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American baby-losers? Robust indirect comparison of affluence across generations*

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Abstract

We propose an indirect and robust method to detect a change in the concentration of economic affluence defined as an aggregate measure of the command over lifetime resources when the full stream of income receipts along the life cycle is unknown and only consumption surveys are available. The method relies on a new stochastic ordering, the "Generalized Top Lorenz" and the key-property of concavity of consumption with respect to wealth. Our application on US data for the period 1980-2002 shows a moderate increase in economic affluence and points out the di¢ cult start in life of people belonging to the "Baby loser generation" (people born in the sixties).

Keywords: concavity, wealth, dominance orderings, consumption.
JEL Classification: D31, D63, D91.

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1 Introduction

Economic growth of the last thirty years has been marked in the US by the increase of top-income shares as documented, among others, by Piketty and Saez (2003). Wolff and Zacharias (2009) used incomes adjusted for wealth to assess US trends in households well-being from 1980 to 2000. The rise of 48.5% for the mean value contrasts with that of 17.9% of rise for the median. This spread is even magnified by net worth data: Wolff (2007) records an increase of about 74% for the mean and 23% for the median value. All in all, these figures seem to confirm an upsurge in US wealth inequality. The generational impact of this growth has caught the attention of economists (Paulin and Riordon1998 and Paulin 2008) and sociologists (Chauvel 2001; 2002) who, using data from different sources, pointed out a gap in favor of the "baby-boomers" born in the 50's, versus their successors born in the 60's and belonging to the so called "generation X". In this paper we propose a novel methodology to investigate the pattern of economic affluence concentration for several US generations from 1980 to 2002. Our analysis is not based on data about households' net worth, but rests on the Friedman (1957) permanent income hypothesis (i.e. households base their spending plans on their expected lifetime income). However, the exact *expected value of lifetime resources* available for an individual at a given time is very difficult to assess empirically, requiring the knowledge of the income stream along all the life cycle and being affected by uncertainty. To overcome this difficulty, we first introduce a new statistical test of the Lorenz type, termed "Generalized Top Lorenz" (GTL) criterion, which cumulates the relevant variable from the top, as the Shorrocks (1983) Generalized Lorenz test cumulates from the bottom. Then we show that, under the concave relation between consumption and wealth established in consumption theory, the results obtained comparing consumption distributions through the GTL test extend to the associated distributions of permanent income. In other terms, we show how to detect a change in the concentration of the latent variable "permanent income", when the full stream of income receipts along the life cycle

is unknown, but consumption data are available. Hence we make the most of information that consumption data convey about economic affluence, defined as an aggregate measure of the command over lifetime resources. Previous articles (Bavier, 2008; Meyer and Sullivan, 2003; 2008) also rely on the permanent income hypothesis to indicate consumption as the better proxy available for lifetime resources. But, as far as we know, we are the first to link the distribution of consumption with that of affluence and to establish their joint properties in terms of stochastic orders.

To assess economic affluence, we show that the GTL quasi ordering is also equivalent to an "affluence ordering": we say that a person is "affluent" with respect to a given attribute if her value in this attribute exceeds a given threshold (an "affluence line") in the same way as a person is deemed poor if his income is smaller than a given poverty line. The comparison of two distributions in terms of affluence is then performed cumulating "affluence gaps" from the top (as one cumulates poverty gaps from the bottom in measuring poverty). It is not clear beyond which threshold a person is affluent, 1 Million $, 10 Million $, or more. We probably would like to have a measure that does not depend too much on the choice of the threshold. To cope with this indeterminacy, we introduce *affluence orderings* as Foster and Shorrocks (1988) have introduced *poverty orderings*. Since the compared distributions of consumption are usually sample drawn from a larger population, the statistical inference is performed through a methodology inspired by Davidson and Duclos's (2000) non parametric stochastic dominance tests. In our empirical application we focus on the period 1980 to 2002 and compare consumption distributions of equally aged individuals belonging to different cohorts. We use data drawn from the Consumption Expenditure survey and elaborated by Krueger and Perri (2006). To tackle the main problems that affect the relation between consumption and wealth in the life cycle model, we control for the influences pointed out by Attanasio and Browning (1995). We divide the population into four age groups to control for life cycle effects, and distinguish between four types of household to control for heterogeneity. We also control for fluctuations

in consumption series due to real business cycles. As expected, we find a general increase of economic affluence over time. We also provide evidence of stable affluence within the baby boom generation (people born from 1940 to 1960). We cannot say the same for the more recent "generation X" (people born from 1960 to 1980) where significant differences emerge between people born from 1960 to 1970 and people born in the following decade. The cohort 1960-1970 starts in life more badly than elder and younger cohorts.

We proceed as follows: in Section 2, we introduce the GTL dominance criterion and the new affluence tests. We also design the statistical methodology able to implement our theoretical results. In Section 3 we carry out the empirical analysis on US data. Section 4 summarizes the main results and provides suggestions for further developments. The Appendix contains additional details on the GTL dominance criterion and the associated statistical tests.

2 Affluence measurement

Given a population composed of n households, indexed by $i = 1, ..., n$, with $n \geq 2$ and endowed with a quantitative variable y_i defined on the finite and positive support $K = [0, k]$, we denote by $\mathbb{D}_n = \{\mathbf{y} \in K^n \mid y_1 \leq y_2 ... \leq y_n\}$ the set of feasible distributions of such a variable ordered in an increasing way. The partial order we are going to introduce has not been considered until now in the economic literature and reflects the idea that distribution $\mathbf{y}$ dominates $\mathbf{y}'$ if any top quantile of the population is richer in $\mathbf{y}$ than in $\mathbf{y}'$.[1]

Definition 1 *For all* $\mathbf{y}, \mathbf{y}' \in \mathbb{D}_n$

$\mathbf{y}$ *dominates* $\mathbf{y}'$*, according to the Generalized Top Lorenz criterion* ($\mathbf{y} \succcurlyeq_{GTL} \mathbf{y}'$)*, if:*

$$\sum_{i=n-k}^{n} y_i \geq \sum_{i=n-k}^{n} y'_i \text{ for } k = 0, .., n-1.$$

[1] In mathematics, this ranking is known as "submajorization" (see Marshall and Olkin, 1979). Related concepts in statistics are studied by Shaked and Shanthikumar (1986).

For our purposes, it is fundamental to understand under which conditions the partial order $\succcurlyeq_{GTL}$ is *preserved* after application of the same function f to the elements of the two distributions. The following proposition clarifies this topic.

Proposition 1 *Let $f : \mathbb{R}_+ \to \mathbb{R}$ be a continuous function. The two following conditions are equivalent:*

i) f is *non-decreasing and convex*;

ii) $\mathbf{y} \succcurlyeq_{GTL} \mathbf{y}' \implies (f(y_1), ..., f(y_n)) \succcurlyeq_{GTL} (f(y'_1), ..., f(y'_n))$ for all $\mathbf{y}, \mathbf{y}' \in \mathbb{D}_n$.

Proof. Marshall and Olkin (1979), Theorem A.2 (i), p. 116 prove that $i) \implies ii)$; The converse can be established by reasoning as in the necessity part of Theorem 1 in Peluso and Trannoy (2007). ■

If the consumption function $c(y)$ (where y is permanent income) is increasing and concave, we can apply the previous result with $f = c^{-1}$, which is increasing and convex, to infer GTL dominance between permanent income distributions from GTL dominance between the corresponding consumption distributions $c(\mathbf{y})$ and $c(\mathbf{y}')$. The old conjecture that marginal propensity to consume is higher for low wealth households than for high wealth households has been proved by Zeldes (1989) and Carroll and Kimball (1996) in the framework of the life cycle consumption model. The former derives the properties of the optimal consumption function by using a numerical technique. Under uncertainty on labor income, the consumption function is shown to be concave with respect to the sum of financial wealth and the present value of expected future income. The latter adds income uncertainty in the standard version of the life cycle consumption model and finds a decreasing marginal propensity to consume out of wealth or transitory income with respect to the level of wealth. More recently, Dynan et al. (2004) provide similar results after introducing uncertainty or bequest motive in the standard consumption model. They also find empirical evidence in favor of a concave relationship between consumption and proxies for permanent income on American data: estimated

saving rates range from zero for the bottom quintile of the income distribution to more than 25 percent of income for the top quintile. More importantly, they present evidence in favor of a marginal propensity to save increasing with household permanent income.

We show now how to test GTL in a statistical framework. Since affluence can be seen as the opposite phenomenon of poverty, we may set an "affluence line" z such that the *affluence excess* of the household i is defined by $w_i = w(y_i, z) = \max(y_i - z, 0)$. The resulting vector for the whole population is $\mathbf{w}(z, \mathbf{y}) = (w_1, ..., w_n)$. Let q_z be the number of households with $y_i \geq z$, then two immediate measures of affluence are the *headcount affluence ratio* $A_1(\mathbf{y},z) = \frac{q_z}{n}$, that is the proportion of affluent households in the population and the *per capita affluence excess* $A_2(\mathbf{y},z) = \frac{1}{n}\sum_i w_i(z)$, which mirrors the poverty gap ratio. Since these indices depend on the chosen threshold, the result of the comparison of two income distributions based on such measures, they may be reversed by considering different values of z. In order to secure the independence of comparisons with the specific value of z, we introduce a couple of *affluence orderings:* $\succcurlyeq_{A_1}$ and $\succcurlyeq_{A_2}$.

Definition 2 *For all* $\mathbf{y}, \mathbf{y}' \in \mathbb{D}_n$,

$\mathbf{y} \succcurlyeq_{A_1} \mathbf{y}' \Longleftrightarrow A_1(\mathbf{y},z) \geq A_1(\mathbf{y}',z)$, *for all* $z \geq 0$

$\mathbf{y} \succcurlyeq_{A_2} \mathbf{y}' \Longleftrightarrow A_2(\mathbf{y},z) \geq A_2(\mathbf{y}',z)$, *for all* $z \geq 0$.

Distribution $\mathbf{y}$ is said to dominate distribution $\mathbf{y}$' in the sense of the *first degree affluence ordering* $\succcurlyeq_{A_1}$ if for any positive richness line, the headcount affluence ratio A_1 is higher in $\mathbf{y}$ than in $\mathbf{y}$'. Similarly, if for any richness line the *per capita affluence excess* A_2 is greater than that in $\mathbf{y}$', then $\mathbf{y}$ dominates $\mathbf{y}$' in the sense of the *second degree affluence ordering* $\succcurlyeq_{A_2}$.

It is immediate to see that $\mathbf{y} \succcurlyeq_{A_1} \mathbf{y}' \iff \mathbf{y} \geq \mathbf{y}'$, where $\geq$ is the usual componentwise comparison among vectors. A Pareto improvement of an income vector increases the headcount affluence ratio. The following proposition clarifies the less obvious link between Generalized Top Lorenz dominance and $\succcurlyeq_{A_2}$.

Proposition 2 *For all* $\mathbf{y}, \mathbf{y}' \in \mathbb{D}^n$,

$$\mathbf{y} \succcurlyeq_{GTL} \mathbf{y}' \Longleftrightarrow \mathbf{y} \succcurlyeq_{A_2} \mathbf{y}'.$$

Proof. $\Longrightarrow$ Let $\mathbf{e}$ the n-dimensional vector with unitary elements. From $\mathbf{y} \succcurlyeq_{GTL} \mathbf{y}'$ we get $\mathbf{y} - z\mathbf{e} \succcurlyeq_{GTL} \mathbf{y}' - z\mathbf{e} \ \ \forall z \geq 0$. Since $\max(x, 0)$ is non-decreasing and convex, the result follows from Proposition 1.

$\Longleftarrow$ By setting $z = 0$, from $\mathbf{y} - z\mathbf{e} \succcurlyeq_{GTL} \mathbf{y}' - z\mathbf{e} \ \ \forall z \geq 0$, we immediately get the result. ■

Testing for the second order affluence dominance is equivalent to test for GTL dominance. Notice that $\succcurlyeq_{A_1}$ is equivalent to first-order stochastic dominance and consequently implies second order affluence dominance.

The statistical procedure we use to test GTL dominance on consumption survey data is based on the nonparametric approach developed by Davidson and Duclos (2000). To check GTL dominance between two distributions of consumption $\mathbf{c}$ and $\mathbf{c}'$ we first test first order affluence dominance of $\mathbf{c}$ over $\mathbf{c}'$ (and vice-versa); If none of them dominates the other, we check second order affluence dominance. If even at the second order we cannot conclude, we look for affluence dominance above some absolute cutoff, concluding that a distribution dominates another only above some absolute threshold (for instance 5000 US $ of quarterly consumption). The Appendix illustrates further properties of the GTL criterion and provides more details on the nonparametric test.

3 Application to American Data

We apply our approach to data drawn from the Consumer Expenditure (CE) Survey of the USA for the years 1980-2002. The data set provides information on the buying habits of American consumers, including data on their expenditures, income, and consumer unit (families and single consumers) characteristics. Expenditures consist of fourteen main categories: Food, alcoholic beverages, housing, apparel and services, transportation, health care, entertainment,

personal care products and services, reading, education, tobacco products and smoking supplies, miscellaneous, cash contributions, and personal insurance and pensions. They are not a measure of consumption in the economic sense because no attempt is made to measure flows of services provided by durable goods. The CE survey records what families spend for consumption, not what they actually consume. To get an adequate measure of consumption, we adopt the measure proposed by Krueger and Perri (2006) who use the same survey. Their definition, summarized in Table A1, includes expenditures on nondurable goods and services plus imputed services from houses and cars. Then expenditures for food, alcoholic beverages, tobacco, utilities, personal care, household operations, public transportation, gasoline and motor oil, apparel, education, reading, health services and miscellaneous expenditures. The imputed values of consumption services from vehicles were obtained by Krueger and Perri (2006) by regressing expenditures for vehicle purchases on a set of covariates such as income, expenditure on gasoline, etc. The predicted expenditures on vehicles are then multiplied by the number of cars the consumer unit owns and by 1/32, assuming that a vehicle completely depreciates after 32 quarters on average. The imputation procedure applied to quantify services from primary residence is very similar to the one used for vehicles.[2] Each expenditure component is deflated by expenditure-specific, quarter-specific consumer price index. Measures of consumption are expressed in 1982-1984 constant dollars.

We carry out the analysis comparing consumption of equally aged individuals over time. To this end, we distinguish between four age groups (21-30, 31-40, 41-50, and 51-60). We pick out three waves Jan.1980-Sept.1981, Jul.1990-Mar.1992, and Apr.2001- Dec.2002. Sample size are 8,028 for the first wave; 8,856 for the second one; and 15,499 for the last.

A crucial point to apply our theoretical result is that the function mapping consumption on lifetime resources must be stable between any couple of waves. Then, to develop our empirical analysis correctly, we have to control for the main factors affecting the consumption function.

[2] For further details see Krueger and Perri (2005, Appendix A.2.2 and A.2.3).

According to Attanasio and Browning (1995), these factors are mainly *life cycle effect*, *business cycle effect*, and *heterogeneity*. Life cycle effect includes influences on consumption due to family composition, labour supply, labour market participation, and saving to bequeath. To mitigate such potential bias, we restrict our analysis to individuals aged between 21 and 60. We exclude younger individuals since their consumption may depend on wealth of their relatives. We also discard elder individuals because their consumption decisions are more exposed to factors which are difficult to control for, as pointed out by Attanasio and Browning (1995). Furthermore, we make comparisons between equally aged individuals across cohorts in different decades, for example consumption of thirty-year-old individuals in the 80s is compared with that of thirty-year-old individuals in the 90s. With the choice of the span of age groups (ten years), we secure that individuals belonging to a given age group in a given wave cannot appear in the same age group in the following wave.[3]

Fluctuations in consumption due to business cycle may introduce a significant bias in our analysis. To control for cyclical effects we consider waves composed of several quarters. Including a large part of a real business cycle in a wave, we smooth the effects of temporary shocks. The waves are Jan.1980-Sept.1981, Jul.1990-Mar.1992, and Apr.2001- Dec.2002. The first period of each cycle (Jan. 1980-Jul. 1980; Sept. 1990-Mar. 1991; May 2001-Nov. 2001) is of contraction. July 1980, March 1991 and November 2001 are the troughs. After the trough the contraction turns into a twelve-months period of expansion (see table A2 in the Appendix for the US business cycle expansions and contractions over the period 1980 to 2001). Table A3 in the Appendix shows the trend of the main macroeconomic variables over the twenty-three years. The first indicators of economic conditions are the per capita gross domestic product (GDP) and the aggregate consumption in chained 2000 dollars (chart a). According to these measures, the three waves, highlighted in grey, experienced almost zero growth. GDP and

[3] If we observed the same individuals across different waves, we would observe differences in consumption due to life-cycle effect or to realizations of exogenous shocks.

aggregate consumption grew at a quarterly rate of about 0.09% and -0.08% in the first wave, -0.1% and -0.04% in the second and 0.072% and 0.41% in the third. Another macroeconomic indicator is the unemployment rate (see chart b) that shows a decline of nearly 2 percentage points from the first wave to the third one (the average quarterly rate is 7.3 in the first wave, 6.7 in the second, and 5.4 in the third). To check the robustness of our results, we repeat the analysis replacing the three waves by three years with very similar real interest rates, i.e. 1980, 1993, 2003, without relevant differences in our results.

Even if we cannot control for the heterogeneity due to possible difference in preferences among individuals of the same age belonging to different cohorts, we refine our analysis by distinguishing individuals belonging to a same age group by household composition. In particular, we consider four types of household, single and couple both with and without children. A last remark concerns the potential impact on consumption and saving decisions of the increasing diffusion of credit cards and other payment methods able to finance short-term consumption. The remarkable evolution of these tools from 1980 to 2002, jointly with the increasing share of e-commerce could introduce a further bias. However, this "technological change" could have been partially contrasted by the parallel introduction of new financial instruments attracting households' saving. The net effect of these innovations over the shape of consumption function could be different all over the lifecycle, and its evaluation goes beyond the objectives of this paper.

4 Results

The results of the affluence dominance tests are summarized in Table 1. Each raw of the table compares different generations for a given age group. Over the twenty-three years (1980-2002) we focus on, we observe six age cohorts, from G20 (people born from 1920 to 1930) to G70 (people born from 1970 to 1980). Of the oldest cohort, G20, (resp. youngest, G70) we observe

only people belonging to the fourth age group, 51-60, (resp. first age group, 21-30) which is compared with the two following cohorts (resp. the two previous cohorts). For the other generations, we observe more age groups and we compare each cohort either with the previous and the following cohorts. The results are presented distinguishing by household type. We only retain results for the household types sufficiently represented at each age group (for instance, the number of singles of the oldest age group is too limited, so we focus only on couples and couples with children). The comparisons are expressed in terms of first or second degree of affluence dominance. In some cases the two distributions are statistically equivalent in terms of affluence. For example, we don't find significant difference in affluence between people born from 1940 to 1950 and people born in the following decade (1950-1960) for the available age groups (from 30 to 50). This proves a substantial homogeneity of affluence within the baby boomer generation. More generally, our results indicate an increase in economic affluence from 1980 to 2002 not so sharp as one could expect looking at the trends of GDP or net worth of US households (see table A-3 and discussion below). Looking at each cell of the table, the more recent generation often dominates the previous one only at the second order. For example, the affluence of 41-50 years old individuals (group age III) of the generation born between 1930 and 1940 (G30) is dominated at the second order from the following cohort, G40. We also document a less drastic increase comparing cohorts G30 and G50 at the third age class. In this case the two distributions cannot be ranked below a cutoff corresponding approximately to the top 20% of richest households, while above this line G50 dominates at the second order G30.

< Insert Table 1 about here >

The most relevant exception to this general trend is represented by the cohort born between 1960 and 1970 (G60). Looking at the first raw of Table 1 (age group 21-30) we see that single people of this cohort, constituting the first wave of the so called "generation X" in the US and labeled "baby-losers" in Europe, get worse both than their predecessors "baby boomers"

born in the 50's (G50) and than people born in the 70' and belonging to the second wave of generation X.

It is interesting to compare our results with some previous works by Wolff (1992), who integrated US tax statistics by data drawn from several household surveys to explain the evolution of net worth inequality from 60's to 80's in terms of variations of income inequality, stock prices and housing prices. Analyzing net worth by age group, people aged between 45 and 69 appear the "winners" over the two decades 70's and 80's. Several papers by the same author (Wolff, 1998; 2007) update these results. The decrease in the share of net worth of the younger age group from 21% to 14% in twenty years (Wolff 2007, table 11) fits with our results on "generation X", which are also consistent with the findings of Chauvel (2001), Paulin and Riordon (1998) and Paulin (2008). These latter researches consider periods of economic expansion, confirming that our findings are robust to the specific choice of the waves.

5 Conclusion

We have introduced the GTL test and the related affluence ordering, applying these novel tools to US consumption data from 1980 to 2002. The increase of economic affluence we infer from consumption data seems less remarkable than the increase of US households's wealth documented for the same period using net worth data, more sensitive to changes in prices of households' real and financial assets. Our analysis also confirms the difficulties of the cohort born in the 60's, when aged between 20 and 30 years.

From the methodological side, our contribution goes beyond the application developed in this paper: Retrieving affluence from consumption data could be helpful studying developing countries, for which changes in wealth are usually much less documented than changes in consumption (e.g. Deaton 1997). Hence, despite this illustration on an advanced economy, our methodology seems well suited to obtain insights about the evolution of wealth concentration

in least developed countries.

Notice that our procedure cannot be replicated to make indirect inference on welfare measures as the generalized Lorenz test and its equivalent poverty ordering (Shorrocks and Foster 1987). Consumption data do not help to assess poverty in the space of permanent income. The reason is that GL dominance is preserved only after concave transformations (see Moyes 1989), while in this paper we use convexity of permanent income with respect to consumption to infer affluence indirectly. However, we could reverse the exercise and make indirect inference in the opposite direction, that is from wealth to consumption distributions. More precisely, given the concavity of the consumption function, checking GL dominance on wealth data allows to infer GL dominance among the corresponding consumption distributions. This exercise could be helpful when good data are available for wealth distributions (as in Sierminska et al. 2007). All in all, our paper introduces a methodology able to provide insights either on affluence (in the space of permanent income) or on poverty (in the space of consumption) starting from data on consumption and wealth, respectively.

References

[1] Atkinson, A.B. (1970) "On the Measurement of Inequality", *Journal of Economic Theory*, 2, 244-263.

[2] Attanasio, O. T. and Browning, M. (1995) "Consumption over the Life Cycle and over Business Cycle", *American Economic Review,* 85, 1118-1137.

[3] Bavier R. (2007) "Reconciliation of income and consumption data in poverty measurement", *Journal of Policy Analysis and Management*, 27, 40-62.

[4] Carroll, D. and Kimball M. (1996) "On the concavity of the consumption function", *Econometrica*, 64, 4, 981-992.

[5] Chauvel, L. (2001) "Un nouvel âge de la société américaine ? Dynamiques et perspectives de la structure sociale aux États-Unis (1950-2000)", *Revue de l'OFCE* 76, 7-51.

[6] Chauvel, L. (2002) "Social Generations, Life Chances and Welfare States ", Working paper for Transforming the Democratic Balance among State, Market and Society: Comparative Perspective on France and the Developed democracies, Minda de Gunzburg Center for European Studies, Harvard University, May 17-18, 2002.

[7] Davidson, R. and Duclos, J.-Y. (2000) "Statistical Inference for Stochastic Dominance and for the Measurement of Poverty and Inequality", *Econometrica*, 68(6), 1435-1464.

[8] Deaton, A. (1997) *The Analysis of Household Surveys: A Microeconomic Approach to Development Policy*, by Angus S. Deaton Softcover, World Bank Publications.

[9] Dynan, K.E., Skinner, J. and Zeldes, S.P. (2004) "Do the Rich Save More?", *Jounal of Political Economy*, 112, 397-444.

[10] Friedman M.A. (1957) *A theory of the consumption function.* NBER, Princeton University Press.

[11] Krueger, D. and Perri, F. (2006) "Does Income Inequality Lead to Consumption Inequality? Evidence and Theory", *Review of Economic Studies,* 73, 163-193.

[12] Marshall, A.W. and Olkin, I. (1979) *Inequalities: theory of majorization and its applications*, Academic Press, New York.

[13] Meyer B.D. and Sullivan J.X. (2003) "Measuring the Well-Being of the Poor Using Income and Consumption", *Journal of Human Resources*, 38, 1180-1220.

[14] Meyer B.D. and Sullivan J.X. (2008) "Changes in the Consumption, Income, and Well-Being of Single Mother Headed Families", *American Economic Review*, 98, 2221-2241.

[15] Moyes,P. (1989) "Some classes of functions that preserve the inequality and welfare orderings of income distributions", *Journal of Economic Theory*, 49, 347-359.

[16] Paulin, G. and Riordon, P. (1998) "Making it on their own: the baby boom meets Generation X", *Monthly Labor Review*, February 1998, 10-21.

[17] Paulin, G. (2008) "Expenditure patterns of young single adults: two recent generations compared" *Monthly Labor Review*, December 2008, 19-50.

[18] Peluso, E. and Trannoy, A. (2007), "Does less inequality among household mean less inequality among individuals?", *Journal of Economic Theory*, 133, 568-578.

[19] Piketty, T. and Saez, E. (2003). "Income Inequality In The United States, 1913-1998", *The Quarterly Journal of Economics*, 118(1), 1-39.

[20] Sahn, D.E. and Stifel, D.C. (2000) "Poverty Comparisons Over Time and Across Countries in Africa", *World Development*, 28, 2123-2155.

[21] Shorrocks, A.F. (1983), Ranking Income Distribution, *Economica*, 50, 3-17.

[22] Shaked,M. and Shanthikumar, J. G. (2006) *Stochastic orders*, Springer.

[23] Sierminska, E., Brandolini A. and Smeeding, T. (2006) "The Luxembourg Wealth Study: A cross-country comparable database for household wealth research" *Journal of Economic Inequality*, **4**(3), 375-383.

[24] Wolff, E. N. (1992) "Changing Inequality of Wealth". *American Economic Review*, 82, 552-558.

[25] Wolff, E. N. (1998) "Recent Trends in the Size Distribution of Household Wealth". *Journal of Economic Perspectives*, 12, 131-150.

[26] Wolff, E. N. (2007) "Recent Trends in Household Wealth in the United States:Rising debt and the Middle-Class Squeeze". *Working Paper*, 12, 131-150.

[27] Wolff, E. N. and Zacharias A. (2009). "Household wealth and the measurement of economic well-being in the United States". J*ournal of Economic Inequality*, 7 (2), 83-115.

[28] Zeldes, S.P. (1989) "Optimal consumption with stochastic income: Deviations from certainty equivalence". *Quarterly Journal of Economics*, 104, 275-298.

Table 1: Affluence comparison among generations, period 1980-2002

Gener. / Age group	G20 (born 1920-30)	G30 (born 1930-40)	G40 (born 1940-50)	G50 (born 1950-60)	G60 (born 1960-70)
I (21-30)	-	-	-	**G50 vs. G60** *singles* $>_2$** *sing+ch* =** *couples* =** **G50 vs. G70** *singles* =** *sing+ch* **NC** *couples* <2***	**G60 vs. G70** *singles* $<_1$ * *(~ top 10%)* *sing+ ch* $<_2$ * *couples* $<_2$ ***
II (31-40)	-	-	**G40 vs. G50** *singles* =** *sing +ch* =** *couples* =** **G40 vs. G60** *single* $>_2$ *sing +ch* =** *couples* <2***	**G50 vs. G60** *singles* =** *sing+ ch* =** *couples* $<_2$ *** *coup + ch* =**	
III (41-50)	-	**G30 vs. G40** *couples* =* *coup +ch* =** **G30 vs. G50** *couples* $\leqq$* *(top 25%)* *coup.+ch* $\leqq_1$ * *(~ top20%)*	**G40 vs. G50** *singles* =** *sing + ch* =** *couples* =** *coup + ch* = **		
IV (51-60)	**G20 vs. G30** *couples* $<_2$ * *coup+ch* =** **G20 vs. G40** *couples*$<_2$ *** *coup+ch* $<_2$ ***	**G30 vs. G40** *couples* $<_2$ * *coup + ch* $<_2$ *			-

$>_i$: the older generation dominates the younger for order i affluence dominance.
$<_i$: the younger generation dominates the older for order i affluence dominance.
=: the two distributions are not significantly different.
NC: the two distributions are not comparable.
* Significance at the 90% level of confidence.
** Significance at the 95% level of confidence.
*** Significance at the 99% level of confidence.

Appendix

Table A1: the measure of consumption

Category
Food
Alcoholic beverages
Tobacco
Personal Care
Fuels, Utilities and Public services
Household operations
Public Transportation
Gasoline and Motor Oil
Apparel
Education
Reading
Health Services
Miscellaneous Expenditres*
Entertainment
Household Equipment
Other Lodging Expenses**
Other Vehicle Expenses***
Rented Dwellings
Imputed Services from owned primary residence
Imputed Services from vehicles

* These are mostly fees for services such as banking or legal assistance.
** It includes mostly expenditures on vacation homes
*** It includes expenditures on maintenance, repairs, insurance and finance charges.

Table A2: Business Cycle Expansions and Contractions

Business Cycle Reference Dates		Contraction	Expansion	Cycle	
Peak	Trough	Peak to Trough	Previous trough to this peak	Trough from Previous Trough	Peak from Previous Peak
Quarterly dates are in parentheses					
January 1980(I)	July 1980(III)	6	58	64	74
July 1981(III)	November 1982(IV)	16	12	28	18
July 1990(III)	March 1991(I)	8	92	100	108
March 2001(I)	November 2001(IV)	8	120	128	128

* Source: NBER

TableA.3: Macroeconomic factors

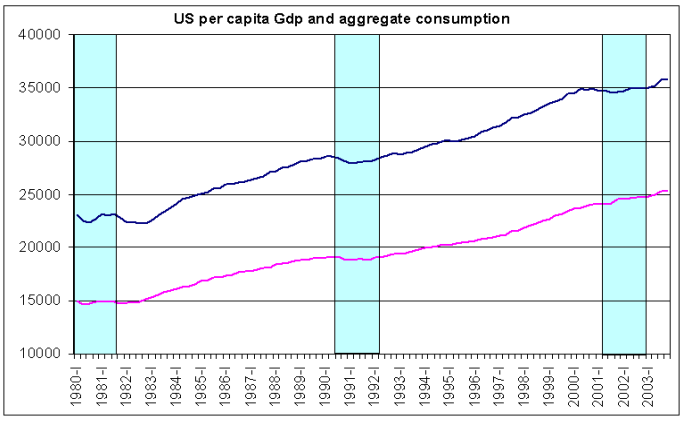

Chart a

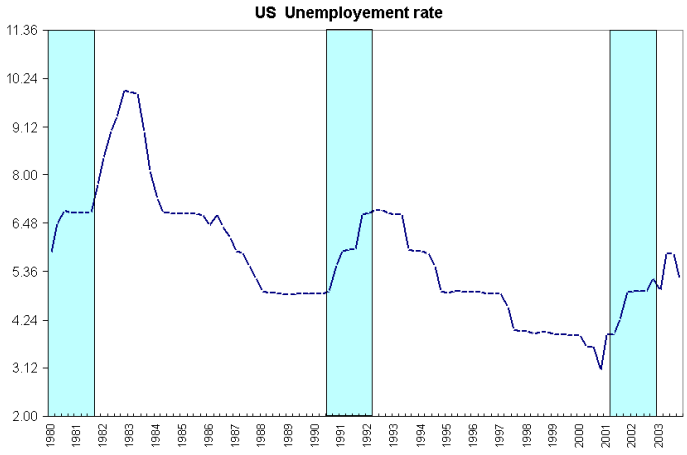

Chart b

5.1 More on GTL and affluence statistical tests

The next proposition explains the link between GTL dominance and the dominance criterion based on the usual Lorenz curve. Let μ_y be the mean of vector $\mathbf{y}$. We designate by $\succcurlyeq_{RL}$ the

relative Lorenz dominance on $\mathbb{D}_n$.[4]

Proposition 3 *For all* $\mathbf{y}, \mathbf{y}' \in \mathbb{D}_n$, *such that* $\mu_y \geq \mu_{y'}$

$$\mathbf{y}' \succcurlyeq_{RL} \mathbf{y} \implies \mathbf{y} \succcurlyeq_{GTL} \mathbf{y}'.$$

Proof. From $\mathbf{y}' \succcurlyeq_{RL} \mathbf{y}$ we know (see Marshall and Olkin, 1979) that $\frac{1}{\mu_y}\mathbf{y} \succcurlyeq_{GTL} \frac{1}{\mu_{y'}}\mathbf{y}'$. Since $\mu_y \geq \mu_{y'}$, by the very definition of $\succcurlyeq_{GTL}$ we get $\mathbf{y} \succcurlyeq_{GTL} \mathbf{y}'$. ■

As expected, since GTL cumulates the attribute from the top, growth with an increase of inequality in terms of the Lorenz curve implies GTL dominance. Suppose now that the population is split into several groups. The following proposition says that GTL dominance for each subgroup implies GTL dominance for the whole population.

Proposition 4 *Let* $\mathbf{y} \succcurlyeq_{GTL} \mathbf{y}'$ *on* $\mathbb{D}_m$ *and* $\mathbf{x} \succcurlyeq_{GTL} \mathbf{x}'$ *on* $\mathbb{D}_p$. *Then* $(\mathbf{y}, \mathbf{x}) \succcurlyeq_{GTL} (\mathbf{y}', \mathbf{x}')$ *on* $\mathbb{D}_{m+p}$

Proof. See Proposition A.7 p. 121 in Marshall Olkin (1979). ■

We now provide more details about the statistical procedure adopted in the paper. Let $\mathbf{c}$ be a distribution of consumption expenditures with support in K.

For a given wealth line z, an unbiased and asymptotically normal estimator for the wealth index at the order s, A^s, is as a mirror image of the one introduced by Davidson and Duclos (2000) for poverty index and it is given by

$$\widehat{A}^s_c(z) = \frac{1}{N_c(s-1)!}\sum_{i=1}^{N_c}(c_i - z)^{s-1} I(c_i \geq z), \tag{1}$$

where i denotes the i^{th} individual, N_c is the sample size of the distribution $\mathbf{c}$, and $I(\cdot)$ an indicator function equal to 1 when its argument is true and 0 otherwise.

Given two consumption distributions $\mathbf{c}$ and $\mathbf{c}'$, for some fixed set of k nonstochastic thresholds $\{z_1, ..., z_k\}$ we define the difference of the vectors of affluence indices at the order s,

[4] The reader can refer to Davidson and Duclos (2000) for a short introduction to inequality and poverty measurement

$\boldsymbol{\Delta}^s = \widehat{\mathbf{A}}_c^s - \widehat{\mathbf{A}}_{c'}^s$, with $\widehat{\mathbf{A}}_c^s = (\widehat{A}_c^s(z_1), ..., \widehat{A}_c^s(z_k))$ resp. $\widehat{\mathbf{A}}_{c'}^s = (\widehat{A}_{c'}^s(z_1), ..., \widehat{A}_{c'}^s(z_k))$. The null hypothesis is defined by a set of k constraints and can be expressed as

$$h_0 : \boldsymbol{\Delta}^s = 0.$$

The k constraints are verified using t statistics for the k nonstochastic thresholds up to an arbitrarily defined highest affluence line. We first test for first order affluence dominance ($s = 1$). In cases where the null hypothesis is rejected for each test point, and the sign on all of the t statistics are the same, then affluence dominance is declared.[5]If the null hypothesis is rejected and first order affluence dominance does not hold, we move at the second order of affluence dominance and repeat the test for $s = 2$. If even at the second order the test is not conclusive, to refine second order affluence dominance we look for affluence dominance at the top of the consumption distributions. If the sign on all of the t statistics above some threshold are the same for a relevant confidence level, then affluence dominance is declared up to the minimum threshold respecting this condition.

[5]The methodology implemented to test the null is analogous to that proposed by Sahn and Stifel (2000) to test poverty dominance.