Income and Effort: An Instrumental Variables Approach

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Abstract Does income affect how much people value effort? If income has a negative causal effect on how much effort is valued, an increase in income will adversely affect the cultivation of a growth mindset. Achievement will then be affected because intelligence, abilities, skills, and intrinsic motivation are affected. By utilizing data from the 2010 Chinese General Social Survey, this paper shows that doubling income reduces the probability of an individual valuing effort by two to three percentage points. This study is the first to examine the effect of income on how much effort is valued. It addresses the endogeneity of income by using the regional unemployment rate, regional Consumer Price Index, and regional retail growth rate as instruments. Placebo tests were performed to evaluate the validity of the instruments. The negative causal effect of income on how much effort is valued implies that creating an environment where intrinsic motivations can flourish is of greater importance among higher income workers. Promoting employees with higher income may have a negative effect on engagement through the cultivation of a growth mindset.

Keywords Income · Effort · Endogeneity · Instruments · Causal effect

JEL M12 · M50

Introduction

The role of pay in motivation and performance has received considerable attention in the literature. Economists and psychologists believe that two effects are associated with pay in organizations: an incentive effect and a sorting effect (e.g., Gerhart and

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Milkovich 1992; Gerhart et al. 2009; Lazear 1986). The incentive effect suggests that financial incentives have a positive effect on productivity, and the sorting effect indicates that higher pay attracts more productive workers while less productive workers self-select to quit (Gerhart et al. 2009). Financial incentive has become an important policy tool that organizations use to prompt employee performance. Companies regarded as creative and successful are those that place great emphasis on high pay since high pay often helps to ensure that employees meet rigorous performance standards (Gerhart and Fang 2015).

Psychologist Carol Dweck argued that individuals cultivate two types of mindsets: a fixed mindset and a growth mindset (Dweck 2008). People with a fixed mindset believe that innate ability determines success and achievement, while individuals with a growth mindset believe that intelligence, ability, and skills can be developed through effort. The law of diminishing returns is well known in economics. If diminishing returns to earning money exist due to diminishing marginal utility of money (e.g., Layard et al. 2008), then more income will reduce engagement by affecting extrinsic motivation. However, a possible second channel exists through which achievement is affected by income. Effort is often treated as a cost that generates disutility in the economics literature. While people enjoy the outcomes or rewards (external or internal) engendered by their effort, effort itself is burdensome. Since higher income enables individuals to liberate themselves from enduring the physical and psychological costs related to effort, income is expected to have a negative causal effect on how much effort is valued. If such a negative causal effect exists, income will impact the cultivation of a growth mindset. Achievement will then be affected as intelligence, abilities, skills, and intrinsic motivation are affected. Therefore, studying whether a causal effect of income exists on how much people value effort is important. However, to the best of my knowledge, no research is available in the literature examining this effect. This study aims to fill this gap, and it provides three major contributions. First, this paper is the first to study the effect of income on how much effort is valued. Second, this paper addresses the endogeneity of income by using the regional unemployment rate, regional Consumer Price Index (CPI), and regional retail growth rate as instruments. The conclusion of this study is that the doubling of income reduces the probability of an individual valuing effort by two to three percentage points. Third, this paper provides policy implications for personnel management and lays the foundation for future studies.

Literature Review

Achievement is positively related to intelligence, ability, and skills. If effort helps one develop intelligence, ability, and skills, effort also affects an individual's achievement, at least for a person with a growth mindset. Many studies support the role of effort in developing intelligence, ability, and skills. Sternberg (2005) found that learning can enhance the fundamental aspects of intelligence. Celebrated psychologist, Angela Duckworth (2016), proposed that *Talent × Effort = Skill*. The formula indicates that effort is positively related to skills. While there is no clear evidence showing that effort increases an individual's innate ability, Arvey et al. (2006) found that leadership behaviors are malleable. Leaders can be produced and developed from external influences. Based on the studies compiled in *The Cambridge Handbook of Expertise*

and Expert Performance, Ericsson et al. (2006) concluded that experts are always made, not born. Deliberate practice is crucial for the development of expertise.

Motivation scholars including behavioral economists distinguish between extrinsic motivation and intrinsic motivation (Bénabou and Tirole 2003; Romaniuc 2017). Extrinsic motivation includes financial and other tangible rewards, while intrinsic motivation comes from enjoyment, curiosity, interests, and challenges. Deci (1971, 1972a, b) found that the motivation for some activities depends on inherent rewards, not external rewards. Deci et al. (1999) concluded that tangible rewards (viz. money) have a significantly negative effect on intrinsic motivation. Many studies have demonstrated that intrinsically motivated employees are more engaged than extrinsically motivated employees and that intrinsic motivation and extrinsic motivation tend to crowd each other out (e.g., Bénabou and Tirole 2003; Cho and Perry 2012).

Achievement is a synonym for performance in organizations. Figure 1 shows the effects of income on effort, motivation, and performance. A growth mindset allows people to value what they are doing instead of focusing on the outcome (Dweck 2015), indicating that an environment that fosters a growth mindset also helps cultivate intrinsic motivation, increase engagement (Bettinger et al. 2018), and improve outcomes (Damgaard and Nielsen 2018). However, the effect of income on performance cannot be ignored. First, income affects how much an individual values extrinsic motives due to diminishing returns to earning money. Engagement is affected as a result. Second, if income has a causal effect on how much people value effort, then engagement will be affected as the cultivation of a growth mindset and the development of intelligence, ability, and skills are impacted. Therefore, it is important to study the causal effect of income on how much people value effort.

Data and Methodology

Data

The data used in this study were collected from the Chinese General Social Survey (CGSS) (2010). The survey included an item on a five-point Likert scale that stated,
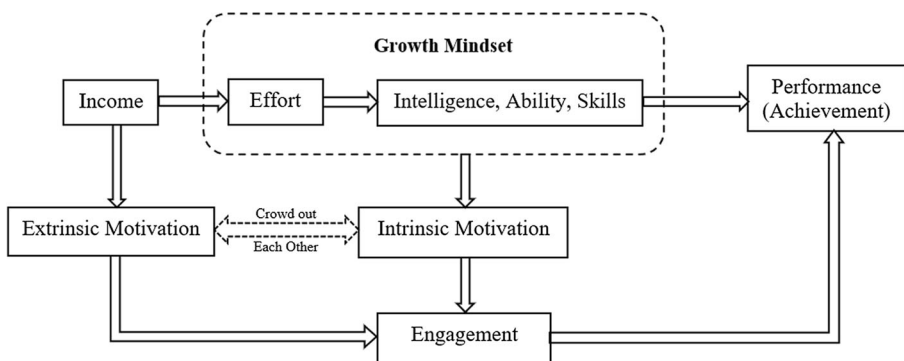

Fig. 1 Effects of income on effort, motives, and achievement

"Personal achievement is mainly due to effort."[1] Participants were asked to select one of the following choices: strongly disagree, disagree, neither agree nor disagree, agree, and strongly agree. A binary indicator was created that equaled 1 if either agree or strongly agree was chosen and 0 otherwise. Male participants over 60 years of age and female participants over 55 were excluded from the sample because 60 is the legal retirement ages for males and 55 is the legal retirement age for females in China. The final sample was restricted to working individuals, and it contained 6286 observations when personal income was used and 6924 observations when household income was used in the analysis. Table 1 displays the summary statistics. Figure 2 shows the percentage distribution of the answers to the Likert item based on the final sample.

Participants reported their annual personal income and annual household income in 2009.[2] The average annual personal income (nominal) was about 21,794 renminbi (RMB). The average annual household income (nominal) was around 45,980 RMB. Figure 3 presents the percentage distribution of the answers to the Likert item by personal income level. Figure 4 shows the percentage distribution of the answers to the Likert item by household income level. The percentage of disagree increased as nominal personal income or nominal household income increased.[3]

Methodology

To estimate the effect of income on how much people value effort, the following regression model was estimated:

$$Y_i = \alpha I_i + X_i^{'}\beta + \varepsilon_i \tag{1}$$

where Y_i was a binary indicator created based on the answers to the five-point Likert item, I_i was the natural logarithm of either annual personal income or annual household income in the previous year, and X_i contained exogenous control variables.[4] Y_i was equal to 1 if the participant answered agree or strongly agree, and 0 otherwise. Since income is likely to be correlated with the error term, the endogeneity of income must be resolved in order to estimate the causal effect of income on how much effort is valued. For example, if an individual with a proactive personality is more likely to value effort and personality is positively correlated with income, omitting personality will lead to an upward bias of the estimated coefficient of income.

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[1] The CGSS aims at surveying different aspects of social structure and quality of life. Survey questions change in different years to cover different survey topics. This question was only asked on the 2010 survey and that was why the 2010 data were chosen.
[2] The survey was conducted in 2010. Participants were asked to report their annual personal income and annual household income in the previous year (2009).
[3] The correlation coefficient of the percentage of disagree and nominal personal income was 0.274. The correlation coefficient of the percentage of disagree and nominal household income was 0.396.
[4] The control variables included gender, age, ethnicity, whether the participant was living in a rural area, and whether the participant was living in western China. Also estimated were models that included additional controls (e.g., marital status, religious belief, number of children, own education level). Including additional controls had little effect on the estimated coefficient of income.

Table 1 Summary statistics of income and exogenous control variables used in the 2SLS analysis

Variable	Mean	SD	N
Personal income (RMB)	21,793.970	95,455.510	6286
Family income (RMB)	45,979.670	119,079.200	6924
Gender (1 = male; 0 = female)	0.524	0.499	6924
Age	41.007	10.309	6924
Ethnicity (1 = majority Han group; 0 = minority groups)	0.902	0.297	6924
Rural (1 = living in rural areas; 0 = living in urban areas)	0.407	0.491	6924
Western (1 = living in the western part of China; 0 = otherwise)	0.271	0.444	6924
Marital status (1 = married and/or living with a partner; 0 = otherwise)	0.907	0.290	6924
Religious belief (1 = religious; 0 = areligious)	0.117	0.321	6924
Number of children	1.417	0.926	6924
Education level (1 = at least a bachelor's degree; 0 = otherwise)	0.078	0.268	6924

Data source: Own computations using data from the Chinese General Social Survey (2010)

There are three possible instruments that can be used to resolve the endogeneity of income: the regional unemployment rate, regional CPI, and regional retail growth rate in different provinces in China. The three instruments are correlated with annual personal income and annual household income and are used as
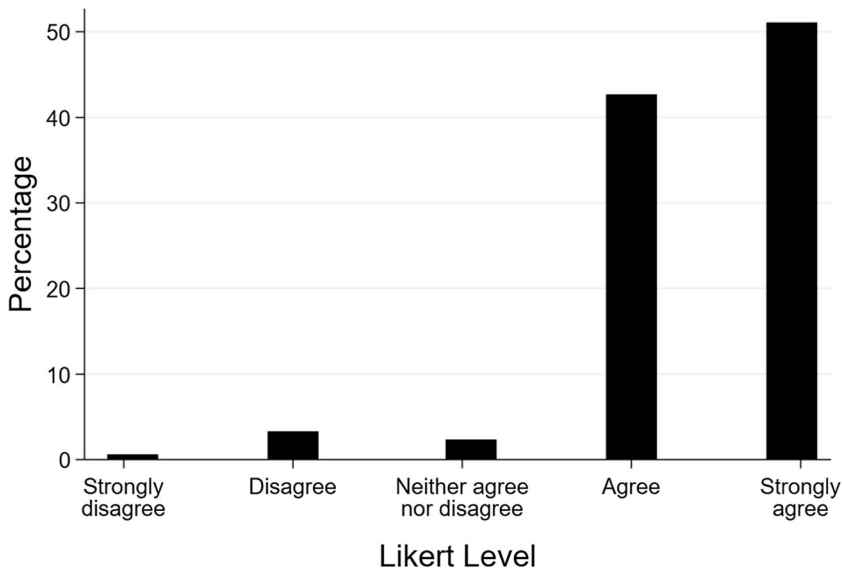

Fig. 2 Percentage distribution of the answers to the Likert item. Data source: Own computations using data from the Chinese General Social Survey (2010)
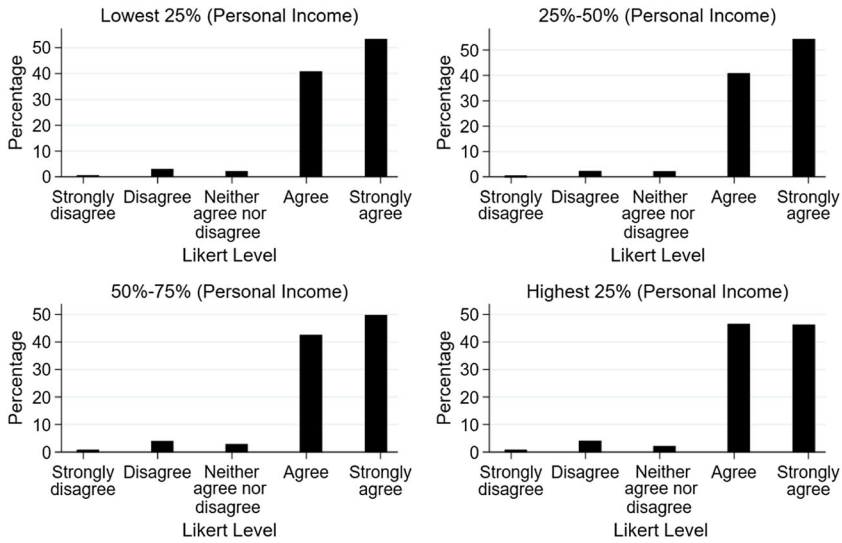
Fig. 3 Percentage distribution of the answers to the Likert item by personal income level. Data source: Own computations using data from the Chinese General Social Survey (2010)

instruments in the literature (e.g., Kuehnle 2014; Xu 2013). The regional unemployment rate and retail growth rate reflect regional economic growth. Regional economic growth is correlated with income. The CPI measures the overall price level and income payments are adjusted based on the CPI. It is worth noting that the three instruments are not expected to affect how much effort is valued other than through income, which means that there is no endogeneity remaining due to omitted variables (e.g., personality).
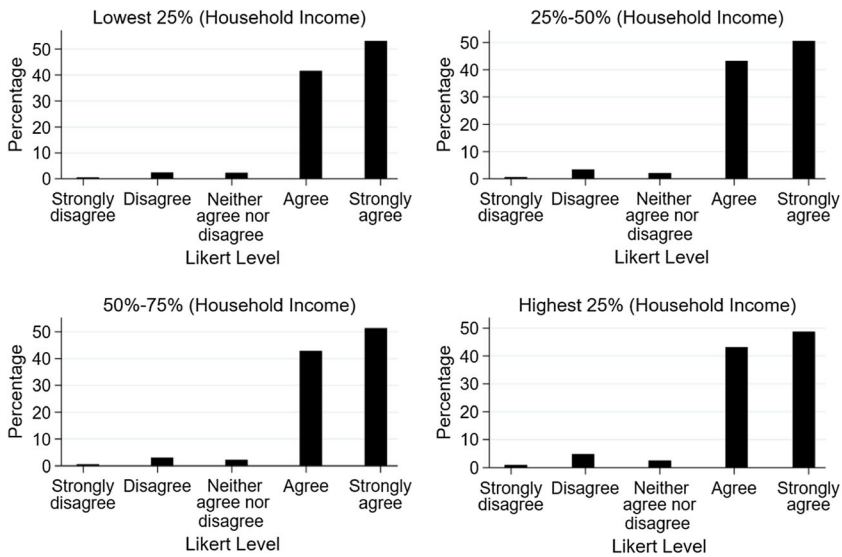

Fig. 4 Percentage distribution of the answers to the Likert item by household income level. Data source: Own computations using data from the Chinese General Social Survey (2010).

Three sets of instrumental variables (IVs) were used to ensure that the results of this analysis were robust to the choice of instruments. Using more than one instrument also enabled an overidentification test to be performed. The Sargan test was used in this study to assess whether the instrumental variables were systematically correlated with the error term.

The following three sets of instrumental variables were used in this study. IV Set 1: regional unemployment rate and regional retail growth rate; IV Set 2: regional CPI and regional retail growth rate; IV Set 3: regional unemployment rate, regional CPI, and regional retail growth rate. There were two instruments in IV Set 1 and IV Set 2, and IV Set 3 included all the three possible instruments. Income was overidentified with each of the three IV sets. The goal was to confirm that the results were not sensitive to the choice of valid instruments.

The data for the regional unemployment rate, regional CPI, and regional retail growth rate were collected from the China Statistical Yearbook (2010). Since the participants reported their personal income and household income in 2009, the instruments used were the regional unemployment rate, regional CPI, and regional retail growth rate in 2009.

How much people value effort may be determined by real income rather than nominal income. To estimate the effect of real income on how much effort was valued, I constructed real personal income and real family income by dividing nominal personal income and nominal family income by the regional CPI. The regional unemployment rate and regional retail growth rate were then used as instruments for real income in the two-stage least squares (2SLS) analysis.

Endogeneity may be caused by reverse causality. It is possible that an individual's personal income or household income is higher because the participant values effort more. Since annual personal income and annual household income in the previous year were reported in the survey, reverse causality was not an issue in this study.

Internal migration occurs when people move from high-unemployment and/or low-income regions to low-unemployment and/or high-income regions. The regional unemployment rate, regional CPI, and regional retail growth rate may not be exogenous if people select into different regions. Participants were asked which year that they moved to the city (town or village) where they resided when the survey was conducted. To test whether internal migration biased the estimated effect of income, I restricted the sample to individuals who never moved and re-estimated the effect of income using the same three sets of instrumental variables. The estimates based on the restricted sample were similar to the estimates from the full sample,[5] indicating that internal migration was also not an issue in this study.

Results

The results of the ordinary least squares (OLS) and 2SLS analyses are shown in Table 2. The OLS estimates of the coefficients of income were slightly positive, while the 2SLS estimates were significantly negative at the 5% significance level. Table 2 shows that there is an upward bias of the estimated coefficient of income using OLS, which is a sign of omitted variable bias if 2SLS is not used. The results of the 2SLS

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[5] Results based on the restricted sample are available upon request.

analysis were similar. The doubling of income reduced the probability of an individual valuing effort by two to three percentage points.[6]

The p values from the Durbin Test and the Wu-Hausman Test are also shown in Table 2. The two tests rejected the null hypothesis that income was exogenous at the 5% significance level.

Valid instrumental variables should be strongly correlated with the endogenous variable. The first-stage F-statistics are presented in Table 3. All the F-statistics were substantially larger than the threshold value of 10 that is widely used in the literature, which indicated that the three sets of instrumental variables were highly correlated with income.

Table 2 Effect of income on how much effort is valued

	Method			
	OLS	2SLS	2SLS	2SLS
Income measure used		(IV1)	(IV2)	(IV3)
1. Nominal personal income	0.0016	−0.0424**	−0.0393**	−0.0403**
	(0.0034)	(0.0191)	(0.0198)	(0.0190)
Durbin test (p value)		0.0179	0.0336	0.0231
Wu-Hausman test (p value)		0.0180	0.0337	0.0232
N	6286	6286	6286	6286
2. Nominal household income	0.0015	−0.0334**	−0.0324**	−0.0326**
	(0.0034)	(0.0152)	(0.0158)	(0.0152)
Durbin test (p value)		0.0178	0.0265	0.0199
Wu-Hausman test (p value)		0.0179	0.0267	0.0200
N	6924	6924	6924	6924
3. Real personal income	0.0016	−0.0417**	–	–
	(0.0034)	(0.0189)	–	–
Durbin test (p value)		0.0180	–	–
Wu-Hausman test (p value)		0.0181	–	–
N	6286	6286	6286	6286
4. Real household income	0.0015	−0.0330**	–	–
	(0.0034)	(0.0150)	–	–
Durbin test (p value)		0.0178	–	–
Wu-Hausman test (p value)		0.0179	–	–
N	6924	6924	6924	6924

Source: Own computations using data from the Chinese General Social Survey (2010). Figures in parentheses are standard errors. IV Set 1: regional unemployment rate and regional retail growth rate; IV Set 2: regional CPI and regional retail growth rate; IV Set 3: regional unemployment rate, regional CPI, and regional retail growth rate. ** Statistically significant at 5% level

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[6] I_i is the natural logarithm of income in the regression model. If income doubles, $\Delta Y_i \approx -0.04\ln 2 = -0.028$. The 95% confidence interval (CI) is (−0.050, −0.008).

If the instruments are correlated with unobserved determinants of how much effort is valued, the instrumental variables will not be valid. Since the model was overidentified, the Sargan test could be used to determine whether the instruments were correlated with the error term. Table 3 shows that the p values of the Sargan test were all greater than 10%. The null hypothesis that the instruments were uncorrelated with the error term was not rejected at any conventional significance levels.

Angrist and Pischke (2009) suggested comparing the overidentified 2SLS estimates with limited information maximum likelihood (LIML) estimates to check the validity of the instruments. LIML estimates are less biased, even though they are less precise than 2SLS estimates. If the estimates provided by 2SLS and LIML are not similar, stronger instruments are needed. The 2SLS and LIML estimates are presented in Table 4. The estimates based on the two methods were almost the same after rounding the results to 4 decimal places, which provided evidence that the instruments used in this study were not weak.

To further investigate whether the instruments were correlated with unobserved determinants of how much effort was valued, two placebo tests were performed to support the validity of the instruments following Frijters et al. (2009) and Kuehnle (2014). If the instruments are correlated with motivation and social norms, they will not be exogenous if motivation and social norms are not observable. The dataset

Table 3 Validity of the instruments

Income measure used	Instrumental variables		
	IV1	IV2	IV3
1. Nominal personal income			
F-statistic of excluded instruments	102.34	95.10	69.27
P value of the Sargan test	0.8010	0.3562	0.6449
N	6286	6286	6286
2. Nominal household income			
F-statistic of excluded instruments	180.56	167.90	121.36
P value of the Sargan test	0.8450	0.5453	0.8313
N	6924	6924	6924
3. Real personal income			
F-statistic of excluded instruments	105.28	–	–
P value of the Sargan test	0.7741	–	–
N	6286	6286	6286
4. Real household income			
F-statistic of excluded instruments	184.70	–	–
P value of the Sargan test	0.8225	–	–
N	6924	6924	6924

Source: Own computations using data from the Chinese General Social Survey (2010)

IV Set 1: regional unemployment rate and regional retail growth rate; IV Set 2: regional CPI and regional retail growth rate; IV Set 3: regional unemployment rate, regional CPI, and regional retail growth rate

Table 4 Comparison of overidentified 2SLS and LIML estimates

	Method					
Income measure used	2SLS (IV1)	LIML (IV1)	2SLS (IV2)	LIML (IV2)	2SLS (IV3)	LIML (IV3)
1. Nominal personal income	−0.0424	−0.0424	−0.0393	−0.0395	−0.0403	−0.0405
2. Nominal household income	−0.0334	−0.0334	−0.0324	−0.0324	−0.0326	−0.0327
3. Real personal income	−0.0417	−0.0417	–	–	–	–
4. Real household income	−0.0330	−0.0330	–	–	–	–
N (Personal Income)	6286	6286	6286	6286	6286	6286
N (Household Income)	6924	6924	6924	6924	6924	6924

Source: Own computations using data from the Chinese General Social Survey (2010)

IV Set 1: regional unemployment rate and regional retail growth rate; IV Set 2: regional CPI and regional retail growth rate; IV Set 3: regional unemployment rate, regional CPI, and regional retail growth rate

used in this study contained information on participants' political status. Participants were asked whether they were a party member of the Communist Party of China (CPC), a Communist Youth League member, a member of one of the democratic parties,[7] or an average citizen with no political affiliation.[8] To become a member of the CPC, the Communist Youth League, or a democratic party, an individual must be considered outstanding and satisfy several criteria. Since party and league memberships were expected to be correlated with motivation, a placebo test could be constructed to test whether the instrumental variables were correlated with party and league memberships. Social norms could possibly affect how much effort was valued. There was a five-point Likert item on the survey that asked participants whether they considered their current income level to be fair given their educational background, abilities, experience, and other factors. The five choices were very unfair, unfair, neutral, fair, and very fair. If the instruments were correlated with social norms and social norms affected an individual's attitude toward income fairness, a second placebo test was then available to investigate whether the instrumental variables were correlated with participants' attitude toward income fairness. *Political status* was first regressed on exogenous covariates and the three sets of instrumental variables. A second placebo test was then performed by regressing *attitude toward income fairness* on exogenous control variables and the instrumental variables. In both placebo tests, income was excluded from the regressions. The F-statistics and *p* values for the joint significance of instruments from the two placebo tests are reported in Table 5. The p values reported were all greater than 10%, which indicated that there was no significant correlation between *political status* and the instruments and that none of the instruments was significantly correlated with *attitude toward income fairness*. The two placebo tests provided further support for the validity of the instruments used in this analysis.

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[7] There are eight democratic parties in China.

[8] People with no political affiliation in China are called the masses.

Table 5 Placebo tests of the validity of the instruments

Dependent variable	IV1		IV2		IV3	
	F-statistic	*P* value	F-statistic	*P* value	F-statistic	*P* value
Political status	0.07	0.9335	0.54	0.5823	0.36	0.7785
N = 6946						
Income fairness	0.61	0.5426	0.36	0.7003	0.44	0.7210
N = 6819						

Source: Own computations using data from the Chinese General Social Survey (2010)

Political status = 1 if the participant was a CPC Party member, a Communist Youth League member, or a member of one of the democratic parties; Political status = 0 otherwise. Income fairness = 1 if participant answered neutral, fair, or very fair; Income fairness = 0 otherwise. IV Set 1: regional unemployment rate and regional retail growth rate; IV Set 2: regional CPI and regional retail growth rate; IV Set 3: regional unemployment rate, regional CPI, and regional retail growth rate

Conclusion

This paper investigates the causal effect of income on how much people value effort using an instrumental variables approach. The regional unemployment rate, regional CPI, and regional retail growth rate were used as instruments to resolve the endogeneity of income. Income was found to have a significant causal effect on how much effort is valued. The doubling of income reduced the probability of an individual valuing effort by two to three percentage points.[9] The estimated effect was robust to the choice of income measures (nominal or real income, personal or household income). All diagnostic tests performed showed that the instruments used in this study were valid. The use of lagged income measures in the study reduced the possibility of reverse causality. Converting into dollars, China's average real per capital income is in line with the world median income (Wen 2018). Since the omitted variable bias was resolved using the instrumental variables approach, the results from this study are applicable in countries with other social norms and customs, even though social norms and customs are not observable.

This study provides policy implications for personnel management. While the motivational effect of higher income cannot be ignored, higher income alone is not sufficient to maintain or increase overall motivation. The negative causal effect of income on how much effort is valued implies that creating an environment where intrinsic motivations can flourish is of greater importance among higher income workers. Promoting employees with higher income may have a negative effect on engagement through the cultivation of a growth mindset.

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[9] Studies have demonstrated that the relationship between intrinsic motivation and performance is significantly positive (e.g., Cerasoli et al. 2014; Liu et al. 2016). If the cultivation of a growth mindset greatly affects intrinsic motivation (the extent needs to be confirmed by future research), the second channel through which income affects achievement may have economic significance. One contribution of this study lies in discovering a new possible channel through which income affects performance based on the identification of the causal effect of income on how much effort is valued. The causal effect identified in this study is meaningful and signficant even though it is small.

Motivation scholars have identified the crowding-out relationship between extrinsic motivation and intrinsic motivation with an increase in income. The findings in this study suggest that an income effect may exist that has a negative impact on intrinsic motivation. As income increases, intrinsic motivation may be negatively affected by both the income effect and the crowding-out effect imposed by extrinsic motivation. The demotivating effect of higher income may have been underestimated so far by economists and psychologists.

This paper lays the foundation for future studies. Since a new channel through which income can possibly affect performance is identified, future studies can focus on measuring the impact of income on perceived effort or performance associated with the effect of income on intrinsic motivation.

Compliance with ethical standards

The Lewis University Institutional Review Board (IRB) approved this study.

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