mean	SD	Median
Family income (1996–2000 average)	63,440	96,169	52,090
Family income (US$500 or higher)	64,277	96,497	52,770
Percentile rank in US family income distribution	37th		
Top parent earner income	48,618	87,261	39,310
Fraction single parents	.185		
Fraction female among single parents	.700		
Fraction married parents	.768		
Fraction common-law partners	.047		
Father's age at childbirth	30.07	6.16	29
Mother's age at childbirth	27.49	5.58	27
Father's age in 1996	45.07	6.23	44
Mother's age in 1996	42.49	5.64	42
Gini coefficient, parental family income	42.07		

The descriptive statistics in the above table show that 76.8% of children grew up in households with married parents, 4.7% with common-law partners as parents, and the balance, 18.5%, with single parents. Our main parental income variable is based on a restriction of having an average income from 1996 to 2000 of US$500 or higher, which puts aside less than 1% of the sample. This is the average of total income including benefits, over 5 years, for one or two parents. Given the relatively more generous social safety net in Canada, ultra-low-income situations are likely to be coding errors and not representative of a low-income situation, and excluding them is the reason for the cutoff.

Following Chetty et al. (2014), we define child income as the mean of the child's total income for the tax years 2011 and 2012. If a spouse is reported, this includes the spouse's total income figures for the same years. If we cannot find a child in both the 2011 T1 file and the 2012 T1 file, meaning that his or her income information is missing, we assign income a value of zero. This is done to be consistent with Chetty et al. (2014). Just under 10% of children in the sample have an average income of US$500 or less (including those who were missing). We also defined a series of analytical samples based on assigning US$500 and US$1,000 to individuals reporting less than those amounts.

Descriptive Statistics for Children	Mean	SD	Median
Family income (2011–12 average, coding missing as US$0)	51,819	49,294	44,950
Percentile rank in US family income distribution	48th		
Fraction with family income under US$500 or missing	.098		
Family income (2011–12 average, excluding less than US$500)	57,441	48,678	50,090
Individual income (2011–12 average)	32,547	31,453	29,220
Individual earnings (2011–12 average)	27,963	28,051	24,610
Fraction female	.490		
Fraction married in 2011	.308		
Fraction married in 2012	.334		
Fraction having a common-law partner in 2011	.160		
Fraction having a common-law partner in 2012	.163		
Child's age in 2011	30.0	1.0	31
Gini coefficient, child family income	44.08		

Dollar figures in the original data files are expressed in Canadian current dollars, and we adjust for inflation by converting to 2012 Canadian constant dollars using the consumer price index, based on the information reported by Statistics Canada. We then convert to 2012 US dollars using the Organization for Economic Cooperation and Development's purchasing power parity for private consumption for 2012, a value of $1.284164 Canadian for each US dollar.[25] Canadian children and their parents are assigned ranks in the US income distribution based on this purchasing power parity–converted total income. The online data appendix from Chetty et al. (2014) offers the national marginal income distributions by percentile in its table 2. We use the midpoints between the mean parent and child incomes for each percentile of the respective income distributions rounded to the nearest 100 as our percentile cutoffs.[26]

All relevant Canadian computations are weighted, with the weights taken as provided for children born in 1980 but rescaled for those born in 1982 to equal the sum of the 1980 weights. Our findings are not sensitive to this rescaling. The geographic coding is based on the postal code in the year linked and the boundary definitions in the 1996 census. Children born in 1980 and 1982 are in different IID cohorts and different years linked, meaning that their residence in their teen years would be closer to the 2001 census than the 1996 census. We use the 1996 geography for all of the observations in our analytical sample to avoid issues associated with boundary changes. The provincial and territorial boundaries do not change, apart from the creation of Nunavut in 1999. The census division is also a stable geographic unit during the time frame of our analysis. Census divisions span

[25] Retrieved online at http://stats.oecd.org/Index.aspx?datasetcode=SNA_TABLE4.

[26] Retrieved online at https://opportunityinsights.org/paper/land-of-opportunity/.

the entire country and reflect local and provincial administrative units, such as counties, regional districts, regional municipalities, and other types of provincially legislated areas. There are 288 census divisions in the 1996 and 2001 census geographies. The following table shows the census population estimates for Canadian census divisions and US commuting zones. The average commuting zone used by Chetty et al. (2014) has more than three times the population of the average census division, the total population of the United States being nine times that of Canada. There are roughly 2.5 times more commuting zones than census divisions.

Population by Region	Census Divisions	Commuting Zones
Number of regions	288	741
Average population	107,712	379,787
Median population	39,367	103,842
Minimum	1,375	1,193
Maximum	2,592,460	16,393,360
Bottom percentile	5,064	2,407
5th	10,490	6,745
10th	13,673	11,487
25th	22,166	38,384
75th	84,551	289,849
90th	170,038	803,201
95th	421,969	1,533,306
Top percentile	1,851,746	4,642,561
Total population	31,021,250	281,421,900

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