Thou Shalt not Covet Thy (suburban) Neighbor's Car*

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Abstract

This paper studies the effect of population density on the intensity of "keeping up with the Joneses" behavior. Using a unique dataset of car registrations from 2004 to 2006 in three counties of Southern California, we show that neighbor effects are stronger in areas with lower population density. The decision to buy a car is strongly influenced by previous car purchases of neighbors, and the effect is substantially stronger in areas with lower population density. Such areas represent small communities in which neighbors are likely to know each other, and can therefore manifest their income or wealth through the public display of their consumption. The evidence is consistent with two possible channels of influence: information and status concerns. We find evidence supporting both channels, as our results cannot be fully explained by information exchange, or word of mouth. We argue that the stronger effect that we find in areas with lower population density is driven by status signaling reasons.

Preliminary and incomplete. Please, do not quote without permission.

*We would like to thank seminar participants at USC for helpful comments. Existing errors are our sole responsibility.

1 Introduction

The notion that individual agents are influenced in their economic decisions by the consumption or wealth of some comparison group (like neighbors, co-workers or relatives) has been present in the social sciences in general, and in economics in particular, for a long time. This type of behavior has been labeled "keeping up with the Joneses" and, arguably, is motivated by the objective to signal a certain level of economic status. In his path-breaking work, Veblen (1899) introduced the notion of "conspicuous consumption" and argued that individual agents spend resources on luxurious goods that indicate a certain status. Duesenberry (1949) postulates that the utility of a consumer depends on the ratio of the consumption of this agent to a weighted average of of a reference group. He further argues that people with whom the consumer has social contacts will have more weight than those with whom the consumer only has casual contacts. There seems to be strong macroeconomic evidence of investment in conspicuous goods. Hirsch (1976) calls "positional economy" this type of activity. In an influential paper, Frank (1984) argues that income comparison effects explain why the dispersion in wages is lower than the dispersion in marginal productivity. Mason (2000) offers a survey of some of the literature on this topic, as well as recommended economic policies. More recently, the availability of data on individual consumption, has permitted the study of the effects of individual purchases decisions on the consumption decisions of neighbors. Grinblatt, Keloharju and Ikaheimo (2008) study the purchase of cars in two Finnish provinces and find evidence of the effect of individual purchases on the decisions of neighbors. Ravina (2007) finds similar evidence on consumption documented by credit card purchases.

In this paper we analyze a new dimension that we conjecture might affect "keeping up with the Joneses" behavior: population density. We predict that population density affects the "strength" of the "keeping up with the Joneses" behavior. In particular, in areas of low population density, the consumption decisions of individual agents are more likely to be influenced by the consumption of their neighbors. The argument in favor of this conjecture is that in areas of low population density, there is a natural peer group that economic agents can compare to (neighbors), and it is also easier to ascertain economic information about this peer group and observe conspicuous consumption. To the best of our knowledge, this has not been directly studied before, although Hong, Kubik and Stein (2008) and Gómez, Priestley and Zapatero (2010) provide some indirect evidence through the equilibrium properties of security prices.

We use data on car purchases for three large counties which include areas with a large range of diversity in population density and other economic and social dimensions. In particular, we study whether there is more clustering of car purchases of higher price segments in areas of lower population density than in areas of higher population density, controlling for household income. Our empirical analysis documents that there is strong evidence of such pattern, and we therefore conclude that population density affects the intensity of the "keeping up with the Joneses" behavior.

The paper is structured as follows. In section 2 we articulate the idea in the context of the related literature on social comparisons. In section 3 we describe the data, and in section 4 we present and discuss the results. section 5 concludes.

2 Hypothesis

There is ample evidence of consumption in conspicuous goods whose main purpose is to denote statues since ancient times. As Mason (2000) points out, "Sumptuary laws were often introduced to suppress excessive levels of ostentatious display," (see Hunt, 1996, for a history of sumptuary laws). However, standard models of utility maximization in the last decades ignore the quest for status and the value of investing in conspicuous consumption. Some authors, starting with Veblen (1899), Frank (1985) and Robson (2001) argue that status seeking has evolutionary basis. In particular, the rate of success in finding mates in many species is higher for individuals endowed with characteristics associated with higher probability of survival. Arguably, wealth is, and has been for centuries, a predictor of survival (or longevity) in the human race. The quest for status as an indicator of wealth and, therefore, a survival predictor is hard-wired in the human being, according to these authors. Frank (1985) postulates that status should be part of the utility function. In fact, the inclusion of relative wealth concerns in the utility function has become a frequent device to explain asset prices since Abel (1990) first suggested it. In an influential paper, Campbell and Cochrane (1999) introduce the notion of "external habit formation". This additional parameter in the utility function has been interpreted as relative wealth concerns by most scholars. However, these are standard asset pricing models, based on a single consumption good, which rules out the possibility of considering dedicated investment in conspicuous goods.

In this paper, we do not postulate (or need) any particular rationalization for the consumption of conspicuous goods. However, based on the overwhelming empirical evidence, we take it as given that economic agents signal status by engaging in conspicuous consumption. According to the Longman Dictionary of Contemporary English[1], conspicuous consumption is: "The act of buying a lot of things, especially expensive things that are not necessary, in order to impress other people and show them how rich you are."

In particular, we focus on car purchases, as status-signaling decisions. Of course, cars do not necessarily fit the definition of conspicuous goods we just provided: for many people a car is just as important for their normal participation in society as proper clothes or adequate dwelling. However, it is also clear that above a certain threshold, the car becomes a luxury good (there is a category labeled "luxury cars") and some of the price is related to car attributes "that are not necessary." See for example Choo and Mokhtarian (2004) for evidence of purchase of luxury cars as a status-signaling device. In addition, the literature has also documented a peer effect in the car purchase decision. Grinblatt, Keloharju and Ikaheimo (2008) show that a car purchase decision influences future car purchase decisions of neighbors in a careful empirical analysis using data from Finland. The following quote from the New York Times, explaining why someone had decided to buy a $190,000 fully electric

[1] http://www.ldoceonline.com/dictionary/conspicuous-consumption

Tesla sports car, provides some anecdotal evidence of the peer influence in the decision to buy a car:

"We asked him how he heard of Tesla and why he bought the car," said Rachel Konrad, a Tesla spokeswoman. "He said, 'Well, three other guys on my block have them.' " (New York Times, Feb 15 2010).

In this paper we want to move a step forward and study the effect of population density on the neighbor's effect we just discussed. As we discussed before, Duesenberry (1949) supports the inclusion of other people's consumption in the utility function of economic agents. Furthermore, he argues that "any particular consumer will be more influenced by the consumption of people with whom he has social contacts than by that of people with whom he has only casual contacts." Following this insight, we postulate that in areas of lower population density neighbors are on average likely to have more intense interaction than in areas of high population density.[2] These people are likely to interact in multiple ways, as a result of possibly having children who attend the same school, shopping in the same places, attending the same church, and even working for the same employer. This can create a sense of belonging to a community that provides an obvious reference for their members. Of course there might be other reference groups that are also influential, like family and co-workers. However, there does not seem to be a reason why the peer pressure should come from just one reference group. In this paper we will focus on neighbors, but we do not rule out other possible sources of influence.

The main empirical challenge for our analysis is the existence of several reasons, other than "keeping up with the Joneses" behavior, that might influence the purchase of a car. The most obvious is possibly the information channel: buyers who are happy with their decision after driving the car for a few days or weeks, might express their satisfaction to their neighbors and influence their choice of brand on purely consumer satisfaction grounds. In

[2] With "lower population density" we mean groups of population that live close enough to each other to have the possibility to chat or wave hello when stepping out of their residences, as opposed to areas in which people are so far apart from each other than they might to have to drive to interact. This will become clear when we describe our data.

our empirical analysis, we control for this "information" effect in two ways: i) we use income dispersion as a control variable in our analysis; lack of dispersion will be associated with more homogenous groups and will facilitate communication; ii) we study the effect across different brands, i.e. how purchases of luxury brands affect purchases of other luxury brands different from the original. Of course there will be also an income effect in the purchase decision, especially of luxury cars, and we do control for the level of income, along with the dispersion. Finally, there are also seasonal effects that tend to lump car purchases around certain times of the year and this might give the false impression of influence in purchase decisions. For that reason we also control for seasonality in purchases. In next section we describe our data in detail.

3 Data

We use information from a dataset from R. L. Polk & Co. that records all car purchases, new and used, from most Department of Motor Vehicles (DMV) in the US. For each purchase we have the model, make and year of the car, price and date of purchase. For privacy reasons, it is not possible to obtain the exact address of the buyer, but we get the census block group (BG), which is more detailed than ZIP codes. BGs are delimited by the US Census Bureau. They contain between 600 and 3,000 people, with an optimum size of 1,500 people. This seems precise enough for our purposes. We merge the Polk dataset with data from the 2000 US census, which includes demographical information at the BG level.

In particular, we have information on all car purchases for three years, 2004-2006, in three large adjacent counties in Southern California: Los Angeles, Orange and Riverside (Orange County is contiguous to both Los Angeles and Riverside; the last two are separated by a narrow sleeve of land belonging to San Bernardino County). Our objective is to compare purchase patterns across different areas with different population density, within these three counties. We have to note that, overall, these are highly populated areas, and "low density" typically represents a suburban neighborhood, usually with relatively high household income. Therefore, in what we call "low population density," neighbors are likely to know each other and have the possibility to communicate with each other easily (as opposed to areas where neighbors are so far apart that direct communication might require an extra effort).

3.1 Descriptive statistics

Table 1 includes descriptive statistics on all three counties. Overall, we have over 7 million observations. Our population unit is a block group. In figure 1 we illustrate that the delimitation of the BGs is based on population, not area. In that histogram we have used the number of households per BG, but population per BG yields a similar graph. Figure 2 provides a histogram of the distribution of population density across BGs, summarized in panel B of table 1 for each of the three counties. Clearly, we have enough dispersion of density across our sample to test whether population density affects how purchase decisions of agents influence the purchase decisions of their neighbors. Similarly, figure 3 shows that we have enough dispersion in the distribution of household income across the BGs. We need dispersion, first so that controlling for income (a main factor in the type of car people buy) is meaningful, but also in order to generate a proxy for homogeneity: areas of low dispersion of household income tend to be more homogeneous and, arguably, will show more communication among neighbors.

4 Results

With this data we can study the time series of purchases and compare empirically different patterns across different areas, especially areas with different population density. The main challenge of our analysis is the need to control for a number of variables that are possibly relevant in purchase decisions, like dispersion of household income. For this purpose, we merge the information of our database with data from the 2000 US Census to control for other variables.

In addition, we need to establish that population density is the reason that explains a given purchase pattern in a BG, as opposed to alternative explanations. In particular, we need to distinguish between informational and behavioral effects: good word of mouth from neighbors who bought a car might explain why some people decide to buy the same model. We address this problem in our empirical tests. We perform several tests that we explain next.

4.1 Counts

In our first exercise we want to establish the BGs are a relevant unit of analysis and that some of the effects we have discussed before are present in our data. At this stage we do not try to establish the source of the effects, that is, whether they are due to status-signaling reasons or to communication, but whether the factors we are going to use, population density and dispersion of income, are relevant at the BG level.

In this test we do not distinguish among different car segments. We proceed as follows: we count the number of car registrations within each BG by car make (i.e. Honda, Toyota etc.) during our sample period. Since we want to verify that the BG is a relevant unit for our analysis, we match each BG is with the ten nearest block groups. This allows us to control for general market trends and general local characteristics. The total number of car purchases in the 10 closest BGs, divided by 10, gives us the "expected count" of car purchases of a given make if the BG is a perfect replica of the area in which it is located. [3]

If the BG is an adequate unit of analysis, the profile of the car purchases in a BG will deviate from the profile of purchases in the area in which it is located; in addition, we want to study if the deviations are explained by the factors we are going to use in our tests, population density and income distribution. We run a test for heteroskedasticity in table 2: We test

[3] Since the population may be different across the BGs (1,500 people for BG only on average), the expected counts based on the 10 nearest block groups are adjusted both by population and by number of household units.

whether transaction counts, controlling for the expected count based on the 10 nearest BGs, are more dispersed in areas with low population density, that is, we test whether the residuals increase in absolute size with our factors.

Panel A of table 2 shows the first-step regression, used to estimate differences in transaction counts between each BG and its 10 nearest BGs. The absolute residuals from this first-step regression are then used as the dependent variable in Panel B. Each column corresponds to a different model specification. We employ both a linear regression and a density fixed-effect model (note that in the fixed effect model, the highest rank is the baseline). Although we do not differentiate across different models within a given car make, we also control for dispersion of income, as an important source of heterogeneity, that might affect the transmission of information. We use the Herfindahl index (HI) of family income (based on 16 income groups within each BG) as a proxy for heterogeneity. We also use both linear regression and a fixed-effect model for income distribution (with the highest value of the index being the baseline). The results in Panel B show that transaction counts of different makes are more dispersed in areas with low population density. This evidence is consistent with higher crowding in specific makes (at the expense of other makes that fit the neighborhood profile) in areas with low population density. In other tests we explore the possible channels through which population density translates into concentration in these makes.

4.2 Intervals

Next we explore the intervals between transactions within a BG during our sample period. For each transaction, we compute the number of days between consecutive transactions of the same car make within a BG. We focus on car make and not on specific models, as model effects may be driven by information exchange to a larger degree than the car make. We test whether the interval between transactions is correlated with population density. We control for the expected interval, defined as the total number of days in the sample divided by the total number of transactions of the same car make within the same block group.

The results for cars of the same make are collected in figure 4. In figure 5, we focus only on luxury car makes (BMW, LEXUS and MERCEDES-BENZ), for which the effect is expected to be stronger. Since even make level effects may be driven by information exchange, we also explore only transactions that follow a luxury car (BMW, LEXUS and MERCEDES-BENZ) of a different make in figure 6. That is, purchases of a car of a given make in this group followed by purchases of a different make within the same group.

Table 3 tests the significance of the results collected in the previous plots. In particular, if intervals between car purchases are shorter in lower density areas and/or lower income dispersion. Table 3 shows a strong effect of population density: lower population density increases the influence of the purchase of a given make on the decision of the neighbors. This is the case both for same make purchases of all cars and for luxury car purchases. With respect to income heterogeneity, low income dispersion is positively correlated with the expected number of days to purchase any car of the same make (more homogeneity and more communication increases influence of a purchase on neighbors' decisions), and, consistent with this first result, it is negatively correlated when cars might be of a different make (columns two and three). The density effect survives when we control for income heterogeneity. The magnitude of the effect is stronger in luxury cars. Notably, the effect is the strongest for luxury cars of a different make, which provides support for the relevance of status signaling effects.

4.3 Logit

We use a Logit model to study the decision whether to buy a luxury car or not. In this test we focus on luxury cars, for which the behavioral effect is expected to be stronger; as such cars are clearly more conspicuous. As in the previous test, we also study whether a purchase decision of a luxury car (of the class we defined before) has an effect on purchase decisions of neighbors of a different luxury make. The dependent variable equals 1 if at least one luxury car of a specific make was purchased in a specific block group within a period of 3 months (calendar quarters). The Logit model includes quarter fixed-effects in order to control for within-year seasonality, as it is widely known that there are times of the year that are more popular for car purchases (right before summer, for vacation traveling, and at the beginning of fall, when new models are rolled out). This can produce some lumping of purchases of luxury cars independent of communication and/or status signaling reasons.

Table 4 shows that the likelihood of buying a luxury car is affected by previous transactions involving luxury cars within the same BG. The magnitude of this relation depends on its interaction with population density. More interestingly, the effect is strong even if the previous transaction involves a different luxury make. Arguably, effects across different makes are driven by status signaling reasons, rather than information exchange. Notably, this effect is present controlling for seasonal effects.

5 Conclusion

In this paper we explore whether population density has an effect on "keeping up with the Joneses" preferences. We use a database of car purchases for areas with different population density. We find strong evidence that car purchases influence the purchase decisions of neighbors and this effect is stronger in areas of lower population density. We control for household income and we use income disparity as a proxy for heterogeneity: low income dispersion (i.e., homogeneous population) will be associated with more intense information exchange. The effect of population density persists even after we control for income distribution (as a proxy for homogeneity) and for seasonal effect.

References

[1] Abel A.B., (1990). "Asset Prices under Habit Formation and Catching up with the Joneses," *American Economic Review* 80, 38-42.

[2] Choo, S. and P. Mokhtarian, (2004). "What Type of Vehicle Do People Drive? The Role of Attitude and Lifestyle in Influencing Vehicle Type Choice," *Transportation Research* Part A 38(3), 201-222

[3] Duesenberry, J., (1949). *Income, Saving and the Theory of Consumer Behavior,* Harvard University Press.

[4] Frank. R., (1984). "Are Workers Paid Their Marginal Products?" *American Economic Review* 74, 549-71.

[5] Frank. R., (1985). *Choosing the Right Pond: Human Behavior and the Quest for Status,* NY: Oxford U. Press.

[6] Gómez, J.P., Priestley, R. and F. Zapatero (2008). "The Effect of Relative Wealth Concerns on the Cross-section of Stock Returns," working paper, University of Southern California.

[7] Grinblatt, M., Keloharju, M. and S. Ikaheimo (2008). "Social Influence and Consumption: Evidence from the Automobile Purchases of Neighbors," *The Review of Economics and Statistics* 90, 735-753.

[8] Hirsch F. (1976). *Social Limits to Growth,* Harvard University Press.

[9] Hunt, A. (1996). *Governance of the Consuming Passions: A History of Sumptuary Regulation,* Macmillan, London.

[10] Hong, H., Kubik, J. and J. Stein (2008). "The Only Game in Town: Stock-Price Consequences of Local Bias," *Journal of Financial Economics* 9, 20-37.

[11] Mason, R. (2000). "Conspicuous Consumption and the Positional Economy: Policy and Prescription Since 1970," *Managerial and Decision Economics* 21, 123-132.

[12] Ravina, E. (2007). "Habit Persistence and Keeping Up with the Joneses: Evidence from Micro Data," working paper, Columbia University.

[13] Veblen, T. (1899). "The Theory of the Leisure Class," www.gutenberg.org.

Table 1: **Descriptive statistics**

Panel A: Counties

	Los Angeles	Orange	Riverside	All counties
		Census 2000		
Number of Block Groups	6,351	1,826	804	8,981
Total population	9,519,338	2,846,289	1,545,387	13,911,014
Total household units	3,270,909	969,484	584,674	4,825,067
Area in sq. meters (millions)	10,517	2,044	18,667	31,229
Area in acres	2,598,957	505,219	4,612,716	7,716,892
		Car registrations in 2004-2006		
Used	2,720,491	787,919	554,287	4,062,697
New	2,038,502	610,846	362,885	3,012,233
All	4,758,993	1,398,765	917,172	7,074,930

Panel B: Block Group medians

	Los Angeles	Orange	Riverside
Area in sq. meters	318,407	454,918	1,353,677
Area in dunam	318	455	1,354
Area in acres	79	112	335
Population density per dunam	3.81	3.08	1.26
Per capita income in 1999	17,296	25,738	16,761
Median family income in 1999	46,685	64,710	44,829

Table 2: Car purchase counts per make, population density and income distribution

Panel A: 1st stage

	Count (population adjusted)		Count (household unit adjusted)	
Model	Linear	Fixed effects	Linear	Fixed effects
Intercept	11.40338***	5.3845***	13.13196***	6.94765***
Expected count	0.50214***	0.50128***	0.39833***	0.39767***
Population density	-0.29935***		-0.24561***	
Family income HI	-7.31151*		-9.44962**	
Low density (Tercile 0)		6.15713***		5.92586***
Medium Density (Tercile 1)		-0.85209		-1.10987
Low income HI (Tercile 0)		5.04348***		5.68326***
Medium income HI (Tercile 1)		1.01223		1.20981

Panel B: Heteroskedasticity test

	Count (population adjusted)		Count (household unit adjusted)	
Model	Linear	Fixed effects	Linear	Fixed effects
Intercept	5.08142***	0.88247	8.9194***	4.08308***
Expected count	0.47455***	0.47275***	0.35941***	0.35803***
Population density	-0.52244***		-0.42659***	
Family income HI	12.30069***		6.7579*	
Low density (Tercile 0)		9.04715***		8.63821***
Medium Density (Tercile 1)		0.16688		-0.52084
Low income HI (Tercile 0)		2.60507***		4.10363***
Medium income HI (Tercile 1)		-1.00446		-0.48131

Table 3: Car purchase intervals, population density and income distribution

	Interval (same make)		Interval (any luxury)		Interval (different luxury)	
Observations Used	6,141,309		613,261		395,163	
Model	Linear	FE	Linear	FE	Linear	FE
Intercept	4.63***	6.3***	2.79***	3.32***	3.83***	4.36***
Expected interval	0.76***	0.76***	0.78***	0.77***	0.47***	0.47***
Population density	0.013**		0.11***		0.14***	
Family income HI	7.08***		-3.04***		-5.96***	
Low density (Tercile 0)		-0.6***		-1.33***		-1.83***
Medium Density (Tercile 1)		0.45***		0.04		-0.19**
Low income HI (Tercile 0)		-1.18***		0.14**		0.13
Medium income HI (Tercile 1)		-0.43***		0.34***		0.43***

Table 4: Logit model per make and block group, 3 months intervals, luxury cars

Parameter	Estimate	Standard Error	Wald Chi-Square
Intercept	-1.578***	0.0201	6,189.28
Family income	0.000021***	1.97E-07	10,989.06
Population density	0.0252***	0.00255	97.97
SameMake_{t-1}	1.5051***	0.0202	5,550.68
$\text{DifferentMake}_{t-1}$	0.6777***	0.0218	965.16
$\text{Same}_{t-1}\times$ Density	-0.0182***	0.00291	39.06
$\text{Different}_{t-1}\times$ Density	-0.00916***	0.00319	8.24
Quarter fixed-effects	Yes		
R-Square	0.1324		
Observations Used	295,020		

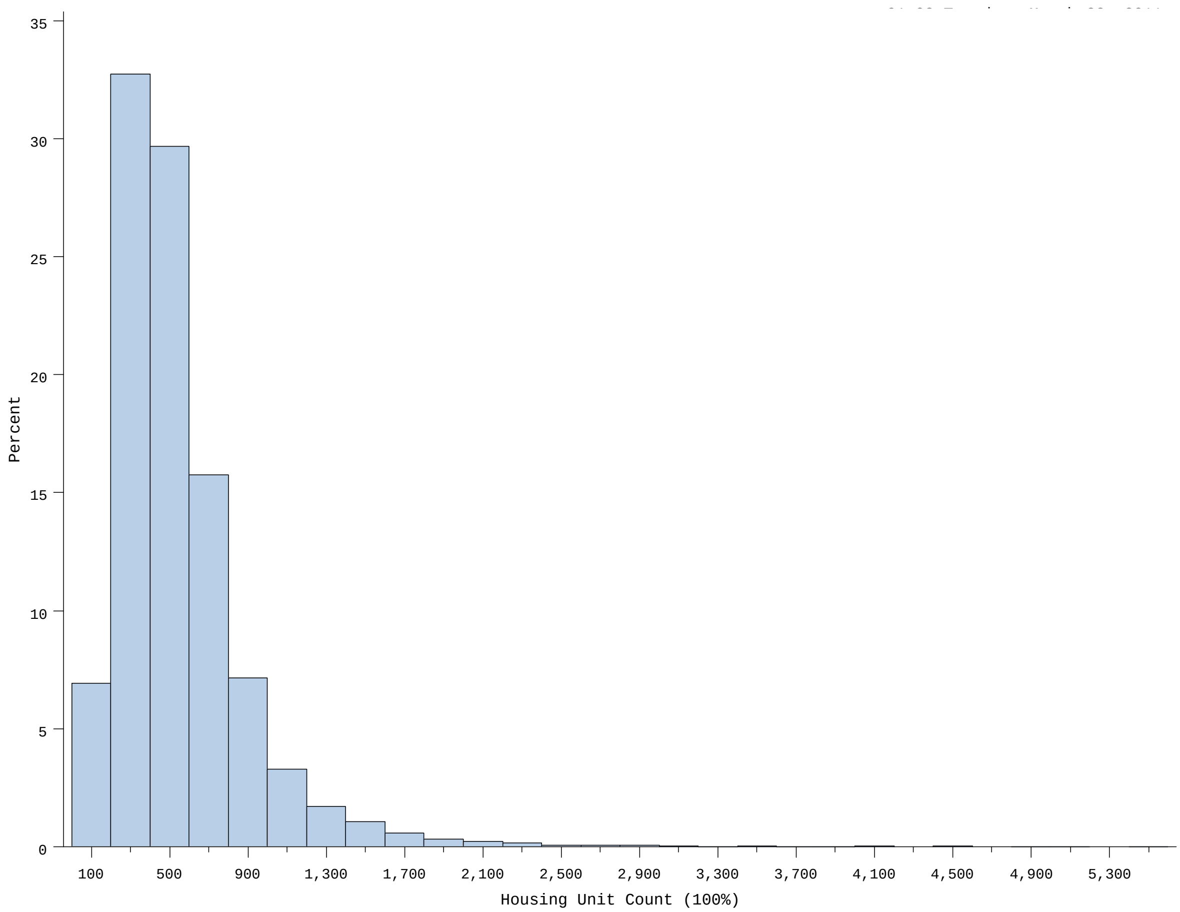

Figure 1: **Household units per block group**

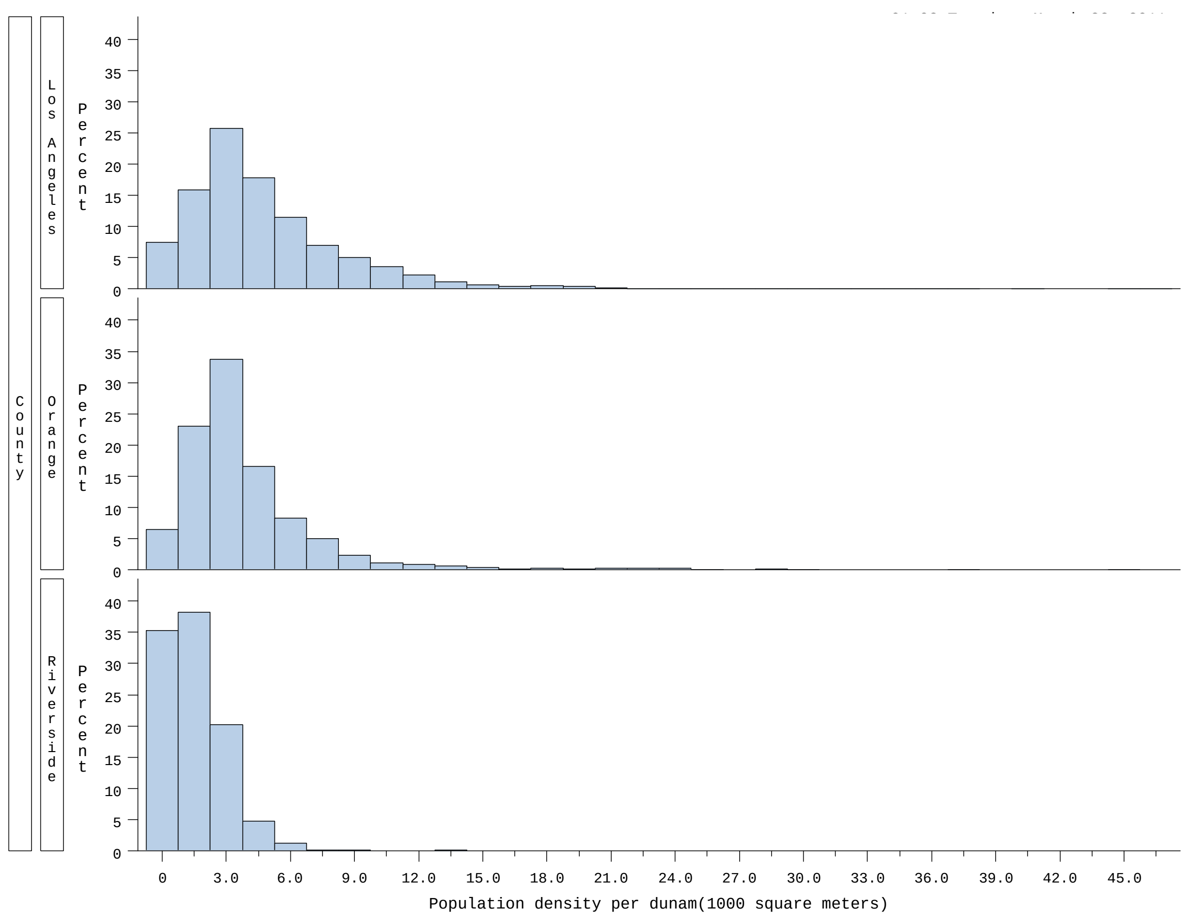

Figure 2: **Population density per block group, by county**

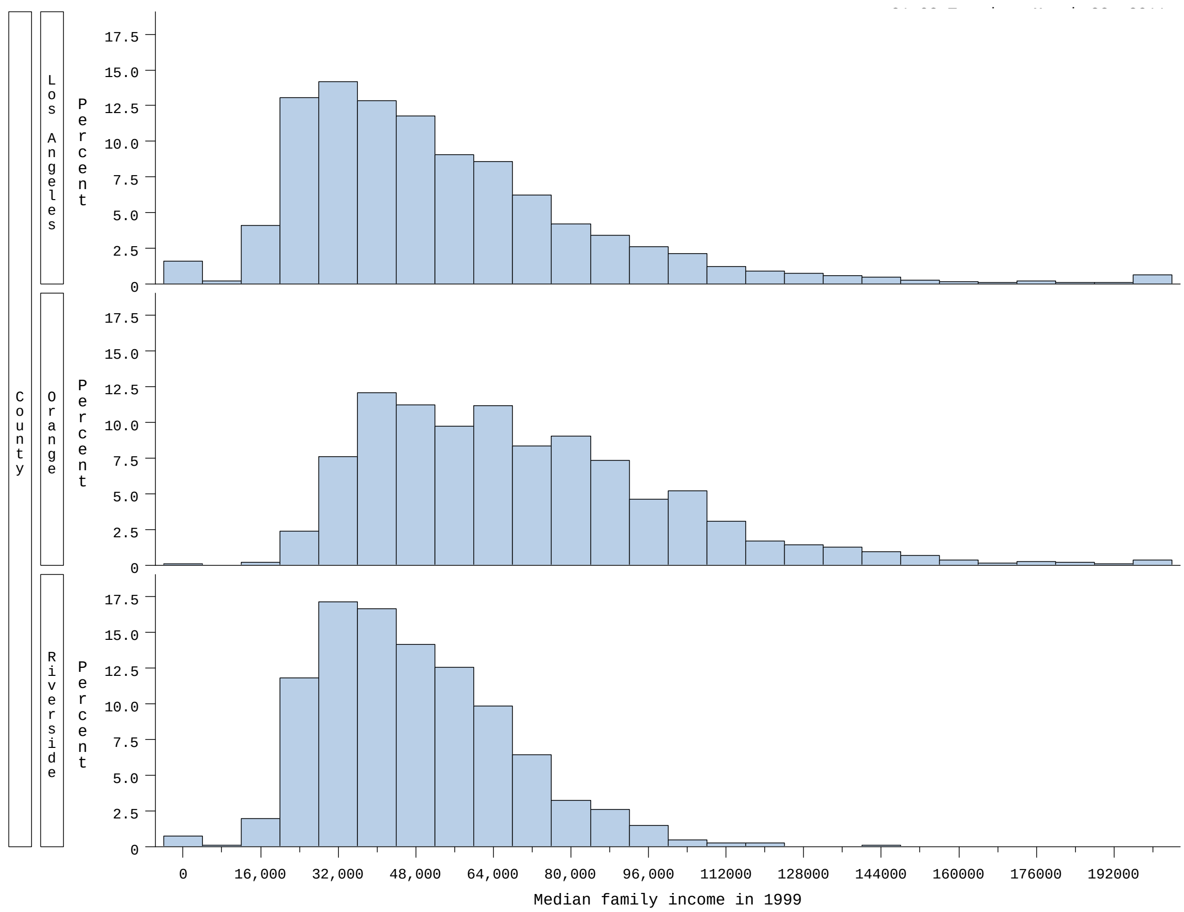

Figure 3: **Median family income per block group, by county**

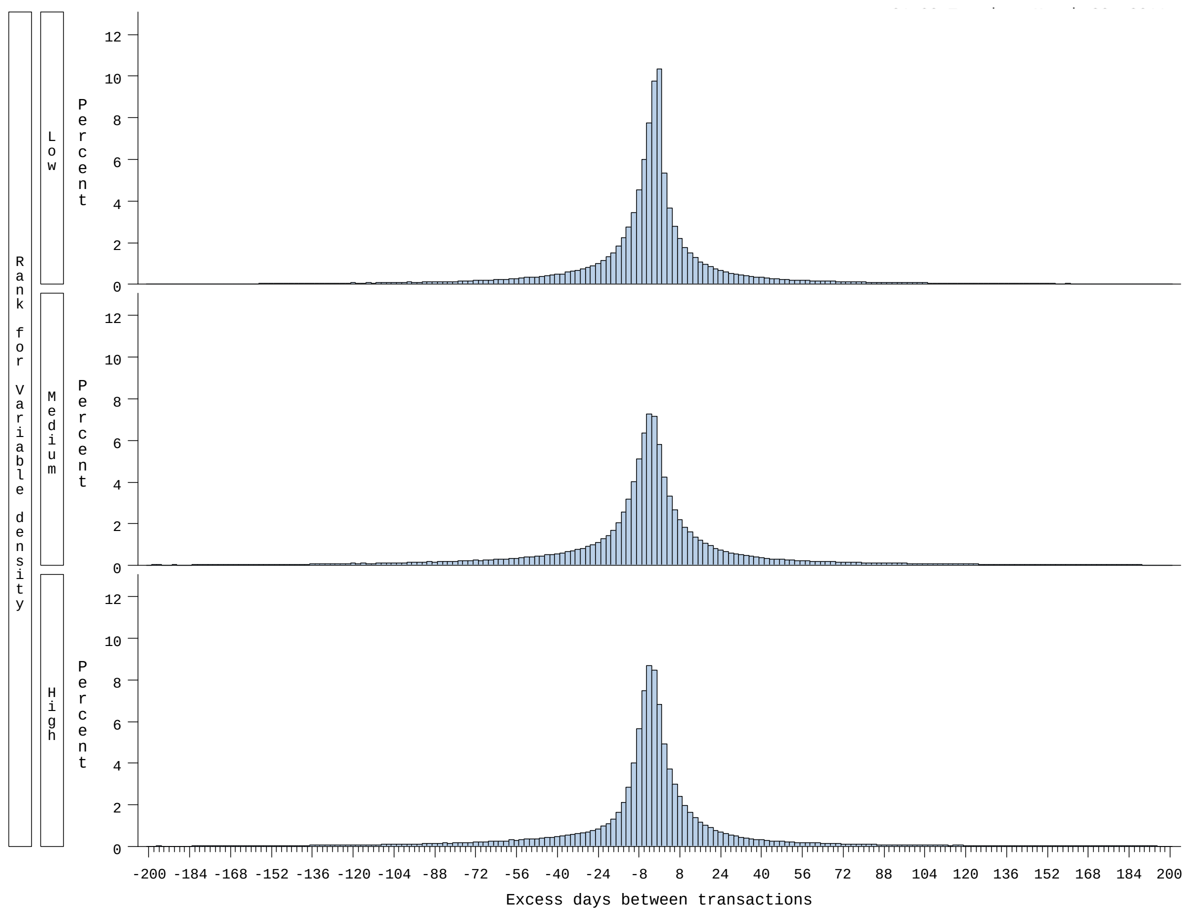

Figure 4: **Days between transactions of the same make within a block group, by density**

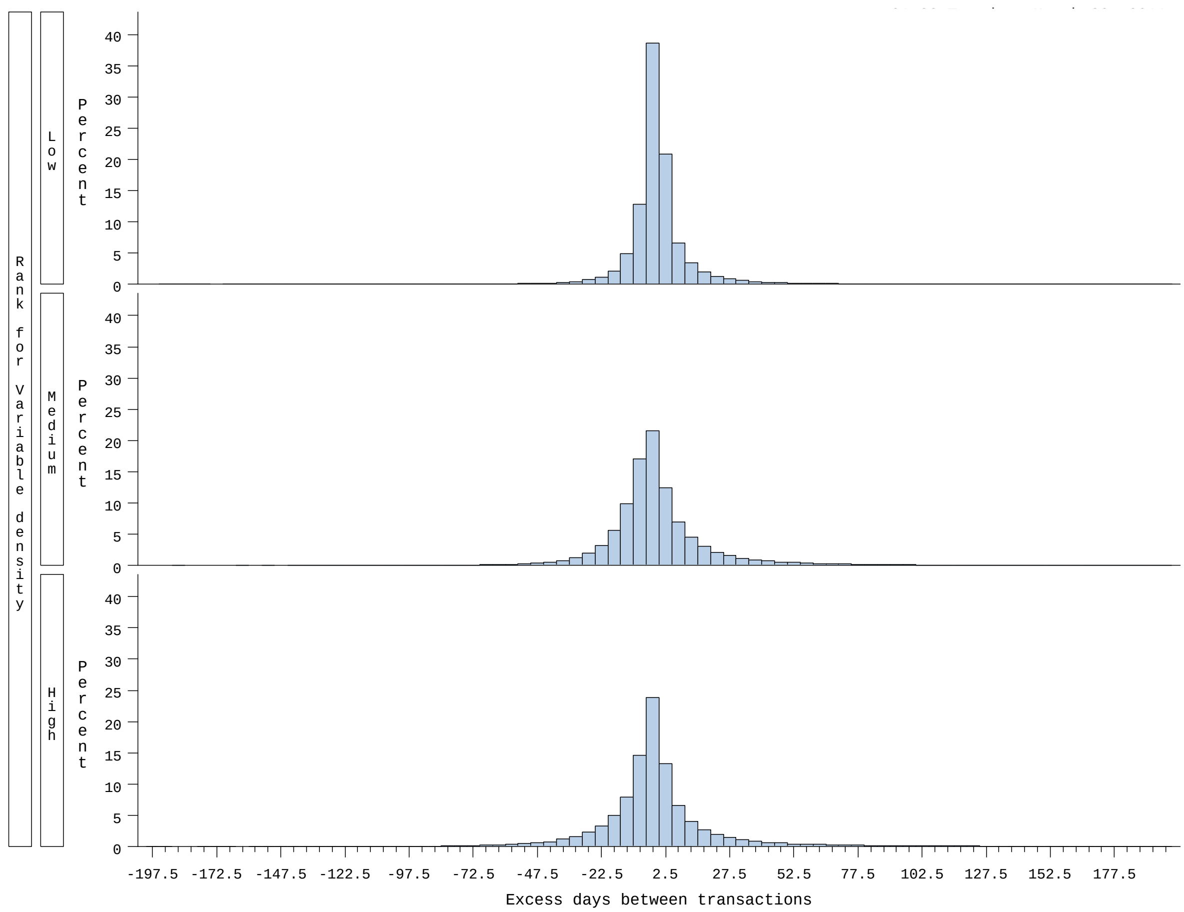

Figure 5: **Days between transactions of any luxury make within a block group, by density**

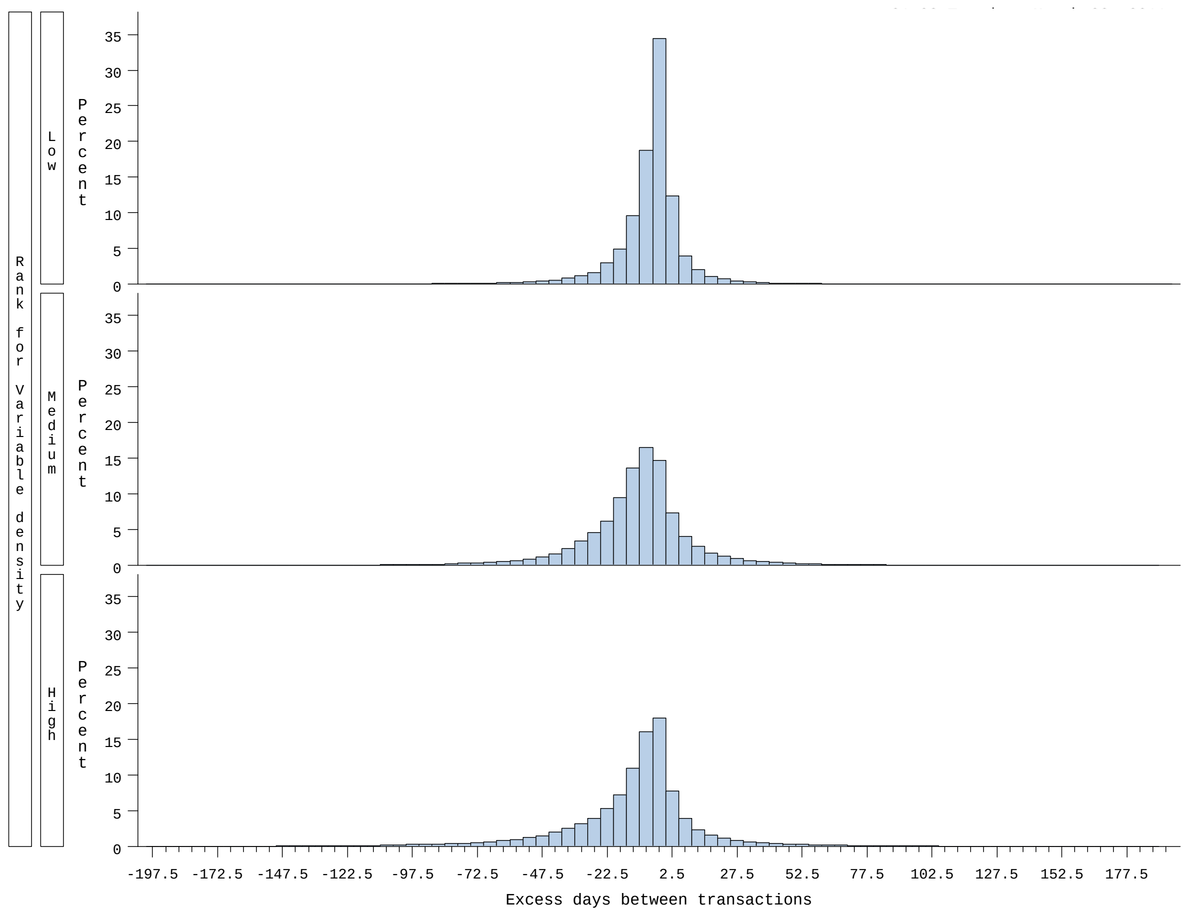

Figure 6: **Days between transactions of different luxury make within a block group, by density**