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# Growth and the Standard of Living in a Pioneer Economy: Upper Canada, 1826 to 1851

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## I. Introduction

Before 1784, Upper Canada (Ontario), then politically a part of Quebec, was virtually unsettled. That year marked the arrival of those persons known as the United Empire Loyalists, followed by some disbanded British army personnel. The coming of new settlers was thereafter a continuous process. And very soon, in 1791 when there were 14,000 people in the region, these lands became a distinct and separate political entity. Settlement continued at very high rates until 1851, when the population was 952,000. In the meantime, a further political change took place with the Act of Union in 1840, whereby Upper and Lower Canada (Quebec) became the Province (Colony) of Canada, with each part keeping its distinct identity. The purpose of our paper is to achieve some understanding of aggregate growth, settlement and their relationship to the standard of living during the last twenty-five years of this early period, namely 1826 to 1851.

The governing structure of Upper Canada was composed of (i) a Governor as chief executive officer appointed by the Imperial Government; and (ii) a legislature, with considerable powers and authority, comprising two units, a Council, nominated by the Governor and, more importantly, an elected House of Assembly, representative of the population at large. For administrative purposes, the province was divided into districts, eleven in number in the 1820s and 1830s, managed by councils appointed by the central authority. Within districts there were counties, mainly performing judicial functions, and within counties, townships managed by locally elected authorities.

The physical layout of the settlements was most important in their development. In the

main, they were in areas where there was some access to water transport. Thus, the early settlements were along the St. Lawrence River and the shores of Lake Ontario and Lake Erie. The depth of settlement varied, but it was typically not more than thirty miles, except where there was alternative access to water transport. This access to transport helped both in the marketing of some surpluses and in the acquisition from outside the province of some of the amenities of life. The water transport itself improved as canals on the St. Lawrence and at Niagara were built.

The sources of information will appear as we proceed but one set of data deserves immediate attention. Almost from the beginning (as early as 1800), the central government required that there be annual assessment of property for taxation purposes. These assessments were done annually for each district, using a standard form prescribed by the government of Upper Canada, with common items assessed and common assessed valuations for each item throughout the province. The holdings of each item were collected for each individual property owner, and reports were compiled by township total.[1]

The interpretation of the district measures of assessed acres of cultivated land, the number of houses of different kinds, and the numbers of livestock requires care especially when presented in per capita terms. In any year the original settlement dates of the reporting farmers normally covered quite a range of time. Farmers with many years of settlement ordinarily had

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[1] Following are the items assessed and reported in the annual statements: Acres of Land (cultivated, uncultivated), Houses (timber - one story; timber - two story; framed - under two story; framed, brick or stone - one story; framed, brick or stone - two story; additional fireplaces), Mills (grist mills - one pair of stones; additional pair of stones; saw mills), Merchant Shops, Store Houses, Stone Horses (ie. stallions), Horses (3 years and older), Oxen (4 years and older), Milch Cows, Horned Cattle (2 to 4 years), Wagons and Carriages (four kinds).

larger amounts of cleared land, better housing and more livestock than farmers of recent settlement. The averages per district depended then on the settlement spans of those in the district. Districts (or townships) of new settlement tended to have low averages and those with mature settlement higher averages.

Agriculture was the main source of support and our attention will be concentrated on it. But it was not, in the main, entirely a subsistence agriculture. In addition to the information on farm output there are data that throw light on the well-being of those in agriculture. The ability to acquire merchandise depended on the presence of shops; the ability to obtain processed products such as flour and lumber depended on the presence of grist and saw mills, respectively; possibility of socializing in public houses depended on the presence of inns and taverns. For the entire population, both rural and urban, the quality of life was improved by the presence of educational institutions, by the presence of tradesmen such as carpenters, shoemakers, tailors, blacksmiths and the like, by the presence of transportation facilities and, of course, by the presence of service personnel, professionals, clerical and domestic servants. We will deal with these in order.

Grist mills played an especially important role as wheat flour was a bread staple from the beginning. Farmers would obtain their flour by taking their own wheat to the grist mill, and the considerable non-farm population depended on locally-produced flour. As well, the major part of the quite considerable export of wheat was in the form of flour. Economizing on transport costs was an important element made possible by the widely spread location of grist mills, since it was cheaper to transport wheat as flour in barrels. Few of these mills would be in operation the year round, partly because they depended on water power which would be

variable over the seasons. The construction and operation of a grist mill was not costly: the common charge to the farmer for milling wheat was one-twelfth of the produce.

The widespread availability of saw mills provided somewhat similar local benefits. The transportation of lumber was expensive, whereas the presence of forest cover meant that the raw material, logs, was available and relatively cheap. Lumber was used domestically for frame buildings on the farms and for the nearby non-farm population. Those farmers who chose could take their own logs to the mills. The milling costs were high, amounting to as much as 50 percent of the produce, nevertheless local saw mills still provided the cheapest source of local lumber supply. Many mills were small and operated only part of the year, although there were also large mills operating on a year round basis, if possible, especially where logging itself was a primary occupation such as in the Ottawa valley.

Reasonable access to shops was an amenity that was important to rural life. The local shop made available not only basic necessities such as sugar and salt, and such beverage materials as tea and coffee but other commodities that included cloth, clothing, sewing needles and the like. The shop keepers frequently provided loans to their customers in the form of credit for goods bought, receiving payment (in cash or in kind) as farm products were disposed of by the farmers. The local shop keeper had access to traders who were much more widely involved in the purchase and sale of a wide variety of products as well as the basics. The availability of spirituous liquors was also of concern to many. They were available in those shops that were licensed to sell them. They were also available in licensed inns or taverns. Data on all the foregoing items; the grist mills, saw mills, shops, and licensed inns are presented in Appendix 2. They show that even in 1826 farmers had access to all these. Indeed there

were, per capita, more mills, more licensed inns, and about the same number of shops as we observe at mid-century.

Communication and intercourse of the Upper Canada communities among themselves and with the rest of the world required the affordable transportation facilities provided by Lake Ontario, Lake Erie and the St. Lawrence River system supplemented, as settlement spread, by the Ottawa system. By 1812 there were twelve to eighteen sailing vessels with an average capacity of 50 tons in the St. Lawrence system; as early as 1816 a steamship was launched, though sail was only gradually replaced; by 1840 there were eighty-one sailing vessels, mean capacity 69 tons, and eighteen steamships, mean capacity 216 tons, supplemented by nineteen steamships on the Ottawa-Rideau system. In addition, much of the timber could be moved in the form of log barges and rafts, especially down the St. Lawrence River. The effectiveness of this system grew as canals on the St. Lawrence and the Welland Canal at Niagara came into use in the 1830s and 1840s.[2] The availability of this transportation is reflected in an almost unchanged cost of one shilling (twenty cents) between 1823-25 and 1850 of moving a barrel of flour from western to eastern Lake Ontario, and a decline in the cost of moving a barrel of flour down the St. Lawrence to Montreal, in the same period, from nearly 3 shillings to 1.5 shillings.[3] On the St. Lawrence River the "down" tonnage substantially exceeded the "up" tonnage with the consequent result of upstream rates being lower than if they had to cover fixed as well as variable cost.

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[2] The rapids on the St. Lawrence had made transportation thereon somewhat difficult, but regular movements of commodities had existed both ways from the beginning.

[3] Douglas McCalla, Planting the Province: The Economic History of Upper Canada, 1774-1870 (Toronto, 1993), 286.

Land transport was admittedly rather crude, but the relatively short distances to water compensated in large measure. In addition, local roads, constructed largely by statutory labor, were sufficiently good for wagon travel, and in the winter, sleigh travel to the local grist mill, the saw mill, the shops and the neighboring farms. It was widely reported to Robert Gourlay that, after a few years of settlement, the statutory labor requirement resulted in decent local roads.[4]

## II. Agricultural Income: 1826 - 1851

Farming was the main source of support of the people of Upper Canada. In 1851, the first year for which we have occupational data, 53 percent of the workforce was engaged in agriculture and the population was more than 80 percent rural. Any measure of aggregate income, therefore, depends largely on agricultural output. We start with the Marvin McInnis's excellent set of farm income estimates for 1851, and project those back to 1826 using the Municipal Assessment records, which we discussed earlier.[5] We also make considerable use of Gourlay's contemporary account of Upper Canada, based largely on a series of questionaires.[6] Wheat and livestock products alone make up over 90 percent of McInnis's farm

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[4] Robert Gourlay, Statistical Account of Upper Canada, Vol.1 (New York, 1966). Originally published 1822. Robert Gourlay circulated a questionnaire to township groups throughout Upper Canada in 1817 asking a total of thirt-one questions about such things as population, number of schools, stores, taverns and about agricultural practises and wages. He tabulated the returns and published them.

[5] Marvin McInnis, "Ontario Agriculture at Mid-Century," in D. McCalla ed., Perspectives on Canadian Economic History (Toronto, 1987), 49-83.

[6] Gourlay, Statistical Account of Upper Canada.

income estimate for 1851, and although we do not have output data on wheat or other crops for earlier years other than some flawed census estimates for 1842, the Assessments do report holdings of livestock and the area of cultivated land.[7] These numbers allow us to approximate agricultural income by district back to 1826.

The Assessments were the basis of provincial and later municipal taxation, creating the danger of some undercounting. In fact, the data appear to have been collected and compiled in a way to suggest reasonable accuracy. Assessors were required to take an oath to encourage honest reporting, and there was the presence of neighbors, in what were small communities, with interests to protect. As well, the incentive to cheat was not all that great. The tax was pegged at at one pence per pound of assessed value, a rate well below 0.5 percent. Although there was no assessment in 1851 with which to compare the census data, a check of the returns against the (incomplete) censuses of 1842 and 1848 suggests there may have been some undercounting of livestock but accurate reporting of the area of cultivated land. Our income estimates may therefore understate slightly the level of agricultural income in the earlier years and overstate the growth rate.

The Assessment data reveal a period of extraordinary development (see Table 1). The area of improved land increased from 617 thousand to 3.7 million acres, or by a factor of six; and the growth was fairly steady, with acreage roughly doubling every ten years. Numbers of animals grew at a somewhat slower pace with significant differences by type. Draft animals, the horses and oxen, increased from 50 to 220 thousand, and there was a change in the

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[7] For example, in 1842 the output of wheat was seriously underreported. There is also an 1848 estimate of wheat output that appears to be too low. See McCalla, Planting the Province, 73.

proportions. In 1826 the number of oxen exceeded the number of horses by 10 percent. In 1836 the ratio was reversed, and by 1846 there were 50 percent more horses than oxen. This pattern is typical of pioneer areas. During the early years of clearing the steadiness of oxen tend to make them the draft animal of choice, but they are gradually replaced by horses as farms become established. This relationship, seen in the province-wide data, is reinforced by the district numbers. Older districts had relatively fewer oxen than more recently settled areas. In Midland, for example, a district occupied by the original United Empire Loyalists, 40 percent of the draft animals were oxen in 1831. By contrast in Bathurst, the last of the eleven districts to be established, farmers used oxen for 75 percent of their draft requirements.

Table 1
Cultivated Acreage and Numbers of Livestock

| | Cultivated Acres | Horses 3 yrs + | Oxen 4 yrs + | Milk Cows | Steers 2-4 yrs |
|---|---|---|---|---|---|
| 1826 | 617,763 | 23,882 | 26,287 | 62,142 | 25,666 |
| 1831 | 818,416 | 33,428 | 36,131 | 84,373 | 35,162 |
| 1836 | 1,283,709 | 55,064 | 48,938 | 121,024 | 44,706 |
| 1841 | 1,734,452 | 76,745 | 51,366 | 160,290 | 57,575 |
| 1846 | 2,443,679 | 105,324 | 68,971 | 211,289 | 65,215 |
| 1851 | 3,703,308 | 134,054 | 88,785 | 296,452 | 103,338 |

Source: See text. The totals by district are available from the authors on request.

Relying mainly on these Assessment data, the calculation of agricultural income is performed in two stages, the second following closely the method of McInnis in his work on

Upper Canada, and Lewis and McInnis, who measured farm income in Lower Canada.[8] Our approach is first to estimate wheat output and then to derive the value of livestock products. Wheat was by far the most important field crop. It accounted for 35 percent of net farm income in 1851 and was the main source of cash income, although forest products were also important.[9] For the period 1826 to 1851 we assume fixed wheat consumption per capita, adjusted for the change in the age distribution of the population.[10] To this estimate of consumption is added wheat exports. Per capita consumption of wheat is assumed to have increased from 6.9 to 7.1 bushels from 1826 to 1851. Since the population grew nearly six-fold and exports of wheat increased from 360 thousand to 4.4 million bushels, aggregate wheat output is estimated to have risen from 1.5 to 11.1 million bushels.[11]

This wheat output is divided among the eleven districts on the basis of improved acreage. It is assumed, first, that the ratio of wheat acreage to improved acreage moved by the same proportion in all districts; and, second, that wheat yields did not change.[12] These assumptions allow us to generate estimates of wheat output and wheat acreage by district, where the potential

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[8] McInnis, "Agricultural at Mid-Century," in McCalla, Perspectives on Canadaian Economic History, 51-83; and Frank D. Lewis and Marvin McInnis,"Agricultural Output and Efficiency in Lower Canada, 1851," Research in Economic History, 9 (1984), 45-87.

[9] There was, in addition, the off-farm sales of animal products to the local non-farm population.

[10] The consumption of children is assumed half the consumption of adults.

[11] These estimates are similar to those given in McCalla, Planting the Province, 265.

[12] Gourlay received reports from forty-nine townships indicating no increase in wheat yields during the first half of the nineteenth century. Indeed the average yield in his sample was 21.2 bushels per acre which is 35% higher than the average yield of 15.7 in 1851. See Gourlay, Statistical Account of Upper Canada, 355, 403, 457, 611.

source of error is the variation across districts in the relative growth of wheat in comparison to other crops. The bias, however, would tend to affect the district values rather than the provincial aggregates.[13]

Our approach to livestock products follows McInnis.[14] We apply a set of coefficients that converts numbers of livestock into product, and another set that generates the cost of feed.[15] The Assessments provide less information about livestock than does the 1851/52 Census. Although numbers of horses, oxen, milk cows, and steers are reported, missing are swine, sheep, and immature animals. The lack of data on pigs is potentially the most serious, as pork accounted for nearly 18 percent of net farm income in 1851. Fortunately, the number of pigs was closely related to the number of milk cows. The four eastern districts averaged 1.35 pigs for each milk cow, the range being 1.13 to 1.58. In the western part of the province there

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[13] Wheat growing conditions varied across the province. Wheat was less prevalent in the east and far west. By making our adjustment at the district level, we allow at least in part for these differences. The equations on which the wheat output acreage measures are derived are as follows:

$$q_{wi}^{j} = k_w \bullet A_i^j \bullet q_{wi}^{51}/A_i^{51},$$

$$k_w = Q_w^j / \sum_{i=1}^{11} A_i^j/A_i^{51} \bullet q_{wi}^{51},$$

where $q_{wi}^{j}$ is wheat output, $A_i^j$ is improved acreage, i refers to the district and j the year. $Q_w^j$ is total wheat output in year j.

[14] McInnis, "Agriculture at Mid-century," in McCalla, Perspectives on Canadaian Economic History, 49-83. See Lewis and McInnis, "Agricultural Output and Efficiency...," Res. Econ. Hist., 9 (1984), 45-87 for a detailed presentation of the method, and justification of the assumptions regarding the feed and output coefficients.

[15] Throughout the Mcinnis assumptions are applied. There were undoubtedly changes in farm practice from 1826 to 1851, but in absence of evidence to the contrary it seems best to stick with the 1851 procedures, especially since the aim is to suggest trends in income. Where appropriate we will indicate possible sources of bias.

were, on average, 2 pigs per milk cow. We have assumed the ratio of pigs to milk cows remained the same in each district from 1826 to 1851. The variation across districts in the ratio of milk cows and sheep was much greater, but together wool and mutton accounted for much less income, less than 6 percent in 1851. We make the same assumption as for swine, recognizing that our estimates of the value of wool and mutton are problematic.[16]

The large number of milk cows made butter, cheese, and fluid milk the most important of the livestock products. We have applied the McInnis coefficient of ninety pounds butter equivalent per year, which is just below the ninety-two pounds assumed in Lewis and McInnis for Lower Canada.[17] Surprisingly, Gourlay, who conducted an extensive survey of Upper Canada in 1817, received reports of butter and cheese output that suggest higher productivity. Outputs range from four pounds per week during the season to ten pounds per week. In the Gore District it was reported that a good milk cow produced 100 lbs. of butter during the summer, "and as much cheese." The issue is whether these reported outputs reflect typical performance and allow for non-producing or little-producing animals.[18] Certainly the reports imply consumption levels far exceeding those of the late nineteenth century. By contrast, the McInnis coefficients imply the 1870 level of per capita dairy consumption.[19] Moreover, the

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[16] Wool output in 1851 is reported in the Census. We assume that the output of wool per sheep was the same in 1826. In 1851 output of wool per sheep averaged 2.8 pounds. Gourlay received reports for 1817 ranging from 2½ to 5 pounds, but by far the most frequently reported output was 3 pounds.

[17] Lewis and McInnis, "Agricultural Output and Efficiency...," Res. Econ. Hist., 9 (1984), 74.

[18] Ibid., 84-85.

[19] M.C. Urquhart, Gross National Product of Canada, 1870-1926, The Derivation of the Estimates (Kingston & Montreal,1993), 115.

implied level of fluid milk output per cow, 2250 lbs., is about 90 percent of the 1870 figure.[20]

Our estimate of livestock product involves one further adjustment. In both McInnis, and Lewis and McInnis, net income is derived by computing the gross value of farm production and then subtracting the cost of inputs, most importantly animal feed. This approach is especially useful in comparing townships, since it allows for sales of feed between farms and differences in feeding practice. Here we are not so concerned with off-farm sales, but we do wish to allow for variations in feeding rates, not just among districts but also over time. If, for example, livestock was fed at a lower rate in 1826 than in 1851, there would be less product per animal. Assuming the 1851 output coefficients would then overstate 1826 farm income. To allow for this possibility we have inferred field crop output from the Assessment reports of cultivated acreage. From this output we subtract the cost of feed implied by McInnis's 1851 feed coefficients.[21]

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[20] Ibid., 114.

[21] The output of feed is derived in the following way. From total cultivated acres in each district, we first subtract the area used to grow wheat. This area, which is multiplied by 1.5 to allow for fallow, is based on wheat output as derived above and assumes the same yields as in 1851. McCalla (Planting the Province, 265) assumes a two-year rotation. McInnis suggests the rotation ranged from two to three years. A three-year rotation gives an output of feed per acre in 1851 that varies less across districts. The adjusted area is then subtracted from total cultivated acreage giving an estimate of the area used for feed (some of this land was used to grow crops for human consumption, notably potatoes, but in 1851 these were of minor importance). The value of feed output in each district is this area times the value of field crops per acre in the same district in 1851. Thus we are assuming yields in field crops did not change from 1826 to 1851. The cost of feed, like the value of livestock products, is based on the feed coefficients assumed by McInnis. The small amounts fed to immature animals is included. The number of colts is set equal to half the number of horses. The number of calves and heifers in each district is based on the number of milk cows. Surprisingly, calves and heifers in 1851 seemed to bear little relation to the number of steers. Number of milk cows alone gives a better fit.

We find feeding practice did indeed change over the period 1826 to 1851. In 1851 the aggregate cost of feed, at $7.7 million, was 10 percent below the value of field crops, excluding wheat (see Table 2). McInnis took the difference to be the value of crops, mainly peas and potatoes, used for human consumption. The Mcinnis coefficients imply a higher ratio of feed to field crops prior to 1851; in fact from 1826 to 1836 the feed requirement exceeds the output available for feed. Thus the general picture would appear to be one of improving husbandry, as relatively more cultivated acreage was available for the growing stock of animals. The procedure we have adopted allows us to adjust income for this change in feeding practice.

Table 2
Agricultural Output: 1826-1851
(thousands of 1851 dollars)

| | Wheat | Livestock Products | Field Crops | Cost of Feed | Net Income |
|---|---|---|---|---|---|
| 1826 | 908.1 | 2,167.9 | 1,514.7 | 1,635.0 | 2,955.7 |
| 1831 | 1,558.1 | 2,951.8 | 1,789.5 | 2,245.1 | 4,054.8 |
| 1836 | 2,109.9 | 4,204.6 | 3,044.4 | 3,315.9 | 6,043.0 |
| 1841 | 2,279.5 | 5,534.2 | 4,479.1 | 4,333.3 | 7,959.6 |
| 1846 | 3,697.6 | 7,238.8 | 6,031.9 | 5,787.9 | 11,180.4 |
| 1851 | 6,662.8 | 11,014.5 | 8,510.6 | 7,671.2 | 18,516.6 |

Source: See text. The price of wheat in 1851 was $.60 per bushel.

The expanding area of improved land and larger holdings of livestock led to rapid output growth. Aggregate net income doubled about every ten years, increasing 525 percent over the twenty-five year period, from just under $3 million to $18.5 million. But these were also years

of rapid population growth fuelled by natural increase and immigration from England, Scotland and Ireland.[22] The net result was almost no change in per capita agricultural income. The increase was from $17.76 in 1826 to $19.45 in 1851. And even these figures may exaggerate the change given the likelihood that assessors undercounted livestock to a greater degree than the 1851 Census enumerators.[23] A roughly constant level of per capita income may be a consequence of our method of overcoming a lack of information on this early period. But as we argue next, our assumptions more likely overstate the true rate of farm output growth.

Of the items about which we have little information, wheat was the most important. To derive wheat output we assume constant per capita consumption from 1826 to 1851,[24] and to derive wheat acreage, constant yields are assumed as well.[25] It seems unlikely growth has been biased downward for these reasons. Gourlay, on the basis of his survey conducted in 1817, reported wheat yields that were generally higher than in 1851, possibly reflecting the fertility of virgin soil. Our income estimates are not sensitive to the other possible source of bias, the

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[22] A large number of settlers were from the northeastern U.S., but most of these immigrants arrived prior to 1826.

[23] If we confine our measures of per capita income to the period 1826 to 1846, years both based on Assessment data, the increase is about 5%. There are unfortunately no assessments available for 1851 to relate to the census for that year. A comparison of the 1848 census returns with the assessment records indicates some undercount of livestock by the assessors. From 1848 to 1851 the censuses record large increases in the numbers of livestock and improved acres.

[24] As noted above, we make a small adjustment for changes in the age distribution of the population.

[25] McCalla also assumes constant wheat yields over this period. McCalla, Planting the Province, 265.

constant level of per capita wheat consumption.[26]

Wheat production and exports have been identified with the success of Upper Canada. In 1851, 40 percent of the crop was exported, and wheat accounted for 35 percent of farm income; nevertheless both McInnis and McCalla suggest the importance of wheat in the economy of Upper Canada may have been overstated. The case for wheat is certainly weaker in the earlier years. In 1826 we estimate total wheat output made up 30 percent of net farm income, and only a quarter of the crop was exported. This means about 7 percent of farm income was derived from wheat exports.[27] Given that, in the absence of this trade, land could have been shifted to other uses, the wheat staple should be regarded as just one element in the growth of Upper Canada.

It appears the success of the agricultural sector was tied more closely to livestock. Making allowance for some human consumption of field crops other than wheat, we estimate that livestock products accounted for between 55 and 65 percent of agricultural income.[28] Most

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[26] If per capita consumption were less than in 1851 that would imply fewer acres in wheat and more land under other field crops. The effect on our net income estimates, however, would not be great. If we assume, for example, that the per capita consumption of wheat in 1826 was 25% below the level in 1851, estimated net farm income would fall by about 1%.

[27] Even this percentage is too high given that our calculation does not include the value of forest products produced on the farm.

[28] The assessment data do not allow us to determine the value of crops used for human consumption, but the 1851 estimates suggest that, with the exception of wheat, nearly all field crops were used as feed. Subtracting the cost of feed from the total value of field crops, excluding potatoes, gives a net value for human consumption of $839.4 thousand. If we assume this was entirely potatoes, annual per capita consumption works out to 2.7 bushels, which is just over half the consumption rate assumed by Urquhart for the period after 1870. See Urquhart, Gross National Product..., 64. Applying this same rate to the earlier years provides one way of deriving the relative contribution of livestock products. For example in 1826, human crop consumption, excluding wheat, was $146.7 thousand representing 5% of agricultural net income. Since wheat output is estimated at 30% of income, it follows that livestock products accounted

important were the milk cows. There were, in 1851, 296,452 cows, or one for every 3.2 persons, providing dairy product close to the 1870 level of twenty-nine pounds butter equivalent per person. In 1826 the Assessments report the number of cows at 62,142 or one cow for every 2.7 persons. Had they produced at the same rate as in 1851, per capita consumption would have been 18 percent higher. Our estimate of field crop output suggests somewhat lower productivity, an output per cow of seventy-five pounds butter equivalent, or 83 percent of the 1851 rate, and about 75 percent of the 1870 rate. This productivity implies per capita consumption of twenty-eight pounds butter in 1826, which is just below the level of twenty-five years later.

The other livestock on which we have data are steers. In 1851 McInnis estimates the number of steers at 103,338 or one per 9.2 persons. In 1826 there was a steer for every 6.5 persons. Even after adjusting for a lower feeding rate, it would appear that beef consumption in 1826 was higher than in 1851. And the 1851 rate itself was high; sixty pounds per person, which compares to a consumption rate of forty pounds in 1870 and fifty-five pounds at the end of the century. Applying the McInnis procedure to steers, oxen, and cows, all of which provided beef, the estimate for 1826 is close to seventy pounds per capita. It seems unlikely that beef exports were large, suggesting the early settlers enjoyed rates of consumption not to be seen again until the twentieth century.

Another indication of the level of income is improved acreage. Despite still being a pioneer region in 1826, the area of improved land per person was almost as high as it was twenty-five years later, 3.7 acres as compared to 3.9 acres. Indeed, this may understate the position of the settlers, since according to Gourlay's 1817 survey much unimproved land

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for 65%.

provided excellent grazing. The use of wild land as pasture may partly explain the apparently low feeding rates in the early years, and indicate even higher output than our estimates would suggest.

The other animals reported in the Assessments are horses and oxen. Although older oxen were a source of beef and some horses may have been raised for sale, both were kept mainly for draft purposes. Again the 1826 holdings compare favourably with the later stocks. The number of horses per person, 0.14, was about the same in 1851; and there were, per capita, nearly twice as many oxen.

## III. A Comparison with 1870

Our estimates of per capita agricultural output in Upper Canada suggest little change over the period 1826 to 1851. But how does income at mid-century compare to later years? Urquhart's national income estimates for Canada, starting in 1870, offer a convenient benchmark. In 1870 total agricultural income, which Urquhart derives by estimating off-farm sales and human consumption, was $159.8 million (current), or $44 per capita.[29] This is well above McInnis's per capita estimate of $19 for Upper Canada in 1851, but certain adjustments are needed. H. Michell compiled an agricultural price index that increased 44 percent from 1851 to 1870.[30] Over this period, for example, the price of wheat more than doubled and pork rose 40 percent. Converting the 1870 output estimate to 1851 prices reduces per capita income

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[29] Urquhart, Gross National Product..., 30, 44.

[30] H. Michell, "A Survey of Prices in Canada from 1848," in C.A. Curtis et al. Statistical Contributions to Canadian Economic History, Vol.2 (Toronto, 1931), 55-62.

to $31, still more than 50 percent above the 1851 value.

There are, however, components of output in the Urquhart agricultural income estimate missing from the Upper Canada census of 1851. The more important of these are vegetables, fruit, poultry and eggs, and forest products. Together they accounted for 22 percent of agricultural output in 1870. The assumption that these items were relatively as important in 1851 increases per capita farm output to $25. This is 18 percent below the adjusted 1870 estimate, suggesting some increase in per capita farm income after 1851.

This comparison almost certainly overstates the performance of agriculture in 1870 relative to the period, 1826 to 1851. As we noted earlier, one of the remarkable features of agriculture in Upper Canada during the second quarter of the nineteenth century was the increase in aggregate farm income. While per capita income stayed about the same, farm output was doubling every ten years. An increased numbers of settlers was the main part of the story, but also important was growth in the capital stock, mainly the area of improved land and the number of livestock. In Table 3 we report estimates of farm capital from 1826 to 1851 based on the Assessment data for 1826 to 1846 and the census of 1851/52.[31]

The value of improved land increased from $7.7 million in 1826, or about twice agricultural income in that year, to $46 million in 1851. Adding the value of livestock gives total farm capital formation over the twenty-five year period of $55 million. Despite the high

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[31] In deriving farm capital, livestock has been valued at 1851 prices and we have assigned cultivated land a price of $12.50 per acre. This price is consistent with reports received by Gourlay on the cost of land clearing, and also with a folder put out by The Canada Company, issued in 1843, responding to potential settlers' questions. According to the Company, the cost was $10 on "moderately timbered land in old settlements," somewhat higher in remote settlements. See Thelma Coleman, The Canada Company (Perth, Ontario, 1988), 117.

Table 3
Farm Capital : 1826 to 1851
(thousands of 1851 dollars)

| | Land | | Livestock | | Total | |
|---|---|---|---|---|---|---|
| | Stock | Annual Change | Stock | Annual Change | Stock | Annual Change |
| 1826 | 7,722 | 446.8 | 4,289 | 282.2 | 12,011 | 729.3 |
| 1831 | 10,231 | 963.7 | 5,898 | 482.6 | 16,128 | 1,447.3 |
| 1836 | 16,046 | 995.4 | 8,740 | 486.6 | 24,786 | 1,482.5 |
| 1841 | 21,681 | 1,538.6 | 11,459 | 677.1 | 33,140 | 2,217.8 |
| 1846 | 30,546 | 2,648.3 | 15,269 | 940.9 | 45,815 | 3,601.0 |
| 1851 | 46,291 | | 20,591 | | 66,882 | |

Source: See text.

level of per capita farm output during these early years, farmers were at the same time clearing land and adding to their stock of animals. In 1826, for example, land clearing added $447 thousand to the value of farms, and this does not include the important item of farm fencing by use of wooden rails.[32] Total capital formation, including additions to livestock, was $729 thousand, or $4.39 per person. In 1826, as noted above, per capita agricultural output was $23.[33] With capital formation added, per capita farm income is $27, which is just 12 percent below the 1870 value for Canada.[34]

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[32] We assume a constant rate of capital formation within each five year interval.

[33] This is the estimate implied by Table 2 plus $5 to allow for omitted production.

[34] This comparison does not include that part of farm capital formation in 1870 due to land improvements. The bias, however, is small. Net farm income grew by just 10 per cent from 1870 to 1880, and the rate over the the first half of the decade was even lower. See Urquhart, Gross National Product..., 11.

## III. Non-Agricultural Activity

The comparison of income to this point has been restricted to the farm sector. Although agriculture was the backbone of the economy of Upper Canada, there was also a significant non-farm population. Good evidence of the relative size of this community emerges in 1851 and may be inferred for earlier years. In 1851 the number of farms was 89,322 and the number of families was 151,107.[35] There is reason to believe that the number of farm families would not exceed the number of farms. In the occupational census for 1851-52, of a total of 232,698 persons, there were 86,224 farmers and 78,584 laborers, including farmers' sons. If half the laborers were farm laborers, the farm labor force would be 125,510 persons or 54 per cent of the total labor force. Excluding laborers, the remaining 67,890 persons were in non-farm occupations. There was large employment in forestry, road building, transportation, saw mills, ordinary construction, among many off-farm uses. There were, in addition, persons in nearly every occupation widely dispersed across the whole range of counties. Table 4 gives the numbers in the larger occupations in total and in the five largest urban centres (population 70,000). These occupation groups accounted for 63 percent of the non-farm labor force, excluding laborers.

The very widespread and even distribution of these persons requires emphasis. They were, in many senses, engaged in rural occupations catering in large measure to the farm population who obtained their services directly. The widespread presence of these trades and occupations in earlier years is apparent from Robert Gourlay, who in 1817 included questions

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[35] McInnis, "Agriculture at Mid-Century," in McCalla, Perspectives on Canadaian Economic History, 70; Census of 1851-52. Note that a slight correction was made to the number of farms.

about the wages of blacksmiths, masons and carpenters, as well as about the number of stores and taverns, numbers of schools and numbers of mills within his whole list of questions.

It is generally true that in nineteenth century North America, the proportion of workers in agriculture was in decline, suggesting the relatively constant level of per capita farm product, that we derived earlier, may have been maintained with a smaller share of the workforce. Although we do not have occupational data for the early years, related evidence on shops, inns, grist mills, and saw mills points to an agricultural workforce that in percentage terms was the same, perhaps even less than in 1851. From 1826 to 1851 the per capita number of each of these non-farm businesses was stable or declining. In 1826 for example, there were 470 merchant shops, one per 349 inhabitants. In 1850 the number of persons per shop had risen slightly to 369 (see Appendix 2). The increase was much greater for the licensed shops and inns. There were twice as many people per licensed shop in 1850 than in 1826 and 50 percent more per licensed inn. Improvements in transportation and greater population density likely contributed to the change. The result was, quite possibly, increased availability of workers to the growing agricultural sector, the reverse of the usual shift of labor away from farming.

After 1851 the proportion of workers in agriculture declined slightly, from 54 percent to 51 percent in 1871.[36] Apparently the high per capita farm output of 1851 was based not on a large agricultural workforce but rather on high labor productivity. Indeed high productivity had already been attained much earlier in the nineteenth century, certainly by 1826; and Gourley's extensive account indicates similar performance even before that.

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[36] M.C. Urquhart, "New Estimates of Gross National Product, Canada, 1870-1926: Some Implications for Canadian Development," in Stanley Engerman and Robert Gallman, eds., Long-Term Factors in American Economic Growth (Chicago, 1986), 28.

Table 4
Employment in Non-Farm Occupations: 1851

| | Total Number | Number in five largest cities |
|---|---|---|
| Boot & shoe makers | 5,808 | 840 |
| Blacksmiths | 4,235 | 287 |
| Carpenters | 7,611 | 1,184 |
| Coopers | 1,935 | 101 |
| Dressmakers and Milliners | 1,235 | 358 |
| Grocers | 476 | 211 |
| Inn keepers | 1,216 | 195 |
| Masons | 1,466 | 250 |
| Merchants | 2,359 | 497 |
| Servants, male<br>female | 3,180<br>12,274 | 616<br>2,705 |
| Tailors | 2,662 | 540 |
| Teachers | 2,422 | 228 |
| Weavers | 1,738 | 30 |

Source: Census of The Canadas, 1851-52, Occupations (Table IV).

## V. Housing

The housing component of the Assessments provides another indication of living standards in early Upper Canada. These assessments, as already noted, were for the purpose of taxation, and not all dwellings were included. The brick, stone, and substantial frame houses were all counted, but reporting of the log houses and lesser-valued frame dwellings was incomplete. As well none of the many shanties, reported in the 1851 census, was assessed. Overall about one-third of dwellings were taxed, a ratio that remained steady over the period

1826 to 1851. Even though the housing assessments are incomplete the fact that the more substantial homes were included throughout the period recommends them as a useful indicator of the change in income.

Three types of houses were assessed; timber, frame, and stone or brick. Houses with more than one story were assessed at a higher rate, and if there were extra fireplaces present these too were included. We do not yet have real estate prices to value this housing, and instead have relied on the assessments themselves.[37] Given the lack of market price data, any conclusions about the importance of residential housing in overall capital formation must be viewed with care, but that taken, it appears housing was a small part of overall capital formation. In 1826, for example, the stock of assessed housing was about $2 million, which was just one-sixth the value of improved land and livestock (see Table 5). Adding the value of non-assessed residential property might raise the ratio to one-third, but it should be noted that, on the other side, farm buildings, most importantly barns, as well as farm implements were not assessed either.

Though a small component of the capital stock, residential housing provides further evidence of high income levels in the early nineteenth century. In 1826 the high quality brick homes made up 15 percent of assessed dwellings, a share that increased to 20 percent by 1846. At the same time the proportion of these houses that were two stories declined from more than 80 percent to less than 70 percent. Although over the same period the proportion of lower-

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[37] We assume the market value of the houses was 50% greater than their assessed values. Livestock, as noted above, were assessed and the values assigned to them were about two-thirds their market values in 1851. Note that we are concerned mainly with how the stock changed over time; so if the assessments gives a reasonable weighting of the different types of houses, our estimate of the relative changes should not be far off.

quality timber (log) houses also fell, overall there was little change in housing quality. The average value of an assessed house increased by less than 4 percent, from $220 to $228. And,

Table 5
The Stock of Housing: 1826 - 1846

| | Timber | | Frame | Brick or Stone[a] | | Avg. Value[b] |
|---|---|---|---|---|---|---|
| | One Story | Two Story | One Story[c] | One Story | Two Story | |
| Value[d] | ($120) | ($180) | ($210) | ($240) | ($360) | (dollars) |
| 1826 | 2,619 | 224 | 5,008 | 236 | 1,193 | 220 |
| 1831 | 3,224 | 557 | 7,591 | 975 | 2,135 | 227 |
| 1836 | 3,963 | 329 | 12,548 | 1,293 | 2,863 | 226 |
| 1841 | 3,924 | 316 | 17,711 | 1,462 | 3,811 | 230 |
| 1846 | 5,563 | 350 | 24,037 | 2,448 | 5,195 | 228 |

[a] Includes frame houses of two stories.
[b] Includes the value of additional fireplaces.
[c] Under two stories.
[d] 1.5 times the assessed value, excluding additional fireplaces (see fn. 36).

Source: See text.

as noted above, the proportion of houses that were assessed did not change by much either.[38] It seems then that the population of Upper Canada was housed about as well in 1826 as it was at mid-century, further evidence of high living standards for the time.

[38] In 1826 it was a third; in 1846, 38% of all residences were assessed. Consistent with the 1851 census, we assume the total number of homes equalled the number of families. Average family size during this period was about six.

## IV. Foreign Trade and the Role of Imports

Foreign trade has played an important role in the development of newly settled countries. The basic significance of the trade lies, most importantly, in its making available imports of some food products and the finer manufactured articles that contribute to the quality of life. It makes possible, in addition, the import of some capital goods. The acquisition of imports depends on the presence of exports to pay for them supplemented by foreign borrowing. While there has been much study of the role of staple exports in economic growth, we limit our discussion of them to a description of the main items of Canadian export; we wish to give somewhat more attention to imports for they played a substantial part in making Upper Canada attractive to settlers.

Upper Canada was fortunate in having two viable staple products that provided large export proceeds; they comprised forest products and wheat, sold mainly in the form of flour. Most of these exports went via Montreal until the late 1830s for sale to Great Britain and the colonies, although some part of the wheat was consumed in Lower Canada. By 1850 much larger values of exports from the Province of Canada (Upper and Lower Canada together) went almost equally to the United States and Great Britain. The scale of these major exports are given in Table 6. Receipts for these products would be shared by the primary producers and those engaged in primary manufacturing, for example, in grist and saw mills, in transportation, in merchandising and in related activities. A comparison of these export values with the values of agricultural production in Table 2 shows that these exports via the St. Lawrence, which were those most clearly related to agricultural production, ranged in value from 30 percent to about 40 percent of net income in agriculture; although, because these exports were valued at

TABLE 6
Export Values of Principal Products from Upper Canada
(thousands of pounds, Halifax Currency)

| Wood and Wheat products via the St. Lawrence River | | | | Ottawa Valley Pine: via the Ottawa River |
|---|---|---|---|---|
| | Wood Products | Wheat & Flour | Total | |
| 1825 | 238 | 44 | 282 | 28[a] |
| 1830 | 225 | 194 | 419 | 89 |
| 1839 | 265 | 191 | 456 | 123 |

[a] 1827. The Ottawa valley pine was obtained mainly from pure commercial forestry production.

Source: McCalla, Planting the Province, 260. These values are exclusive of goods imported from the U.S. and re-exported to Lower Canada.

Montreal, they represented a considerably smaller proportion of the income of farmers.

From 1840 onward, the published data are for the Province of Canada (the combined Canadas). The total value of exports in 1850 for the Province amounted to £3,236,000 ($12,944,000).[39] Total agricultural products exports of £1,217,000, of which wheat and flour accounted for £942,000, went about 64 percent to the United States and 36 percent to Great Britain and the North American colonies. Total exports of forest products were valued at £1,361,000 of which £385,697, more than half in the form of planks and boards, went to the

[39] Where values are given in £s, the unit is Halifax Currency which had a rate of exchange throughout the period: £1 = $4.00. The official rate between Halifax Currency and sterling was: £1 sterling = £1 4s 4d Halifax Currency.

United States and nearly all the rest to Great Britain.[40] The value of exports in total, in 1850, amounted to 76 percent of the value of all imports. Foreign borrowing plus the net balance on service account must have covered the difference.

The data on imports into Upper Canada are such as to limit one's ability to determine the nature and volume of imports with certainty; nevertheless, some reasonable conjectures may be made. Until the 1840s, Canadian imports from overseas arrived and were recorded primarily at Quebec City until 1832, then, in addition, at Montreal; overland imports from the United States were recorded at St. Jean (Lower Canada) throughout. Some portion of these goods went on to Upper Canada. Our data for 1826 to 1840 are based on the records of imports at these centres.[41]

Total values of imports to Upper and Lower Canada and the amounts attributed to Upper Canada alone are given in Table 7. The proportions going to Upper Canada until 1840 were

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[40] One can make a rather crude estimate of the proportion of exports originating in Upper Canada. All of the wheat exports should be clearly credited to Upper Canada: wheat production in 1851 in Upper Canada was 11,105,000 bushels (11.7 bushels per capita), in Lower Canada 3,073,943 bushels (3.45 busels per capita); net exports of wheat and flour in wheat equivalent, was 4,391,000 bushels worth £925,000. Nearly all the exports of planks and boards valued at £199,000 went to the United States from Upper Canada. Well over half the potash and pearlash exports must have originated in Upper Canada, but say, 50%, value £150,000: production of ashes in Upper Canada in 1848 (census 1948) was 30,000 barrels; exports from Canada in 1850 were 43,000 barrels. Add 20% of exports from inland ports, excluding St. Jean, for under-reporting, value £180,000. These items alone add to £1,455,000 ($5,820,000) - an amount equivalent to 31% of net agricultural product in Upper Canada in 1851.

[41] The records of direct inland imports into Upper Canada from the United States are not good until the 1840s, except for the year 1834, for which data were published for inland custom centres with commodity detail. The total of these inland imports amounted to the substantial sum of £257,305, however, by far the larger part of these inland imports comprised those of wheat and flour and salt pork most of which appear to be for re-export via the St. Lawrence. The records at Montreal of imports from Upper Canada distinguish between produce of Upper Canada and that of the United States. See McCalla, Planting the Province, 258, source notes.

negotiated between Upper and Lower Canada to provide a basis for sharing the import duties collected in Lower Canada at the points of entry.[42] We assume a share of 50 percent for 1850, based on the nearly equal populations in each of the Canadas at that time.

TABLE 7
Imports to Upper and Lower Canada:
1826 – 1850

| Year | Lower and Upper Canada Total Value (£)[a] | Upper Canada | |
|---|---|---|---|
| | | Share (%) | Value (£)[a] |
| 1826 | 1,237,790 | 25 | 309,448 |
| 1830 | 1,753,801 | 30 | 526,143 |
| 1833 | 2,032,063 | 33.3 | 670,581 |
| 1839 | 2,572,364 | 40 | 1,028,946 |
| 1840 | 2,535,185 | 40 | 1,014,074 |
| 1850 | 4,245,516 | 50 | 2,122,758 |

[a] Halifax Currency.

The detail of information about the composition of imports depends on the tariff classification, which, in turn reflects the nature of those imports. There are essentially three categories of data. Category (1) comprises foods, beverages, tobacco and the like, not readily producible in Canada, which are levied with significant specific and ad valorem duties and which are given in measures of physical quantities only in the annual import data until 1850. Category (2) comprises processed commodities levied at 2½% ad valorem, of which textile manufacturers and hardware and iron products are by far the most important items and which are typically

[42] For example, in 1825 official estimates of category (2) items (see below), entered at Quebec totalled £990,000. Of this amount, £252,000 was sent to Upper Canada.

reported in aggregate values only, except in 1850.[43] Category (3) comprises free goods, a miscellany that changed over time, in which the larger items by value, in 1850, were books, military stores and wheat.

The values, by category, in a sample of years in our period are shown in Table 8: the values for category (1) are measured in 1851 prices throughout owing to the reports being in physical quantities; the values for category (2) and (3) are in current prices.[44]

The main items in category 1 in 1826 and 1850 are given in Table 9. The population of Canada was 1,842,000 in 1851; that of Upper Canada was 952,000, of which in both cases about 50 percent were over 16 years of age. It may be seen that the annual consumption of tea by the adult population was about four pounds per person and of tobacco about three pounds. Consumption of imported sugar was about seven pounds per head for the entire population.[45]

A breakdown of category (2), by far the largest category, is not available until 1850: a breakdown by major items is given in Table 10.

It may be seen that imported textiles amounted nearly to the substantial value, for those days, of £2 per adult. The foregoing data indicate that imports were large in value relative to agricultural output and probably also to total national product. Our data from Tables 2 and 7 show that in 1850, the total value of imports to Upper Canada approximated 45 percent of the value of net agricultural product. The proportions were slightly larger for earlier years.

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[43] The tariff on category (2) items had changed by 1850 but the content of the assignments to category (2) were unchanged.

[44] Prices in general appear not to have moved significantly between 1826 and 1851; the prices of specific commodities did change, some upward, some downward.

[45] It was supplemented strongly by domestic production of maple sugar, given by the census of 1851 at 3,670,000 pounds in Upper Canada and 6,068,000 pounds in Lower Canada.

TABLE 8
Value of Imports to Upper and Lower Canada
by Category: 1826 - 1850

| | Category 1 | | Category 2 | | Category 3 | | Total Imports |
|---|---|---|---|---|---|---|---|
| | Value in £ 1851 | % of Total | Value in £ current | % of Total | Value in £ current | % of Total | Value in £[a] |
| 1826 | 324,178 | 26.2 | 898,526 | 72.6 | 15,086 | 1.2 | 1,237,790 |
| 1830 | 402,086 | 22.9 | 1,306,892 | 74.5 | 44,823 | 2.6 | 1,753,801 |
| 1833 | 524,897 | 25.8 | 1,483,468 | 73.0 | 23,686 | 1.2 | 2,032,063 |
| 1839 | 464,912 | 18.1 | 1,969,340 | 76.6 | 138,112 | 5.4 | 2,572,364 |
| 1840 | 426,149 | 16.8 | 1,988,494 | 78.4 | 120,542 | 4.8 | 2,535,185 |
| 1850 | 654,956 | 15.4 | 3,296,437 | 77.6 | 294,133 | 6.9 | 4,245,516 |

[a] Although Category 1 goods are expressed in 1851 prices and the other categories in current prices, summing the components is probably reasonable in that prices did not change much over the period.

Agricultural income amounted to about 40 percent of gross national product in 1870; and it may be reasonable to assume agricultural income was 50 percent of gross national product in 1850. The value of imports would then approximate 25 percent of gross national product throughout. A flow of imports of these dimensions made available large quantities of goods of a kind not produced in Canada.

TABLE 9
Significant Import Items in Category 1:
1826 and 1850

| 1850 quantities | | Imports at Quebec and St. Jean 1826 Quantities |
|---|---|---|
| 550 | Spirituous beverages (000 gallons) | 253 |
| 3,517 | Tea (000 lbs.) | 1,075 |
| 12,827 | Muscovite sugar (000 lbs.) | 2,371 |
| 1,223 | Loaf sugar (000 lbs.) | 230 |
| 863 | Salt (000 bushels) | 231 |
| 637 | Tobacco (leaf) (000 lbs.) | 250 |
| 2,517 | Tobacco manufactured (000 lbs.) | 268 |

Sources: Journal of the House of Assembly of Lower Canada, 1827; Appendix A; Journal of the Legislative Assembly of the Province of Canada 1851, Appendix A.

TABLE 10
Components of Import Values of Category 2 in 1850

| Item | Value in £ | % of Category 2 | % of All Imports |
|---|---|---|---|
| Woollen goods | 548,344 | 17 | 13 |
| Cotton goods | 906,916 | 28 | 21 |
| Silk goods | 138,950 | 4 | 3 |
| Linen goods | 68,563 | 2 | 2 |
| Iron & hardware | 330,261 | 10 | 6 |
| All other | 1,237,590 | 39 | 55 |

Source: Journal of the Legislative Assembly of the Province of Canada, 1851, Appendix A.

## V. The School System of Upper Canada

The educational system of a society provides one measure of its well-being. The available information for Upper Canada is not adequate to provide a really clear description of the development of education from 1800. The reporting system on public education emerged in useful form only gradually; the information about the private schools, which preceded the establishment of the public schools and overlapped with their presence, is sketchy. However, there are sufficient data for one to form some useful impressions of its course.

Background information is provided by the acts of legislation that led to the establishment of public schools. In 1797, in response to a request from the legislative body of Upper Canada, certain public lands were set aside, by Imperial decree, for the support of grammar schools and a university; in 1807 the central government of Upper Canada provided for support of one "grammar" (ostensibly upper) school in each district; and in 1816 an act provided for establishment of common schools and for the dispersion to the districts of some moneys for their support. In organization there was a central board of education, boards of education for each district and local boards of trustees for local schools. The members of the central board and the district boards were appointed by the central government; members of each local board of trustees were elected by supporters of each common school. The local school boards, who reported to the district boards, could appoint teachers who were examined and certified by those district boards.

The central government grants were not sufficient to pay all the costs of those common schools that met the eligibility requirements of having twenty pupils enrolled. Thus the local board of trustees had to arrange for building a school and paying part of the teacher's salary and

covering other running costs. The other sources of revenue were voluntary local rates and fees charged for individual pupils. The individual rural school districts were of dimensions presumably permitting daily travel of pupils to the school. Egerton Ryerson, influential director of the school system from the mid-1840s to the 1870s, put the area of a school section as "from three to five square miles, intended for one school."[46] Individual schools generally had between twenty and thirty pupils and thus qualified for central government funding. Partial support of common schools by fees was widespread. In fact, it was not until 1860 that the number of free common schools matched the number of fee schools. Finally, in 1870, all schools were made free schools; only then, effective in 1871, did attendance at schools become compulsory.

Before the common schools were established, and from the early time of settlement, there were private schools, supported in the main by student fees. Comments on these schools in the literature tend to be impressionistic but there are some data for 1817, collected by Robert Gourlay in a widely circulated questionnaire. While these data, calculable for three districts, show a lower ratio of population to number of schools than the common school data show for 1839, they must be interpreted with caution. A recent work on education in Upper Canada states that: "One has the impression that the early private venture schools were very much family affairs. To begin with, most, especially the boarding schools, were very small."[47] This study

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[46] Egerton Ryerson, "Annual Report of the Normal Model and Common Schools of Upper Canada for the Year 1850," Journal of the Legislative Assembly of Canada, 1851.

[47] Susan E. Houston and Alison Prentice, Schooling and Scholars in Nineteenth Century Ontario (Toronto, 1988), 56. See also R.D. Gidney and W.P.J. Millar, Inventing Secondary Education, The Rise of the High School in Nineteenth Century Ontario (Montreal, 1990), 26; and Frank Eams, "Pioneer Schools in Upper Canada," Ontario History, 18 (1920), 92-96.

and others mention some as night schools or even weekend schools. They also explain, however, that there were numbers of full-blown private schools that were well-regarded by teachers and parents.[48] Many schools were denominational.[49]

The common schools were required to report to the district boards, but in the early days compliance appears to have been irregular – the first rather limited published data are only available for 1829 and 1830, and then only for six out of the eleven districts; the next sets of fairly comprehensive data are for 1838 and 1839; by 1850, the data are quite complete and full. The availability of data no doubt reflects the fact that it would take time, after provision for their establishment, for the common schools to spread and grow to maturity and that the establishment of new schools would be an ongoing process with the very rapid growth of population. Undoubtedly the continuation of private schools would overlap the establishment of the common schools: the earliest reliable data (for 1850) record 224 private schools having 4,463 students, which is about 3 percent of the common school enrollment then.[50]

The main characteristics of growth in education are reflected in the data of Table 11. The numbers in the age group from six years to fifteen years of age were reported in the 1850 and 1870 reports of the Department of Education for Upper Canada (Ontario). We call this the school age group. Since census data show that there was little change in the general age

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[48] Houston and Prentice,Schooling and Scholars..., 56; Gidney and Millar, Inventing Secondary Education, 32.

[49] Gidney and Millar, Inventing Secondary Education, 31.

[50] Gidney and Millar state that official figures understate the number of private schools and enrollment in 1850. However, the number of students reported in the 1851-52 census does not exceed the total reported by the Department of Education. In addition, Gidney and Millar themselves state that the average life of private schools was short (pages 65 and 334).

TABLE 11
School Attendance and Teachers, Common Schools

| | Panel A School Age Population 6 - 15 years (000s) | | | | Panel B Ratio Total Pupils to School Age Population | | | | Panel C Number of Teachers | | | | Panel D Number of Pupils per Teacher | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Districts | 1830 | 1839 | 1850 | 1870 | 1830 | 1839 | 1850 | 1870 | 1830 | 1839 | 1850 | 1870 | 1830 | 1839 | 1850 | 1970 |
| Eastern | 7.3 | 10.7 | 14.1 | 17.4 | 0.21 | 0.24 | 0.52 | 0.90 | 49 | 83 | 182 | 221 | 29 | 31 | 41 | 71 |
| Ottawa | 1.3 | 2.7 | 5.2 | 7.1 | | 0.31 | 0.46 | 0.77 | | 36 | 69 | 101 | | 23 | 35 | 54 |
| Johnston | 7.3 | 11.8 | 16.4 | 16.0 | 0.09 | 0.17 | 0.67 | 0.84 | 27 | 84 | 294 | 242 | 24 | 25 | 37 | 55 |
| Bathurst | 4.8 | 6.9 | 11.4 | 25.8 | | 0.31 | 0.62 | 0.83 | | 86 | 152 | 345 | | 25 | 47 | 62 |
| Midland | 12.4 | 18.9 | 26.3 | 33.0 | | | 0.67 | 0.88 | | | 491 | 461 | | | 36 | 61 |
| Newcastle | 4.9 | 12.2 | 22.8 | 37.0 | 0.17 | 0.13 | 0.59 | 0.91 | 33 | 55 | 318 | 409 | 27 | 28 | 43 | 82 |
| Home | 10.0 | 24.6 | 38.9 | 54.1 | 0.10 | 0.13 | 0.56 | 0.93 | 36 | 113 | 446 | 508 | 29 | 27 | 49 | 99 |
| Gore | 6.1 | 14.9 | 29.7 | 44.9 | | | 0.57 | 0.97 | | | 350 | 450 | | | 49 | 97 |
| Niagara | 6.3 | 9.2 | 13.7 | 17.8 | 0.14 | 0.14 | 0.74 | 0.93 | 35 | 41 | 260 | 248 | 29 | 33 | 39 | 67 |
| London | 7.8 | 18.0 | 41.3 | 94.1 | | 0.19 | 0.62 | | | 110 | 626 | 1089 | | 31 | 41 | 99 |
| Western | 3.4 | 7.1 | 12.4 | 26.1 | 0.16 | 0.09 | 0.56 | 0.91 | 19 | 24 | 174 | 300 | 27 | 24 | 40 | 79 |
| Cities | | | 12.0 | 31.9 | | | 0.38 | 0.83 | | | 33 | 253 | | | 128 | 106 |
| Towns | | | 12.8 | 38.1 | | | 0.42 | 0.91 | | | 66 | 340 | | | 82 | 104 |
| Villages | | | 2.4 | 22.8 | | | 0.54 | 0.88 | | | 12 | 194 | | | 108 | 105 |
| Total | 71.6 | 137.0 | 259.3 | 484.0 | | | | | | | 3473 | 5165 | | | | |

Source: Data from the Journals of the Legislative Assembly of Upper Canada for 1831 and 1839-40; Journals of the Legislative Assembly of the Province of Canada, 1851, appendix KK; Sessional Papers of the Province of Ontario, 1871-72; Sessional Paper No. 3; Census of Canada 1871, volume 4.

distribution of the population before 1850, the numbers in the school age groups for 1830 and 1839 were estimated from census data by assuming that the same proportion of the population as in 1850 was in this school age group on a district by district basis. In aggregate, the population of school age approximated 35 percent of the total population. Panel A shows that the aggregate population in the school age group nearly doubled in each decade between 1830 and 1850, there being considerable differences in growth rates across districts. Growth then slowed to slightly less than doubling in the two decades between 1850 and 1870. Unfortunately, the data are lacking for six districts in 1830 and two large districts in 1839.

Panel B presents the ratio of all students on the registers of the common schools to the numbers in the school age group – these data for registered students include a relatively small number of mature students aged sixteen years and over. As may be seen, school attendance (the ratio of pupils to population in the school ages) increased regularly from very low levels in the 1830s to something over 50 percent attendance in the 1850s and quite high levels of attendance in 1870. Some caution is needed in the interpretation of the data. It seems probable that the low levels of attendance in the 1830s reflect a very small number of years of attendance per student rather than no schooling at all for any substantial number of children – the 1860-61 census, which includes those who had attended the common schools, records quite low levels of illiteracy at that time.[51] At the same time, it is noted in the relevant school reports that the average attendance of registered pupils in 1850 only slightly exceeded 50 percent; of like nature, in 1870 the total number of registered pupils of all ages attending school less than 100 days in

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[51] The 1860-61 Census of Canada. For an elaboration, see Houston and Prentice, Schooling and Scholars..., 85.

the year exceeded 50 percent in the counties and only slightly below 50 percent in the cities, towns and villages.

Panel C presents the number of teachers by district and panel D the number of pupils per teacher. The large increase in the latter in 1870 may be accounted for, in some measure, by the records in that year giving total attendance per calendar year as distinct from total attendance per school year or per term as provided in the earlier data.

Whatever the limitations of the data, it is clear that the level of schooling in the common schools was very low in these early years, which may be explained in part by the fact that the common school act had only been passed in 1816 and that, in the periods of early settlement, there may have been problems of acquiring, in one place, the twenty students necessary to receive the state grant. Whatever the reason for the early shortfall, the amount of schooling increased thereafter regularly at quite high rates: the overall growth of the school system then involved both the high rate of increase in the school age population and the increase in schooling within the school age group.

It was in the 1840s that the common school system became firmly established: by 1850, all districts were reporting regularly and in considerable detail to the central education authority. Ryerson, Director of Education and the acknowledged architect of the ongoing school system, was responsible for establishing the structure of education in Ontario and the initial results of his enterprise were beginning to show by 1850. By that year most students of school age had several years of schooling, albeit with irregular attendance to accommodate agricultural work. Of course, improvement in schooling still had a long way to go.

Data for 1870 are given to show the substantial further growth in schooling that had taken

place at that time: the percentage of the school age group attending school appears to be respectably high, although it must be kept in mind that about 50 percent of the students attended for fewer than 100 days.

In summary, schooling in the common schools in Upper Canada was only established gradually, despite the relatively high level of per capita income in the early years. From rather primitive conditions in the 1820s, the school age population received gradually increasing education per person to moderate levels by 1850; it took another twenty years to achieve a moderately high level of schooling for those in the school age group.

The attendance at grammar schools (high schools) while possible before the establishment of the common schools, was at much lower levels than in the common schools. In 1870 there were 101 grammar schools with a total student enrollment of just over 7,000 students, compared with 57 schools with a total enrollment of 2,070 students in 1850 and enrollment in 1838 of 311 students. The quality of instruction at grammar schools left something to be desired in earlier years. Queen's University had its own upper school establishment in the 1840s and 1850s designed to upgrade the educational standing of many who entered the university.[52]

## VI. The Standard of Living, Forestry and Farm Settlement: A Hypothesis

Per capita farm income was about equal in 1826 and 1851; moreover living standards may have been as high in early Upper Canada as in Canada as a whole shortly after

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[52] Gidney and Millar, Inventing Secondary Education, 45.

Confederation. The region, not surprisingly, attracted large numbers of immigrants.[53] From 1826 to 1851 the population of Upper Canada grew by a remarkable 470 percent, from 166,379 to 952,004. Indeed with the exception of a modest slowdown in the period 1836 to 1841, the growth rate exceeded 7 percent per year. By comparison, the rate in the United States was under 3 percent and in Lower Canada just 2.4 percent. Upper Canada also grew much faster than the American states that were its southern neighbors. New York, Pennsyvania, and Ohio had in 1821 a combined population more than 25 times that of Upper Canada. By 1851 the ratio had fallen to less than 8. Ohio, furthest west and the most agricultural, grew at just over half the Upper Canada rate.

Throughout this period the export of forest products was a large contributor to income, even more important than wheat until the late 1840s (see Table 6). Following the Napoleanic wars, and indeed partly in response to the Napolean's blockade of the Baltic, Britain introduced a set of tariffs preferential to timber exports from British North America. The hope was that by protecting a colonial industry the Mother country would be assured a source of supply even in time of war. Here we propose an approach to farm settlement that emphasizes the emerging forest industry, and may help explain some features of the economy such as the high level of income per capita and the rapid settlement. Key is the implication that the settlers' ability to supplement agricultural income with earnings from forestry may have crucially affected the decision to start a farm.[54]

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[53] Before 1826 large numbers Americans immigrated to Upper Canada, but during our period Europeans, especially the Irish, predominated.

[54] Of course the forest also provided the material for first homes, in the form of logs, and fuel in the form of firewood.

Following are the main aspects of our model, which we detail in Appendix 1. A potential settler faces the choice of staying put or moving to a new area, where land must be cleared before it becomes productive. If the settler can borrow against future income, the decision is straightforward; he simply compares the present value of the alternate income streams. But if capital markets are imperfect in that borrowing against future income is not an option, the settler must save to tide him over until enough land has been improved. This characterization seems consistent with the settlement of Upper Canada, a region where clearing land was the main obstacle to farming. Gourlay and, in later work, Peter Russell and others, describe clearing efforts and estimate the cost of preparing land for planting.[55] Russell reports that, at a maximum, four to seven acres could be cleared in a year.

Clearing was of course a gradual process. At first a settler could devote nearly all his effort converting wild to improved land, but as the cultivable area increased more time would be spent farming. This meant that as a new farm became established agricultural output increased. This pattern, descibed by equation (1), is a central feature of our settlement model:

$$(1) \qquad y(t) = 1 - e^{-p(t-t_0)},$$

where y(t) is the income produced on a farm in year t, $t_0$ is the year the farm is broken, and p

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[55] Peter A. Russell, "Forest into Farmland: Upper Canadian Clearing Rates, 1822-1839," Agricultural History, 57 (1983), 326-39.

is the maximum clearing rate.[56] At $t_0$ no land has been cleared, so farm income is zero. But as land is improved income begins to rise. Agricultural output thus increases at a decreasing rate, gradually approaching the normalized value of one, which represents the income on a fully-cleared farm. To illustrate equation (1), consider a farm with a completed size of fifty (cleared) acres, and where the maximum clearing rate is five acres per year ($p = 0.1$). The area cleared on such a farm would be twenty acres after five years, just over thirty acres after ten years, and close to forty-five acres after twenty years. With this specification, the farmer would be clearing an average of four acres per year for the first five years, and about one acre per year after that.[57]

A serious problem facing the early settlers was their inability to borrow against future farm income. There were land companies, The Canada Company being the most important, that provided funds for the purchase of land and implements; the local store was often a source of credit, and a few settlers, although from the accounts very few, had outside resources.[58] In general, though, even if settlers could borrow some of the funds needed to purchase land, equipment and livestock, they still had to maintain consumption during the early years of farm-

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[56] For the purpose of the model, income is defined more narrowly than in a national accounting sense. The clearing of land is of course an investment that is appropriately included in national income. Here though we are concerned with that part of farm income directly available for consumption.

[57] These rates are consistent with the clearing patterns estimated by Russell, "Forest into Farmland," Ag. Hist., 57 (1983), 326-39. As a further check of these simulation rates we compared the overall rate of farm clearing in Upper Canada implied by equation (1) with the actual increase in cultivated acreage from 1826 to 1851. The simulated value in 1851 was close to the actual.

[58] An important exception were farmers' sons, who normally could count on substantial support from the family farm.

making. Typically this meant a period of saving prior to starting a farm and continued low consumption until enough land had been improved. Thus settlers sacrificed consumption in their early years in return for higher standards of living later on.

The necessity of saving may have changed the age and income profile of farm settlers. It is almost axiomatic that migration tends to be of the young, but in the case of farm-making this view may have to be modified. Certainly by starting a farm at a younger age the settler could expect more income over his lifetime. The problem was that purchasing the land and implements, and, more importantly, maintaining consumption during the early years, required an initial period of capital accumulation, unless the settler could count on an inheritance. This initial capital requirement likely affected the type of people who chose to settle. Normally those with the lower opportunity cost would have more to gain. But if their incomes were close to subsistence, they would be unable to save enough to start a farm.

To give a sense of the quantitative importance of these implications, we have simulated the model using parameter values that are roughly consistent with the early economy of Upper Canada. Perhaps most surprising are the results of a simulation where we include the initial cost of the land, farm equipment, and draft animals. We put the cost at one year's income on a fully-cleared farm.[59] Although this is a modest capital requirement, we find that no potential settler, regardless of their alternative income, would be better off starting a farm than simply receiving that alternative income throughout their lifetime. For example, consider someone

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[59] Russell puts the basic cost of clearing a farm at £100, or $400. This is somewhat higher than the $250 annual income we have assumed. At the same time we assume no possibilty of borrowing. There were in fact some sources of credit available, as noted in the text. See Peter Russell, "Upper Canada: A Poor Man's Country? Some Statistical Evidence," Papers in Rural History, 3 (1991), 129-47.

whose alternative income is only 30 percent of the income they would receive on a fully-cleared farm. According to the simulation, the best they could do, given settlement, would be to save for thirteen years, and after starting a farm put up with continued low consumption an additional three years. Even assuming a total working lifetime of thirty-five years, the higher income they would receive over the remaining nineteen years would be insufficient compensation. In general, we find that for reasonable parameter values and a modest initial capital requirement, starting a farm in the absence of a well-functioning credit market would not have been in the long-run interest of any potential settler.

Fortunately there was another source of income which, unlike the products agriculture, did not entail a start-up cost. Forest products were a by-product of the clearing operation and thus provided immediate income to the settler. And not only did the potash and lumber obtained through clearing generate cash income, forestry companies were a source of employment especially during the winter.[60] Although the total income from forestry is difficult to determine, it is notable that each township had at least one sawmill, and most had more than one. In fact, as shown in Appendix 2, the number the number of sawmills far exceeded the number of grist mills. In Table 6 we presented export data showing that exports of wood products exceeded wheat and flour as a source of foreign exchange. Clearly, the forest industry

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[60] Easterbrook and Aitken describe the pattern of settlement along the Ottawa river in the following terms: "A man would establish a small farm near an active lumbering area and work on it for part of the year, counting on being able to sell his produce to the camps at a good price. Then, when winter began, he would hire himself out as a lumberjack,taking his team of oxen with him if he had one." Although Easterbrook and Aitken go on to suggest that otherwise marginal farms could not count on lumber camps that would move on after an area had been cleared of the best trees, that does not diminish the importance of forestry to farmers, especially when they were breaking the land. See W.T. Easterbrook and Hugh G.J. Aitken, Canadian Economic History (Toronto, 1967), 198.

provided an important supplement to the income of farmers.[61]

Indeed the forest may have been vital to early settlement in that it allowed farmers to maintain their consumption during the initial years of farm-making. To illustrate the impact on the settlement decision, we have run a simulation that includes an income supplement equal to 10 percent of the income on a completed farm. The results accord with much of the historical discussion of the central role of forestry in the settlement of Upper Canada. Most importantly, we find that some potential immigrants, those with alternative incomes between 30 and 50 percent of the income on a completed farm, now find it optimal to settle (see Appendix 1, Table 1A). Significantly, those who choose to settle eventually enjoy a much higher living standard: their income has to at least double.

This relationship between the incomes of those who settle, and those who do not, may help explain the high living standards in Upper Canada. It suggests not that the early settlers were especially lucky or able, but rather the long period of saving required, which was followed by additional years of low income as the farm was cleared, required that settlers be compensated with high incomes later in life. Indeed this finding may have implications that go well beyond the populating of Upper Canada. High incomes in other settler economies, Australia, Argentina, and of course the Thirteen Colonies, have been described elsewhere. By emphasizing the initial savings that were required and the possibly long period of very low consumption, we might

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[61] In 1830, for example, the value of wood product exports, excluding Ottawa Valley pine, was $900 thousand, which is about 20 percent of 1831 agricultural income. Of course, given the cost of transport and given that fees at the saw mill were considerably higher than those at the grist mill, only part of this income would have accrued to farmers. At the same time, the export figures are confined to wood and ashes; missing is domestic consumption of forest products. Also the processing of potash was done mainly on the farm. Farmers thus received the full value of potash less transport and marketing costs.

better explain why these settlers eventually did so much better than the neighbors they left behind.

Finally, as we conjectured earlier, an initial capital requirement causes settlement to be delayed. Even excluding the lower-income settlers, the initial period of saving according to our simulation is about ten years. Thus we would expect settlers not to begin farms until they are at least thirty years of age unless they had other sources of capital. We do not yet have data on the ages of new farmers, but the delay in starting farms seems high and may indicate that settlers consumed at even lower rates of consumption than our simulation implies. At the same time, some of the reports compiled by Gourlay for 1817 suggest the settlers to Upper Canada were in fact into their thirties when they began clearing. In Norwich township, London district, Gourlay received reports from eleven farmers who migrated from New York State and started their farms in 1811. By 1817 they all had at least five children; and two of the farmers had nine. In Talbot Road, also in the London district, the farmers had begun clearing land between 1812 and 1815, and in 1817 many already had large families.

The foregoing model presents the optimal path of consumption of an individual who, on settling a farm, dissaves from some source of income (previous savings) and currently reduces consumption in order to clear land (produce capital goods), to gradually increase farm production and to ultimately achieve higher levels of consumption than at any time previously. From a national accounts point of view, net saving, and hence capital formation, will be positive.[62] A view of these developments in the agricultural economy of Upper Canada as a

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[62] We do not include a period of retirement in our model, with it's attendant dissaving. Settlers are thus assumed to leave cleared land and other capital goods to the next generation. Such was often the case with farm children who may have contributed to production on the home

whole is given in Table 12. It is evident that as agricultural production grew, it was accompanied by substantial capital formation: the farm capital formation enhanced production; the housing capital formation increased consumer comforts. These levels of capital formation are of a respectable order compared with later ratios for Canada as a whole. Some of this farm capital formation may have been financed by outside borrowing, but a major part of it must have been the product of saving within the agricultural sector itself.

Although it goes well beyond the scope of this paper, the approach to settlement that we propose extends to any migration where an initial period of saving is required. The key insight is that, in the absence of borrowing, new migrants require some temporary source of income to tide them over while they are accumulating the capital, whether it be physical or human capital, that will eventually allow them to attain the high income levels that attracted them. In Upper Canada it was the forest industry. Settlers could count on immediate income as they cleared their land and sold potash or logs and timber to the local saw mill. As well, many hired themselves out to lumber companies during the winter.[63] In the late nineteenth and early twentieth century, perhaps it was the sweat shops of the garment and other industries that, in a sense, attracted immigrants, not because they regarded them as their ultimate source of income, but because it allowed them to "get a start," that is, to receive some income while they, or possibly their children, acquired the capital. Today the taxi cabs in nearly all major North

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farm before setting up independently. They thus started in a somewhat different way from the original settlers.

[63] Many new settlers also were employed on already established farms. The problem with this arrangement is that, given the problem of timing, it interfered with the clearing of the settler's land.

American cities seem to play this role.

TABLE 13
Gross Agricultural Production and Capital Formation
(all values in thousands of 1851 dollars)

| Years of Annual Average Calculations | Average Net Agricultural Product (1) | Average Farm Capital Formation (2) | Average Housing Capital Formation (3) | Average Total Capital Formation (2) (3) & (4) | Average Gross Domestic Product Agriculture (5) | Ratio Farm Capital Formation to GDP Agriculture (6) | Ratio Total Capital Formation to GDP Agriculture (7) |
|---|---|---|---|---|---|---|---|
| 1826 - 31 | 3505.3 | 729.3 | 265.3 | 994.6 | 4,494.0 | 0.162 | 0.221 |
| 1831 - 36 | 5049.9 | 1447.3 | 293.6 | 1640.9 | 6,473.0 | 0.223 | 0.253 |
| 1836 - 41 | 7001.3 | 1482.3 | 292.7 | 1775.0 | 8,976.0 | 0.165 | 0.198 |
| 1841 - 46 | 9570.0 | 2217.8 | 412.6 | 2630.4 | 12,269.2 | 0.181 | 0.214 |

Notes: Column (1): The entries are the average values of net agricultural output of the beginning and the ending years of each period. Column (3): These entries cover only the values of log and frame buildings from Table 5 on the assumption that the entries for stone and brick houses would form an estimate of non-farm housing. Column (5): The entries herein, as well as in column (1), do not include the values of farm capital formation as a part of gross farm production even though this capital formation will have been largely produced by the farmers themselves.

Source: All data except entries in column (5) derived from Tables 2, 3 and 5. Column (5) obtained by dividing column (1) by 0.78, the ratio of the coverage of agricultural production in 1851 to the coverage in 1871 (see Section III, infra).

## Appendix 1

### A Model of Farm Settlement

The agent, a potential settler, is assumed to maximize lifetime utility subject to an income constraint. If the agent does not settle a farm, he receives a constant income, $y^*$, over his lifetime, 0 to T. Alternatively, the agent may choose to settle a farm at year $t_0$ in which case he recevies $y^*$ until that time and an income after $t_0$ that depends on the amount of land that is cleared. The relationship is described by:

$$\text{(1a)} \qquad y(t) = \begin{cases} y^* & t \leq t_0 \\ 1 - e^{-p(t-t_0)} & t > t_0 \end{cases}$$

The pattern of income after the farm is settled, $t > t_0$, is based on the view that the amount of agricultural output depends on the area of improved land. At $t = t_0$ no land has been cleared, so farm income is zero. But as land is cleared at the rate $e^{-p}$, income begins to rise. At first all the settler's time is devoted to clearing, but as the area of improved land get larger more time is spent raising crops. Agricultural output thus increases at a decreasing rate, approaching asymptotically the normalized value of one, which represents the income generated by a fully-cleared farm.

A crucial feature of the model is the assumption that capital markets have the imperfection that settlers are unable to borrow against future farm income. This means that in order to maintain consumption during the early years of farm-making, the immigrant must save for some period prior to settlement and then draw down those savings once the farm is broken.

The process of clearing thus involves not just a change in the pattern of income the person receives, but also a change in the consumption stream. Settlers must sacrifice consumption in their early years in return for higher rates of consumption later on. We formalize this idea by assuming that agents receive utility each period:

$$(2a) \qquad u(t) = u[c(t)]e^{-\rho t}, \qquad u'>0,\ u''<0$$

where c is consumption and $\rho$ is the pure rate of time preference. The agent is constrained not to borrow, but he may save at discount rate, r. Assuming r and $\rho$ are the same, it follows that consumption will be constant throughout his life if he chooses not to settle.[64] If he settles, consumption will be constant while he is saving, that is prior to $t_0$; and consumption will continue at the same rate while these savings are being drawn down. It is only after enough of the farm has been cleared that consumption will begin to rise.

The agent faces two related decisions; the first is when to settle, and the second is how much to consume prior to and during the early years of settlement. Finally, assuming settlement time and consumption would be chosen optimally, the agent compares lifetime utility depending on whether or not he settles. The formal lifetime optimization problem follows.

$$(3a) \qquad \max_{t_0, c(t)} U = \int_0^T u[c(t)]\, e^{-\rho t} dt,$$

subject to

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[64] Assuming r and $\rho$ are the same simplifies the presentation without affecting the main implications of the model.

$$(4a) \qquad \int_0^n y(t)e^{-rt}dt \geq \int_0^n c(t)e^{-rt}dt, \quad 0 \leq n \leq T$$

where income, y(t), is described by equation (1a).[65] The income constraint, equation (4a), ensures non-negative aggregate savings at each age, which is consistent with the assumption that settlers cannot borrow against future income. Assuming the potential settler starts a farm at time $t_0$, he will save during the years up to $t_0$ and then run down the accumulated savings during the early years of settlement. We can decompose the settler's problem into two periods, the years up to some period $t_1$, when the borrowing constraint is not binding, and the time after $t_1$ when it is. Assuming the pure rate of time preference and the discount rate are the same, optimization implies a constant rate of consumption up to $t_1$. After that, consumption will equal the rising farm income. These standard life-cycle results allow us to rewrite the optimization problem as:

$$(5a) \qquad \max_{t_0, c^*} U = \int_0^{t_1} u(c^*)e^{-rt}dt + \int_{t_1}^{T} u[y(t)]e^{-rt}dt + \lambda \int_0^{t_1} [y(t) - c^*]e^{-rt}dt,$$

where $c^*$ is optimal consumption during the period of saving and dissaving, and $t_1$ is the point at which the farm generates income equal to $c^*$. The first order condition with respect to $c^*$ is:

$$(6a) \qquad u'(c^*) = \lambda,$$

which says simply that the lagrange multiplier of the problem is the marginal utility of consumption at time 0. The first-order condition with respect to settlement time, $t_0$, is more revealing. It requires:

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[65] One could modify the lifetime utility function to allow for a bequest motive.

$$(7a) \qquad -pe^{pt_0}\int_{t_1}^{T} u'[y(t)]e^{-rt}dt + \lambda\{y^* e^{-rt_0} - pe^{pt_0}\int_{t_0}^{t_1} e^{-(p+r)t}dt\} = 0.$$

Equation (7a) illustrates the trade-off associated with decision when to settle. If settlement time is postponed one period, the settler gains income $y^*$ during the period prior to $t_1$, offset partly by lower income due to the delay in starting the farm. The net gain, multiplied by the marginal utility of consumption, $\lambda$, which is given by the last two components of the equation, is compared to the loss of utility after $t_1$. Again, because the farm is started one period later, the farmer receives less income and hence enjoys less utility from $t_1$ to T. This loss is described by the first term of equation (7a). At the optimal settlement time the two effects are equal. Finally, assuming $c^*$ and $t_0$ are chosen optimally, the potential settler compares lifetime utility in the states where he does and doesn't start a farm:

$$\int_0^T u(y^*)e^{-rt}dt \quad vs \quad \int_0^{t_1} u(c^*)e^{-rt}dt + \int_{t_1}^{T} u[y(t)]e^{-rt}dt.$$

We have simulated the model using parameter values that are roughly consistent with the early economy of Upper Canada. We begin by assuming the agent's preferences are characterized by a Stone-Geary utility function. This specification allows for the introduction of a subsistence level of consumption. In addition we make the standard assumption that the function is isoelastic. Thus:

$$(8a) \qquad u(c) = \begin{cases} (c-s)^{1-\delta}/1-\delta & \delta \neq 1,\ \delta > 0 \\ \ln(c-s), & \delta = 1 \end{cases}$$

where s can be interpreted as subsistence consumption, and $\delta$ is the elasticity of marginal utility

with respect to consumption. In the simulations, $\delta$ is put at 1 and s is assumed 0.2.[66] Both the pure rate of time preference and the discount rate are assumed 0.03. The discount rate is of course lower than contemporary mortgage and bond rates, although given that this is intended as a net lending rate adjusted for any risk premium, it does not seem unrealistic. The pure rate of time preference is perhaps slightly above values assumed in contemporary work, which may be appropriate given the long-term decline in mortality rates. Finally the time horizon, T, is put at thirty-five years, consistent with contemporary life expectancies at age twenty.

The simulation generates some possibly surprising results. The first is that agents with alternative incomes close to subsistence will settle, those with incomes as low as 0.22. The much higher future income is enough to compensate for the long period of saving required, twelve years, during which time their consumption is just 0.007 above subsistence, or $1.75 above subsistence of $50.[67] Also surprising is the implication that those with incomes above 0.54 will not settle. In other words, the income from a cleared farm has to be nearly double the agent's alternative income in order that lifetime utility increase. The utility cost of the lower initial consumption must be compensated by much higher consumption levels later on.

It is perhaps instructive to compare the settlement pattern implied by our model with the

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[66] We take a typical completed farm to have fifty improved acres generating $250 in agricultural output annually. Based on the normalization in our model, an income of $250 is assigned a value of one. Thus subsistence consumption is by implication $50. Fifty dollars is roughly equal to per capita income in the U.S. at this time, a period when average household size was over five. Contemporary estimates of $\delta$, which can also be interpreted as the measure of risk aversion, are about 2. It might be argued that the people who chose to settle were probably less risk averse than the average. The level of subsistence consumption assumed is possibly on the low side given that the consumption unit is the farm family.

[67] This low rate of consumption also continues for the first 2.3 years of settlement, giving a total period of very low consumption of 14.5 years.

expected pattern when capital markets are perfect. Of course one difference is in the timing. Since agents are now permitted to borrow against future income, those who choose to settle will begin their farms in period zero. There is, perhaps surprisingly, little impact on those with low incomes since they would choose to settle in any case. The main effect is at the upper end. Agents with alternative incomes as high as 0.65 will settle.[68] This is 10 percentage points more than in the previous case.

A potential barrier to settlement, missing from the basic model, is the initial cost of the land, farm equipment, and draft animals. For the purpose of illustration, we put the cost of this capital at the annual income of a fully-cleared farm. Although this is a relatively modest capital cost, the impact on the the settlement decision is dramatic. If the parameter values are otherwise assumed the same, it turns out that no agent, regardless of their alternative income, will settle. Consider an agent with income, $y^*$, of 0.30. In the absence of an initial fixed cost, he saves for under four years and ends with a large net benefit from starting a farm. If, however, there is a capital cost of 1 (ie. normalized income on a fully-cleared farm), the same agent must save for nearly thirteen years before settling, and the remaining time available is not enough to compensate for the period of lower consumption. For most income levels above 0.35 the additional period of savings due to the capital requirement is four to five years.

To illustrate the possible impact of revenue from lumber on the settlement decision, we

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[68] The value 0.65 is the solution of $y^*$ to the following equation:

$$y^* \int_0^T e^{-rt}dt = \int_0^T (1 - e^{-pt}) e^{-rt}dt,$$

where r=0.03, p=0.1, and T=35.

have run a further simulation, which includes an income of 0.1 each year following initial settlement (see Table 1A).[69] Most importantly, the supplementary forest income of 0.1 makes it optimal for those with incomes between 0.32 and 0.52 to settle. In the absence of this income, it is optimal for no one to settle. Secondly, the simulation supports the hypothesis suggested by the theoretical model as well as the historical literature that the poorest will not settle, that is anyone with an alternative income below 0.32. As with the basic model, the incomes of settlers must eventually double in order that starting a farm be the optimal decision. Finally, as conjectured, an initial capital requirement causes settlement to be delayed. Even excluding the low income settlers, those with alternative incomes below 0.40, the initial period of saving is roughly ten years. Thus we would expect settlers not to begin farms until they are at least thirty years old unless they have other sources of capital.

[69] Assuming a completed farm generates $250 (see text), forestry income would amount to an additional $25 per year.

Table 1A
Farm Settlement: Simulation Results

| Income (%)[a] | Consumption (%)[a] | Saving (years) | Dissaving (years) | Utility | |
|---|---|---|---|---|---|
| | | | | Settle[b] | Don't Settle[b] |
| 30 | 25.3 | 18.1 | 1.7 | 50.2 | 49.9 |
| 32 | 26.3 | 15.3 | 1.8 | 44.4 | 45.9 |
| 34 | 27.1 | 13.5 | 1.9 | 40.2 | 42.6 |
| 36 | 28.0 | 12.2 | 2.0 | 36.9 | 39.7 |
| 38 | 29.0 | 11.2 | 2.1 | 34.2 | 37.2 |
| 40 | 30.2 | 10.5 | 2.2 | 32.1 | 34.9 |
| 42 | 31.4 | 10.0 | 2.4 | 30.3 | 32.8 |
| 44 | 32.7 | 9.7 | 2.6 | 28.8 | 30.9 |
| 46 | 34.0 | 9.4 | 2.8 | 27.5 | 29.0 |
| 48 | 35.4 | 9.3 | 2.9 | 26.4 | 27.2 |
| 50 | 37.0 | 9.3 | 3.1 | 25.4 | 26.4 |
| 52 | 38.7 | 9.4 | 3.4 | 24.5 | 24.9 |
| 54 | 40.5 | 9.6 | 3.6 | 23.7 | 23.4 |

[a] Percent of income on a fully-cleared farm.

[b] All values negative.

## Appendix 2

Table 2A
Number of Mills, Shops and Inns: 1826 to 1851

| Shops, Inns, Saw Mills, and Grist Mills 1826 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| District | Population (census data) | No. of Townships | No. of Shops Assessment data | Number of Persons per Facility | | | | |
| | | | | per assessment shop | per licenced shop | per licenced inn | per saw mill | per grist mill |
| Eastern | 13,522 | 9 | 42 | 321 | 436 | 222 | 436 | 613 |
| Ottawa | 3,175 | 7 | 11 | 289 | 454 | 176 | 318 | 794 |
| Bathurst | 11,364 | 14 | 31 | 367 | 758 | 355 | 947 | 812 |
| Johnstown | 15,670 | | 30 3/4 | 505 | 603 | 215 | 320 | 540 |
| Midland | 29,425 | 22 | 133 | 221 | 654 | 334 | 398 | 754 |
| Newcastle | 12,290 | 15 | 28 | 439 | 492 | 300 | 396 | 819 |
| Home | 19,670 | 24 | 70 | 281 | 469 | 333 | 269 | 635 |
| Gore | 13,017 | 16 | 32 | 407 | 592 | 289 | 260 | 651 |
| Niagara | 19,059 | 18 | 56 | 340 | 477 | 258 | 414 | 515 |
| London | 18,077 | 25 | 25 | 723 | 4519 | 822 | 362 | 516 |
| Western | 7,533 | 15 | 18 | 418 | 753 | 260 | 1883 | 1256 |
| Total | 166,379 | | 477 | 349 | 623 | 307 | 391 | 668 |

Source: Journal of the Legislative Assembly of Upper Canada.

| Shops, Inns, Saw Mills, and Grist Mills 1830 | | | | | | | |
|---|---|---|---|---|---|---|---|
| District | Population (census data) | No. of Shops Assessment data | Number of Persons per Facility | | | | |
| | | | per assessment shop | per licenced shop | per licenced inn | per saw mill | per grist mill |
| Eastern | 19,755 | 55 | 359 | 412 | 278 | 681 | 1162 |
| Ottawa | 3,941 | | | 328 | 141 | 358 | 785 |
| Bathurst | 16,082 | 59 | 273 | 315 | 140 | 1005 | 731 |
| Johnstown | 21,473 | 71 | 302 | 358 | 176 | 488 | 795 |
| Midland | 34,519 | 121 | 288 | 933 | 236 | 411 | 933 |
| Newcastle | 14,850 | 44 | 338 | 330 | 165 | 371 | 782 |
| Home | 28,375 | 113 | 251 | 326 | 251 | 277 | 728 |
| Gore | 20,954 | 65 | 322 | 487 | 283 | 291 | 676 |
| Niagara | 20,886 | 61 | 342 | 614 | 161 | 298 | 746 |
| London | 22,803 | 53 | 430 | 1341 | 530 | 304 | 600 |
| Western | 9,288 | 24 | 387 | 387 | 290 | 2322 | 844 |
| Total | 213,156 | | | 381 | 221 | 387 | 775 |

Source: Journal of the Legislative Assembly of Upper Canada.

| Shops, Inns, Saw Mills, and Grist Mills 1839 | | | | | | | |
|---|---|---|---|---|---|---|---|
| District | Population (census data) | No. of Shops Assessment data | Number of Persons per Facility | | | | |
| | | | per assessment shop | per licenced shop | per licenced inn | per saw mill | per grist mill |
| Eastern | 28,827 | 64 | 450 | 771 | 450 | 686 | 1602 |
| Ottawa | 8,510 | 27 | 315 | 709 | 851 | 426 | 851 |
| Bathurst | 24,632 | 82 | 246 | 309 | 385 | 795 | 880 |
| Johnstown | 32,771 | 75 | 437 | 745 | 504 | 596 | 1311 |
| Midland | 52,523 | 145 | 363 | 1382 | 343 | 449 | 955 |
| Newcastle | 36,932 | 106 | 348 | 2841 | 1679 | 397 | 821 |
| Home | 70,350 | 140 | 412 | 1050 | 299 | 354 | 938 |
| Gore | 51,527 | 153 | 337 | 1431 | 500 | 355 | 1120 |
| Niagara | 30,694 | 101 | 304 | 30694 | 327 | 323 | 653 |
| London | 53,015 | 98 | 541 | 2424 | 884 | 371 | 930 |
| Western | 19,177 | 45 | 426 | 1009 | 342 | 1198 | 1369 |
| Total | 409,048 | 1036 | 396 | 1255 | 442 | 426 | 974 |

Source: Journal of the Legislative Assembly of Upper Canada

| Shops and Inns 1850 | | | | | |
|---|---|---|---|---|---|
| District | No. of Townships | Population | Persons per Facility | | |
| | | | Shops | Licenced shops | Licenced inns |
| Eastern | 12 | 40,195 | 344 | 1,546 | 467 |
| Ottawa | 11 | 11,334 | 436 | 1,889 | 493 |
| Johnstown | 16 | 44,439 | 380 | 1,851 | 252 |
| Bathurst | 34 | 59,644 | 328 | 1,193 | 609 |
| Midland | 44 | 87,274 | 488 | 1,455 | 235 |
| Newcastle | 33 | 76,765 | 495 | 1,828 | 424 |
| Home | 43 | 136,741 | 304 | 998 | 264 |
| Gore | 36 | 158,585 | 437 | 1,416 | 370 |
| London | | 101,608 | 389 | 1,613 | 454 |
| Niagara | 26 | 53,029 | 226 | 1,105 | 293 |
| Western | 31 | 33,979 | 378 | 809 | |
| Total | | 803,593 | 369 | 1,317 | |

Source: Journal of the Legislative Assembly of the Province of Canada 1851, Appendix B.

## Shops, Inns, Saw Mills, and Grist Mills 1851-52 (Census Data)

| District | Population Census (000) | NUMBER | | | | | | PERSONS PER FACILITY | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Shops | Inns & Tavern | Grist Mills Total | Grist Mills No. Ret[a] | Saw Mills Total | Saw Mills No. Ret[a] | Shops | Inns & Taverns | Grist Mills Total | Grist Mills No. Ret[a] | Saw Mills Total | Saw Mills No. Ret[a] |
| Eastern | 46.0 | 332 | 63 | 20 | 7 | 61 | 23 | 139 | 730 | 2300 | 6571 | 754 | 2000 |
| Ottawa | 13.4 | 46 | 20 | 6 | 2 | 17 | 3 | 291 | 670 | 2233 | 6700 | 788 | 4467 |
| Johnstown | 51.0 | 344 | 53 | 37 | 15 | 60 | 34 | 148 | 962 | 1378 | 3400 | 850 | 1500 |
| Bathurst | 60.3 | 276 | 114 | 39 | 19 | 76 | 38 | 218 | 529 | 1546 | 3174 | 793 | 1587 |
| Midland | 93.2 | 672 | 131 | 66 | 29 | 171 | 93 | 139 | 711 | 1412 | 3214 | 545 | 1002 |
| Newcastle | 88.8 | 739 | 146 | 66 | 46 | 182 | 152 | 120 | 608 | 1345 | 1930 | 488 | 584 |
| Home | 131.5 | 915 | 274 | 120 | 69 | 316 | 223 | 144 | 480 | 1096 | 1906 | 416 | 590 |
| Gore | 125.6 | 1145 | 284 | 68 | 39 | 219 | 140 | 110 | 442 | 1847 | 3221 | 574 | 897 |
| London | 162.9 | 1028 | 294 | 175 | 44 | 292 | 214 | 158 | 554 | 931 | 3702 | 578 | 761 |
| Niagara | 62.8 | 633 | 179 | 57 | 30 | 117 | 78 | 99 | 351 | 1102 | 2093 | 537 | 805 |
| Western | 45.1 | 316 | 98 | 29 | 6 | 50 | 21 | 143 | 460 | 1555 | 7517 | 902 | 2148 |
| 5 cities | 70.6 | 1308 | 334 | 9 | 3 | 6 | 4 | 54 | 211 | 7844 | 23533 | 11767 | 17650 |
| Total | 951.2 | 7754 | 1990 | 692 | 309 | 1567 | 1023 | 123 | 478 | 1375 | 3078 | 607 | 930 |

[a] Number returning data.