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Conspicuous Consumption and Within-Group Income Inequality (Not for Public Circulation)

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Abstract

Individuals engage in conspicuous consumption to signal their income to their own reference groups, defined in a fine manner by observable identifiers such as race, gender, education, and occupation. The more income inequality within a reference group, the less prior information concerning the income of an individual, and hence the more effective the conspicuous consumption signal. Therefore, within-group income inequality causes substitution from non-conspicuous consumption to conspicuous consumption. We find strong evidence supporting this prediction regarding aggregate conspicuous consumption for all income percentiles. Disaggregating into smaller consumption categories, most consumption items categorized by the previous literature as conspicuous and non-conspicuous using survey methods agrees with this prediction as well.

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1 Introduction

Rather than consuming directly for one's well-being, people may consume to influence the public perception of their well-being instead. This second kind of consumption, known as conspicuous consumption, serves to signal for status — through conspicuous consumption, one can reveal himself as having high income to the public. Conspicuous consumption, as a means of signaling rather than just for its intrinsic value, can crowd out non-conspicuous consumption, sometimes to an extreme that draws the attention of many economists. This paper studies the substitution between these two kinds of consumption, and relates that to income inequality within one's reference group, defined by observables such as occupation, race, gender, age, and education level.

This substitution effect applies to reference groups at all income levels. Consider two featuring examples. One reference group of interest consists of farmers in the developing countries, who spend 10% of their annual budget on festivals (Banerjee and Duflo, 2007).[1] Motivated by this finding, Neeman et al. (2012) constructs a conspicuous consumption model in which the poor signals their wealth through conspicuous consumption. Whereas the rich is the original focus of the conspicuous consumption literature founded by Veblen (1899). As another featuring reference group, NFL players are reported to spend conspicuously during their career, yet they file bankruptcies soon after retirement.[2]

[1] Banerjee and Duflo (2007) reports:

> Yet the average person living at under $1 per day does not seem to put every available penny into buying more calories. Among our 13 countries, food typically represents from 56 to 78 percent among rural households, and 56 to 74 percent in urban areas. For the rural poor in Mexico, slightly less than half the budget (49.6 percent) allocated to purchase food. (...) Perhaps more surprisingly, it is apparent that spending on festivals is an important part of the budget for many extremely poor households. (...) The median household spent 10 percent of its annual budget on festivals.

[2] Carlson et al. (2015) reports,

> A career lasting 6 years (the median length) will provide an NFL player with more earnings than an average college graduate will get in an

These two reference groups, which we take as leading examples, are clearly distinct by occupation — knowing a person being an NFL player easily distinguish him from a farmer in a developing country. More generally, the public would use observable group identifiers as predictors of an individual's income, before using conspicuous consumption as an indirect means of inference. This conditioning, though, do not explain all the aggregate income inequality in earnings regressions; a significant portion of the variation in income is within-group. A large macro literature reports on the wage dispersion among observationally homogeneous workers (Hall and Mueller, 2017).[3]

In this paper, we claim that within-group income inequality is related to conspicuous consumption. To this end, we build and test a simple model of conspicuous consumption that hinges on a straightforward application of Bayes' theorem. In this model, the public infers an agent's income by first conditioning on observables that defines his reference group; this prior, as the within-group income inequality, is non-degenerate. As Bayes' theorem dictates, the public spread its updating weights on the prior and a conspicuous consumption signal sent by the agent.

Suppose that the income inequality within his reference group increases; now it becomes harder to determine his income a priori because of a more diffused prior. Being less informed, the public puts a higher weight on the conspicuous consumption signal. His conspicuous consumption, with increased influence to the public inference process, would increase in the expense of non-conspicuous consumption.

We then extend this analysis to include dynamics. Even in a world without capital markets, conspicuous consumption establishes an

> entire lifetime, plus a modest pension. However, earnings are risky because an injury can cut a player's career short. (...) Indeed, we find that initial bankruptcy filings begin to occur very soon after retirement and continue at a substantial rate through at least the first 12 years of retirement (Carlson et al., 2015).

[3]For our two reference group examples, harvest income is idiosyncratic among farmers, partly due their low mobility causing difficulties in avoiding geographic risks such as bad weather (Munshi and Rosenzweig, 2006, 2009); while the income distribution of NFL players is highly skewed due to the presence of superstars (Rosen, 1981).

intertemporal link because signaling for status today also have effects on future inferences, in case income is persistent. The cumulative signaling effects leads to more conspicuous consumption relative to the i.i.d. case.

In our empirical exercise, we examine this implication by comparing across reference groups, which differ in within-group income inequality. We discover that conspicuous consumption and within-group inequality are positively related for all permanent income percentiles; the reverse conclusion holds true for non-conspicuous consumption. In making this comparison, we control for mean permanent income of the group, in order to hold the average purchasing power within a reference group constant.

Some confounding factors may undermine the validity of this comparison. First, reference groups may have heterogeneous preferences — some groups may particularly prefer certain goods that economists regard as conspicuous consumption, such as clothing and jewelry, without an intention of being conspicuous. Second, reference groups may also have different persistence in income, which we have shown to affect the demand for conspicuous consumption. To address these identification concerns, we divide the references groups further by year to obtain a short panel of groups; using this panel, we perform the same exercise controlling for group and year fixed effects, and the results still hold. The identifying assumption is that preferences and persistence are time-invariant, while price changes over time are common across the reference groups, and thus being absorbed by the time trend.

We make four remarks about our main result. First, based on our theory, we define reference groups using a vector of characteristics typically considered in wage regressions. We arrive at a large number of reference groups relative to the existing literature, which focus on prescribed single criterion such as race (Charles et al., 2009; Kaus, 2013) or gender (Griskevicius et al., 2007).

Second, according to the permanent income hypothesis (PIH), consumption should depend on permanent income, while in cross-sectional data permanent income is hard to directly identify. If PIH holds, then the total current expenditure of each period should be equal to permanent income. Following Charles et al. (2009), we proxy permanent income by current total expenditure. This proxying implies

that both mean permanent income and within-group inequality are measured with error. Under a classical measurement error assumption, the resulting attenuation bias would drive the estimated correlations towards zero. Since our tests are to reject the null of zero correlation, the attenuation bias results in a more stringent test.[4]

Third, our main result is established using aggregate conspicuous consumption defined by Charles et al. (2009). As an extension, we evaluate whether each of the consumption items used by Charles et al. (2009) shows their expected correlations, i.e. positive for conspicuous consumption, negative for non-conspicuous consumption. We find that the correlation coefficient for most consumption items have their respective expected signs, even though there are partial exceptions. Among non-conspicuous items in Charles et al. (2009), food, rent, utility and health show negative correlations as expected; however, entertainment is shown to be conspicuous for all income percentiles, whereas travel is conspicuous only for the rich. Among conspicuous items in Charles et al. (2009), while cars has positive correlations as expected, clothing and personal care occupy insignificant consumption shares; consequently, they show almost zero correlations with income inequality. On the whole, our prediction is consistent with the survey-based categorization.

Fourth, we repeat the exercise using data from Vietnam, a developing country, to corroborate our findings. The consumption pattern of Vietnamese are different from that of people of the United States, whom the main sample is drawn from. The mean level of income and other group-defining characteristics are also different. Nonetheless, we do observe a similar conclusion.

2 Literature Review

The modern literature on conspicuous consumption formalizes the arguments exposited in Veblen (1899)'s theory of the social class, which defines conspicuous consumption as the consumption for status. In most models of consumption, the utility function depends directly

[4]Identifying the true causal effect of income inequality requires searching for exogeneous instruments for both mean permanent income and within-group income inequality, which are hard to come by; this important task is left for future exercises.

on the amount of consumption. Conspicuous consumption models depart from the standard model by including social status as part of the utility function. Specifically, social status refers to how the society regard the well-being of an individual.

Ireland (1994); Bagwell and Bernheim (1996) build the canonical model of conspicuous consumption.[5] This canonical model is an application of signaling models to the consumption context. The rich have an incentive to reveal themselves as rich using conspicuous consumption as a signal, distinguishing thsemelves from the poor. Like Spence (1973)'s classical signaling model on education, the result is a separating equilibrium — the rich spends sufficiently much on conspicuous consumption until the poor cannot follow suit; whereas the poor would optimally give up altogether in engaging in conspicuous consumption, since an insufficient amount of conspicuous consumption cannot alter the public inference.

Notably, in a separating equilibrium the inference process is degenerate, since the types are fully revealed; the public completely disregard the prior distribution on the types. Whereas in our model, conspicuous consumption sends a noisy signal of income to the public — it would be difficult to quickly access the value of a luxury good by merely observing it. As the noise mingles the signals, the public no longer completely disregard the prior. Hence within-group income inequality, as the prior, matters.

The theoretical literature considers a number of issues regarding conspicuous consumption which we abstract from. Bagwell and Bernheim (1996) consider a general equilibrium model and study the conditions for the existence of Veblen effects. They also show that the equilibrium is inefficient. Neeman et al. (2012) consider an overlapping generation model with human capital investment, proving that conspicuous consumption can lead to a poverty trap.

Charles et al. (2009), in their study of conspicuous consumption by race, mention that between-race heterogeneity in preferences can explain any between-race difference in consumption levels, but the resulting theory is tautological. Instead, they abstract from preferences and emphasize differences in income instead. They find that a Black person has a less incentive to engage in conspicuous consumption than

[5] See also Cole et al. (1992, 1995); Glazer and Konrad (1996).

a White person with comparable income. To explain this fact, they propose that people in each race signals within their own reference group. Since Blacks are poorer than Whites on average, a Black person, being relatively rich within his group, would signal more; whereas a comparable White person, being relatively poor within his group, would signal less. Kaus (2013) performs a similar exercise using data from South Africa. Our paper is related to theirs by extending the analysis to many finely defined reference groups instead of two.

Conspicuous consumption are often considered as irrational, which invites lack of self-control as another candidate explanation of the same phenomenon. For instance, Carlson et al. (2015) appeal to the lack of self-control to explain why the NFL players do not save during their career. Most self-control models consider a single consumption good, thus abstracting from the concern of substitution between conspicuous and non-conspicuous goods. As a notable exception, Banerjee and Mullainathan (2010) consider a theoretical model in which they define temptation goods as those which generate positive utility to the self which consumes the good, but not to the previous selves that anticipates the consumption.

3 The Model

3.1 Static Case

For simplicity, we first consider a static economy. There is a continuum of agents indexed by $i \in \mathcal{I}$. Agent i's income is an endowment $y_i \in \mathbb{R}_+$, being log-normally i.i.d. distributed such that $log(y_i) \sim N(m_y, 1/h_y)$, where $h_y > 0$ is a precision parameter (the inverse of variance). The public does not know the realization of y_i but only its distribution.

For a particular agent i, $c_i \in \mathbb{R}_+$ is his non-conspicuous (ordinary) consumption, and v_i is his conspicuous consumption. Conspicuous consumption $v_i \in \mathbb{R}_+$ does not enter the utility function directly, so that it has no intrinsic consumption value; it can be used to manipulate his status $s_i \in \mathbb{R}_+$ according to an updating rule $S : \mathbb{R}_+ \to \mathbb{R}$ such that $s_i = S(v_i)$. The status, as we shall specify later, represents the public posterior mean of agent i's income. Shutting down the intrinsic value of conspicuous consumption v_i is not necessary but rather for

exposition; we highlight that even in this case, the demand for status implies a strictly positive value of conspicuous consumption.

Agent i's utility is quasi-linear in non-conspicuous consumption:

$$U(c_i, v_i) \equiv \log c_i + bS(v_i) \tag{1}$$

This functional form is assumed for obtaining a closed-form solution.

Denote the prices of (c_i, v_i) by $(p_c, p_v) \in \mathbb{R}^2_+$. The budget set of the agent is $\mathcal{B}(y_i) = \{(c, v) \in \mathbb{R}^2_+ | p_c c + p_v v \leq y_i\}$. Given $\{p_c, p_v, y_i, S\}$, agent i solves the following utility maximization problem:

$$\max_{(c_i, v_i) \in \mathcal{B}(y_i)} U(c_i, v_i) \tag{2}$$

which yields policy functions $r_c(y_i), r_v(y_i)$ for c_i, v_i respectively.

The updating rule S is to be determined in the equilibrium. The public observes a noisy signal of log conspicuous consumption of agent i:

$$q_i = \log v_i + \varepsilon_i \tag{3}$$

where $\varepsilon_i \sim i.i.d.N(0, 1/h_\varepsilon)$ is a noise term, known to the agent but not to the public; the agent has no control over ε_i. The public knows agent i's policy function of v_i, and hence q_i is indirectly a function of y_i — to the public, observing q_i is informative on y_i. On the other hand, non-conspicuous consumption c_i is not observable to the public.

Given the assumed functional forms, there is a simple solution to this problem. Assume that the updating rule S takes a form of:

$$S(v) = s_0 \log(v); s_0 \in \mathbb{R} \tag{4}$$

In this case, the policy functions are linear in y as $r_c(y_i) = r_c y_i, r_v(y_i) = r_v y_i$, where $r_c = 1/[p_c(1 + bs_0)], r_v = bs_1/[p_v(1 + bs_0)]$.

In the equilibrium, the public would first adjust the signal on log conspicuous consumption by an amount of $-\log r_v$, such that the adjusted signal is the log income plus noise $\tilde{q}_i = \log(y_i) + \varepsilon_i$. Then the public uses Bayes' rule to determine agent i's status, which takes the form of an weighted average of its prior mean and the adjusted signal as:

$$s_i \equiv m_y \phi + \tilde{q}_i(1 - \phi) \tag{5}$$

where $\phi \in [0,1]$ is the updating weight put on the prior mean m_y, and $1-\phi$ is the updating weight put on the adjusted signal. According to Bayes' rule,

$$\phi = \frac{h_y}{h_y + h_\varepsilon} \tag{6}$$

so that the weight on the prior depends on the relative precision of the prior and the signal.

Taking this updating rule as given, for agent i his marginal effect of signal manipulation using conspicuous consumption is:

$$\frac{\partial s_i}{\partial v_i} = \frac{\partial s_i}{\partial \tilde{q}_i}\frac{\partial q_i}{\partial v_i} = \frac{1-\phi}{v} \tag{7}$$

which agrees with the assumed log functional form of the updating rule S, with $s_0 = 1-\phi$. This implies that $r_c = \frac{1}{1+b(1-\phi)}, r_v = \frac{b(1-\phi)}{1+b(1-\phi)}$.

Our model includes that of noiseless signaling as a special case, such that $h_\varepsilon = \infty, \phi = 0$, and that $r_c = 1/(1+b), r_v = b/(1+b)$. In this special case, the prior is completely discarded in Bayesian updating; consequently, within-group income inequality h_y has zero impact on conspicuous consumption. Hence for our theory to hold, the signaling noise is key.

Whereas the opposite case is that $h_\varepsilon = 0$ such that the raw signal is pure noise, then $\phi = 1$ and $r_c = 1, r_v = 0$; in this case where conspicuous consumption cannot be valued by the public, then there can be no conspicuous consumption.[6]

It is straightforward to obtain the following comparative statics:

Proposition 1 (Comparative Statics)**.** $\partial r_c/\partial h_\varepsilon < 0, \partial r_v/\partial h_\varepsilon > 0, \partial r_c/\partial h_y > 0, \partial r_v/\partial h_y < 0, \partial r_c/\partial b < 0, \partial r_v/\partial b > 0.$

Proposition 1 states that within-group income inequality causes substitution from non-conspicuous consumption to conspicuous consumption. Specifically, consider two groups A and B with the same group mean income $m_{yA} = m_{yB}$, but Group A has a larger within-group inequality relative to Group B such that $h_{yA} < h_{yB}$. Proposition

[6]Certainly, if the conspicuous good has intrinsic value, then its consumption is still positive.

1 would imply that Group A will spend more on conspicuous consumption relative to Group B. This is the main proposition that we are going to test.

3.2 Multiple Goods Model

It is straightforward to generalize the above to consider multiple goods. Now goods are indexed by $j \in \mathcal{J} \equiv \{1, 2, \ldots, J\}$, and denote the vector of all goods of agent i as $\mathbf{c}_i \in \mathbb{R}^J_+$. Let the vector of prices be $\mathbf{p} \in \mathbb{R}^J_+$. The budget set is $\mathcal{B}(y_i) \equiv \{\mathbf{c} \in \mathbb{R}^J_+ | \mathbf{p}'\mathbf{c} \leq y_i\}$. Each good agent i consumes has a different signaling noise; we denote the vector by $\boldsymbol{\varepsilon}_i \in \mathbb{R}^J$; we assume that $\boldsymbol{\varepsilon}_i \sim N(\mathbf{0}, \boldsymbol{E})$ where $\boldsymbol{E} \equiv diag(1/\boldsymbol{h})$ is a diagonal matrix to impose independence across goods. Utility is given by:

$$U(\boldsymbol{c}_i) \equiv \sum_{j \in \mathcal{J}} a_j \log(c_{ij}) + bS(\boldsymbol{c}_i) \tag{8}$$

where $S : \mathbb{R}^J_+ \to \mathbb{R}$ is the updating rule that depends on the consumption of all goods, which we assume the following form:

$$S(\boldsymbol{c}) = \sum_{j \in \mathcal{J}} s_j \log(c_j); s_j \in \mathbb{R}_+, \forall j \in \mathcal{J} \tag{9}$$

The first-order conditions for c_{ij} for a particular good $j \in \mathcal{J}$ is:

$$\frac{a_j + bs_j}{c} = \lambda p_j \tag{10}$$

so that $c^*_{ij} = r_j y_i$, where $r_j = (a_j + bs_j)/[p_j \sum_{j' \in \mathcal{J}}(a_{j'} + bs_{j'})]$.

The public receives the signals $\boldsymbol{q}_i = \log(\boldsymbol{c}_i) + \boldsymbol{\varepsilon}_i = \boldsymbol{r} + \log(y_i)\mathbf{1} + \boldsymbol{\varepsilon}_i$, where $\boldsymbol{r} = (r_1, r_2, \ldots, r_J) \in \mathbb{R}^J_+$. The adjusted signals are: $\tilde{\boldsymbol{q}}_i = \boldsymbol{q}_i - \boldsymbol{r}$. Since the signals are independent, Bayes' rule imply that:

$$s_{it} = \phi_0 m_y + \sum_{j \in \mathcal{J}} \phi_j \tilde{q}_{ij} \tag{11}$$

where

$$\phi_0 = \frac{h_y}{h_y + \sum_{j \in \mathcal{J}} h_j}; \phi_j = \frac{h_j}{h_y + \sum_{j \in \mathcal{J}} h_j}, \forall j \in \mathcal{J} \tag{12}$$

Using the same reasoning as the two-good case,

$$p_j r_j = \frac{a_j + b\phi_j}{\sum_{j' \in \mathcal{J}} a_{j'} + b\phi'_j} \tag{13}$$

Consider the ratio of two goods $A, B \in \mathcal{J}$. Their ratio of consumption expenditure is $\frac{p_A r_A}{p_B r_B} = \frac{a_A + b\phi_A}{a_B + b\phi_B}$ and that $\phi_A/\phi_B = h_A/h_B = c_\phi \in \mathbb{R}_+$. Suppose that good A is a better conspicuous good, such that its is more observable to the public, with $h_A > h_B$ such that $c_\phi > 1$.

When within-group inequality rises, h_y decreases so ϕ_A, ϕ_B increases while maintaining their ratio c_ϕ. Since:

$$\frac{\partial}{\partial \phi_B}\left[\frac{a_A + bc_\phi \phi_B}{a_B + b\phi_B}\right] = \frac{b(a_B c_\phi - a_A)}{(a_B + b\phi_B)^2} \tag{14}$$

This implies that if two goods have the same intrinsic value such that $a_A = a_B$, then the ratio of consumption expenditure increases since $c_\phi > 1$.

3.3 Infinite-Period Model

The one-period model ignores an important concern that, if learning is allowed for multiple periods, then eventually the income of the agent will become perfectly known to the public; therefore, it is not possible to sustain conspicuous consumption at the steady state, even in the presence of a non-degenerate cross-sectional within-group heterogeneity. This observation is shared in Holmström (1999) as well.

As the next step, we consider a dynamic extension of the baseline in which the current income of an agent stochastically evolves over time. We shut down the credit market here so there is no direct intertemporal trade-off. We show that even in this case, the conspicuous consumption is non-zero; furthermore, conspicuous consumption can generally affect future status when income is persistent. Thus an intertemporal link exists.

At any time $t \in \mathcal{T}$ where $\mathcal{T}$ is the set of integers, agent i's income y_{it} is given by:

$$y_{it} = Z_{it}\eta_{it} \tag{15}$$

such that Z_{it} is known and η_{it} is an log-normally distributed innovation unknown to the public. This innovation follows a log AR(1) process that starts from the infinite past:

$$\log \eta_{it} = \rho \log \eta_{it-1} + \xi_{it} \tag{16}$$

where $\xi_{it} \sim_{i.i.d.} N(0, 1/h_\xi)$, $\rho \in (0,1)$ is a persistence parameter.

The sequence problem at time $t = t^*$ is:

$$\max_{\mathbf{c}_{t^*}, \mathbf{v}_{t^*}} \mathbb{E}_t[\sum_{t=t^*}^{\infty} \beta^\tau [\log(c_t) + S_t(v_t, v_{t-1}, \ldots)]] \tag{17}$$

where $\mathbf{c}_{t^*} \equiv \{c_t\}_{t=t^*}^{\infty}, \mathbf{v}_{t^*} \equiv \{v_t\}_{t=t^*}^{\infty}$; in every period t, $(c_t, v_t) \in \mathcal{B}(y_t) \equiv \{(c,v) | p_c c + p_v v = y_t\}$; $\beta \in (0,1)$ is the discount factor; prices (p_c, p_v) are constants.

Although the budget set $\mathcal{B}(y_t)$ has no intertemporal link, current status is generally affected by not only the current conspicuous consumption, but the past conspicuous consumptions as well; the economy is assumed to be stationary, and that the sequence of past conspicuous consumption up to time t^* is an infinite series.

The updating rule at time t, S_t, is assumed to take the following form, which shall be justified:

$$S_t(v_t, v_{t-1}, \ldots) = \sum_{\tau=0}^{\infty} s_\tau \log(v_{t-\tau}) \tag{18}$$

The first-order conditions for (c_t, v_t) for any $t \geq t^*$ are:

$$\frac{1}{c_t} = \lambda p_c \tag{19}$$

$$\frac{b \sum_{\tau=0}^{\infty} \beta^\tau s_{t-\tau}}{v_t} = \lambda \tag{20}$$

Which means that the solution is still in the form of $c_i^* = r_c y_{it}, v_i^* = r_v y_{it}$ as constant proportions of current income.

As before, the second step is to determine the equilibrium updating rule. The public constructs the adjusted signal of current income for each period as:

$$\tilde{q}_{it} = q_{it} - \log r_v = \log Z_{it} + \log \nu_{it} + \varepsilon_{it} \tag{21}$$

At time t, agent i's status depends on the public perception given the history of adjusted signals $\tilde{\boldsymbol{q}}_i^t \equiv \{\tilde{q}_{i\tau}\}_{-\infty}^t$. Because of the AR(1) structure of innovations, past adjusted signals are informative on current income. Consequently, the status s_{it} is determined by the Bayes' rule according to the following:

$$\begin{aligned} s_{it} &= \log Z_{it} + \mathbb{E}[\log \nu_{it} | \tilde{\boldsymbol{q}}_i^t] \\ &= \log Z_{it} + \mathbb{E}\left[\sum_{\tau=0}^{\infty} \rho^\tau \xi_{it-\tau} | \tilde{\boldsymbol{q}}_i^t\right] \\ &= \log Z_{it} + \sum_{\tau=0}^{\infty} \rho^\tau \mathbb{E}[\xi_{it-\tau} | \tilde{q}_{it-\tau}] \\ &= \log Z_{it} + \sum_{\tau=0}^{\infty} \rho^\tau (1-\phi) \tilde{q}_{it-\tau} \end{aligned} \tag{22}$$

where

$$\begin{aligned} \phi &= \frac{h_\eta}{h_\eta + h_\varepsilon} \\ &= \frac{(1-\rho^2) h_\xi}{(1-\rho^2) h_\xi + h_\varepsilon} \end{aligned} \tag{23}$$

Therefore, we have $s_{t-\tau} = \rho^\tau (1-\phi)$ for any $\tau \in \{0, 1, 2, \ldots\}$ and

$$S'(v) = \frac{\sum_{\tau=0}^{\infty} \beta^\tau \rho^\tau (1-\phi)}{v} = \frac{1-\phi}{(1-\beta\rho)v} \tag{24}$$

which is strictly positive. In turn, it implies that

$$r_c = \frac{1}{p_c[1 + b(1-\phi)/(1-\beta\rho)]}, r_v = \frac{b(1-\phi)/(1-\beta\rho)}{p_v[1 + b(1-\phi)/(1-\beta\rho)]} \tag{25}$$

This result implies that conspicuous consumption is more prevalent in reference groups that have a high persistence parameter in their earnings — these reference groups are typically having random-walk like income paths and are perceived as risky.

If $\rho = 0$, income is i.i.d., with $h_\eta = h_\xi, \phi = h_\xi/(h_\xi + h_\varepsilon)$, and

$$r_v = \frac{b(1-\phi)}{p_v(1 + b(1-\phi))}$$

In this case, learning about the income of agent i in one period has no prediction power to his income in another period. This i.i.d. feature prevents the public to fully learn about agent i's income, and hence conspicuous consumption is effective even in the long run.

If $\rho \to 1$, the income process approaches a random walk. In this case, $\phi \to 0$ since the within-group income inequality explodes. In this case, and

$$r_v \to \frac{b/(1-\beta)}{p_v[1+b/(1-\beta)]}$$

We plot r_v as a function of ρ, setting $h_\xi = h_\varepsilon = 1 = b = p_v = 1$ to visualize the relationship for intermediate values of ρ in Figure 1:

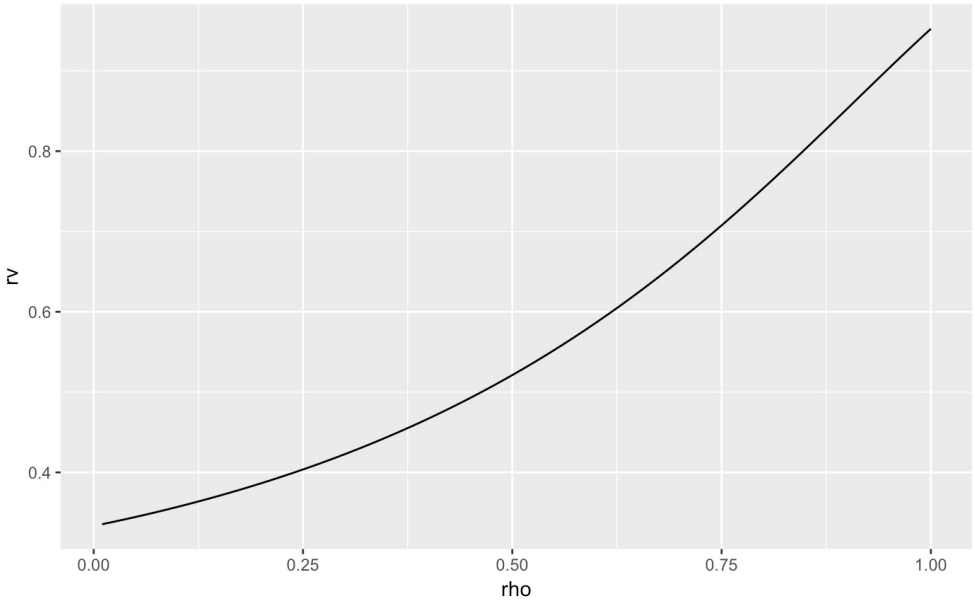

Figure 1: Relationship between ρ and r_v

We summarize the above in the following proposition

Proposition 2 (Persistence)**.** $\partial r_v/\partial\rho > 0, \partial r_c/\partial\rho < 0$*. As the persistence parameter* ρ *increases, conspicuous consumption becomes more useful since its manipulation effect persists over time. The result is substitution from non-conspicuous consumption to conspicuous consumption.*

4 Data and Empirical Results

4.1 Construction of Reference Groups

Following Charles et al. (2009), we are indebted use their publicly available data set produced using the Consumption Expenditure Survey (CEX) to establish these claims. Hence here we describe only the essentials about the raw data here; the reader is referred to Charles et al. (2009) for details.

[We later supplement it by another data set about farmers in Vietnam, a developing country.]

The CEX reports how the Americans consume. Specifically, the CEX provides information on consumer buying habits, incomes, and expenditures, as well as characteristics of households. The main advantage of CEX is its vast number of consumption items. Since the primary purpose of the CEX is to construct consumption weights for inflation adjustment, the Bureau of Labor Statistics spends significant effort in guaranteeing its quality.

In constrast, the income measure in CEX is unreliable. Charles et al. (2009) report that 27% of the households have their income missing, and the CEX does not impute missing data. The income distribution obtained from the CEX does not match that of better data sets in this aspect either, such as the Current Population Survey (CPS).

To address this problem, Charles et al. (2009) proxy permanent income by total expenditure. The idea is that according to permanent income hypothesis (or life-cycle hypothesis in a finite horizon setting), a rational household, with perfect self-insurance, should amortize his present value of all income equally to guarantee smooth consumption over all periods. Consequently, the amortized present value —the permanent income— should be equal to the total expenditure in any period. We follow their approach and use total expenditure to approximate permanent income.

As discussed in the introduction, we aggregate over households and construct reference groups defined by a vector of household characteristics, in order to capture the publicly predictable component of permanent income. We consider household characteristics that are typically considered in wage regressions (gender, age, race, education, occupation). Given our fine definition of groups, some groups are

unavoidably being too small to construct a reliable estimate of the group mean and variance. Therefore we select the groups that are above 10 observations, which is close to the first quartile in terms of group size.

For each group, we evaluate within-group inequality as its log coefficient of variation (within-group variance normalized by the mean).

To get a sense of how within-group inequality distributes across reference groups, Table 1 sorts the constructed reference groups by permanent income inequality, and report the average group-defining characteristics (gender, age, race, education) for each inequality quartile. The young, female have more income inequality on average, while there is no clear pattern with respect to race or education (with a scale of 1-4). The relationship is particularly obvious for gender: the 1st inequality quartile consists of almost entirely males, whereas the reverse is true for the 4th inequality quartile.

The reverse relationship holds with respect to permanent income. The richest reference groups are on average older and male-dominated. See Table 2.

Given these opposing correlations, it is unsurprising that without proper control of permanent income to keep purchasing power constant, conspicuous consumption by age and gender do not have a monotonic relationship. See Table 3.

Within-Group Income Inequality	Age	Male	White	Education
1st Quartile	61.27	0.95	0.62	2.23
2nd Quartile	48.11	0.72	0.47	2.33
3rd Quartile	50.56	0.28	0.54	2.25
4th Quartile	38.65	0.02	0.49	2.36

Table 1: Group-Defining Characteristics by Inequality Quartile

Mean Permanent Income	Age	Male	White	Education
1st Quartile	37.80	0.02	0.46	2.39
2nd Quartile	50.78	0.27	0.55	2.17
3rd Quartile	48.41	0.73	0.50	2.37
4th Quartile	61.68	0.95	0.61	2.23

Table 2: Group-Defining Characteristics by Permanent Income Quartile

Conspicuous Consumption Share	Age	Male	White	Education
1st Quartile	43.30	0.06	0.47	2.35
2nd Quartile	50.61	0.48	0.51	2.33
3rd Quartile	53.37	0.78	0.58	2.30
4th Quartile	51.34	0.65	0.56	2.18

Table 3: Group-Defining Characteristics by Conspicuous Consumption Quartile

In our main analysis, we first sort our reference groups by permanent income. For each permanent income percentile, we compute the average expenditure shares of conspicuous consumption and non-conspicuous consumption. Figure 2 shows that the expenditure on conspicuous consumption is almost a constant fraction of 8-10% of permanent income. Notably, the very poor in the United States maintain their conspicuous consumption, much like the farmers in developmental countries. Whereas the very rich in the United States, generally speaking, are not particularly conspicuous in relative terms.

Next, we match groups by permanent income, and compare matched groups whose income inequality and conspicuous consumption differ. Figure 3 plots the conditional correlation of consumption shares and income inequality (in logs) by permanent income percentile.

To compute the conditional correlation

$$Corr(C, \text{In}|\text{PI})$$

where C stands for log consumption share, In stands for inequality, and PI stands for permanent income, we first run a regression:

$$C_g = \beta_0 + \beta_1 \text{In}_g + \beta_2 \text{PI}_g + \beta_3 \text{PI}_g * \text{In}_g + \varepsilon_g \tag{26}$$

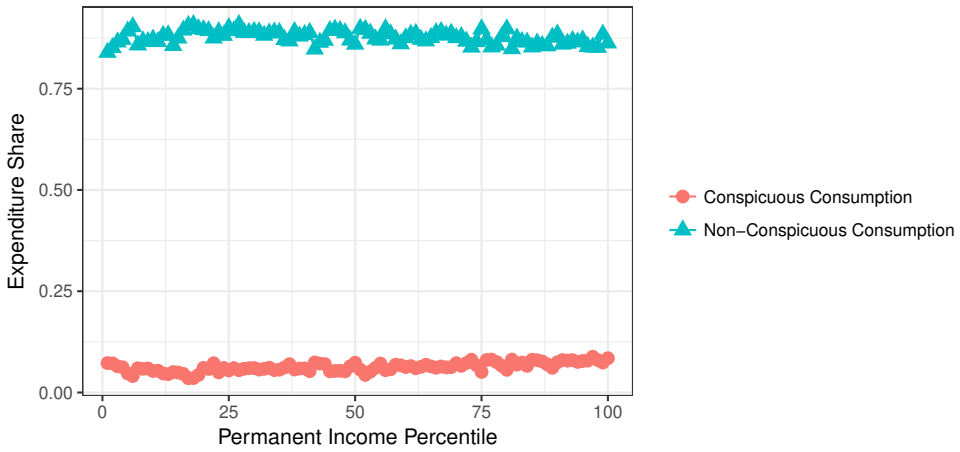

Figure 2: Consumption Expenditure Shares by Permanent Income Percentile (United States)

where g is the group subscript. Given this model,

$$Corr(C, \text{In}|\text{PI}) = \frac{(\beta_1 + \beta_3 \text{PI}) Var(\text{In}|\text{PI})}{sd(C|\text{PI}) sd(\text{In}|\text{PI})} \tag{27}$$

We then find $Var(C|\text{PI})$ and $Var(\text{In}|\text{PI})$ by separately regressing C, In on PI, obtaining and squaring the residuals, and regress the squared residuals on PI again. Finally we take square roots to estimate the standard error terms.

As Figure 3 shows, for all percentiles, conspicuous consumption is positively correlated to income inequality while non-conspicuous consumption is negatively correlated to income inequality, agreeing with our hypothesis.

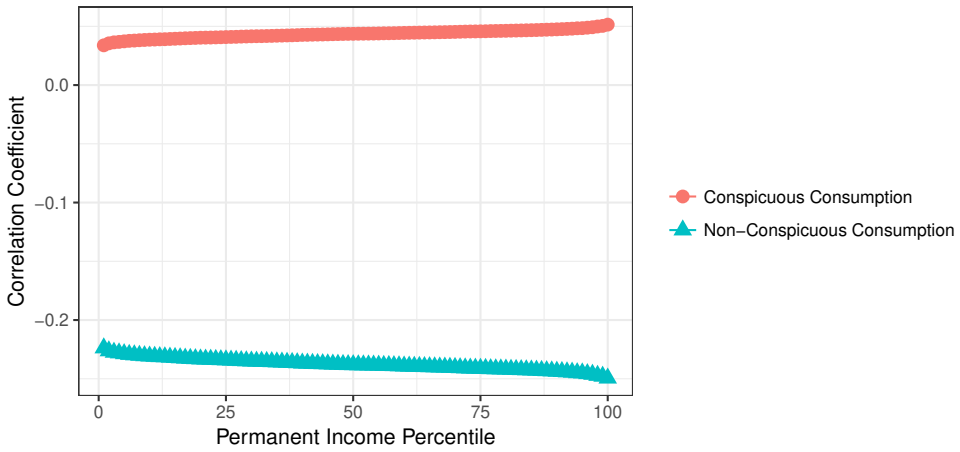

Figure 3: Correlation Coefficients of Log Consumption Shares and Inequality by Permanent Income Percentile (United States)

4.2 Controlling for Heterogeneity

To control for heterogeneous preferences across groups, time-series variation is needed. Hence we introduce year as a new group-defining criterion. The result is a panel of groups where each gender $*$ race $*$ age $*$ education reference group has repeated observations by year. We then run the following OLS regression:

$$C_{gt} = \beta_0 + \beta_1 \text{In}_{gt} + \beta_2 \text{PI}_{gt} + \mu_g + \lambda_t + \varepsilon_{gt} \tag{28}$$

where μ_g, λ_t are group and year fixed effects, respectively. Since both the dependent variable and independent variables are in logs, the interpretations of the regression coefficients are in terms of percentage changes.

Table 4 shows the regressions of log consumption expenditure shares on inequality and mean permanent income. For interpretation, we normalize both the log consumption shares C_{gt} and inequality In_{gt} to Z-scores, with mean zero and variance 1.

In the second and third columns, we partial out the group and year fixed effects, in order to control for preference heterogeneity and yearly macroeconomic fluctuations (including changes in relative prices). For non-conspicuous consumption, the regression coefficients are negative;

for conspicuous consumption, the regression coefficients are positive. Once full controls are introduced, the regression coefficients magnified in their respective directions.

The fourth column introduces interaction between inequality and permanent income, which corresponds to the correlation figure above. When permanent income is below mean (Z-score being negative), the conditional correlation for conspicuous consumption increases, thus proving that conspicuous consumption is particularly relevant for the relatively poor groups, consistent with the correlation by percentile graph.

	Dependent variable:		
	Conspicuous Consumption (Log Share, Z-score)		
	(1)	(2)	(3)
Inequality (Z-score)	0.325^{***} (0.052)	0.179^{***} (0.042)	0.160^{***} (0.042)
Mean (Z-score)	0.799^{***} (0.052)	0.822^{***} (0.048)	0.825^{***} (0.048)
Interaction			-0.057^{***} (0.013)
Group-Defining Dummies	No	Yes	Yes
Year Dummies	No	Yes	Yes
Observations	3,020	3,020	3,020
R^2	0.249	0.720	0.722
	Dependent variable:		
	Non-Conspicuous Consumption (Log Share, Z-score)		
	(1)	(2)	(3)
Inequality (Z-score)	-0.567^{***} (0.055)	-0.421^{***} (0.057)	-0.386^{***} (0.057)
Mean (Z-score)	-0.890^{***} (0.055)	-1.230^{***} (0.064)	-1.230^{***} (0.064)
Interaction			0.104^{***} (0.017)
Group Dummies	No	Yes	Yes
Year Dummies	No	Yes	Yes
Observations	3,020	3,020	3,020
R^2	0.152	0.491	0.498
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 4: OLS of Log Consumption Shares on Within-Group Moments (United States)

5 Categorizing Conspicuous Items

According to the categorization by of consumption items by Charles et al. (2009), non-conspicuous consumption is responsible for about 80% of all expenditure. While conspicuous consumption has personal care, clothing and car expenditures as sub-items.

In Charles et al. (2009), the survey question is in the form of:

> Consider a person who lives in a household and community roughly similar to yours. How closely would you have to interact with this person in order to observe that they consistently spend more than average on each of the following consumption categories?

Hence by construction, the answer would depend on the community in which the respondent lives in, who are the graduate students in University of Chicagos Harris School and Graduate School of Business.

We further investigate if our model holds for each of these items. We plot their expenditure shares in Figure 4. Food expenditure falls along the percentiles. Whereas rent, utility and entertainment has roughly constant expenditure shares. Notably, health expenditure is very low (less than 5%), because health expenses are idiosyncratic; most individuals has zero expenses during the month of interview. After within-group averaging, the group means would be small.

In contrast, conspicuous consumption items is a much smaller category. For upper percentiles, car-related expenditure become dominant. We plot their expenditure shares in Figure 5.

Then we compute the conditional correlations by permanent income percentile for each of these items. The results for non-conspicuous items are shown in Figure 6. Food, rent, utility has negative correlations, while entertainment and travel shows unexpected signs. Furthermore, entertainment is decreasingly conspicuous, while travel is increasingly conspicuous.

In Banerjee and Duflo (2007) and Neeman et al. (2012), entertainment, that in festivals in particular, is regarded as conspicuous. As noted by Banerjee and Duflo (2007) though, there are substantial differences in the exact form of entertainment among the rich and poor:

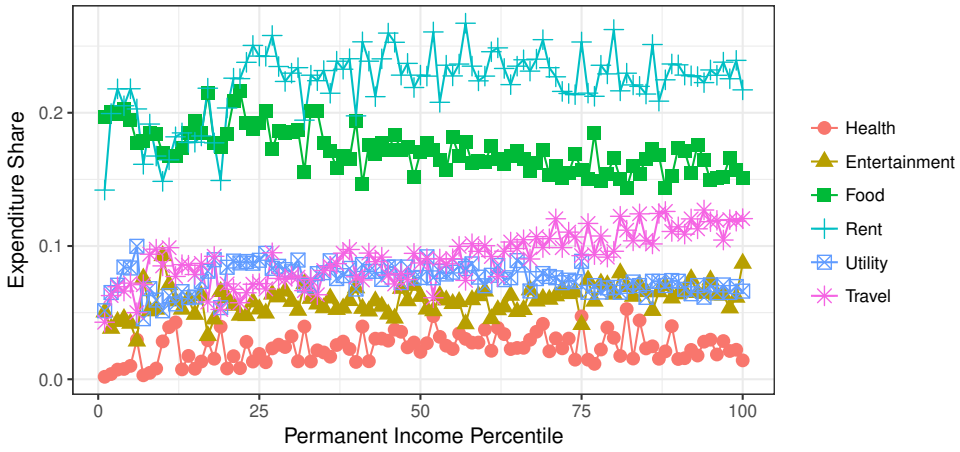

Figure 4: Expenditure Shares by Group Mean Expenditure (Non-Conspicuous Items, United States)

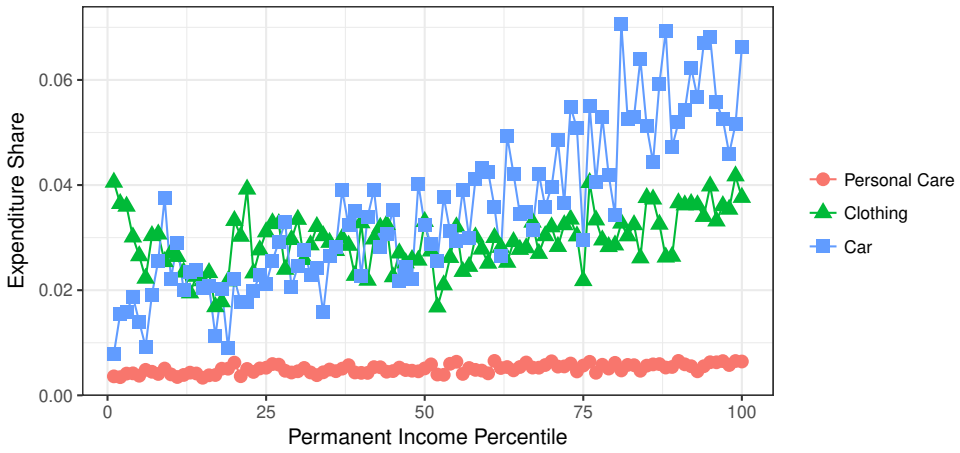

Figure 5: Expenditure Shares by Percentile (Conspicuous Items, United States)

The under $1 per day households spend very little on the forms of entertainment that are common in rich countries, such as movies, theater, or video shows. In all 13 of the countries in our sample, in the month preceding the survey the average extremely poor household spent less than 1 percent on any of these forms of entertainment. The comparable number for the United States is 5 percent.

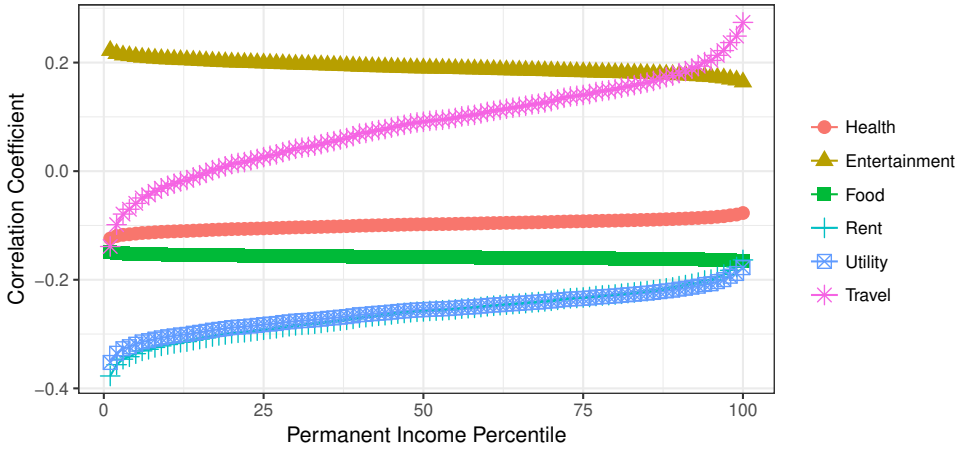

Figure 6: Correlation by Percentile (Non-Conspicuous Items, United States)

For the conspicuous items, we plot the corresponding correlations in Figure 7.

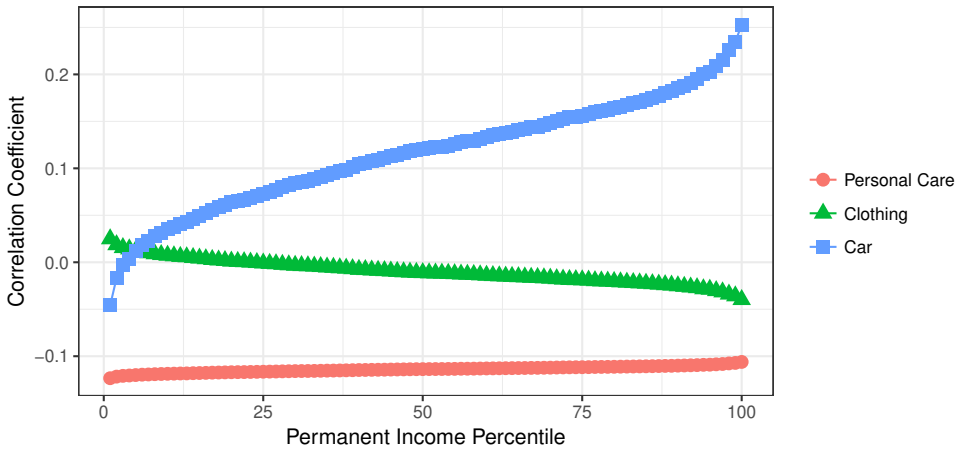

Figure 7: Correlation by Percentile (Conspicuous Items, United States)

6 Conclusion

This paper studies the relationship between the substitution effect between conspicuous and non-conspicuous goods, and examine how it is related to within-group income inequality. As our theory predicts, within-group inequality generates a need for the consumers to signal their income to the public, thereby promoting conspicuous consumption. This prediction is validated from the CEX data, and that it also agrees with a popular press notion that some particular occupations with risky income such as being sportstars, tend to involve in conspicuous consumption. Whereas the same conclusion can hold for relatively poor reference groups such as farmers in developing countries.

As a take-away message, signaling for status is a last resort when other means are not available. This theory predicts that if income becomes more transparent, then conspicuous consumption would decrease. As one instance, the salary of some particular professionals, like economics professors, are essentially known within the reference group. The welfare benefit of having public information on income can be enormous. As our model shows that even if conspicuous consumption has no intrinsic value, the equilibrium action is to engage in it; if income becomes observable, then all income can be reallocated

to non-conspicuous consumption.

Another intervention is to introduce risk sharing. For farmers in developing countries, their risk is largely idiosyncratic. Establishing a risk sharing agreement between farmers would even out the income distribution, thereby reducing conspicuous consumption. Hence although risk sharing does not improve the average income of farmers, it helps the poor in terms of their welfare.

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