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# Do smiles have a face value? Panel evidence from Amazonian Indians

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**Abstract**

Research suggests that physical attractiveness pays off. We estimate the returns to one dimension of attractiveness: smiling. Across cultures, genuine smiles produce a halo effect that correlate with friendliness, kindness, and altruism. In experimental and observational studies in industrial economies, the frequency of smiling correlates with greater trust, cooperation, and earnings. Do results hold up in other cultures after controlling for the role of unobserved third variables? Drawing on five-quarter panel data from 329 women and 350 men over 16 years of age in a foraging and farming society of the Bolivian Amazon, we estimate the returns to smiling using body-mass index (BMI; kg/m$^2$) as a proxy for income. Subjects who smiled, smiled and laughed, and laughed openly during interviews had 2.4%, 3.1%, and 5.4% higher BMI than subjects who neither smiled nor laughed. The mirth premium is robust to many econometric specifications, but not to the use of a person-fixed effect model, suggesting that the positive correlation between smiling and desirable outcomes found in

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industrial economies and in this study picks up the role of unobserved and unmeasured fixed attributes of subjects (e.g., stable physiological and psychological attributes). Subjects who smiled had more social capital and better self-perceived health than those who did not smile; these intermediary variables might explain the positive correlation between smiling and BMI. Smiling did not correlate with wages nor access to credit.


*JEL classification:* C7; C91; J71; J10; J31
*PsycINFO:* 3040; 2360
*Keywords:* Smiling; Beauty premium; Economic returns; Tsimane; Anthropometrics

> ...I smile because I know it pays.
> It means dollars and cents in many ways...
> I can't sell goods with a hard luck tale,
> So I smile, keep happy, and make my sale.
> W.E. Hooker, "The Smile That Pays", 1911, quoted in Strasser (1993, p. 168)

## 1. Introduction

Research and causal observations suggest that physical attractiveness pays off (Biddle & Hamermesh, 1998; Hamermesh & Parker, 2003; Roszell, Kennedy, & Grabb, 2001). Hamermesh and Biddle (1994) found that beautiful people in the labor force of the United States and Canada earned 10–15% more than homely people. The beauty premium was large, significant, and similar to the race and gender gap in earnings. Results held up across many occupations and applied to women and men. More recently, Mobius and Rosenblat (in press) took the research a step further and explored why beauty mattered. They did a laboratory experiment with university students in Argentina and found that physical attractiveness affected wages through three paths. Attractive people projected self-confidence, were seen as more competent by employers, and communicated better, all of which enhanced their status in the eyes of the employer, who, as a result, paid them higher wages.

We build on this line of inquiry by estimating the returns to smiling, an attribute of attractiveness (Lau, 1982). Historical, observational, and experimental studies suggest that smiling pays off (Trumble, 2004). Starting in the late nineteenth century, a promotional literature in the United States urged traveling salesmen to smile to increase sales revenues, as the doggerel verse in the epigraph shows (Strasser, 1993). In industrial nations, researchers have found a positive link between smiling, earnings, and customer satisfaction (Pugh, 2004). In one study discussed later researchers found that customers gave larger tips to a smiling than to a non-smiling waitress (Tidd & Lochard, 1978), and in another study researchers found that smiling confederates in a department store received more help from clerks than non-smiling confederates (Solomon et al., 1981).

Though promising, the studies raise questions about the accuracy of the estimates, the reasons why smiling pays off, and the applicability of findings to other cultures and types of economies. The positive correlation between smiling and economic outcomes could reflect the role of unmeasured traits rather than smiling. Smiling correlates negatively with social rank (Deutsch, 1990), socioeconomic status (Amick et al., 2000), dominance (Mazur, Mazur, & Keating, 1984; Mueller & Mazur, 1996), and testosterone (Dabbs, 1990, 1997; Dabbs, de la Rue, & Williams, 1990), and may be stable over the life cycle (Adams, 1977a, 1977b; Dabbs & Dabbs, 2000). Some occupations (e.g., waitressing) require more smiling than other occupations (Vermeulen & Verdonck, 1992). Smiling varies across the sexes; women smile more than men (Briton & Hall, 1995; Brody & Hall, 1993; Hinsz & Tomhave, 1991; O'Quin & Aronoff, 1981), perhaps because of their lower socioeconomic status and greater pro-social propensity (LaFrance, Hecht, & Levy Paluck, 2003).

The correlation between smiling and economic outcomes could change after controlling for the role of these or other unmeasured variables. Further, even if smiling pays off, we know little about why this might be so. Smiling could produce pay-offs through several paths, such as trust, cooperation, and social capital. Although researchers have examined some of the paths in the laboratory with subjects from industrial nations (Scharlemann, Eckel, Kacelnik, & Wilson, 2001), they have yet to assess whether the paths also operate in natural settings of developing nations.

Last, the pay-offs to smiling might differ across cultures and economies (Lutz & Abu-Lughod, 1990; Lutz & White, 1986). In an industrial economy where formal institutions protect anonymous people in one-shot interactions, smiling signals trust and cooperation but is not central to the interaction because formal institutions protect people in economic transactions when disputes arise. But in a small-scale, pre-industrial societies the pay-offs to smiling from economic transactions with outsiders should be larger than in industrial nations because economic transactions in those settings are not protected by formal institutions. In those transactions, personal trust and cooperation expressed through smiling gain prominence because they form most of the glue holding the transaction together.

There is another reason why smiling should play a prominent role in a small-scale, low-income, highly autarkic collectivistic rural society. In those societies, people need to cooperate with each more often than in richer, more individualistic industrial societies. In highly autarkic settings where the same people come into contact with each other day after day, the display of negative emotions, such as anger, can disrupt social life. In those settings posed or genuine smiles help lubricate daily social interactions and keep frictions from disrupting social life (Matsumoto, 1990). The ethnography of Briggs (1970) among the Inuit of the artic circle and of Lutz (1988) among the Ifaluk of the Philippines stress how aboriginal, highly autarkic populations suppressed anger at nearly all costs.

To estimate the returns to smiling we use an unusual data set. We draw on panel information from Tsimane' Amerindians, a highly autarkic society of foragers and farmers in the Bolivian Amazon. The use of panel information allows us to circumvent many of the problems just noted and explore the paths by which smiling shapes economic outcomes.

First, the use of panel information allows us to lag the chief explanatory variable, smiling, to partly reduce the bias from possible reverse causality (Biddle & Hamermesh, 1998; Roszell et al., 2001). People who display mirth openly might earn more, but people who earn more might display mirth more openly. A panel allows us to correlated mirth at time $t$ with economic outcomes at time $t + 1$.

Second, the use of panel information allows us to remove the role of attributes that do not change during the study (e.g., stable personality traits) that might affect both smiling and economic outcomes. For example, suppose that some people are naturally more optimistic, outgoing, and cheerful, but we do not measure the traits, either because we cannot observe them or because we do not know how to measure them. Some of the traits may not change during the study (Adams, 1977a, 1977b; Dabbs & Dabbs, 2000), perhaps because they link with stable physiological processes or with sex. Further, suppose that the traits correlate positively with smiling and economic outcomes. Then, failure to control for the traits would inflate the estimate of mirth because the estimate would pick up the positive indirect effect of the unmeasured traits. To remove the role of fixed traits, we use a personal-fixed model, discussed later.

Last, the use of observational data from a highly autarkic society allows us to assess whether findings from industrial economies and the laboratory transfer to other settings. Highly-autarkic, pre-industrial societies provide an ideal case to estimate the returns to smiling because they lack the fine-grained occupational division of labor and the racial and ethnic diversity that have made it hard to estimate the returns to beauty in industrial nations (Hamermesh & Biddle, 1994).

## 2. Paths and expectations

Researchers distinguish between the felt, genuine, or Duchenne smile and the false or pose smile (Duchenne de Boulogne, 1990; Ekman, 1990). The two types of smiles correlate with different physiological and psychological states. In genuine smiles, both the muscles that encircle the eyes and the muscles that pull up the corners of the lips get activated, whereas in posed smiles only the muscles that pull up the corners of the lips get activated (Ekman, Davidson, & Friesen, 1990; Ekman & Friesen, 1971). Ekman and Davidson (1993) suggest that people have greater control over the muscles around their mouth than their eyes, and so have a greater capacity to display a posed smile.

Across cultures, people associate the felt smile with a spontaneous feeling of enjoyment (O'Quin & Aronoff, 1981) or happiness (Ekman, 1993, 2002; Fernandez-Carrocera, Chavez-Torres, & Casanueva, 2003; Fridlund, 1994), friendliness (Thompson & Meltzer, 1964), and with responsiveness (Dabbs & Dabbs, 2000). Unlike genuine smiles, posed smiles have a pro-social component and arise from people's conscious effort to smooth social interactions (Saarni & Weber, 1999).

Smiles create a halo effect around the person who smiles (Lau, 1982). Observers like smiling persons, and perceive them as more intelligent, pleasant, sincere, optimistic, and kind (Lau, 1982; Otta, Pereira, Delavati, Pimentel, & Pires, 1993). In new situations, smiles induce positive reciprocity (Hinsz & Tomhave, 1991), pro-social behavior, and altruism, not only toward the person who smiles, but toward others as well (Gueguen & de Gail, 2003). Smiles reduce anonymity between people (Solomon et al., 1981). In laboratory experiments, researchers found that smiling promoted cooperation and trust among anonymous actors in one-shot games (Eckel & Wilson, 2003; Scharlemann et al., 2001).

If true, then smiling should pay off in pre-industrial natural settings through at least three paths. First, smiling should ease access to scarce resources by promoting greater trust, cooperation, and positive reciprocity. For instance, creditors in rural areas of developing nations should be more likely to lend to customers who smile than to customers who do not smile (or who do not smile as much) because creditors should perceive smiling customers as more trustworthy. Second, since smiles convey friendliness and induce positive reciprocity, people who smile should receive higher wages and higher prices for their output. The smile premium arises because buyers and employers value trust, cooperation, and friendliness, and reward it with a premium above what they would pay non-smiling sellers of good and services. Last, by encouraging trust and cooperation, smiles should allow people to invest in and expand their social capital (Glaeser, Laibson, & Sacerdote, 2002; Pfann, Bosman, Biddle, & Hamermesh, 2000). Social capital correlates with better health (Kawachi & Berkman, 2000; Kawachi & Kennedy, 2002), protects consumption, and, in rural areas of developing nations, correlates with higher income (Narayan & Prichett, 1999; Woolcock & Narayan, 2000). Through social capital, smiling should improve health, variability in food consumption, and income level.

In sum, in a highly autarkic society, the paths by which smiling might enhance income include greater access to credit and thicker social capital. It follows that people who smile should be able to protect their food consumption better than people who do not smile, or who do not smile as much. In the balance of the article we examine whether Tsimane' who display mirth earn higher income than those who do not, and whether social capital and credit act as intermediary variables between mirth and income.

## 3. The measure of income in autarky

We want to estimate the pay-offs to smiling in autarky, but this presents a challenge because of the difficulties of measuring income in such settings (Deaton, 1997). One cannot use cash earnings because people in autarky produce to consume; only a small share of goods produced enter the formal market, and few people work for wages. Further, measures of earnings are subject to random measurement errors from poor recall that get exacerbated with repeated measures over time from the same subjects (Angrist & Krueger, 1999). Neither can one use expenditures to proxy for income because highly autarkic people do not buy many goods and services.

To overcome the hurdle, we equate income with body-mass index (BMI, kg/m$^2$) rather than with cash earnings or with expenditures. BMI provides a reliable general measure of short-run nutritional status (Dietz & Bellizzi, 1999; Mei et al., 2002; Shetty & James, 1994). The rationale for using BMI as a surrogate for income in autarky is simple. People in autarky spend much of their time and resources obtaining food; the share of time and resources spent obtaining food declines as income rises (Deaton, 1997). Further, autarkic people consume a large share of what they produce or extract. If people in autarky spend a large share of their time and other resources obtaining food, and if they eat much of their own production, then anthropometric indicators of short-run nutritional status will reflect a person's total income.

BMI has other desirable properties. BMI requires measuring only weight and stature, so it has small measurement error relative to the measurement error of income. Further, because it contains no zero values, BMI, unlike monetary income, does not produce selectivity bias when used as a dependent variable.

Last, studies by economic historians and economists suggest that BMI and stature correlate reliably with monetary income across time and space (Alderman, Hoddinott, & Kinsey, 2003; Fogel, 1994; Komlos, 1989, 1994; McLean & Moon, 1980; Steckel, 1995, 2003; Strauss & Thomas, 1998). We too found that BMI correlated positively with conventional measures of income. We regressed the logarithm of cash earned during the last two weeks (dependent variable) against the logarithm of BMI controlling for age and sex (with clustering by subjects) and found a BMI elasticity of cash earnings of 0.78 ($p < 0.08$; $n = 1258$) (elasticity = % Δearnings/ % ΔBMI).

## 4. The econometric model

We care about the effect of smiling on income, so we use a standard earnings equation similar to the one used by Hamermesh and Biddle (1994) in their study of beauty in the labor force of the United States and Canada. The expression we want to estimate takes the following form:

$$\ln Y_{ihvq} = \alpha + \beta S_{ihvq} + \delta \ln I^{\mathrm{p}}_{ihvq} + \eta H_{ihvq} + \zeta C_{ihvq} + \theta T_q + \lambda V_v + \varepsilon_{ihvq}. \quad (1)$$

$Y$ represents the logarithm of BMI for person $i$ of household $h$ and village $v$ during quarter $q$. $S$ includes a vector of variables capturing whether the subject smiled, laughed, smiled and laughed, or did neither during the interview. $I^{\mathrm{p}}$ stands for permanent income and includes the logarithm of stature during quarter $q$. $H$ captures self-perceived illness. $C$ stands for control variables, including household size during quarter $q$, and subject's schooling, sex, and age. $T$ includes a full set of dummy variables for quarters to capture seasonal effects, and $V$ includes a full set of village dummies to control for village fixed effects. We run the regressions with clustering by subject.

After presenting the main results, we carry out analysis of robustness. To deal with biases from reserve causality, we lag the smile variables by a quarter. To deal with possible biases from omitted variables we (i) add variables not included in expression (1) likely to affect both smiles and BMI and (ii) estimate parameters using person and household fixed-effect models. We also test for attrition and interviewer bias and use different types of regressions. We discuss all the topics mentioned in this paragraph after presenting the main results.

We use three types of regressions, ordinary least squares (OLS), random effect, and personal fixed-effect models, because they each have advantages. OLS provides the benchmark. Random-effect models are more appropriate when trying to draw inferences about a population from a sample and when the error term is randomly correlated with explanatory variables (Kennedy, 1998). When the error term is systematically correlated with explanatory variables and when the sample covers most of the population, then a fixed-effect model is more appropriate (Green, 1993; Wooldridge, 2003).

More importantly for us, a fixed effect model is apt when trying to control for the role of unseen, fixed attributes, endowments, and preferences of people, households, or villages. One can control for fixed effects in several ways. For instance, we use a village fixed-effect model by including a full set of dummy variables for villages. We do so because we want to control for the unseen attributes of villages that might affect BMI and smiling. For instance, some villages have poorer endowments of natural resources, a higher parasite load, and more mosquitoes. Failure to control for these village attributes might bias the parameter estimate of the smile variable. To control for these biases we run a village fixed-effect model by including a full set of dummy variables for villages.

Similarly, we might expect household attributes that we cannot measure (e.g., role models, assets) but that remain stable over the course of the study to introduce biases. To control for the biases, we run a household fixed-effect model by including a full set of dummy variables for households (Table 4, Panel D).

In column [3] of Tables 3 and 4, we report the results of person fixed-effect models to control for the effect of individual traits that do not change over the course of the study. As mentioned, fixed traits could relate to sex, physiology, and stable personality traits. Later we present evidence to suggest that mirth is both stable and variable over time. To control for the role of person fixed effects one could introduce a dummy variable for each person, as we do with households and villages, but in practice we use "computational short-cuts" to avoid running a regression with 679 variables, one for each subject (Kennedy, 1998, p. 227).

Fixed-effect models come at a cost. Fixed-effect model make it impossible to estimates variables that do not vary over time or the course of the study. Examples of such variables include human-capital attributes (e.g., schooling) among adult subjects. Further, fixed-effect models increase the ratio of noise to signal, producing more attenuation bias for variables with random measurement errors.

Later we shall see that the effects of mirth wane once we control for personal fixed effects. Why then also use a random-effect model? In part because one cannot tell whether the weak effects from the fixed-effect model reflect true absence of effect or lack of variance and random measurement error in the explanatory variable. The advantage of using the three models is that they provide a range of estimates.

## 5. The people

The Tsimane' are an Amerindian society of 8000 people living at the foothills of the Bolivian Andes in the department of Beni (Byron, 2003; Chicchón, 1992; Daillant, 1994; Ellis, 1996; Godoy, 2001; Huanca, 1999; Reyes-García, 2001). The Tsimane' live along riverbanks and logging roads in villages of about 24 households (SD = 10). Households contain an average of six people (SD = 2.81), evenly split between females (mean = 2.88; SD = 1.55) and males (mean = 3.10; SD = 1.93), children below 13 years of age (mean = 3.20; SD = 2.07) and people over 13 years of age (mean = 2.79; SD = 1.34). Like other native Amazonian populations, Tsimane' practice cross-cousin marriage (men marry mother's brother's daughter), a preferential system of marriage that creates a thick and wide web of kin tied by bonds of marriage and blood. Subsistence centers on hunting, fishing, and traditional slash-and-burn farming (Vadez et al., 2004).

Tsimane' have low income and are highly autarkic. Mean annual personal income from cash earnings and from the imputed value of farm and forest goods consumed from their own fields and forests is US$332, a third of the average income in Bolivia (US$980/person), one of the poorest nations in Latin America (Godoy et al., 2002). Purchased goods account for only 2.70% of the total value of household consumption. Though highly autarkic, the Tsimane' take part in the market economy. To earn cash, they work as unskilled laborers in logging camps, cattle ranches, and in the homesteads of colonist farmers. They also earn cash by selling crops and forest goods (Vadez et al., 2004).

As is true in many rural societies of developing nations, Tsimane' are credit constraint (Morduch, 1999; Ray, 1998). Traders who ply the rivers advance alcohol, sugar, and commercial goods as they go upriver in exchange for future deliveries of thatch palm, due a few weeks later as they return downriver. A quarter (25.64%) of subjects over 16 years of age had incurred debts during the two months before the day of the interview. Their average debt amounted to 68.80 *bolivianos* (SD = 179), equivalent to about three days of work as an unskilled laborer (1 US$ = 7.45 *bolivianos*). To assess whether Tsimane' perceived themselves as credit constrained, we asked them whether they could borrow 100 *bolivianos* in an emergency. Only 10.85% of women and 18.98% of men said they had access to such credit.

Like many native Amazonian populations, the Tsimane' engage in many forms of reciprocity. We asked subjects about labor help and gifts they had given to other Tsimane' and about selected items they had borrowed during the week before the day of the interview from other Tsimane'. Labor help included help in activities such as hunting, fishing, and farming. Gifts included items such as cooked and raw food and medicines. Borrowing included items such as cooking pots, canoes, rifles, and fishing nets. A quarter of the subjects (26%) said they had offered labor help, and more than a third of the subjects (37%) said that they had given a gift to another Tsimane' during the week before the day of the interview. 51% had either helped or given a gift to another Tsimane', and 48% had borrowed an item from another household. The figures suggests that social capital expressed through gifts and reciprocity permeates daily life.

The Tsimane' word for smile or laughter is *dyisi*, which also connotes happiness or to make fun of someone. Tsimane' often sit around in a circle drinking *chicha*, a drink made from fermented manioc. At those times people often make jokes, triggering laughter and smiles. Tsimane' believe that a married man should not laugh openly among married women, and vice versa. A pregnant women and the father should not laugh, smile, or make fun of a person with a physical disability because the baby might acquire the defects. Tsimane' believe one should not smile in front of strangers because the smile might allow the stranger to bewitched the smiling person. One myth tells of a time in the past when there was no sun, and when a taboo prohibited women from smiling. Worms filled the vagina of women who broke the taboo.

## 6. Data and methods

Data consists of five quarterly surveys done between August 2002 and November 2003 among 329 women and 350 men over the age of 16 in 13 villages along the Maniqui River. We selected villages at different distances from the market town of San Borja (population ∼19,000) to capture cross-sectional variance in participation in the market economy. In each village we surveyed all people over 16 years of age. We exclude the first quarter of observations from the analysis because we used it to pilot test the survey. Four women and four men did the surveys. Seven of the eight surveyors lived permanently in the study site during the duration of the study, and four had lived longer as part of other studies with the Tsimane'. Although three of the surveyors were moderately fluent in Tsimane', all used translators.

### 6.1. Dependent variables: Body-mass index

We followed the protocol of Lohman, Roche, and Martorell (1988) and measured subjects in light clothing without shoes or hats. We recorded stature (standing height) to the nearest millimeter using a portable stadiometer or a plastic tape measure and body weight to the nearest 0.20 kg using a standing scale.

### 6.2. Explanatory variables: Smiles and laughter

During the interview, surveyors assessed whether the subject did one of the following: (1) smiled, (2) smiled and laughed, (3) laughed openly, or (4) neither laughed nor smiled (somber). In the regressions we exclude (4). The other three categories were coded as binary dummy variables; we refer to variables (1–3) as mirth. We distinguish between laughter and smile because people might use the two responses in different situations (Kraut & Johnston, 1979).

The mirth variables pose problems of measurement and interpretation. First, because we did not have video cameras or trained personnel to differentiate between genuine and posed smiles, we cannot assess how the three mirth variables overlap with genuine or posed smiles. The mirth variables reflect intensity, but they cannot tell us about the common distinction made in the literature between genuine and posed smiles. Thus, it is better to read the mirth variables as reflecting intensity of enjoyment; we cannot say whether the enjoyment is genuine or posed.

Second, interviewers might have influenced a subject's display of emotions. Subjects may have been more likely to display mirth with surveyors of one sex, either because they felt more comfortable with surveyors of one sex or because some surveyors laughed and smiled more, inducing subjects to reciprocate with a smile or laugh. Since surveyors had to include their unique identification number in the survey, we can control for interviewer bias by adding a binary dummy variable for each surveyor.

Last, the displays of mirth we measured cover mirth toward interviewers with their translators, not mirth toward strangers or mirth toward other villagers in ordinary interactions. Perhaps expressions of mirth toward total strangers and toward other villagers in daily interactions correlate weakly with expressions of mirth toward a team made up of an interviewer and a translator during a formal interview in the subject's house. We did not have surveyors act as observers of subjects when subjects interacted with other people besides the surveyor and the translator in regular settings. We suspect that the expressions of mirth we measured probably approximate what a subject would express in normal interactions because interviewers lived permanently in the study sites and interacted frequently with subjects (and were therefore not perceived as total strangers) and because another Tsimane' (the translator) was present in the interview.

Of the 2011 interviews, 11.29% did not include smiles or laughter (women = 12.72%; men = 9.81%), 43.56% included smiles without laughter (women = 46.28%; men = 40.75%), 39.13% included smiles and laugher (women = 36.40%; men = 41.96%), and 6.02% included open laughter (women = 4.60%; men = 7.48%). Women accounted for a larger share of subjects who were somber and who only smiled, whereas men accounted for a larger share of subjects with more open displays of laugher and smiles.

The within-subject correlation coefficient for smiling was modest and increased as the study unfolded. For the pooled sample, the within-subject correlation coefficient for smiles increased from 0.23 between the second and third quarter (women = 0.20; men = 0.26) to 0.36 between the fourth and fifth quarter (women = 0.37; men = 0.34). If mirth reflected only fixed attributes, then one should have observed within-subject correlation coefficients close to ±1 for each sex; if they reflected only situational factors, then one should have observed within-subject correlation coefficients close zero. In fact, the within subject correlation coefficients lie in between, suggesting that mirth reflects both a stable personality trait and situational factors

Table 1
Definition and summary statistic of variables used in regression analysis for Tsimane' Amerindians over 16 years of age

| Name | Definition | *N* | Mean | Std. Dev. |
|---|---|---|---|---|
| *Dependent variable* | | | | |
| BMI | Body-mass index (kg/m$^2$) measured quarterly; in regression body-mass index entered in logarithms | 1764 | 23.223 | 2.540 |
| *Explanatory variables* | | | | |
| Smile | Somber; never smiled or laughed during quarterly interview (excluded category) (%) | 227 | 11.29 | |
| | Smiled only = 1; otherwise = 0 (%) | 876 | 43.56 | |
| | Smiled and laughed during the interview = 1; otherwise = 0 (%) | 787 | 39.13 | |
| | Open laughter; subject laughed loudly during interview = 1; otherwise = 0 (%) | 121 | 6.02 | |
| | Total | 2011 | 100.00 | |
| Male | Sex of subject; 1 = male; 0 = female (%). Summary statistics are only for first quarter | 643 | 51.477 | |
| Age | Age of subject in years; summary statistics are only for first quarter | 643 | 34.168 | 15.596 |
| Health | Self-reported person-days ill during the last 14 days from three principal ailments; measured quarterly | 2005 | 4.567 | 5.931 |
| Stature | Height of subject in centimeters; measured each quarter | 1765 | 156.596 | 7.737 |
| Schooling | Maximum schooling achieved by subject; summary statistics are only for first quarter | 643 | 1.978 | 2.331 |
| Household size | Household size measured with head count; summary statistics are only for first quarter | 247 | 6.072 | 2.810 |

(Hess, Banse, & Kappas, 1995). Table 1 contains definition and summary statistics of the variables used in the regressions.

## 7. Main results

Table 2 contains the results of pair-wise partial correlations between the logarithm of BMI and the mirth variables. The results suggest that more open displays of laughter (with or without smiles) correlated with better anthropometric indicators among women and men. Being somber or only smiling correlated with lower BMI.

Table 3 contains the main regression results. Column [1] is equation estimated with OLS with villages as a fixed effect. Column [2] is like column [1] but treats villages and individuals as random effects. Column [3] is like column [1] but adds individuals as a fixed effect.

The results of the OLS regression in column [1] suggest that smiling correlates with higher BMI. The correlation increases as one goes from smiles only, to smiles and laughter, to open laughter. Subjects who only smiled during the interview had

Table 2
Bivariate pair-wise partial correlation between the logarithm of body-mass index and mirth variables

| Variable | Women ($n$ = 935) | Men ($n$ = 829) | Pooled ($n$ = 1764) |
|---|---|---|---|
| Somber | −0.088 (0.066) | −0.116 (0.007) | −0.099 (0.0003) |
| Smile only | −0.077 (0.168) | −0.024 (0.998) | −0.057 (0.141) |
| Smile and laugh | 0.105 (0.012) | 0.051 (0.770) | 0.084 (0.004) |
| Open laugh | 0.079 (0.146) | 0.076 (0.241) | 0.076 (0.013) |

*Note*: Coefficients reported and, in parenthesis, significance levels adjusted to account for multiple comparisons using the Šidák method.

Table 3
Returns to smiles and laughter among Tsimane' over 16 years of age, dependent variable = logarithm of body-mass index (BMI=kg/m$^2$) ($n$ = 1762)

| Explanatory variables | OLS with robust standard errors [1] | Random effect [2] | Person fixed effect [3] |
|---|---|---|---|
| *Mirth variables* | | | |
| Smile only | 0.024*** | 0.0009 | 0.0003 |
| | (0.009) | (0.003) | (0.003) |
| Smile and laugh | 0.031*** | 0.001 | 0.001 |
| | (0.009) | (0.003) | (0.003) |
| Open laugh | 0.054*** | 0.009* | 0.007 |
| | (0.013) | (0.005) | (0.005) |
| *Other explanatory variables* | | | |
| Male | −0.019 (0.016) | 0.046 (0.011)*** | |
| Health | −0.0009 (0.0005)* | −0.0004 (0.0001)** | −0.0003 (0.0001)** |
| Age | 0.0006 (0.0003) | 0.0004 (0.0003) | 0.083 (0.022)*** |
| Stature | 0.001 (0.001) | −0.003 (0.0006)*** | −0.008 (0.0008)*** |
| Schooling | 0.002 (0.002) | 0.003 (0.002) | |
| Household size | 0.0008 (0.001) | −9.3e$^{-06}$ (0.0008) | −0.0003 (0.001) |
| Joint test | 5.82 | 4.14 | 0.84 |
| | (0.0006) | (0.246) | (0.470) |
| Breusch–Pagan | 1795 (0.0001) | | |
| Hausman | | 19 (0.108) | |

*Note*: Standard errors in parenthesis. *, **, *** significant at the 90%, 95%, and 99% confidence level. Joint is test of joint significance for the three mirth variables; $F$ and, in parenthesis, $p > F$. Breusch–Pagan Lagrangian test for random effects. Hausman is Hausman specification test for the equality of coefficients estimated with random and fixed-effect models. Control variables not shown include a full set of dummy variables for villages and quarters. Regressions include clustering by subjects and constant (not shown). Excluded category among smile variables is somber – people who did not smile or laugh during the interview. OLS = ordinary least squares.

2.43% higher BMI ($p < 0.009$) than somber subjects. Subjects who smiled and laughed, or subjects who laughed openly had 3.10% ($p < 0.001$) and 5.50% ($p < 0.001$) higher BMI than somber subjects. Jointly, the three smile variables – smiling, smiling and laughter, and open laughter – were statistically significant ($F = 5.82$; $p > F = 0.0006$).

The regression results just discussed are sensitive to the econometric model used. The Breusch–Pagan test suggests that the random-effect model might be more appropriate than the OLS model. The results of the random and the fixed-effect models suggest that the smile premium remains positive, but becomes trivial and statistically insignificant in all but one case. An open laughter during the interview correlated with 0.98% higher BMI ($p < 0.069$) in the random-effect model. The results of the Hausman test suggest that parameter estimates with the random and with the fixed-effect model yield essentially the same results, so we can tentatively conclude that the model is well parameterized.

Results shown in column [3] suggest that once we control for fixed traits that affect both smiling and BMI, the pay-offs to smiling remain positive, but wane and become statistically insignificant. For instance, in the OLS regression smiles correlated with 2.4% higher BMI ($p < 0.009$), but in the fixed-effect model smiles correlated with only 0.03% higher BMI ($p < 0.907$). We advance at least two reasons why the use of a fixed-effect model causes parameter estimates for the mirth variables to shrink.

First, the use of a fixed-effect model controls for unmeasured fixed attributes that correlate with both the mirth variables and BMI. Since parameter estimates became smaller, we know the unmeasured traits correlated positively with both BMI and mirth, or negatively with both. We cannot identify such attributes, but they might include variables such as stable physiological or psychological attributes.

Second, fixed-effect models accentuate attenuation bias. If the variables for mirth contained random measurement error, then the use of a fixed-effect model would diminish the estimated impact of mirth. One should probably not attribute the weak correlation between smiles and BMI in the fixed-effect model to attenuation bias because smiling and laughter are cultural universals; there is little ambiguity deciding when a subject smiles or laughs, though there are difficulties distinguishing between varieties of smiles (Ekman, 2002). For this reason we suspect that the lack of significance of the mirth variables in the fixed-effect model probably has to do more with the removal of unmeasured fixed attributes than with random measurement error of the mirth variables. We next assess the robustness of the main results.

## 8. Robustness

Table 4 contains a summary of the results to check for the robustness of the main results. In Panel A we lag the value of the mirth variables by one quarter to correct for possible bias from reverse causality; results resemble the results of Table 3. In Panels B–E we control for the following possible omitted variables: social isolation, pregnancy, household characteristics, and stature. Adding a variable for social isolation hardly changes results (Panel B). Excluding pregnant women (Panel C) increases slightly the coefficients for all the smile variables. Panel D contains a full set of household dummies to control for household fixed effects; coefficients become smaller, but remain significant for several of the smile variables in the OLS model. In Panel E we drop the stature variable and coefficients become slightly larger. In Panel F we add a full set of dummy variables for each surveyor; results hardly change compared with the main results, suggesting that interviewer effects do not drive results. In

Table 4
Robustness analysis

| Explanatory variables | Type of regression | | | Notes |
|---|---|---|---|---|
| | OLS with robust standard errors [1] | Random effect [2] | Person fixed effect [3] | |
| *A. Smiled variables lagged by one quarter (n = 1163)* | | | | |
| Smile only | 0.026 (0.012)** | 0.001 (0.004) | 0.001 (0.004) | |
| Smile and laugh | 0.031 (0.012)** | 0.0001 (0.004) | −0.001 (0.004) | |
| Open laugh | 0.046 (0.017)*** | 0.003 (0.006) | 0.0003 (0.006) | |
| *B. Control for isolation by including number of visitors (n = 1762)* | | | | |
| Smile only | 0.024 (0.009)*** | 0.0009 (0.003) | 0.0003 (0.003) | # of visitors received last week |
| Smile and laugh | 0.030 (0.009)*** | 0.001 (0.003) | 0.001 (0.003) | |
| Open laugh | 0.054 (0.013)*** | 0.009 (0.005)* | 0.007 (0.005) | |
| *C. Exclude pregnant women (n = 1624)* | | | | |
| Smile only | 0.027 (0.009)*** | 0.002 (0.003) | 0.002 (0.003) | |
| Smile and laugh | 0.035 (0.009)*** | 0.002 (0.003) | 0.002 (0.003) | |
| Open laugh | 0.057 (0.014)*** | 0.009 (0.005)* | 0.007 (0.004) | |
| *D. Household fixed effect (n = 1762)* | | | | |
| Smile only | 0.010 (0.007) | −0.0001 (0.003) | −0.0001 (0.003) | Full set of household dummies added |
| Smile and laugh | 0.016 (0.007)** | −0.0004 (0.003) | 0.0005 (0.003) | |
| Open laugh | 0.034 (0.010)*** | 0.008 (0.005) | 0.007 (0.005) | |
| *E. Without stature (n = 1762)* | | | | |
| Smile only | 0.025 (0.009)*** | 0.001 (0.003) | 0.0004 (0.003) | |
| Smile and laugh | 0.031 (0.009)*** | 0.0006 (0.003) | −0.0001 (0.003) | |
| Open laugh | 0.055 (0.013)*** | 0.009 (0.005)* | 0.007 (0.005) | |
| *F. Control for interviewer effect (n = 1762)* | | | | |
| Smile only | 0.023 (0.009)** | 0.0009 (0.003) | 0.0001 (0.003) | Dummy variables added for interviewers |
| Smile and laugh | 0.029 (0.009)*** | 0.0008 (0.003) | 0.0006 (0.003) | |
| Open laugh | 0.051 (0.013)*** | 0.009 (0.005) | 0.007 (0.005) | |
| *G. Control for attrition (n = 1762)* | | | | |
| Smile only | 0.023 (0.009)*** | 0.0009 (0.003) | 0.0003 (0.003) | Dummy for attriters added |
| Smile and laugh | 0.030 (0.009)*** | 0.0009 (0.003) | 0.001 (0.003) | |
| Open laugh | 0.055 (0.013)*** | 0.009 (0.005)* | 0.007 (0.005) | |
| *H. Dependent variable = age and sex-standardized z scores of four skinfolds (n = 1762)* | | | | |
| Smile only | 0.046 (0.044) | 0.008 (0.025) | 0.013 (0.025) | *z* Scores follow Frisancho's (1990) norms |
| Smile and laugh | 0.082 (0.045)* | 0.009 (0.026) | 0.015 (0.027) | |
| Open laugh | 0.121 (0.069)* | 0.036 (0.040) | 0.022 (0.042) | |
| *I. Cash earnings added as explanatory variable (n = 1748)* | | | | |
| Smile only | 0.024 (0.009)*** | 0.0009 (0.003) | 0.0002 (0.003) | |
| Smile and laugh | 0.031 (0.009)*** | 0.001 (0.003) | 0.001 (0.003) | |
| Open laugh | 0.051 (0.013)*** | 0.009 (0.005)* | 0.007 (0.005) | |

*Note*: Same as in Table 3, except where noted.

Panel G we add a binary dummy variable for the 10.42% of subjects from baseline who left the sample; adding the variable did not change the main results partly because attrition correlated weakly with smiling and laughter at baseline.

We deal with two last concerns: the possible confounding effects of sex when using BMI and the absence of direct proxies for socioeconomic status. BMI does not adjust for age or sex; controlling for stature and age, women have higher BMI than men (Jackson, Stanforth, & Gagnon, 2002). In Panel I we replace BMI with another anthropometric index of short-run nutritional status: age and sex standardized *z* score of the sum of triceps and subscapular skinfolds (Frisancho, 1990). We leave age and sex as covariates and find that results do not differ from the main results, though they are not strictly comparable because we use a *z* score as a dependent variable.

Other than stature, we do not control for direct proxies of socioeconomic status. Since socioeconomic status (e.g., credit) correlates negatively with being female (e.g., 10.85% of women but 18.98% of men reported having access to credit in an emergency) and positively with BMI, the omission of socioeconomic status would produce a negative indirect effect, attenuating the coefficient for the mirth variables. In Panel J we add monetary earnings and find that results resemble the main results of Table 3, suggesting that stature captures well socioeconomic status.

In sum, the results of the robustness analysis suggest that the correlation between BMI and mirth increases with the intensity of mirth, and that the positive correlation between mirth and BMI disappears after controlling for personal fixed effects.

## 9. Paths and extensions

Here we explain the positive correlation between smiling and BMI in the OLS regressions. We had hypothesized that smiling might shape BMI through credit, social capital, and wages. Table 5 contains the results of regressions with indicators of social capital and credit as dependent variables and smile variables on the right side, along with covariates. Contrary to expectations, credit and the two forms of social capital (labor help offered to others and assets borrowed from neighbors) did not correlate with smiling (Panels A, C, and D). Panel B suggests that smiling correlated with more expressions of generosity measured through gifts to others. Subjects who only smiled tended to give 0.32 more gifts/week than somber subjects, and subjects who smiled and laughed tended to give 0.45 more gifts/week than somber subjects. We found no evidence that smiling correlated with higher wages, cash earnings, or value of goods from barter, as one might have expected from results in industrial nations.

We also estimated the correlation between smiling and self-perceived health and whether smiling correlated with the growth rate of BMI. Mirth correlated with fewer self-reported days feeling ill (Panel E; Table 5) but not with days confined to bed (Panel F; Table 5) during the previous week. We regressed quarterly changes in the logarithm of BMI against quarters, controlling for the subject's sex and age and BMI at baseline. The results of the regressions (not shown ) suggests that for subjects with more open displays of smiles and laughter, the quarterly growth rate in BMI was near zero, but for somber subjects and for those who only smiled, BMI grew by 0.8%/quarter and by 0.5%/quarter.

Table 5
Smiling, social capital, access to credit, and illness among Tsimane' adults

| Explanatory variables | Dependent variables | | | |
|---|---|---|---|---|
| | Tobit | RE Tobit | Tobit | RE Tobit |
| | *A. Social capital, help (n = 1749)* | | *B. Social capital, gifts (n = 1749)* | |
| Smile only | 0.168 (0.183) | 0.168 (0.182) | 0.326 (0.182)* | 0.048 (0.067) |
| Smile and laugh | 0.044 (0.187) | 0.043 (0.186) | 0.457 (0.185)** | 0.092 (0.069) |
| Open laugh | 0.297 (0.245) | 0.287 (0.244) | 0.389 (0.257) | 0.063 (0.101) |
| Joint test | 1.01 (0.388) | 2.97 (0.396) | 2.11 (0.097) | 2.11 (0.550) |
| | *C. Social capital, borrowing (n = 1749)* | | *D. Credit, last two months (n = 1751)* | |
| Smile only | −0.358 (0.485) | −0.123 (0.227) | −15.080 (20.13) | −15.04 (19.96) |
| Smile and laugh | −0.618 (0.495) | −0.289 (0.234) | −37.59(20.45)* | −37.26 (20.20)* |
| Open laugh | 0.184 (0.700) | −0.062 (0.351) | −10.56 (27.279) | −10.78 (27.11) |
| Joint test | 1.05 (0.371) | 2.33 (0.506) | 1.83 (0.139) | 5.44 (0.142) |
| | *E. Days feeling ill (n = 1763)* | | *F. Days sick in bed (n = 1763)* | |
| Smile only | −0.980 (0.492)** | −1.008 (0.485)** | −0.610 (0.573) | −0.610 (0.573) |
| Smile and laugh | −0.427 (0.506)*** | −1.44 (0.499)*** | −1.055 (0.593)* | −1.055 (0.593)* |
| Open laugh | −1.482 (0.749)** | −1.525 (0.741)** | −0.242 (0.844) | −0.242 (0.844) |
| Joint test | 2.82 (0.037) | 8.95 (0.030) | 1.39 (0.243) | 4.17 (0.243) |

*Note*: Standard errors in parenthesis. *, **, *** significant at the 90%, 95%, and 99% confidence level. Tobit regressions are lowered censored. Help includes all episodes of communal labor and labor help offered to other Tsimane' during the week before the interview; gift includes all gifts of goods given to other Tsimane' during the week before the interview. Borrowing refers to frequency with which the subject borrowed selected physical assets from other Tsimane'. Credit refers to the amount of money borrowed in last two months. Days ill and day bed-ridden refers to the total number of days subjects reported feeling ill (Panel E) with three main ailments, and to the total number of days subjects reported being bed-ridden during the two weeks before the day of the interview. Control variables include sex, age, days ill (not for Panels E or F), stature, schooling, and full set of dummy variables for villages and quarters. RE = random effect.

In sum, smiling and BMI correlate positively, probably from better self-perceived health and, less importantly, from the role of social capital. A study in the US suggests that acts of generosity stimulate physiological states that enhance health, and the same may be true among Tsimane' (Brown, Nesse, Vinokur, & Smith, 2003). Access to credit did no correlate with smiling. Among subjects low in mirth, smiling correlated with both the level and growth rate in BMI. Mirth may be a path by which the body catches up in nutritional status.

## 10. Discussion and conclusions

Here we have tried to contribute to the nascent field of the economics of beauty by estimating the returns to mirth in a society of foragers and farmers in the Bolivian Amazon. Using BMI as a surrogate of income, we find a smile premium in the range of 2.4–5.4%. How do results compare with results of other studies? We find it hard to answer the question with confidence because we have found only one study on the returns to smile using earnings as a dependent variable, and studies on the returns to beauty from developed nations pose other difficulties. To answer the query well would require using the same methods of data collection with adequate comparison groups (e.g., sample of subjects in an industrial nation or in cities in Bolivia).

Bearing the caveats in mind, we can provide a tentative answer. In the 1970s Tidd and Lochard (1978) did a study with a female college student 23 years of age who served as a confederate by acting as a waitress. During February 12–March 16, 1977, the waitress approached 96 customers (48 females, 48 males) sitting alone in a cocktail lounge in Seattle, Washington. The waitress approached the customer with a broad or with a small smile. Researchers selected at random the type of smile, so the estimate of the returns to smiling is relatively free of biases from endogeneity. Customers receiving a small smile left an average tip of only US$0.10, compared with customers receiving a broad smile, who left an average tip of US$0.24. The smiling premium of 147% overshadows the 2.4–5.4% premium we found, but one cannot compare the results mechanically because Tidd and Lochard used the monetary value of tips as an outcome and we used BMI. To make the results more comparable, we dropped BMI as an outcome variable and replaced it with the logarithm of cash earnings. We then regressed the logarithm of cash earnings against the three dummy variables for mirth, and found that smiles, smiles and laughter, and open displays of laughter correlated with 22% ($p < 0.094$), 20% ($p < 0.103$), and 45% ($p < 0.019$) higher earnings. The results of the analysis using cash earnings as an outcome variable are closer but still below the estimates of Tidd and Lochard. Since the estimate of Tidd and Lochard is free of biases from endogeneity and ours is not, one could conclude that we have presented conservative estimates of the returns to mirth. If we were to introduce random variation in mirth, as did Tidd and Lochard, to identify the causal effect from mirth to economic outcomes, then our estimate of the impact of mirth would increase.

To compare our results with the results of previous studies, we can also broaden the comparison and include studies that contain estimates of the returns to physical attractiveness. If we do so, we find that the 2.4–5.4% smile premium among the Tsimane' falls below the beauty premium of 12% that Hamermesh and Biddle (1994) found in their study of the labor market in the United States and Canada. The difference in the order of magnitude makes sense but is hard to interpret with confidence. If mirth forms part of the larger construct of beauty, then the returns to mirth should be lower than the returns to beauty, and the results of the two studies would complement each other. But the difference in returns could also reflect cultural differences between non-industrialized and industrial societies.

Bearing all these caveats in mind, we tentatively conclude that the positive returns to smiles are not be confined to industrial economies; smiles also pay off in very different economic and social setting, though the magnitude of the return requires further empirical work. There is some reason to believe that our estimates represent lower bounds of true estimates.

We find some evidence to suggest that smiles correlate with greater expressions of social capital in the form of gift giving and with better self-perceived health, and we suggest that these two paths may help explain why smiling and BMI correlate positively in natural settings of highly autarkic populations. Unlike previous studies from industrial economies, we find that the positive correlation between economic outcomes and mirth weakens once we control for personal fixed effects. This hints at the possibility that the positive correlation between smiling or beauty and desirable economic outcomes found in developed nations might reflect the role of unmeasured fixed attributes of subjects. The results are not surprising. We noted earlier some interpersonal variation in smiles, but also within-subject persistence. Fixed-effect models eliminate the within-subject persistence.

Future cross-cultural studies of the returns to smiles and beauty could produce more reliable estimates and a deeper understanding of the links between physical attractiveness and socioeconomic outcomes by using more objective methods to measure beauty and smiles (Ekman, 2002), and by eliciting local explanations of why smiles and beauty might pay off. The hypotheses and paths explored in this article come from the perspective of outsiders. People from different cultures may have different explanations for why smiles and beauty pay off. Those explanations deserve testing in future empirical studies.

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