# *Zipf, Gibrat and Wealth: Implications for the Interpretation of Canadian Economic Growth and Development*

By

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## *1. Introduction*[1]

Empirical evidence is presented documenting the existence of Zipf's and Gibrat's Law using census-linked wealth micro-data from 1892 and 1902. The implication of the existence of these laws in this data for Canadian economic history is that ultimately, the sources of wealth creation are irrelevant. What is most important is that economic growth and development is occurring while the sources and nature of that activity are of secondary interest at best.

Canadian economic history has been marked by debates over whether its economic growth was staples driven/export-led or supply side driven and this debate continues.[2] As Altman (2003: 230) recently remarks, staple theory helps account for differences in real per capita GDP across regions and countries and "staple theory, therefore, contributes towards an explanation of the lack of convergence of real per capita GDP between regions and nations." Recently however, the debate has acquired an international perspective with work on the "resource curse" by economists such as Sachs and Warner and Auty who argue that employment of factors in resource industries removes them from other sectors thus reducing long run economic growth and performance.[3]

Di Matteo, Emery and Shanahan (2005) using examples from Canada and Australia find that comparable episodes of natural resource activity generated similar growth rates in wealth though different levels of wealth suggesting that successful natural resource based development can occur with long-term success hinging on the ability to retain linkages. Most recently, Keay (2007) finds that resource industries did not constrain the rate of change of Canadian real per capita GNP over the period 1900-1999 and indeed had a substantial impact on the level of income. Keay finds that in the absence of resource intensive production "real GNP per capita would have grown at virtually the same rate that is

[1] The author acknowledges the financial support of the Social Sciences and Humanities Research Council of Canada.

[2] There is a vast literature on the staples approach to Canadian economic history and whether Canadian economic growth was export-led or supply side driven. For some of the debate, see Altman (2003), Ankli (1980), Bertram (1963), Buckley (1958), Caves (1975), Chambers and Gordon (1966), Green and Sparks (1999), Innis (1930), Lewis (1981), Norrie (1975), Southey (1978), Watkins (1963).

[3] See Sachs and Warner (1995, 1997, 1999, 2001) and Auty (2001).

bserved in the actual data: 2.07 percent versus 2.01 percent per year, respectively."

When combined with this recent Canadian work, the results in this paper suggest that it does not matter whether economic activity was export-led or neoclassical in terms of its origins. Economic patterns and distributions are explainable by power laws and these patterns appear to be independent of the nature or sources of economic growth. So long as economic activity is occurring, wealth formation ensues and given a random wealth generation process with an expected growth rate and standard deviation, distributions of wealth and other economic activity distributions will conform to Zipf's Law and by extension Gibrat's Law.

## *2. Zipf's Law and Gibrat's Law*

Explanations of wealth distribution and the determinants of wealth can be rooted in models of economic determinants or in broad laws based on mathematical relationships such as the Pareto Distribution. Pareto (1896) showed that the distribution of income in the upper tail essentially follows a power law distribution. Power laws are relationships between two scalar quantities taking the form:

(1) $y=ax^k$

When the log of both sides is taken, the relationship takes the form of a straight line. Power law relationships and power law probability distributions are observed in many fields and are used to explain the distribution of phenomena such as individual wealth.

Fr example, in urban economics, a power law known as Zipf's Law provides an explanation for the size distribution of cities (Gabaix, 1999a,b). Zipf's Law for cities states that if one ranks city sizes from the largest to the smallest, the probability that a city's population is greater than some size S is proportional to 1/S. A regression to test Zipf's Law for cities would regress the natural log of rank on the natural log of population size and if the law holds, it should yield a coefficient estimate that is close to –1. That is:

(2) LnRANK = a – bLnSIZE

where b is equal to one.[4]

Furthermore, it has been shown that if Zipf's Law holds, then another Law known as Gibrat's Law likely also holds (Gabaix, 1999a). Gibrat (1931) formulated his law to explain the distribution and growth of firms. Gibrat's Law states that growth rates are not correlated with size or put another way that growth processes are homogenous with respect to size. Gabaix (1999a,b) shows that if cities grow randomly, with the same expected growth rate and the same standard deviation, then at the limit the distribution will converge to Zipf's Law. In other words, Gabaix argues that for cities, if Gibrat's Law holds, then Zipf's Law does also and vice versa.

Explanations as to why Zipf's Law, and by extension Gibrat's Law, hold are rooted in either economic determinants or random factors. One explanation is that these laws are simply manifestations of stochastic exponential growth processes over time with time itself as a random variable (Reed, 2001). Economic explanations usually provide a story rooted either in productivity differences, externalities, or some other type of cost differences in the ranking distribution under consideration (Gabaix, 1999b: 129).

Does Zipf's Law and by extension Gibrat's Law hold for wealth? The implications are intriguing for it would imply that the growth rate of wealth over time follows a common growth process that is independent of the size of wealth or indeed the structure of the economy. Put another way, wealth accumulation and hence economic growth, are independent of the character and composition of economic activity.

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[4] In general, Zipf's Law holds if the product of the rank and the frequency is equal to a constant so that taking the natural logarithm of both sides and plotting the natural log of the frequency against the natural log of the rank yields a straight line with slope of –1. See Alexander et al., 1998: 155-156.

## *2. The Data*

The micro-data consists of 7,156 census-linked probated decedents from all counties and districts of Ontario, Canada for the years 1892 (3,515) and 1902 (3,641) with the 1902 data representing a new research contribution that doubles the amount of data. The data set was constructed from the probate records of the county surrogate courts and the 1891 and 1901 Census of Canada.[5] Probate is an institutional process that transfers property from the dead to the living making the inventory and valuation of property of key importance. The executor of the estate (or administrator in intestate cases) conducted the inventory,[6] legally in response to a request by a legatee or creditor. In practice, it was brought in voluntarily without awaiting the compulsory summons (Howell 1880: 325-326).[7] The inventory provided wealth estimates grouped into sixteen categories[8] allowing for separate estimates of real estate, financial assets and personal property.

Any potential limitations to using probate records must be balanced against the fact that wealth in the probate records is inventoried in detail not found in other nineteenth century primary sources.[9] While the

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[5] Sources for the data set were: (1) Public Archives of Ontario, Surrogate Court Wills, 1892, 1902 and (2) Public Archives of Canada, Census of Canada, 1891,1901 Manuscripts.

[6] Intestates are decedents without a will.

[7] According to Howell's (1880: 325-326) Probate, Administration and Guardianship "The inventory should contain a statement of all the goods, chattels, wares and merchandize, as well moveable as not moveable, which were of the person deceased at the time of his death within the jurisdiction of the court. A proper inventory should enumerate every item of which the personal estate consisted, and should specify the value of each particular. But unless by order of court, or in obedience to a citation, an inventory does not set forth the goods and chattels in detail." It should be noted that real estate was usually recorded net of any mortgages outstanding so that the wealth figure used in this paper is a measure of net wealth.

[8] The inventory categories were:(1) Household goods and furniture, (2) Farm implements, (3) Stock in trade, (4) Horses, (5) Cattle, (6) Sheep and Swine, (7) Book Debts and Promissory Notes, (8) Moneys secured by mortgage, (9) Life Insurance, (10) Bank stocks and other shares, (11) Securities, (12) Cash on hand, (13) Cash in bank (14) Farm produce, (15) Real estate, (16) Other personal property.

[9] Discussions of Ontario probate records as historical sources of data are contained in Elliott (1985: 125-32) and Osborne (1980: 235-47). See also Siddiq and Gwyn (1991:

presence of estate taxes may provide the incentive for an executor or administrator to underestimate inventoried wealth the wealth data from nineteenth century Ontario probate records does not likely suffer from such a bias because succession duties in Ontario appear July 1, 1892 when the *Succession Duty Act* (Statutes of Ontario, 55 Vict., Cap. 6, 1892) came into effect. Even then the Act allowed for many exemptions.[10] Generally, the property liable to duty was quite comprehensive. After 1896, it even included property vested jointly with interest to survivor. The Succession Duty Act applied even to property "voluntarily transferred by deed, grant or gift made in contemplation of the death of the grantor or bargainor, or made or intended to take effect, in possession or enjoyment after such death..."[11] if they were made in the 12 months preceding death. Moreover, after 1896, *donatio mortis causa*, that is, goods and possessions delivered in apprehension of death, were also clearly defined as property liable to duty.[12]

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103-117). For a discussion of the Ontario probate data, see Di Matteo (1997). When studying the wealth holding of the general population, an attempt can be made to adjust the data for potential biases using the estate multiplier technique. See Siddiq and Gwyn (1991: 103-17) and Di Matteo and George (1992: 453-483). A noted scholar of Ontario's civil registration of vital events statistics writes that: "For years after 1869 Ontario's civil registration of vital events was unsatisfactory. Although its legislative provisions surpassed Quebec's, Ontario was less successful in obtaining registrations...the registrar-general estimated that registrations for 1870 captured only a fifth of the province's deaths..." By 1893, reported death rates for municipalities ranged from 26 to 2 per thousand. See Emery (1993: 32-34).

[10] The Succession Duty Act did not apply: (1) To any estate the value of which, after payment of all debts and expenses of administration, does not exceed $10,000; nor (2) To property given, devised or bequeathed for religious, charitable or educational purposes; nor (3) To property passing under a will, intestacy or otherwise, to or for the use of the father, mother, husband, wife, child, grandchild, daughter-in-law, or son-in-law of the deceased, where the aggregate value of the property of the deceased does not exceed $100,000 in value. Revisions to the Act in 1897 (Revised Statutes of Ontario (1897), Cap. 24) kept the $100,000 exemption value but it was later reduced to $50,000 in 1907 (5 Edw.VII, c.6, s.6) which is well after the period of these two cross-sections.

[11] A report on the Succession Duty Act in the Welland Tribune (April 1, 1892: 2) asserted that: "The act provides for evasion by transfers before death, although the fear of revival makes such attempts very rare."

[12] There is a drop in average other personal property in Ontario between 1892 and 1902 that is quite large but can be attributed to outliers. For example, in the four Niagara region counties in 1892, Wentworth County reports the two largest amounts of other personal property $66,500 by Thomas Myles, a coal merchant, and $23,522 by Jacob Zingsheim, a furniture manufacturer. These two individuals represent almost half the

The construction of the data set proceeded by recording onto standardized data collection forms those estates probated in the years 1892 and 1902. Individuals were then linked back to census returns in order to obtain additional information.[13] Those individuals who died prior to the taking of the census or were non-Ontario residents with property in one of the counties were omitted from the census tracing procedure.[14] For 1892, a total of 4,925 estates were taken down of which 4,236 were traceable and 3,515 successfully traced for a success rate of 83 percent. For 1902, a total of 4,969 estates were taken down of which 4,233 were traceable and 3,646[15] successfully traced for a success rate of 86 percent.

The period between 1892 and 1902 witnessed some economic change as a survey of some selected aggregate statistics for this data reveal (See Tables 1 & 2). Average wealth declines between the two years with the decline being driven by a decline in real estate values.[16] The average value of financial assets actually rises over the time period. In terms of other social-economic characteristics, the percent of decedents who were male declines as do the average number of children and the proportion of married decedents. On the other hand, the proportion of Canadian born decedents rises fairly dramatically.

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average value of other personal property in 1892. The maximum amount in 1902 in these four counties is $15,000 reported by one Thomas Bates, a brewer.

[13] For a full account of the data collection process, see Di Matteo (1997).

[14] Some of these omitted probated decedents were residents of other provinces of Canada, the United States and Britain but with property in Ontario. Other omitted individuals were Ontario residents who died before the taking of the census (in April) and therefore would not have been recorded in the Census schedule of the living. There often was a lag between the date of death and the probating of the estate. For example, in some intestate cases, time was expended searching for a will. As well, there were sometimes complicated intestate estates with incomplete administrations. For example, an individual could die intestate and the surviving spouse apply for administration of the estate and in turn die leaving the administration incomplete. If there were no surviving children or none resident in the immediate vicinity, it could take many months to apply for probate and settle the estate.

[15] Five of these individuals did not have age recorded and therefore for analysis, the final number for 1902 is actually 3641.

[16] Such a decline in real estate values has also been documented by Darroch (1983) using assessment rolls for Toronto.

As for wealth across counties, there are both increases and declines across Ontario between these two years. Declines were clustered in the counties of central southern Ontario stretching from York-Simcoe to Lennox and Addington, the contiguous counties of Glengarry, Stormont and Dundas in eastern Ontario, and a swath of counties starting from Norfolk and Haldimand on Lake Erie running north through Wentworth, Wellington to and then along western southern Ontario. The other counties – notably a cluster around Middlesex County, the tip of the Niagara peninsula and most of eastern Ontario and the North all saw increases in average county wealth.

## *3. Empirical Analysis*

The analysis of the data begins with an examination of the relationship between the natural log of rank versus the natural log of wealth in order to see if Zipf's Law is upheld. Figures 1 and 2 plot rank against size for the 1892 decedents while Figures 3 and 4 do it for 1902. An OLS regression between the natural logs of rank and size is also estimated and the line plotted on the diagrams. For both years, the relationship is examined for all the decedents as well as after dropping the bottom 20 percent of the wealth distribution as many power laws are applied to the upper tail of distributions.

The results show strong support for the existence of Zipf's Law particularly when the bottom 20 percent of the distribution is dropped. Figure 2 shows an estimated coefficient for b in 1892 of –0.9874 while Figure 4 shows an estimate of –0.9755 for 1902.[17]

The next step is to see if the growth rates of wealth between 1892 and 1902 behave according to Gibrat's Law – that is, the growth rates should be independent of the size of the starting values. For this test, the average wealth of each county as shown in Table 2 is used and the percent change in the growth rate of wealth is plotted against the level of wealth in 1892 in Figure 5. The regression of the growth rate in wealth versus average county wealth in 1892 is also reported in Table 3.

[17] All regressions in Figures 1-4 yielded coefficient estimates that were significant at the 5 percent level.

The results of the plot in Figure 5 show a negative relationship between the growth rate and size and the regression relationship has significant coefficients at the 5 percent level. However, when the growth rates across counties are ranked from highest to lowest and the bottom 20 percent dropped from the analysis, the resulting graph (Figure 6) shows that there is almost no relationship between growth rate and size. As well, the regression results after dropping the bottom 20 percent also show there is no significant relationship between growth rate and average county wealth. This evidence suggests support for Gibrat's Law after the lower tail of the distribution of growth rates is eliminated.

The results of the examination of wealth in Ontario counties finds evidence supporting the existence of Zipf's Law as well as Gibrat's Law. This can imply that with respect to accumulation of wealth across Ontario's counties in the late 19th century, size did not matter. If size does not matter for wealth accumulation, which is an outcome of economic growth and activity, then there is a strong possibility that size and initial advantage may not matter for economic growth.

An additional simple test of this hypothesis involves looking at the production value of industrial and manufacturing output for Ontario's census divisions over the period 1871 to 1911 to see if the evidence also is supportive of Zipf's Law.[18] For each of these years, the value of manufacturing output by census division was ranked from highest to lowest and then the natural log of rank regressed on the natural log of the produced value of manufacturing output. The results for all census subdivisions for each census year are presented in Figure 7 and show an estimate of b ranging from a low of –0.5109 to a high of –1.2565 with an average across all five years of –0.9423. The years 1881, 1901 and 1911 present estimates that are the closest to -1 ranging from –0.92 to –1.06. In addition, when the estimates for each year are done dropping the bottom 20 percent of growth rates (results not shown), the estimate of b ranges from –1.0902 to –1.4627 with an average of –1.3034.

The additional step of calculating the growth rates in the value of manufacturing output from year to year to test Gibrat's Law is difficult given potential differences in the quality of census taking over the years, and measurement of the manufacturing sector as well as the changes in

[18] Sources: Census of Canada: 1871, Vol. III, 458-451; 1881, Vol. III, 501-503; 1891, Vol.III, 383-385; Vol.III, 174-219; 1911, Vol. III, 235-289.

the boundaries of census subdivisions. Nevertheless, the growth rate of the value of manufacturing output across census divisions in Ontario from 1891 to 1901 (the period corresponding to the wealth data in this paper) was calculated and was regressed on the value of produced manufacturing output in 1891.[19] The results of this regression were not as supportive of the existence of Gibrat's Law as a positive and statistically significant relationship was found between growth rates and initial size from 1891 to 1901.[20] However, the effective magnitude of the relationship is such as to be so small as to be nearly zero.

[19] No adjustment was made for inflation as evidence shows prices the same between 1902 and 1892. See Green and Urquhart (1987: 183).

[20] The estimated regression is PERCENT = -16.633905 + 1.579E-06SIZE`. Both coefficients are statistically significant at the 5% level, the adjusted R-squared os 0.035620 and the value of the F-statistic is 4.103.

## *4. Conclusion*

The results of the empirical analysis using wealth data from Ontario's counties in 1892 and 1902 show support for the existence of Zipf's Law and Gibrat's Law. These results imply that with respect to accumulation of wealth across Ontario's counties in the late 19th century, size did not matter. Counties that had higher levels of wealth in 1892 did not derive any accumulation advantage from that higher level of wealth. Over the course of the 1890s, counties that were wealthier in 1892 did not appear to have had any advantage or disadvantage relative to counties that had lower average wealth. Additional empirical evidence from census manufacturing output data for Ontario between 1871 and 1911 also provides some support for the existence of Zipf's Law and Gibrat's Law.

Given the diversity of economic activity across these counties, ranging from agriculture, to manufacturing, to resource exploitation, the additional implication from this is that when it came to economic development and growth, the nature of the economic engine did not matter. Put another way, the debate over whether Canadian economic growth was staples driven, export-led or neoclassical in terms of its orientation may not be as important an issue as to whether or not any economic activity is actually underway. While export-led or supply side activity are important as a source of activity, they will not differ in terms of their impact on the ultimate level or distribution of economic growth rates. Extended to our current era, much of the anguish over declining economic sectors is similarly misplaced. While declining sectors or industries are a source of short-term dislocation, in the long run, what matters is the presence of wealth and income generating economic activity. It composition is of secondary importance.

Table 1: Selected Aggregate Statistics

| | 1892 | 1902 |
|---|---|---|
| N | 3515 | 3641 |
| AVERAGE AGE | 61.2 | 61.7 |
| PERCENT MALE | 76.6 | 70.3 |
| PERCENT TESTATE | 73.0 | 72.1 |
| AVERAGE WEALTH($) | 7427.4 | 6334.5 |
| AVERAGE REAL ESTATE($) | 3468.3 | 2551.3 |
| AVERAGE FINANCIAL ASSETS($) | 2988.8 | 3093.5 |
| PERCENT MARRIED | 61.1 | 58.2 |
| PERCENT CANADIAN BORN | 38.4 | 51.4 |
| AVERAGE NO. OF CHILDREN | 3.3 | 2.8 |

## Table 2: Average Wealth by County ($)

| | 1902 | 1892 | % Change |
|---|---|---|---|
| WENTWORTH | 8483 | 10105 | -16.0 |
| LINCOLN | 8419 | 5383 | 56.4 |
| WELLAND | 5451 | 4141 | 31.6 |
| HALDIMAND | 4460 | 5027 | -11.3 |
| NORFOLK | 3857 | 9180 | -58.0 |
| ELGIN | 5094 | 4386 | 16.1 |
| KENT | 5520 | 6227 | -11.3 |
| ESSEX | 4937 | 4847 | 1.8 |
| LAMBTON | 3462 | 5198 | -33.4 |
| MIDDLESEX | 5880 | 5733 | 2.6 |
| OXFORD | 8202 | 4917 | 66.8 |
| BRANT | 4148 | 10043 | -58.7 |
| WATERLOO | 6471 | 5491 | 17.8 |
| PERTH | 7267 | 7396 | -1.7 |
| HURON | 4849 | 4983 | -2.7 |
| WELLINGTON | 5721 | 5752 | -0.5 |
| BRUCE | 3474 | 4189 | -17.1 |
| GREY | 5020 | 4175 | 20.2 |
| SIMCOE | 4651 | 5441 | -14.5 |
| DUFFERIN | 4193 | 5341 | -21.5 |
| PEEL | 4977 | 4729 | 5.2 |
| HALTON | 6230 | 7067 | -11.8 |
| YORK | 9225 | 18556 | -50.3 |
| ONTARIO | 5523 | 4379 | 26.1 |
| VICTORIA & HALIBURTON | 4352 | 4994 | -12.8 |
| DURHAM & NORTHUMBERLAND | 5556 | 6400 | -13.2 |
| PETERBORO | 5635 | 11274 | -50.0 |
| HASTINGS | 4209 | 7206 | -41.6 |
| PRINCE EDWARD | 2935 | 5527 | -46.9 |
| LENNOX & ADDINGTON | 4755 | 5582 | -14.8 |
| FRONTENAC | 6957 | 5541 | 25.5 |
| LEEDS & GRENVILLE | 4739 | 4703 | 0.8 |
| DUNDAS,GLENGARRY,STORMONT | 4847 | 6616 | -26.7 |
| PRESCOTT RUSSELL | 4330 | 3805 | 13.8 |
| CARLETON | 17241 | 10483 | 64.5 |
| LANARK | 5964 | 3984 | 49.7 |
| RENFREW | 9371 | 6687 | 40.1 |
| NORTHERN ONTARIO | 2508 | 2415 | 3.9 |

FIGURE 1

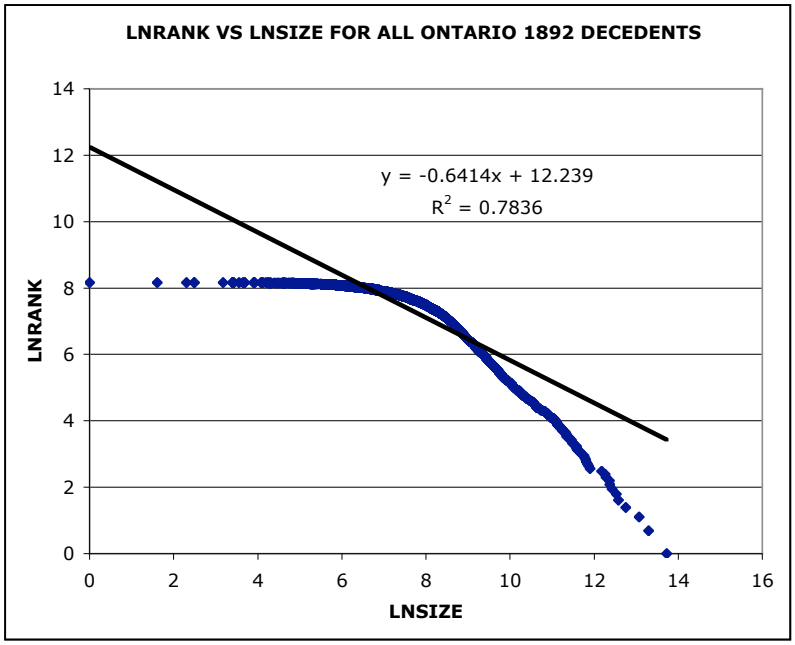



FIGURE 2

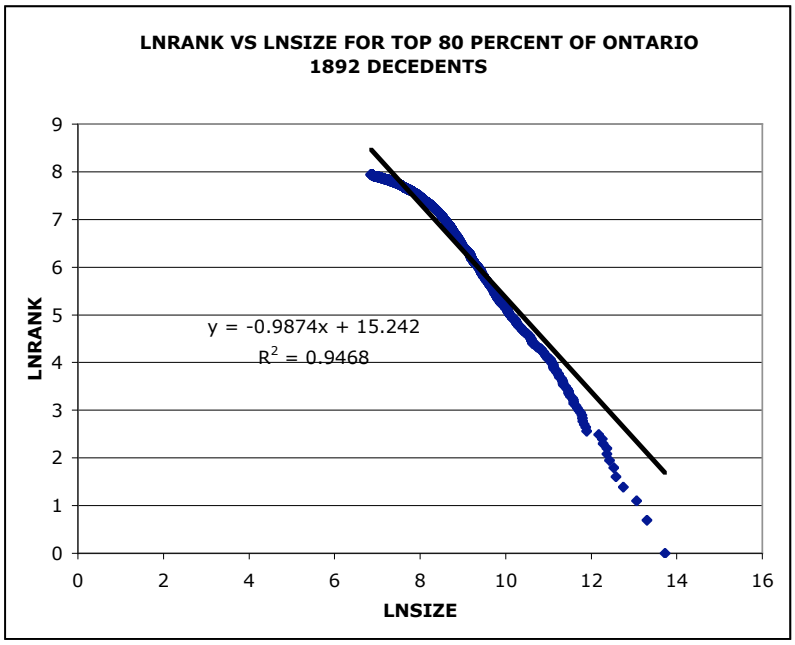


FIGURE 3

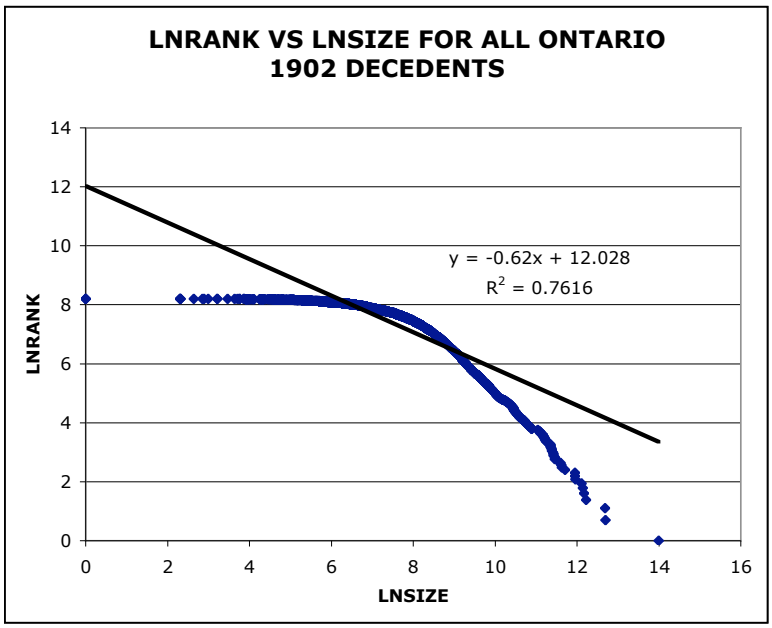



FIGURE 4

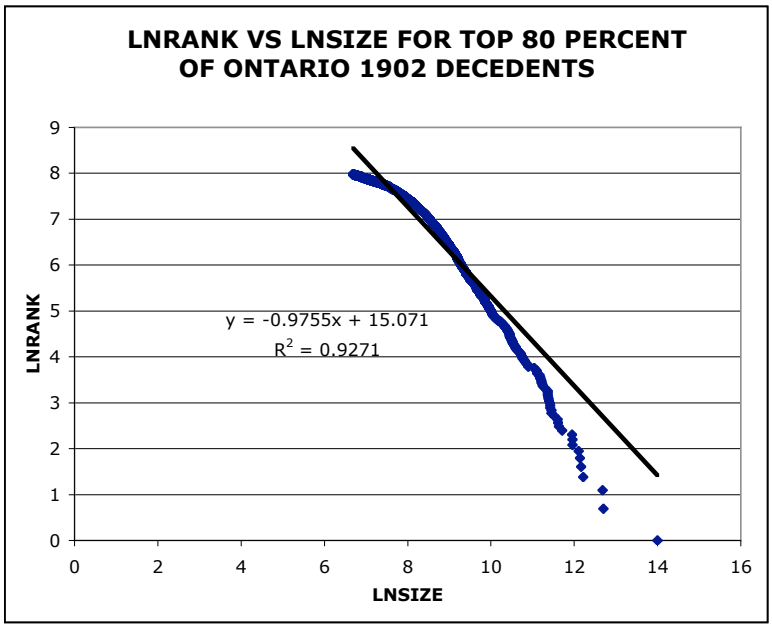


**FIGURE 5**

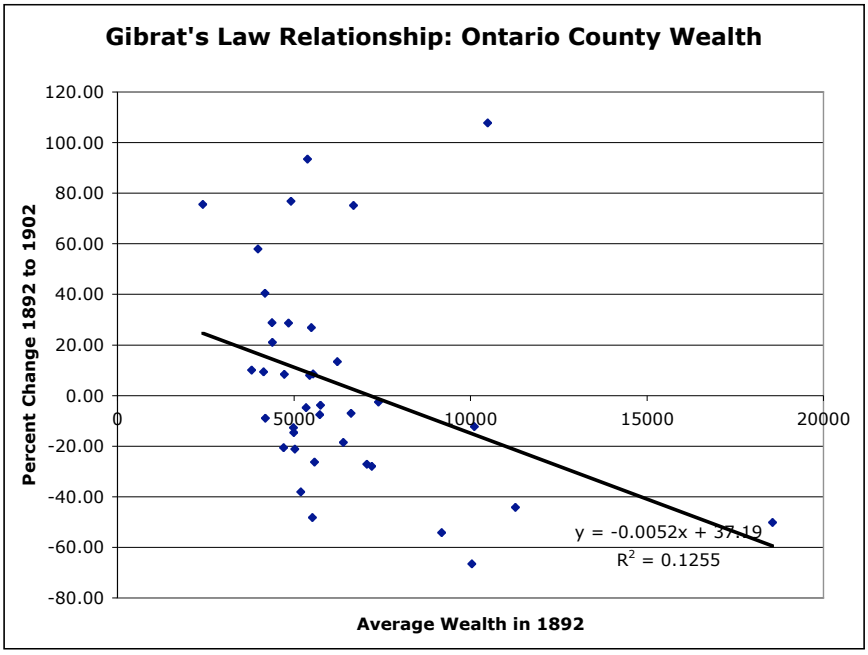



**FIGURE 6**

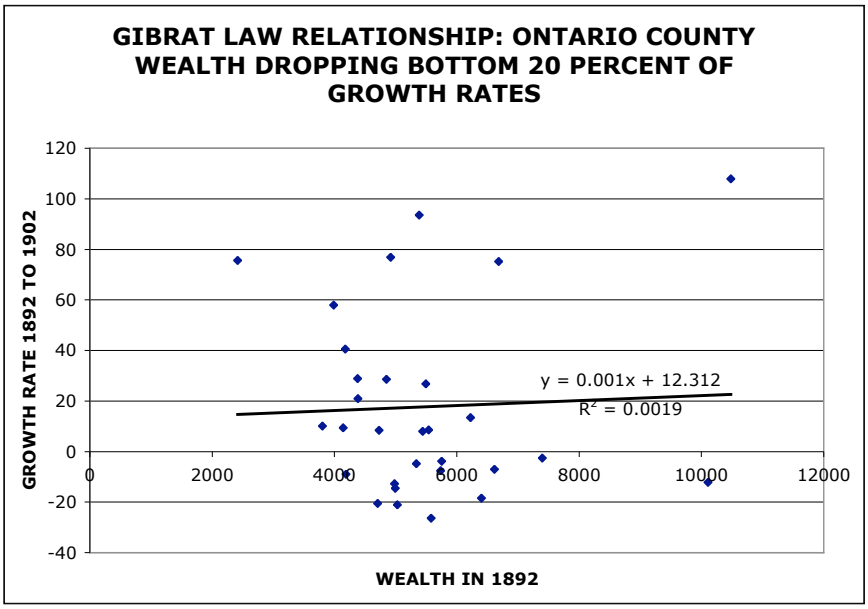
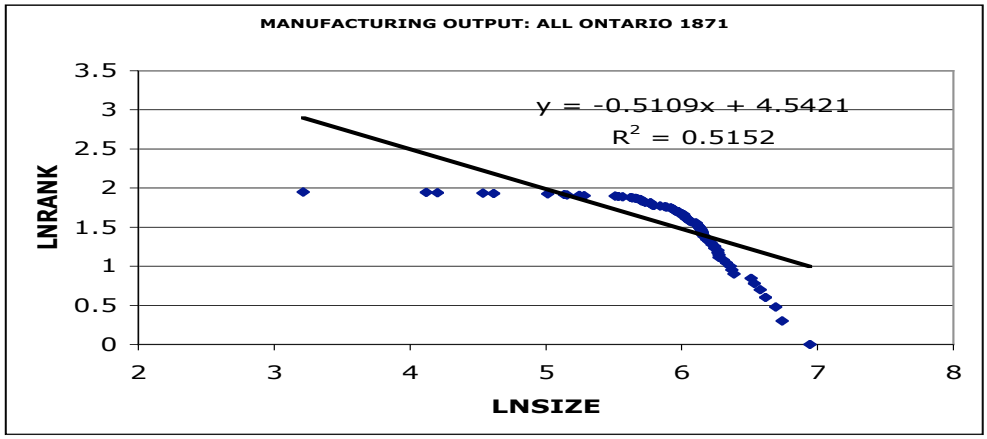


**TABLE 3: Regression Results – Growth Rate of Wealth from 1892 to 1902 Versus Wealth in 1892**

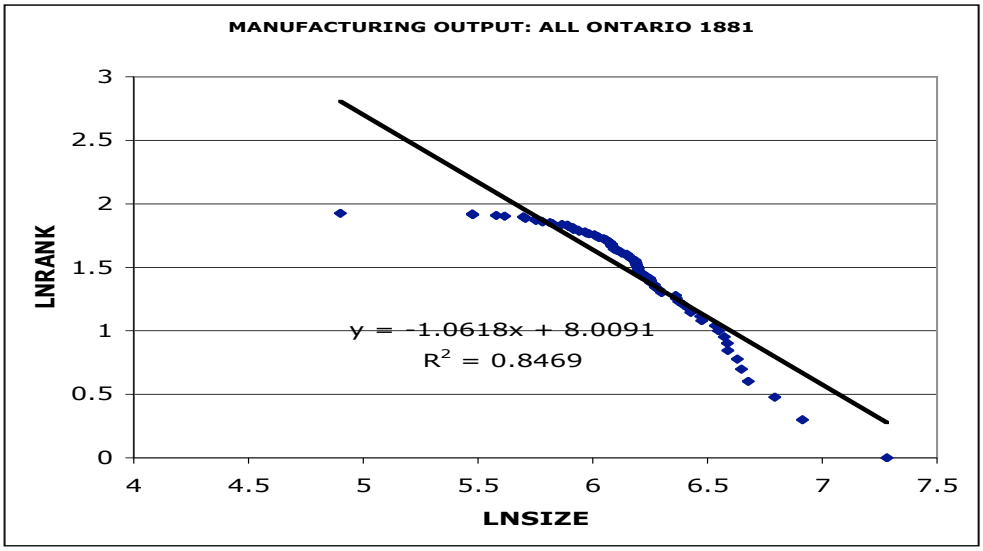
| | *ALL COUNTIES* | *TOP 80 PERCENT BY GROWTH RATE* |
|---|---|---|
| *VARIABLE* | | |
| Constant | 37.190 (2.72) | 12.312 (0.35) |
| Wealth in 1892 | -0.005 (-2.29) | 0.001 (0.15) |
| F-statistic | 5.169 | 0.054 |
| R-squared | 0.126 | 0.002 |

**FIGURE 7**

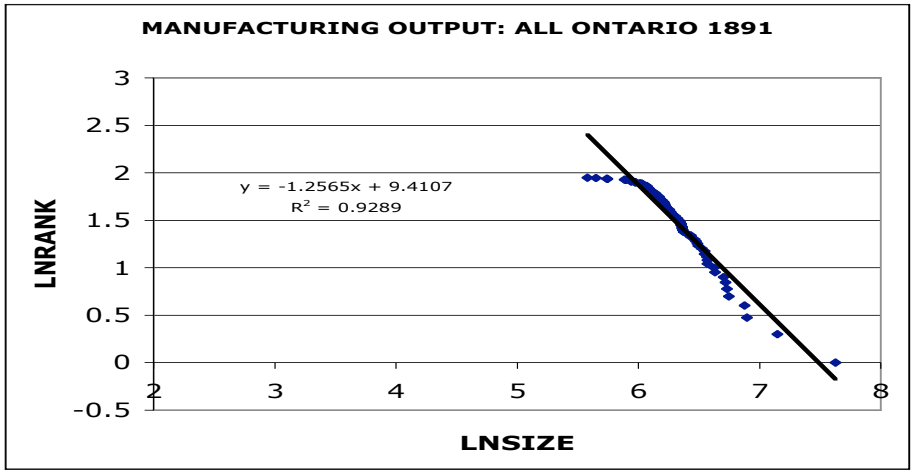
***Zipf's Law for the Value of Ontario Manufacturing Output by Census Division: 1871-1911***



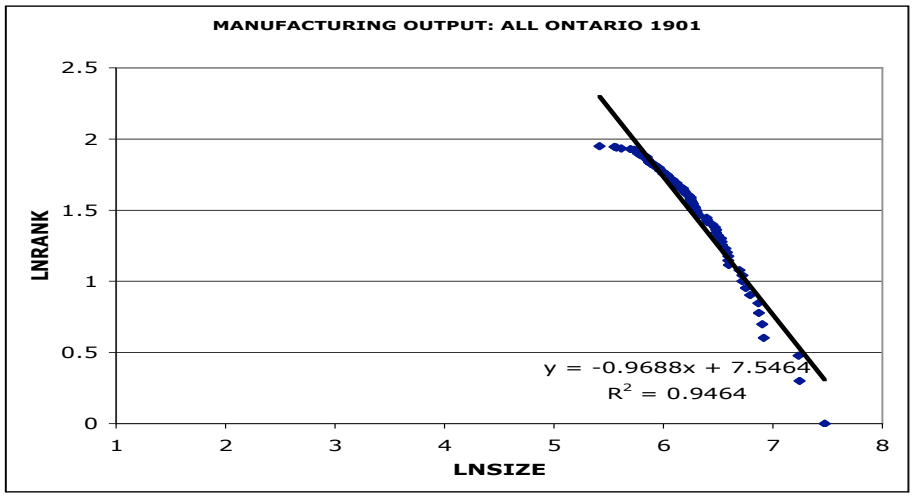

***7a***



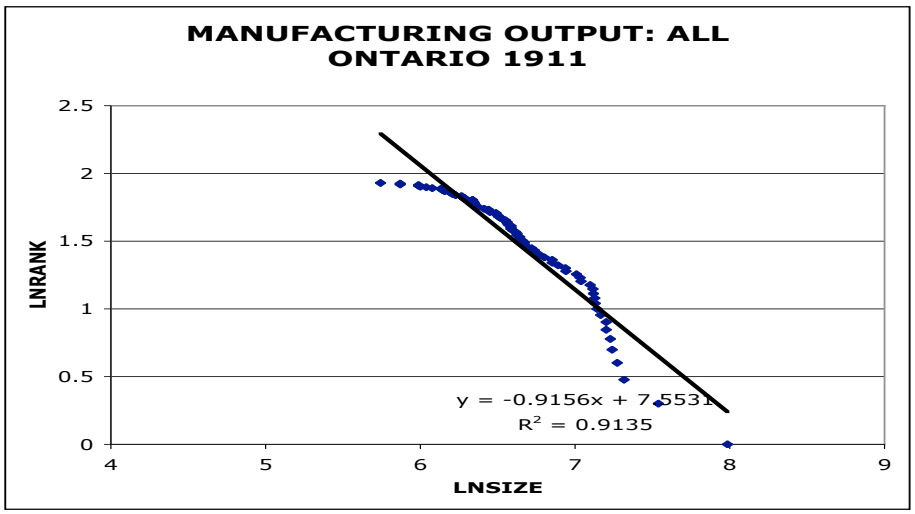

***7b***


MANUFACTURING OUTPUT: ALL ONTARIO 1891
y = -1.2565x + 9.4107
R² = 0.9289
LNRANK
LNSIZE
3
2.5
2
1.5
1
0.5
0
-0.5
2
3
4
5
6
7
8

*7c*


MANUFACTURING OUTPUT: ALL ONTARIO 1901
y = -0.9688x + 7.5464
R² = 0.9464
LNRANK
LNSIZE
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8

*7d*


MANUFACTURING OUTPUT: ALL ONTARIO 1911
y = -0.9156x + 7.5531
R² = 0.9135
LNRANK
LNSIZE
2.5
2
1.5
1
0.5
0
4
5
6
7
8
9

*7e*

**References**

Alexander, A., R. Johnson and J. Weiss (1998) "Exploring Zipf's Law," Teaching Mathematics and its Applications, 17, 4, 155-158.

Altman, M. (2003) "Staple Theory and Export-Led Growth: Constructing Differential Growth" Australian Economic History Review, 43,3,230-255.

Ankli, R. (1980) "The Growth of the Canadian Economy, 1896-1920: Export Led and/or Neoclassical Growth" Explorations in Economic History, 17, 251-274.

Auty, R. "The Political Economy of Resource Driven Growth," European Economic Review, 45, 5, 839-46.

Bertram, G.W. (1963) "Economic growth in Canadian industry: the staple model and the take-off hypothesis," Canadian Journal of Economics and Political Science, 24, 159-184.

Buckley, K. (1958) "The role of Staples Industries in Canada's Economic Development," Journal of Economic History, 4, 439-50.

Caves, R.E. (1971) "Export-led growth and the new economic history." In:J.N. Bhagwati e a.eds. Trade, Balance of Payments and Growth. Amsterdam: North-Holland.

Chambers, E.J. and D.F. Gordon (1966) "Primary products and economic growth," Journal of Political Economy, 74, 315-332.

Darroch, A.G. (1983) "Early Industrialization and Inequality in Toronto, 1861-1899," Labour/Le Travailleur, 11, 31-61.

Di Matteo, L., H. Emery and M. Shanahan (2005) "Natural Resource Exports, Wealth Accumulation and Development in Settler Economies: Northwestern Ontario and South Australia" University of Calgary, Department of Economics, Discussion Paper 2005-14.

Di Matteo, L. (1997) "The Determinants of Wealth and Asset Holding in 19th-Century Canada: Evidence from Microdata," Journal of Economic History, 57, 4: 907-934.

Elliot, B.S. (1985) "Sources of bias in nineteenth-century Ontario wills," Histoire sociale-Social History, 18: 125-132.

Emery, G. (1993) The Facts of Life: The Social Construction of Vital Statistics, Ontario 1869-1952. Montreal: McGill-Queen's.

Gabaix, X. (1999a) “Zipf’s Law for Cities: An Explanation,” The Quarterly Journal of Economics, Vol. 114, No. 3, August, 739-767.

Gabaix, X. (1999b) “Zipf’s Law and the Growth of Cities,” The American Economic Review, Papers and Proceedings, May, 129-132.

Gibrat, R. (1931) Les Inégalités économiques (Paris, France: Librairie du Recueil Sirey).

Green, A.G. and G.R. Sparks (1999) “Population Growth and the Dynamics of Canadian Development: A Multivariate Time Series Approach,” Explorations in Economic History, 36, 56-71.

Green, A.G. and M.C. Urquhart (1987) “New Estimates of Output Growth in Canada: Measurement and Interpretation,” in Perspectives on Canadian Economic History, ed. D. McCalla, Toronto: Copp Clark Pitman, 182-199.

Howell, A. (1880) The Law and Practice as to Probate, Administration and Guardianship in Surrogate Courts. Toronto: Carswell.
Innis (1930)

Lewis, F. D. (1981) “Farm settlement on the western prairies, 1898-1911,” Journal of Economic History, 41, 517-535.

Norrie, K.H. (1975) “The rate of settlement on the Canadian prairies 1870-1911,” Journal of Economic History, 35, 410-427.

Osborne, B.S. (1980) “Wills and Inventories: Records of Life and Death in a Developing society,” Families, 19, 235-47.

Pareto, V. (1896) Cours d’Economie Politique (Geneva, Switrzerland: Droz, 1896).

Reed, W.J. (2001) “The Pareto, Zipf and other power laws,” Economics Letters, 74: 15-19.

Sachs, J.D. and A.M. Warner (1995) “Natural Resource Abundance and Economic Growth.” N.B.E.R. Working Paper No. 5398.

Sachs, J.D. and A.M. Warner (1997) “Source of Slow Growth in African Economies.” Journal of African Economics, 6, 3, 335-76.

Sachs, J.D. and A.M. Warner (1999) “The Big Push: Natural Resource Booms and Growth.” Journal of Development Economics, 59, 1, 43-76.

Sachs, J.D. and A.M. Warner (2001) “Natural Resources and Development: The Curse of Natural Resources.” European Economic Review, 45, 5, 827-38.

Siddiq, F.K. and J. Gwyn (1991) “The Importance of Probate Inventories in Estimating the Distribution of Wealth,” Nova Scotia Historical Review, 11: 103-17.

Southey, C. (1978) “The Staples Thesis, Common Property and Homesteading,” Canadian Journal of Economics, 11,3, 547-559.

Watkins, M.H. (1963) “A staple theory of economic growth,” Canadian journal of Economics and Political Science, 24, 141-158.