



The hidden costs of informal work: lack of social protection and subjective well-being in Colombia

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Abstract

Objectives To examine the association between informal work and subjective well-being in Colombia.

Methods Repeated cross-sectional study based on data from three nationally representative surveys of 1997, 2005 and 2011 ($n = 4485$). Life satisfaction was measured with a Likert scale ranging from 1 to 10 points. Informal work was defined as paid work without pension/unemployment contributions. Individual-level pooled Generalized Estimating Equation (GEE) models were used to assess the association between informal work and life satisfaction. Propensity Score Matching (PSM) was applied to address potential selection into informal work.

Results Informal work increased from 52 % in 1997 to 68 % in 2011. Informal workers averaged significantly

lower life satisfaction than formal (GEE: $b = -0.14$, 95 % CI $-0.26, -0.01$, $p < 0.05$). These results were confirmed in PSM models that controlled for selection by measured confounders (PSM: $b = -0.15$, 95 % CI $-0.23, -0.03$, $p < 0.05$).

Conclusions Informal workers who are not covered by social security systems had lower subjective well-being than workers in the formal economy. Results suggest that recent increases in informal work may also translate into reduced subjective well-being.

Keywords Informal work · Social protection · Life satisfaction · Colombia · Subjective well-being

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Introduction

Informal work, defined as paid work outside the regulatory framework, covers about three-quarters of the global workforce (International Labor Organization 2012), and it is particularly concentrated in the developing world (Biles 2009; Sánchez and Alvarez 2011). Informal work is characterized by the absence of job-related benefits such as pension or unemployment insurance (International Labor Organization 2013). Informal work affects the financing and functioning of the state, as lack of social protection contributions derived from paid work undermine governments' ability to provide social services, especially pensions. Nearly half of people worldwide over pensionable age do not receive a pension, and many of those who do, receive inadequate pensions (International Labor Organization 2014). Despite a growing body of research has established that measures of subjective well-being such as life satisfaction or happiness have become an ever more important indicator public policies evaluation internationally (Diener et al. 2009;

Graham and Lora 2010), the link between work informality and workers' well-being remains unclear.

Studies have examined the negative impact of unemployment on subjective well-being in high-income countries (Avendano and Berkman 2014; Dooley et al. 2000; Friedland and Price 2003; Lucas et al. 2004). However, there is a need to focus on informal work, a significant feature of labor markets in many emerging economies. The limited evidence available suggests that there is a negative relationship between informal work and well-being. A cross-sectional study in Brazil showed 8–12 % greater odds of fair/poor self-reported health for individuals living in households where at least one member worked in the informal sector as compared with households where no member was in the informal economy (Giatti et al. 2008).

Colombia is an interesting case of study due to the high prevalence of informal work; in the last two decades, rates of informal work have oscillated between 40 and 65 % (Sánchez and Alvarez 2011), and changes in these rates have been linked to legislation regarding social protection contributions, particularly related to non-wage labor costs (Camacho et al. 2013). While in 1997 pension contributions were set at 6.5 % of the wage (whereby 4.3 % was paid by the employer and 2.2 % by the employee), a 2005 social protection reform increased contributions to 16 % (12 % paid by the employer and 4 % by the employee) (Santa María et al. 2009). Currently, taxes and social security contributions (i.e. health, pension, unemployment and other job-related benefits) represent about 80 % of the wage, and these costs are considerably higher than the Latin American average of 53.5 % (The World Bank 2014).

While informal work is undesirable from a social welfare perspective, Latin American studies have argued that informality is driven to an extent by choice rather than exclusion from the labor market (Maloney 2004; Perry et al. 2008). Informal work is believed to arise when the costs of complying with the regulatory framework are perceived greater than its potential benefits. This situation is more germane to self-employed and low-income workers. Self-employed workers are more likely to forego formal pension contributions in order to avoid its non-wage labor costs (Chen 2005). Self-employed entrepreneurs have more discretion reporting taxable income and earnings, and informality may be preferred if it grants them greater independence, or if taxes and social security contributions exceed the workers' valuation of the services they provide (Camacho et al. 2013), or if they not confide in the pension system (Madrid 2003). Likewise, low-income workers, especially those in welfare, might have perverse incentives to forego formal pension contribution to keep needs-based eligibility of governments'

subsidies such as health insurance and income support programs (Camacho et al. 2013).

Partly as a result of these selection processes, informal workers are more likely to share some socio-economic characteristics. Informal workers tend to be younger than 45 years, women, members of ethnic minorities, self-employed, lower paid and lower educated (Bernal 2009; Maloney 2004). Informal work is also more prevalent in industries such as transportation and services as compared with manufacturing and professional industries (Guataquí et al. 2010).

Study aims and hypotheses

The aim of this study is to examine the relationship between subjective well-being and informal work in Colombia. We used data from three repeated cross-sectional surveys taken in 1997, 2005 and 2011. As measure of subjective well-being we focused on global life satisfaction, an outcome that prior evidence has shown sensitive to labor policies. Our main hypothesis is that informal work, defined on the basis of no contributions to pensions/unemployment benefits, is associated with lower levels of subjective well-being because it deprives workers from the long-term benefits afforded by social protection (Hypothesis 1). Acknowledging the potential issue of selection into informality, the difference in life satisfaction would be confirmed using Propensity Score Matching (PSM) in order to account for observable sources of selection (Hypothesis 2). Likewise, we examined this association using three waves of cross-sectional data, testing whether the average difference in life satisfaction between formal and informal workers changed over time (Hypothesis 3). We also examined if this association would vary by industry, so that the difference in life satisfaction between formal and informal workers would be smaller at sectors where informal work is more prevalent (Hypothesis 4). Finally, we explored the association between informal and life satisfaction by employment status; we focused on self-employed workers because they have greater autonomy and discretion in declaring taxes and social protection contributions as compared with other employment arrangements (Asher and Kimura 2015) (Hypothesis 5).

Methods

Data and participants

This study used data from repeated cross sections of the Barometer of Social Capital survey (BARCAS), based on a quota samples of the Colombian population in 1997, 2005 and 2011 (Hurtado et al. 2013; Sudarsky 2001, 2007). The

survey was applied in 56 municipalities, covering Colombia's capital and main cities, other departmental capitals, and towns selected at random. At each town, blocks were selected at random, and within each block, subjects were surveyed based on gender, age and urban-origin quotas determined by the National Department of Statistics. Towns were excluded if they had less than 5000 inhabitants or were located in remote locations (e.g., Amazonia or San Andres Island). Out of a total sample of 9082 individuals in working ages (18–65), analyses were restricted to a sample of those reporting doing paid work ($n = 5084$), and excluded respondents who self-declared as unemployed, retired, homemakers or students. We also removed 589 individuals with missing data for covariates, resulting in a complete case sample of 4495 individuals.

Measures

Life satisfaction

The main outcome was measured with a standard and validated item that asks individuals the following question: “all things considered, how satisfied are you currently with your life?” (Diener 2000). Respondents are asked to rate their life satisfaction in a ten-point Likert scale ranging from 1 (completely unsatisfied) to 10 (completely satisfied). This measure was modeled as a continuous variable.

Informal work

We created an indicator variable to signal participants who reported paid work, and if so whether they made contributions to a pension/unemployment fund. We classified workers in the informal economy if they reported making no such contributions.

Employment conditions

Employment status was determined with categorical variables that asked respondents whether they classified themselves as self-employed, part-time employees (less than 30 h per week) or full-time employees (more than 30 h per week). Sector of employment was categorized using the Colombian National Code of Occupational Classifications as reference (Servicio Nacional de Aprendizaje 1996) which classifies occupations into nine major groups: (1) managerial, (2) finances and business administration, (3) basic and applied sciences, (4) health-care, (5) social sciences, education, and public services, (6) arts, entertainment, sports and culture, (7) retail and services, (8) extraction of natural resources (e.g., agricultural, mining, oil and gas), (9) laborers, transportation and equipment

operation, (10) manufacturing. Given the small number of cases per sector in our sample, we reclassified these ten categories into five groups, collapsing the first six codes into a single category for professional occupations.

Control variables

We controlled for individual-level known predictors of informal work (Bernal 2009) such as age (modeled in bivariate analyses as a dummy variable for age older than 45 and with a continuous variable in regression models), gender (men vs. women set as reference), race/ethnicity (indicator variable for ethnic minorities or those who self-classified as indigenous or black), marital status (married or living with partner vs. other), educational attainment (less than high school, up to high school and greater than high school), and household income (in quintiles). We also controlled for contextual variables such as urban or rural setting, and whether the town was a major labor market, where official labor market information is routinely collected.

Statistical analyses

We first performed univariate and bivariate statistics to examine the distribution of informal work by each covariate as well as the differences in life satisfaction between informal and formal workers. The average difference in life satisfaction between informal and formal workers was investigated with pooled Generalized Estimating Equation (GEE) models (Hypothesis 1). GEE models had exchangeable correlation matrices, a structure that is recommended for small clustered with no time ordering. To partially account for selection into work informality by observables, we also implemented a Propensity Score Matching (PSM) approach to investigate the difference in life satisfaction between formal and informal workers (Hypothesis 2). This statistical technique attempts to reduce selection bias by estimating the effect of informal work accounting for selection into informal work. In a first step, to obtain the propensity scores of being treated, we used a logit model regressing a binary variable indicating whether a respondent worked in the formal or informal sector conditional on a set of covariates. In a second stage, we used a kernel-based estimator with replacement (Caliendo and Kopeinig 2008) which weights observations based on how well they were matched in the first step. Standard errors in the PSM models were based on a bootstrapping of 200 repetitions. The average difference in life satisfaction between formal and informal workers across waves was examined with an interaction term between informal work with each wave (Hypothesis 3). This same approach was used to examine variations by

industry of employment (Hypothesis 4) and employment status (Hypothesis 5).

Results

Distribution and predictors of informal work

Table 1 shows the distribution of the sample and the proportion of informal workers per covariate and year. Table 1 also shows the percentage-change in the share of informal workers from 1997 to 2005 and then from 2005 to 2011. The share of informal workers increased from 43.5 % in 1997 to 63.4 % in 2011, and most of this change occurred between 2005 and 2011. Across waves, informal work was most common in workers in the extractive sector (e.g. agriculture, oil and mining) (60–72 %), and least common among workers in professional occupations (22–39 %). However, from 2005 to 2011, informal work significantly increased by 67.7 % in professional workers as opposed to 22.6 % in the extractive sector. In this period, there were similar increases in the share of informal work across employment statuses.

In these samples, rates of informal work were similar for workers older and younger than 45 years of age, but informal work was also more prevalent among women (only in 2011), ethnic minorities, Colombian with less than high school education, and in lower quintiles of household income. Informal work was also less common among married or workers living with partners, in urban settings and main labor markets. From 2005 to 2011, rates of informal work increased more for women as well as for Colombians with education greater than high school, and in income quintiles 3 and 4.

Differences in life satisfaction between formal and informal workers

Table 2 shows the average of life satisfaction by informal work across covariates and waves. Overall, workers in Colombia reported very high levels of life satisfaction (grand mean across waves of 8.42), but on average, informal workers reported lower levels of informality (average difference = -0.15 , 95 % CI -0.04 , -0.26 , $p < 0.001$). Absolute differences in life satisfaction between formal and informal workers were larger for workers in the manufacturing and professional sectors, the self-employed, workers in rural areas, workers in main labor markets, older workers, women, married workers, ethnic minorities, and workers with only high school education.

Table 3 shows results from the GEE models (Hypothesis 1). Adjusted models showed that informal workers averaged significantly lower life satisfaction than formal

workers ($b = -0.15$, 95 % CI -0.26 , -0.01 , $p < 0.05$). This association was independent of other statistically significant predictors of life satisfaction such as gender, marital status, educational attainment and household income.

Results from linear regression models were confirmed in PSM models that controlled for the probability of selection into informality. Table 4 shows adjusted probabilities of working informally according to measured characteristics. Informal work was significantly more common in 2011 than in previous years. Informal work was associated with higher age, non-marriage or partnership, ethnic minority status, less than high school education, lower household income, part-time or self-employment, and not being a professional worker. Overall, the balancing tests suggest that the kernel-based matching approach succeeds in removing these observable differences between the control (formal) and treatment (informal) groups leading to an overall reduction in bias of 86 % (ESM Appendix Tables 1 and 2). As a result, the two groups in the matched sample do not differ significantly in terms of any observable characteristics. PSM models suggest that informal work was associated with lower life satisfaction ($b = -0.15$, 95 % CI -0.26 , -0.05 , $p < 0.05$) (Hypothesis 2).

Differences in life satisfaction between formal and informal workers across waves

Life satisfaction significantly increased in Colombia from 1997 (8.36) to 2011 (8.59). As mentioned before, the share of informal workers also increased in this period, especially from 2005 to 2011. Figure 1 shows the predicted value of life satisfaction based on the GEE model presented in Table 3. Despite some increase in life satisfaction overall, the difference in life satisfaction between formal and informal workers has remained relatively stable over time (Hypothesis 3), with the same average difference across waves.

Differences by sector of employment and employment status

Figure 2 shows the adjusted, pooled averages of life satisfaction by sector of employment (Hypothesis 4). Across sectors, formal workers reported higher life satisfaction than informal workers, except in the extractive sector (e.g., agriculture, mining, oil and gas), which had the highest rates of informality across waves (63.66 %). The adjusted average of life satisfaction for formal, extractive workers was 8.25 points, which was statistically significantly lower than the average for informal, extractive workers of 8.49 points. In turn, the professional sector had the lowest rates of informality (29.90 %), and formal workers had much

Table 1 Distribution and changes of informal work in Colombia, 1997, 2005 and 2011 ($n = 4495$)

	Distribution of informal work (%)									Percent-change in informal work (%)	
	1997 ($n = 1184$)			2005 ($n = 1758$)			2011 ($n = 1553$)			1997–2005	2005–2011
	<i>n</i>	Informal	Diff.	<i>n</i>	Informal	Diff.	<i>n</i>	Informal	Diff.		
National sample	1184	43.5		1758	45.6		1553	68.4		4.7	50.1
Industry			*			***				***	
Professional	231	22.1		210	22.9		165	38.8		3.5	69.7
Extractive	133	60.2		374	59.1		247	72.5		−1.8	22.6
Manufacturing	199	45.2		373	47.7		327	71.3		5.5	49.3
Retail	542	45.4		630	44.8		646	72.5		−1.5	61.9
Services	449	52.3		171	42.1		168	70.2		−19.5	66.8
Employment			*			***				**	
Full time	688	38.7		1126	42.5		943	62.7		10.0	47.3
Part time	248	47.2		418	48.8		392	73.7		3.4	51.1
Self-employed	248	53.2		214	55.1		218	83.5		3.6	51.4
Main labor markets			***			***				**	
No	626	47.6		1107	52.9		931	75.1		11.0	42.1
Yes	558	38.9		651	33.2		622	58.4		−14.7	75.9
Setting			***			***				**	
Urban	932	39.3		1237	37.7		1195	64.3		−4.1	70.6
Rural	252	59.1		521	64.3		358	82.1		8.7	27.7
Age											
45 or younger	934	43.2		1320	45.4		1084	68.1		5.2	50.0
Older than 45	250	44.8		438	46.1		469	69.1		2.9	49.8
Gender			*							*	
Male	808	45.5		1135	47.1		957	66.1		3.5	40.3
Female	376	39.1		623	42.7		596	72.0		9.2	68.6
Marital status			***								
Other	477	49.7		653	45.8		658	70.1		−7.8	53.0
Married/partner	707	39.3		1105	45.4		895	67.2		15.5	47.8
Race/ethnicity			*			*				***	
Non-minority	1115	42.6		1622	44.7		1484	67.5		4.9	50.9
Minority	69	58.0		136	55.9		69	88.4		−3.6	58.2
Education			***			***				***	
<High school	495	58.0		593	66.3		421	82.7		14.3	24.7
High school	480	38.8		793	41.0		745	70.6		5.8	72.3
>High school	209	20.1		372	22.3		387	48.6		11.0	117.7
Household income			***			***				***	
Quintile 1 (lowest)	172	72.7		466	72.3		225	90.7		−0.5	25.4
Quintile 2	480	52.1		687	46.4		697	73.9		−10.8	59.1
Quintile 3	271	34.69		369	26.6		389	59.1		−23.4	122.6
Quintile 4	134	21.64		162	17.3		139	50.4		−20.1	191.4
Quintile 5 (highest)	127	13.39		74	25.7		103	41.8		91.8	62.6

Difference in informal share by covariate. * $p < 0.05$; ** $p < 0.001$; *** $p < 0.0001$

higher life satisfaction than their formal counterparts (8.55 vs. 8.18). The service sector had informality rates similar to the national average for the period of the study (54.79 vs. 52.90 %), yet informal workers scored 0.36 fewer points of

life satisfaction than formal workers. The manufacture and retail sectors had similar results as the sample, with an average difference of 0.15 life satisfaction points between formal and informal workers.

Table 2 Differences in life satisfaction between formal and informal workers in Colombia, 1997, 2005 and 2011 ($n = 4495$)

	1997 ($n = 1184$)					2005 ($n = 1758$)					2011 ($n = 1553$)				
	Formal		Informal		Diff.	Formal		Informal		Diff.	Formal		Informal		Diff.
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Sample	8.47	2.02	8.26	2.2	-0.21*	8.41	1.79	8.2	1.94	-0.17*	8.71	1.57	8.47	1.89	-0.24**
Industry															
Professional	8.44	1.91	8.14	2.1	-0.30	8.49	1.53	7.7	1.57	-0.76**	9.00	1.26	8.56	1.72	-0.44*
Extractive	8.15	2.34	8.56	1.8	0.41	8.2	1.86	8.4	1.84	0.16	8.50	2.03	8.69	1.77	0.19
Manufacturing	8.71	1.95	8.34	2.1	-0.37	8.33	1.95	8.3	1.95	-0.01	8.69	1.55	8.40	1.84	-0.29
Retail	8.41	2.05	8.01	2.4	-0.40	8.38	1.86	8.3	2.04	-0.11	8.74	1.49	8.44	1.97	-0.30**
Services	8.65	2.05	8.51	2	-0.14	8.87	1.36	7.89	2.06	-0.98**	8.36	1.68	8.37	1.89	0.01
Employment															
Full time	8.38	2.07	8.31	2.1	-0.07	8.43	1.75	8.32	1.90	-0.11	8.78	1.45	8.55	1.77	-0.23**
Part time	8.45	2.04	8.07	2.3	-0.38	8.41	1.95	7.99	2.15	-0.42**	8.45	1.93	8.34	2.04	-0.11
Self-employed	8.83	1.79	8.31	2.4	-0.52	8.26	1.67	8.37	1.73	0.11	8.81	1.55	8.41	2.01	-0.40**
Main labor markets															
No	8.38	2.11	8.41	2	0.03	8.29	1.93	8.29	1.90	0.00	8.65	1.62	8.45	1.85	-0.20
Yes	8.56	1.93	8.04	2.4	-0.52**	8.55	1.59	8.10	2.05	-0.45**	8.77	1.53	8.52	1.96	-0.25
Setting															
Urban	8.55	1.94	8.31	2.2	-0.24	8.38	1.77	8.07	2.12	-0.31**	8.74	1.57	8.45	2.00	-0.29**
Rural	8.04	2.39	8.12	2.1	0.08	8.52	1.84	8.48	1.64	-0.04	8.55	1.54	8.54	1.57	-0.01
Age															
45 or younger	8.47	2.01	8.31	2.1	-0.16	8.42	1.75	8.26	1.87	-0.16	8.71	1.64	8.49	1.85	-0.22*
Older than 45	8.49	2.08	8.07	2.4	-0.42	8.38	1.91	8.19	2.16	-0.19	8.71	1.40	8.43	1.98	-0.28
Gender															
Male	8.55	1.96	8.44	2	-0.11	8.45	1.7	8.30	1.87	-0.15	8.79	1.46	8.55	1.84	-0.24**
Female	8.34	2.12	7.79	2.4	-0.55**	8.34	1.93	8.11	2.09	-0.23**	8.56	1.75	8.35	1.95	-0.21
Marital status															
Other	8.32	2.04	8.30	2.1	-0.02	8.37	1.74	7.99	2.12	-0.38**	8.78	1.42	8.37	1.94	-0.41**
Married/partner	8.56	2.00	8.22	2.3	-0.34**	8.43	1.81	8.39	1.82	-0.04	8.67	1.66	8.55	1.85	-0.12
Race/ethnicity															
Non-minority	8.45	2.04	8.25	2.2	-0.20	8.41	1.78	8.23	1.96	-0.18	8.71	1.57	8.47	1.89	-0.24
Minority	8.93	1.62	8.28	2.3	-0.65**	8.35	1.89	8.33	1.78	-0.02	8.88	1.36	8.57	1.92	-0.31**
Education															
<High school	8.51	2.16	8.36	2.1	-0.15	8.23	2.18	8.40	1.84	0.17	8.37	1.68	8.37	2.07	0.00
High school	8.50	1.98	8.04	2.4	-0.46**	8.50	1.75	8.19	2.02	-0.31**	8.83	1.52	8.48	1.86	-0.35**
>High school	8.38	1.91	8.48	1.9	0.10	8.39	1.51	7.66	2.01	-0.73**	8.71	1.57	8.64	1.60	-0.07
Household income					0.00					0.00					0.00
Quintile 1 (lowest)	8.32	2.38	8.02	2.4	-0.30	8.03	2.29	8.11	2.10	0.08	8.19	1.75	8.29	2.03	0.10
Quintile 2	8.26	2.15	8.21	2.2	-0.05	8.35	1.79	8.37	1.80	0.02	8.58	1.73	8.43	1.93	-0.15
Quintile 3	8.59	1.92	8.61	1.7	0.02	8.62	1.54	8.24	1.92	-0.38**	8.76	1.49	8.47	1.84	-0.29**
Quintile 4	8.65	2.00	8.41	2	-0.24	8.43	1.82	8.14	1.94	-0.29**	9.03	1.19	8.94	1.44	-0.09
Quintile 5 (highest)	8.64	1.73	8.38	2.7	-0.26	8.60	1.27	8.42	1.46	-0.18	8.82	1.56	9.12	1.24	0.30

Difference in life satisfaction of formal to informal workers: * $p < 0.01$; ** $p < 0.05$

Finally, the average difference in life satisfaction between informal and formal workers did not vary by employment status (Hypothesis 5). After controlling for

covariates, informal workers had lower life satisfaction than formal workers, independently of employment statuses, including self-employment.

Table 3 Pooled-estimates from generalized estimating equations (GEE) for the association between informal work and life satisfaction in Colombia 1997, 2005 and 2011 ($n = 4495$)

	<i>b</i>	SE	95 % CI	
Intercept	8.00***	0.14	7.72	8.29
Informal work	-0.15*	0.07	-0.28	-0.01
1997 vs. 2005 (ref)	-0.05	0.12	-0.29	0.19
2011 vs. 2005 (ref)	0.23*	0.09	0.05	0.41
Age	0.00	0.00	-0.01	0.00
Female vs. male (ref)	-0.18*	0.06	-0.30	-0.05
Racial/ethnic minority vs. no (ref)	0.17	0.12	-0.06	0.40
Married, living w/partner vs. no (ref)	0.15*	0.06	0.02	0.27
Less than high school vs. more than high school (ref)	0.24*	0.11	0.03	0.45
High school vs. more than high school (ref)	0.15	0.09	-0.03	0.32
Household income quintiles	0.18***	0.03	0.12	0.23
Part time vs. full time (ref)	-0.10	0.07	-0.24	0.03
Self-employed vs. full time (ref)	0.06	0.09	-0.11	0.23
Extractive vs. professional (ref)	-0.04	0.12	-0.27	0.19
Manufacturing vs. professional (ref)	-0.01	0.12	-0.24	0.22
Retail vs. professional (ref)	-0.05	0.10	-0.25	0.15
Services vs. professional (ref)	-0.04	0.14	-0.31	0.23
Rural vs. urban (ref)	0.08	0.09	-0.09	0.26
Main labor markets vs. secondary labor markets (ref)	0.07	0.09	-0.11	0.25

Exchangeable working correlation: 0.02; QICu: 4514; * $p < 0.05$; ** $p < 0.001$; *** $p < 0.0001$

Table 4 First Step of Propensity Score Matching: generalized estimating equations (GEE) log-odds of work informality by individual characteristics in Colombia 1997, 20,025 and 2011 ($n = 4495$)

	<i>b</i>	SE	95 % CI	
Intercept	-1.10***	0.10	-1.29	-0.91
1997 vs. 2005 (ref)	0.03	0.06	-0.08	0.14
2011 vs. 2005 (ref)	0.49***	0.05	0.39	0.59
Age	0.00**	0.00	-0.01	0.00
Female vs. male (ref)	-0.02	0.03	-0.08	0.04
Racial/ethnic minority vs. no (ref)	0.10*	0.04	0.02	0.18
Married, living w. partner vs. no (ref)	-0.12***	0.03	-0.18	-0.07
Less than high school vs. more than high school (ref)	0.40***	0.06	0.28	0.52
High school vs. more than high school (ref)	0.23***	0.05	0.13	0.33
Household income quintiles	-0.20***	0.02	-0.25	-0.16
Part-time vs. full-time (ref)	0.12***	0.03	0.06	0.18
Self-employed vs. full-time (ref)	0.20***	0.04	0.12	0.29
Extractive vs. professional (ref)	0.40***	0.07	0.26	0.55
Manufacturing vs. professional (ref)	0.32***	0.07	0.19	0.46
Retail vs. professional (ref)	0.26***	0.07	0.13	0.39
Services vs. professional (ref)	0.29***	0.07	0.14	0.43
Rural vs. urban (ref)	0.09*	0.04	0.02	0.17
Main labor markets vs. secondary labor markets (ref)	-0.08	0.05	-0.18	0.01

Exchangeable working correlation: 0.03; QICu: 16,535.28; * $p < 0.05$; ** $p < 0.001$; *** $p < 0.0001$

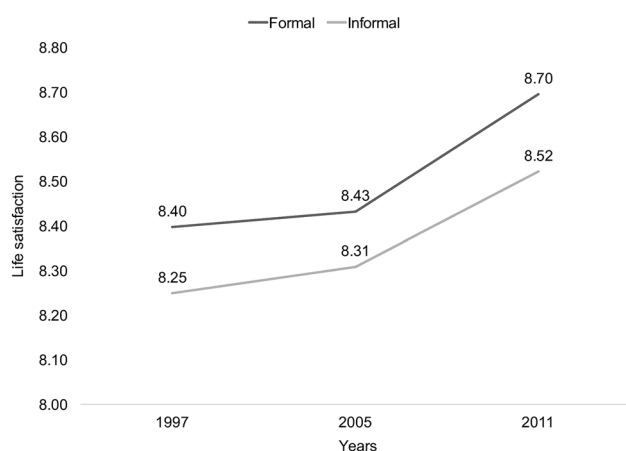


Fig. 1 Predicted means of life satisfaction for formal and informal workers

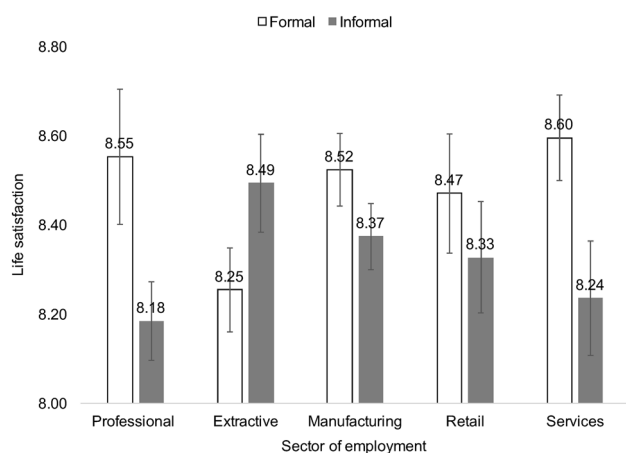


Fig. 2 Predicted means of life satisfaction for formal and informal workers by sector of employment

Discussion

Though informal work covers about three-quarters of the global workforce, fewer studies, however, have examined its subjective well-being consequences. Results show that increments in informal work over the last decades have implications for worker's subjective well-being, a hidden cost that has not been usually considered. Informal workers had lower life satisfaction than their formal counterparts, even after accounting for differential selection into informality and controlling for socio-demographic characteristics. Our findings are in line with those from studies in other Latin American countries (Giatti et al. 2008; Ludermir 2003), reporting worse health for individuals in households with at least one member working in the informal economy. Informal work in Colombia was associated with a significant 0.15 lower score of life satisfaction. This corresponds to a Cohen

d effect size of 0.08, which would be considered a small according to Cohen's conventional criteria of 0.20. Nonetheless, it is important to interpret this effect in the context of very high levels of life satisfaction (e.g., grand mean of 8.4; median of 9). Moreover, the magnitude of the association between informal work and life satisfaction was statistically similar to the estimates of stronger predictors of subjective well-being in this sample, such as the differences in life satisfaction between women and men (-0.19), between racial/ethnic minorities and non-minorities, those who were married or in partnership vs. other marital statuses (0.14), or the difference between having only a high school vs. more than a high school education (0.18). Considering the great share and increasing trends in informal work, this difference in life satisfaction also needs to be interpreted in light of the great number of Colombians that comprise the informal economy. Furthermore, the main well-being effect is also going to be seen in the long term, where a vast proportion of people in pensionable age will not have adequate social protection.

The survey noted an important increase in informal work over the last two periods (i.e., from 46 % in 2005 to 68 % in 2011). This increase has been linked to several recent changes in legislation over the last decade, including rising non-wage labor costs (Santa María et al. 2009), the expansion of government-funded social programs that generated perverse incentives to under-report income to qualify for benefits (Camacho et al. 2013; Organisation for Economic Co-operation and Development (OECD) 2013), and the unification of base income to contribute to both health insurance and pensions for self-employed workers (Calderón-Mejía and Marinescu 2012). These policies were originally aimed to expand access to social services and decrease the incentive to contribute less to the health than the pension system. However, an unintended consequence of these legislation reforms may have been an increase in informality, which translates in a reduction of worker's subjective well-being.

Though we did not have sufficient data to examine potential mechanisms, we argue that informal work could diminish subjective well-being through several pathways such as unstable and insecure jobs, lack of health insurance or social benefits (Avendano and Berkman 2014; Benach and Muntaner 2007), which make informal workers more vulnerable to unemployment, illness or disability (Case 2004; Jensen and Richter 2004). Informal workers are unprotected by labor laws and may therefore be more susceptible to exposures to hazardous physical and psychosocial environments (Benach and Muntaner 2007). As they approach old age, informal workers will also face the prospect of no pension income from formal employment contributions, significantly contributing to uncertainty and

vulnerability in old age (Organisation for Economic Co-operation and Development (OECD) 2013).

Contrary to our expectations, we did not find differences according to employment status; formal workers had higher life satisfaction than informal workers among Colombians employed full-time, part-time or that were self-employed. Even though self-employed workers have more discretion to report taxable wages and therefore have incentives to be informal in order to avoid non-wage labor costs, rates of informality were similar to those found among full-time or part-time workers. Moreover, informal self-employed workers averaged lower life satisfaction than their formal counterparts. The pooled association between life satisfaction and informal work did vary by sector of employment. Across all sectors of employment, informal workers reported lower life satisfaction than their formal counterparts, except in the extractive sector (e.g., agriculture, mining, oil and gas). Rates of work informality were very high in this sector, with almost three-quarters of workers being informal. This was the exact situation for professional workers, where formality was much more common, and where formal workers had much higher life satisfaction compared with informal workers. A potential explanation for the lack of an association with life satisfaction is that informality is so common practice in this sector that workers do not value or consider relevant the potential long-term benefits of contributing to pensions or health. In addition, the alternative scenario for many low-skilled workers in these sectors might be unemployment, so that informality might be viewed less negatively than in higher-skilled sectors where workers might have larger expectations and awareness of their legal rights.

Study strengths and limitations

Our study has several strengths: we used nationally representative samples with a breadth of individual-level information. We attempted to address selection into informality using a PSM approach. However, there are also important limitations to our approach. Our study is based on repeated cross sections, so that the analysis cannot reveal the temporal ordering of associations. In addition, while we incorporated a broad array of potential confounders and Propensity Score Matching, these methods do not account for unmeasured variables that may be correlated with both informality and subjective well-being. Longitudinal, individual-level analyses are also needed to establish whether the association between work informality and health is causal.

Another limitation refers to our measure of informal work. While our definition—based on whether workers made contributions to a pension/unemployment fund—is consistent with that used in earlier studies (Bernal 2009; Hu and Stewart 2009; Sánchez 2013), this measure does not

cover other contributions or benefits, especially health insurance. However, unlike countries such as the USA, health insurance eligibility in Colombia is not contingent upon employment in the formal sector, with almost half of the population being insured through the subsidized scheme (Arroyave et al. 2013). We therefore believe informality is best defined based on benefits other than health insurance. We did not ask about history of contributions and it could be the case that respondents made contributions in the past. Another limitation was lack of employer-based details such as size of the firm or the labor contract, which could help us better characterize informality and elucidate some of the mechanisms. In addition, measures were self-reported, as we had not linkage to administrative records to verify self-reports. Nevertheless, our rates of informality are very similar or higher than those reported by the OECD or other studies (Organisation for Economic Co-operation and Development (OECD) 2013), suggesting that it is unlikely that we have grossly underestimated informality.

Conclusions

Our study is among the first to show that workers in the informal economy fare lower subjective well-being than workers in the formal economy. We also note a large increase in work informality over the period 2005–2011, which may translate into a reduction in workers' subjective well-being. Pension reforms in Colombia and other middle-income countries have focused primarily on the formal sector. Yet, our results echo recent calls for the need to develop policies to address the fact that informal workers are left out structured pension arrangements, a serious problem as this group comprises less-skilled and lower earners vulnerable to economic and health shocks (Hu and Stewart 2009). While longitudinal studies are required to determine the causal nature of this association, if proven causal, our results would suggest that efforts to increase social security coverage among informal workers may also increase worker's well-being.

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Compliance with ethical standards

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964

Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

Conflict of interest David A. Hurtado declares that he has no conflict of interest. Philipp Hessel declares that he has no conflict of interest. Mauricio Avendano declares that he has no conflict of interest.

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