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Economic growth, financial crisis, and property rights: observer bias in perception-based measures

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Recent years have seen an increasing number of empirical papers using subjective indicators in cross-country quantitative analyses of growth. We evaluate potential observer biases in the three most commonly employed subjective measures of property rights – taken from the Heritage Foundation, Fraser Institute, and World Economic Forum. Drawing on cross-national data for 156 countries during the years 2000 – 2010, we use Granger causality tests to assess whether exposure to recent information on economic performance introduces bias to coding of property rights scores. Further, we evaluate whether the Great Recession led observers to change property rights scores in advanced nations. We find consistent evidence that observers who provide subjective coding of property rights scores rated nations more positively when their economic performance was positive, and more negatively during the recent global financial crisis. Taken together, our findings suggest that coding of commonly employed property rights measures are subject to substantial observer bias.

Keywords: property rights; institutions; growth; financial crisis; methodology

JEL Classifications: P14, O43, B49, O11

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1. Introduction

A majority of economists, political scientists, and sociologists have come to view protecting private property rights as an important condition for economic development (Rodrik, Subramanian, and Trebbi 2004). It is claimed that when private property is secure, investors are more likely to invest because transaction costs are lower and there is less risk of government appropriation (North 1981). Apart from a few exceptions (see Chang 2011), these propositions are widely accepted across the social sciences (e.g. Acemoglu, Johnson, and Robinson 2001; Barro 1991; Clague et al. 1999; Hall and Jones 1999; Knack and Keefer 1995; Leblang 1996; de Long and Shleifer 1993; North and Thomas 1970; Svensson 1998; Torstensson 1994). The World Bank, International Monetary Fund, and other leading international financial institutions have also made securing property rights a central component of their poverty-reduction strategies, stating that secure property rights are 'a main vehicle for investing, accumulating wealth, and transferring it between generations' (Deininger 2003, xix).

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Numerous models postulate mechanisms of how property rights increase investment and capital formation, and several econometric studies have identified a significant association with indicators of economic development (Acemoglu, Johnson, and Robinson 2001, 2002; Acemoglu and Johnson 2005; Bose, Murshid, and Wurm 2012; Heitger 2004; Kerekes and Williamson 2008). Many of these studies, however, have been critiqued for failing to adequately address endogeneity from unobserved factors (Chang 2011; Glaeser et al. 2004). Further inquiries have also criticised the validity of the measures of property rights employed, noting they are too broad to contain meaningful information, measure entirely different phenomena, and contain high degrees of measurement error (Glaeser et al. 2004; Shirley 2008; Voigt 2012; Woodruff 2006). In this study, we extend the critique of existing statistical studies by focusing on a major limitation receiving relatively little attention: observer bias.

Data on property rights are generated by subjective evaluations of experts, who are often linked to institutions that support the view that property rights are beneficial for development. For example, the Heritage Foundation's indicator of private property rights is among the most widely used and cited measure in this literature, yet the Foundation's mission statement specifies that it advocates 'conservative public policies based on the principles of free enterprise, limited government, individual freedom, traditional American values, and a strong national defense.'[2] These conflicting roles and vested interests raise the possibility that observers from, or selected by, organisations like the Heritage Foundation may code better performing countries with higher scores on property rights protections. However, because there is no set of true, objective property rights data for comparison (and if these existed researchers would use them instead), it is notoriously difficult to test the validity of perception-based measures as well as the hypothesis of whether these perceptions are not just random measurement error but systematically biased towards economic growth.

In this article we assess the hypothesis of observer bias for 156 countries from the period 2000 – 2010 in the three most commonly-used property rights indices: the Heritage Foundation and *Wall Street Journal*'s property rights index (a component of the Index of Economic Freedom); Fraser Institute's legal structure and security of property rights index (Economic Freedom of the World Index); and World Economic Forum's property rights index (Global Competitiveness Index).[3] We adopt Granger causality tests to check for whether prior growth predicts the score of the property rights indicators, i.e. testing for short-term reverse causality. In addition, we investigate the overall effect that the recent financial crisis has had on property rights scores and then evaluate at a disaggregated level the evolution of property rights perceptions during the Great Recession in advanced nations. As these nations have high levels of property rights and institutional stability, it would be implausible for their actual level of property rights to diminish in such a short period of time, especially given that the policies instituted, if anything, were designed to improve property rights protections in this period. Since virtually all theoretical discussions of property rights institutions argue that they develop slowly over time, any contemporary association of economic growth and financial crisis with property rights we believe must be spurious. Our findings suggest that economic growth is a cause of increases to property rights scores and that the recent financial crisis is a cause of decreases. This evidence, strongly pointing to observer bias, calls into question numerous studies relying on these perceptual indices of property rights.

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The rest of the paper proceeds as follows. First, we briefly review the existing literature supporting a positive relationship between property rights and economic growth. Second, we discuss the property rights measures themselves and compare internal cross-validities as well as convergent validities via an examination of bivariate relationships with the natural logarithm of GDP per capita. We then explain the methods used to diagnose potential observe bias. In the final section, we test for observer biases in property rights coding. Our conclusion offers methodological advice on the use of subjective indicators.

2. Effects of property rights on economic development

Before analysing the property rights measures, we briefly outline the conceptual link between growth and property rights. There are two interrelated theoretical bodies explicating the importance of property rights, one emphasising micro- and the other macro-level factors. As a champion of the former, de Soto (2000) argues that underdeveloped countries have untapped assets and entrepreneurial ability, but are trapped in poverty by an inability to convert these resources into capital because of the lack of property rights. As he notes, '[the poor] have houses but not titles; crops but not deeds; businesses but not statutes of incorporation' (de Soto 2000, 7). Such capital, in the form of extra-legal, informal, or communal property, is illiquid because it cannot be traded outside of narrow local circles or offered as collateral to obtain credit. De Soto estimates that the sum of this capital may be as great as US$9.3 trillion and, through establishing private property rights via titling programs, could be used as collateral to enhance investment and ultimately economic growth.

At the macro level, advocates of the new institutional economics school emphasise secure and well-defined property rights as the main institution for promoting long-run economic development. Douglass North (1981) postulates that, on the one hand, a lack of constraints against government expropriation of property and, on the other hand, a framework non-conducive to private contracts, are problematic because they increase transaction costs and reduce capital formation. Institutions of property rights protections are thus viewed as providing incentives for investment – key component of long-run economic growth.

These theories have found support in econometric studies at both household and country levels.[4] At the household level, several studies find evidence that property rights increase investment (see Alston, Libecap, and Schneider 1996; Besley 1995; Field 2005, 2007; Schweigert 2006). Field (2007) examined a survey evaluating a nationwide titling program that occurred in Peru between 1995 and 2003. Using a difference-in-difference design, Field found after correcting for timing and pre-program tenure status that the households issued with titles spent 13.4 fewer hours per week protecting their property themselves, allowing for households to reallocate time more efficiently from inside the home to the labour market. Field (2005) also found that within urban squatter settlements, land titling was associated with a 68% increase in the rate of housing renovation within only four years of receiving the title. Schweigert (2006) used household level data on rural Guatemala in 1993 to test the effect of land titling, controlling for credit access. The study found farmers who held land titles had greater output and greater investment in quality labour processes. Besley (1995) examined surveys of farmers from two regions of Ghana, Wassa and Anloga, finding that better land rights facilitated investment in the former but not in the latter.

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At the country level, nearly all studies identify a strong, positive association of higher levels of property rights with greater income per capita (see Acemoglu, Johnson, and Robinson 2001, 2002; Acemoglu and Johnson 2005; Heitger 2004; Kerekes and Williamson 2008).[5] We describe the higher quality studies in the cross-national literature which have addressed the main issues of endogeneity and reverse causality. Acemoglu and colleagues (2001) regress per capita income in 1995 on the average of Political Risk Services' risk of expropriation index (a measure of property rights protection) between 1985 and 1995 using a cross-country sample of 64 countries. Innovatively, they use European settler mortality rates during colonial periods as an instrument to correct for the endogeneity of property rights protection (arguing that where conditions were more hazardous, more extractive institutions with weaker property rights were established). Although initially they find no effect of property rights on growth, after using their instrumental variable the effect turns positive and significant, a pattern subsequently observed with alternative property rights measures and outcomes (including investment, private sector credit, and stock market capitalisation). Kerekes and Williamson (2008) replicate the work of Acemoglu and colleagues using a larger sample of 103 countries, finding the Heritage Foundation index of secure property rights correlates positively with both economic growth and capital formation. Only one study has attempted to explicitly test – rather than simply control for – reverse causality. Heitger (2004), using the black market premium of the exchange rate in 1985 as an instrument for the Fraser Institute property rights index, reports a positive association of property rights with per capita income in the period 1975–1995 in 84 countries. However, using a Hausman specification test, Heitger finds evidence of long-term bi-directionality between growth and property rights, suggesting that greater wealth may allow for greater education and result in a more professional bureaucracy to uphold and extend property rights protections.

3. Measures and method

The three indices are summarised in Table 1. They are all coded on the basis of judgements of experts, widely cited throughout the literature, and are updated on a yearly basis. We focus on the period 2000 – 2010 because observations fall on those years for all the indices.

The cross-validity of the indicators is supported by strong inter-correlations of their levels at greater than 0.70 throughout (see Appendix 1). This pattern suggests that the indices may capture a similar underlying construct. We also check for convergent validity: according to theory and in line with previous studies, we would expect to see positive and significant associations of these indices with GDP per capita. In Figure 1, all three property rights indices fulfil this criteria, showing a strong positive relationship with the natural log of GDP per capita ($r_{\text{heritage}} = 0.68$; $r_{\text{fraser}} = 0.72$; $r_{\text{wef}} = 0.69$). While these results are comforting with respect to the validity of the measures, they are far from definitive since all measures are liable to suffer the same biases as a consequence of their underlying methodological similarities.

To our knowledge, no study has attempted to test potential biases in the coding of these data, as separate from random measurement error. We can specify this possibility mathematically as follows:

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Table 1. Description of property rights indices.

Source	Name of Index	Number of countries	Years of data availability	Scale	Description	Measurement	Example studies
Heritage Foundation and Wall Street Journal Index of Economic Freedom	Property rights index	180	Annually from 1995–2013	0–100	The more guaranteed the legal protection of property, the higher a country's index score. Likewise, the greater the probability of government expropriating property, the lower a country's score.	A panel of Heritage Foundation experts and WSJ journalists base scores on the following sources of information: Economist Intelligence Unit, Country Report and Country Commerce; US Department of Commerce, Country Commercial Guide; US Department of State, Country Reports on Human Rights Practices; and various news and magazine articles.	Acemoglu and Johnson (2005); Bose, Murshid, and Wurm (2012); Claessens and Laeven (2003); Estrin, Korosteleva, and Mickiewicz (2009); Goldsmith (1995); Hanke and Walters (1997); Johnson, Kaufmann, and Zoido-Lobaton (1998); Kerekes (2011); Kerekes and Williamson (2008); Norton (1998); Powell (2002); Yasar, Paul, and Ward (2011)
Fraser Institute Economic Freedom of the World Index	Legal structure and security of property rights index	123	Five yearly from 1970–2000, annually from 2001–2010	1–10	The index is intended to capture the security of property rights and the enforcement of contracts. A rating close to 10 indicates that property rights are well established and that the quality of the supportive legal system is high.	A composite index is additively formed based on seven criteria judged on a 0–10 scale. Country experts evaluate statements, that are then averaged, related to (a) judicial independence, (b) impartial courts, (c) protection of property rights, (d) military interference, and (e) legal system integrity. The World Bank's Doing	Bose, Murshid, and Wurm (2012); Butkiewicz and Yanikkaya (2007); Claessens and Laeven (2003); Hanke and Walters (1997); Heitger (2004); Norton (1998); Powell (2002)

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						Business Report is then used to provide estimates for the time and money required to (f) collect debt and (g) transfer ownership of property.	
World Economic Forum Global Competitive Index	Property rights index	144	Annually from 2000–2012	1–7	A high country score suggests that property rights are clearly defined and well protected by law. A low country score implies poorly defined property rights not protected by a proper legal system.	Country experts evaluate the following statement: 'Property rights, including over financial assets, are poorly defined and not protected by law (= 1) or are clearly defined and well protected by law (= 7).' Responses are then collected from individual experts and averaged to form the sub-index score.	Claessens and Laeven (2003); Desai, Gompers, and Lerner (2003); R. Freeman (2003); Hur, Raj, and Riyanto (2006)

Note: The description of each property rights index is based on information derived from the source website. Heritage Foundation and *Wall Street Journal* Index of Economic Freedom: http://www.heritage.org/index. Fraser Institute Economic Freedom of the World Index: http://www.freetheworld.com. World Economic Forum Global Competitive Index: http://www.weforum.org/issues/global-competitiveness/index.html.

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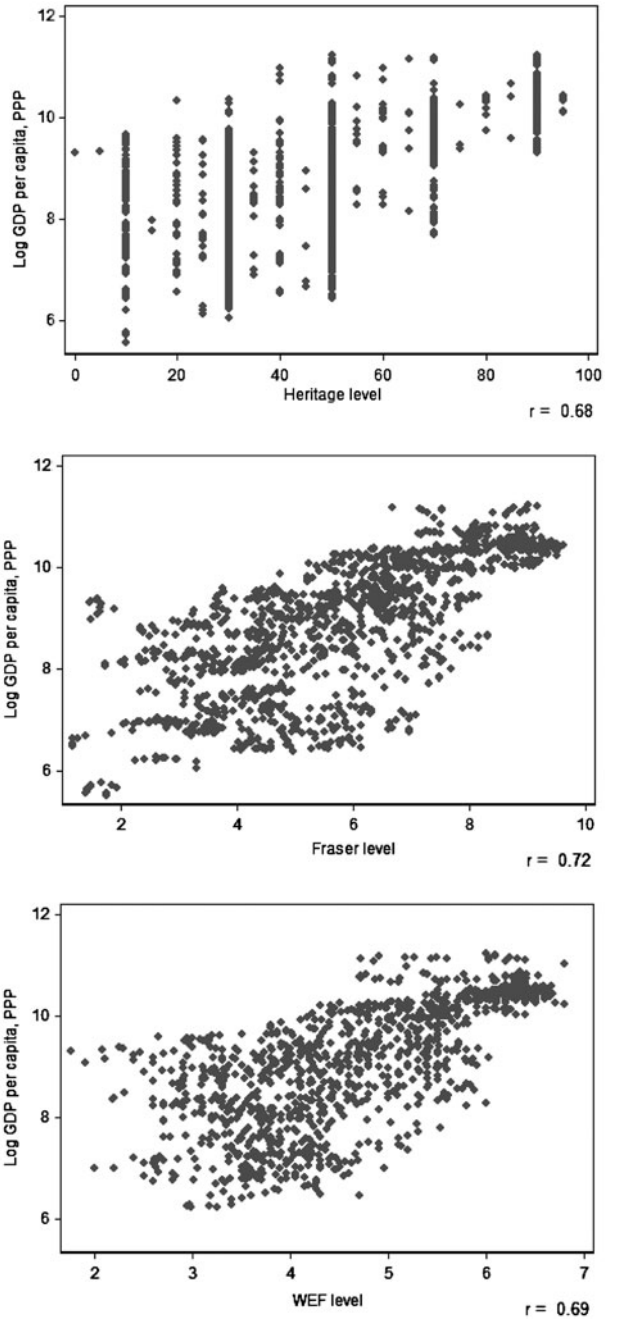


Figure 1. Association of levels of property rights with log GDP per capita, 2000–2010.

$$\mathrm{PR}^{*} = \mathrm{PR} + \varepsilon \tag{1a}$$

Here, *PR** is the index, *PR* is the actual unobserved level of property rights the coders seek to measure, and ε is an independent, identically-distributed error term

containing measurement error and omitted variables, which are uncorrelated with property rights. If there is coding bias within ε, this term of the data-generating process can be deconstructed as:

$$\mathrm{PR}^{*} = \mathrm{PR} + \sigma + \varepsilon \tag{1b}$$

Here, σ represents coding bias. We hypothesise that the covariance of σ and growth is greater than zero. If this is correct, then its omission will upwardly bias the estimated effect of the property rights index on growth in the following equation:

$$\mathrm{Growth}_{\mathrm{i,t}} = \alpha + \beta \mathrm{PR}_{\mathrm{i,t}}* + \varepsilon_{\mathrm{i,t}} \tag{2}$$

where subscript i is country and subscript t is year.

Psychologically, although coding bias may not be deliberate, it could still occur as a sub-conscious result of exposure to information about country economic performance. This translates into observer bias ($\sigma_{i,t} > 0$) as coders hear about economies performing well or not and accordingly adjust the property rights score higher or lower.

Since observer bias is likely to operate cognitively by a coder receiving recent information about growth and coding a higher property rights score, one diagnostic test is the presence of a significant, short-term relationship between property rights and the preceding year's growth, as follows:

$$\Delta \mathrm{PR}_{\mathrm{i,t}}* = \alpha + \gamma \Delta \mathrm{PR}_{\mathrm{i,t-1}}* + \beta \mathrm{Growth}_{\mathrm{i,t-1}} + \Delta \varepsilon_{\mathrm{i,t}} \tag{3}$$

We adapt this method from Kurtz and Schrank's (2007) study of governance quality measures, where they argue that a government effectiveness indicator should not vary with the rate of recent economic growth since most analysts consider governance quality to be constant over relatively short periods of time. We argue likewise that it is implausible for economic growth to significantly relate to actual improvement of property rights policy or institutions in the following year. Our analysis hinges on this assumption, but we believe it to be a judicious decision. As North (1987, 422) notes, 'the key to understanding institutions, and indeed the dilemma of institutional change, is to recognize that … [they] will only gradually evolve over a lifetime.' Dutt (2011, 533) also points out that 'legislatures take time to change laws, constitutions require large majorities to change, and even though judges can change laws by setting precedents, this change follows lengthy legal processes.' Delays in the policymaking process also render inconceivable the proposition that property rights policies could respond within the year to growth, especially considering budget and policy priorities are set ahead of time, i.e. at the beginning of a term or fiscal year, before growth information for that year becomes available.

The model in equation (3) is a component of so-called Granger causality tests (J. Freeman 1983; Granger 1969), often used to assess bi-directionality and disentangle which of two factors precedes the other (one criterion of causality, temporality). In its standard formulation, a control is also included for the previous year's value of the outcome variable, in this case the change in the property rights index, to account for the fact that there is new information available to the coder about the preceding year's property rights performance that could sway perceptions, i.e. potential autocorrelation. The models are initially estimated using pooled OLS before applying country fixed effects.

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We applied this analysis to three main property rights indicators from the Heritage Foundation, Fraser Institute, and World Economic Forum. Our measure of growth rates is calculated from GDP levels in per capita at PPP (constant 2005 international dollar), taken from the World Bank's World Development Indicators, April 2013 edition. Following this, we more closely inspect how the Great Recession has impacted on property rights scores in advanced nations, hypothesising that no decline should occur given that actual property rights protections did not diminish in this period (in contrast, if anything the policies implemented have been designed to further protect property rights).

4. Testing for observer bias

Table 2 shows the results of our tests on whether higher growth rates in the preceding year are associated with improvements in property rights coding in the following year (a Granger causality test, see equation (3)). We initially run a simple pooled model with no controls. Focusing on the row for previous year's growth, the results of all three property rights indices suggest reverse causality: the coefficients for the previous year's economic growth are positive throughout and significant at $p < 0.05$ for Heritage, $p < 0.01$ for Fraser, and $p < 0.001$ for the World Economic Forum. Since it is theoretically possible that an omitted variable exists that drives changes in both property rights and growth, we re-run the analyses to include standard controls of growth – GDP per capita, investment, inflation, education, and country dummies to correct for time-invariant factors that might impact a country's growth and property rights over the long run, such as culture, geography, and political history. With the exception of the Heritage index (which loses over 300 observations but approaches standard thresholds of significance), the relationship of reverse causality is strengthened throughout. Holding all else constant, a growth rate of 5% for the previous year would result in a 0.2 point increase in the Heritage index (on a 0–100 scale), a 0.1 point increase in the Fraser index (a 1–10 scale), and a 0.1 point increase in the World Economic Forum index (a 1–7 scale). These effect sizes are on a *per year* basis, implying a substantial distortion of the property rights measures once factoring in the cumulative iterations of these biases over several successive years.

4.1. Financial crisis sub-analysis

To further test potential observer bias, we add to the model a period dummy for financial crisis years. The period dummy is significantly negative for both the Fraser ($p < 0.001$) and the World Economic Forum indices ($p < 0.01$), indicating that property rights scores diminished during the financial crisis despite controlling for a host of variables, including growth. These results suggest a generalised erosion of coder confidence in property rights protection in all countries – a further source of bias.

We then further disaggregated the sample to examine specifically how property rights scores changed during the Great Recession in advanced nations.[6] These nations were chosen because property rights were at high levels prior to the crisis and, to our knowledge, have not declined. Countries not exposed to the structural conditions of international financial institutions possess extremely stable institutional configurations with elaborate consensus-based legislative procedures required for

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Table 2. Granger causality coefficients, one-year lag.

	Dependent variable: Change in property rights								
	Heritage			Fraser			World Economic Forum		
	Simple	Controls	Period	Simple	Controls	Period	Simple	Controls	Period
Previous Year's Coding Change	−0.071**	−0.166***	−0.166***	−0.145***	−0.202***	−0.215***	−0.204***	−0.284***	−0.274***
	[0.024]	[0.028]	[0.028]	[0.027]	[0.030]	[0.030]	[0.031]	[0.034]	[0.034]
Previous Year's Growth	0.051*	0.046	0.045	0.009**	0.012**	0.013***	0.016***	0.027***	0.028***
	[0.026]	[0.039]	[0.039]	[0.003]	[0.004]	[0.004]	[0.002]	[0.003]	[0.003]
Log GDP per capita		1.036	0.823		−0.224	−0.035		−0.342	−0.195
		[1.552]	[1.604]		[0.176]	[0.180]		[0.181]	[0.186]
Investment		0.091*	0.090*		−0.008	−0.007		0.000	0.000
		[0.044]	[0.044]		[0.005]	[0.005]		[0.005]	[0.005]
Log Inflation		−0.177	−0.206		0.029	0.050*		−0.033	−0.012
		[0.226]	[0.233]		[0.021]	[0.021]		[0.022]	[0.022]
Education		1.062	1.008		0.064	0.107		0.047	0.074
		[0.556]	[0.566]		[0.063]	[0.063]		[0.068]	[0.068]
Financial Crisis			0.213			−0.130***			−0.092**
			[0.405]			[0.032]			[0.031]
Country Fixed Effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Constant	−0.976***	−21.762*	−19.336	0.005	1.58	−0.529	−0.073***	2.496*	0.938
	[0.138]	[10.642]	[11.605]	[0.012]	[1.176]	[1.277]	[0.012]	[1.188]	[1.289]
Observations	1637	1324	1324	1071	955	955	873	790	790
Overall R-squared	0.007	0.118	0.118	0.032	0.116	0.133	0.082	0.219	0.229

Note: Based on observations between 2000 and 2010. Standard errors in brackets. GDP per capita is at PPP constant 2005 international dollar; investment is gross fixed capital formation as a share of GDP; inflation is the annual change in consumer prices, where rates less than 1% are recoded to 1% before taking the log; education is the average number of years of schooling in the over-15 population, where some interpolations are used since observations are only available for every five years; financial crisis is a period dummy for 2007 and 2008. All controls are lagged one year, with the exception of the period dummy. The education variable is taken from Barro and Lee's (2013) Education Attainment in the World dataset; remaining controls are from the World Bank's World Development Indicators, April 2013 edition.
* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

property rights changes, making it highly unlikely that they would have experienced genuine transformations in property rights institutions within a short timeframe. They were also the most greatly exposed to the financial crisis and ensuing

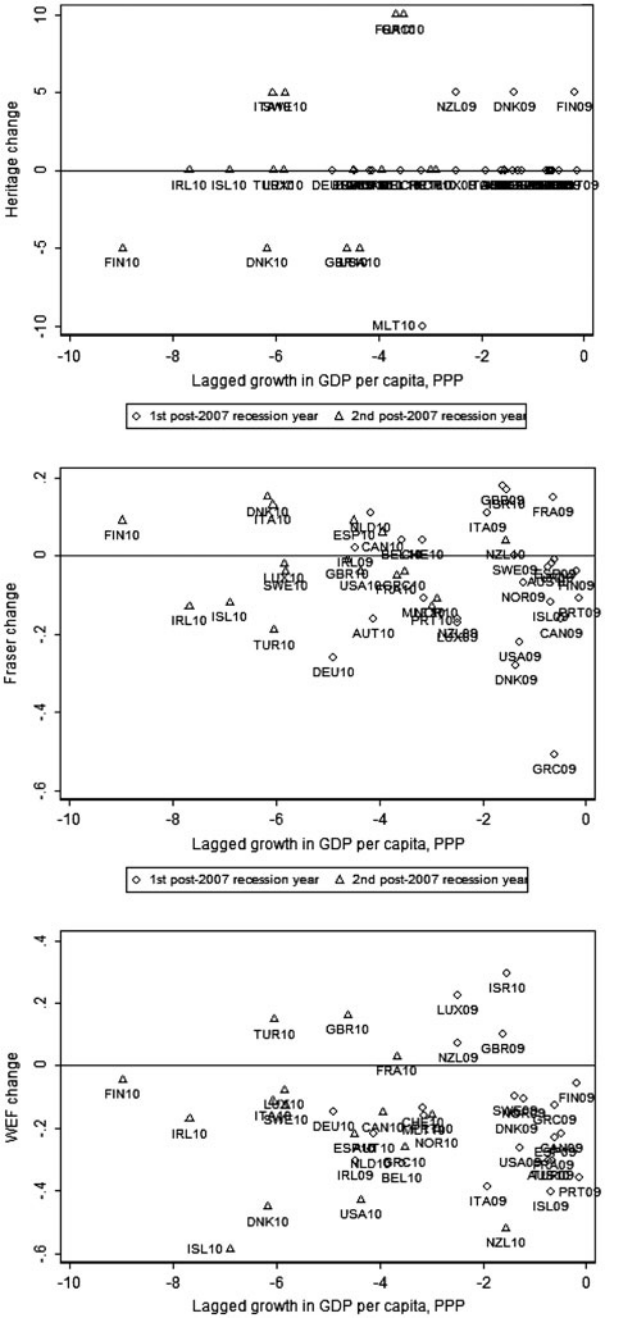


Figure 2. Changes in property rights during the Great Recession in advanced nations.

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recession, providing a quasi-natural experimental setting for observing how expert coding of property rights responds to economic change.

In Figure 2, changes in property rights during the Great Recession are plotted against the lagged growth in GDP per capita for each year that a country was experiencing a recession – defined here as a post-2007 country-year with (lagged) negative growth. The evidence for the Heritage index reveals little relationship between growth and property rights changes, which is consistent with results reported above, where it was the least significant measure to changes in growth. For the Fraser index, decreases in property rights scores occur in about one-third of years following recession. Greece's decrease in property rights score in 2009 is by far the largest drop (a finding not replicated in the other indices). There also appears to be a high degree of noise in the measure, with small fluctuations in both directions. The World Economic Forum index also illustrates perceptual bias. Almost all points fall below the zero line, indicating a decrease in property rights scores for recession years. Although there is little association between the intensity of the recession and the size of the change, this is most likely because the occurrence of a recession presents a louder signal to coders than the exact growth figure. For this measure, the four largest decreases in property rights occurred in 2010 within countries that had just experienced a second year of recession, specifically Iceland, New Zealand, Denmark, and the United States. We find it implausible that all these countries could have experienced such dramatic – and undocumented – erosions of property rights within the coverage period, and therefore take this result as further indication of bias.

4.2. Robustness tests

Since a priori it is not known how many previous years of growth coders may have taken into account for a single year, we also performed robustness checks on the Granger tests with several lag specifications for the controls model. When there is more than one lag, an F-test of joint significance is used to determine whether Granger causality exists. We add up to three lags of both change in property rights and GDP growth to the original equation and report the F-statistics of the GDP growth lags for each lag specification. Appendix 2 shows that results are robust to multiple lag specifications. Since the combined effect sizes of the lags are equivalent to the effect size of the single lag above, we have not reported them.

Additionally, we tested alternative measures that may capture coders' perceptions of country property rights. While these are numerous, we evaluated two main factors apart from economic growth and financial crisis, including changes in political leadership and democracy. As reported in Appendix 3, neither of these political factors was significant.

Finally, we checked for the possibility that the incidence of the Great Recession may have confounded our results by replicating our analysis using only the pre-recessionary periods (years 2000–2007), finding no substantive change in results (not shown, available from the author). Separately, we also re-ran analyses with a control for long-run growth included (average growth over the previous 20 years). As Kaufmann and colleagues note (Kaufmann, Kraay, and Mastruzzi 2007), to the extent that recent growth performance is correlated with long-run growth performance, the former may spuriously correlate with property rights measures

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because the latter is omitted from the regression. Again, we found no substantive change in results (not shown, available from the author).

5. Conclusion

We began this paper by surveying the literature on the link between property rights and economic development. The consensus formed, that the extension and consolidation of property rights could induce economic growth, was partly theory-driven and partly informed by macro- and micro-level quantitative research. Our additional analyses raised questions about the levels of measurement validity in the property rights indices that have been widely used in these studies. In particular, the spurious short-term associations captured by the Granger causality tests confirm that the indices in part measure relative economic success rather than the actual evolution of property rights protection. Investigations of advanced nations during the Great Recession also revealed that property rights scores decreased in many countries such as Iceland and the United States, despite no obvious evidence that their actual property rights protections had changed.

Overall, we find strong evidence of observer bias in the coding of property rights. The evidence is strongest for the World Economic Forum index, followed by the Fraser index. Results are less conclusive for the Heritage index. Our analyses, however, have several limitations. First, we cannot identify whether the perceptual biases are conscious or sub-conscious. Second, our sub-analysis of the recessionary period assumes that property rights did not deteriorate. Moreover, in countries such as Greece where troika bailout packages led to major structural reforms, property rights could have improved; and the declines seen may instead reflect how inspections by the international financial community revealed new information about the country that suggested lower property rights than previously thought. However, if this were the case, it introduces further sources of perceptual bias and measurement error, corroborating our study's findings. Third, we are also unable to capture observer bias linked to a measure's original level of property rights rather than its subsequent changes, i.e. economically successful countries may have been assigned higher scores in the originating year of a property rights index regardless of actual property rights protections.

For researchers, our findings call into question hundreds of studies that rely on the World Economic Forum, Fraser Institute, and Heritage Foundation indices. Lessons from this exercise also appeal to a more general set of methodological concerns surrounding the pitfalls of subjective indicators (see Kurtz and Schrank 2007; Razafindrakoto and Roubaud 2010). Furthermore, these concerns are unlikely to be resolved through the use of instrumental variable techniques that may, perversely, amplify bias if the instrument set used also correlates with unobserved coder perceptions. Thus, we suggest that cross-national studies should use objective data that directly measure the purported mechanisms. This would include, for example, measures of actually existing de jure property rights or, preferably, de facto rights. Where there is a lack of viable alternatives, necessitating subjective indicators, then researchers should demonstrate the validity of these data, distinguishing observed effects from spurious associations with past performance and subjective evaluations. We suggest following Keefer and Knack (2000), who directly control for recent growth performance in order to capture any biases in the subjective evaluations of

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property rights, although we note that this correction is unlikely to be completely sufficient.

Given these limitations, as well as criticisms raised elsewhere that the indices are too broad to be useful, measure different phenomena, and have very large measurement error (see Glaeser et al. 2004; Shirley 2008; Voigt 2012; Woodruff 2006), the most prudent step in our view would be to abandon the strategy of studying property rights of an entire country with subjective indicators – especially those, as with property rights, that were not explicitly designed for scientific purposes. Instead, researchers should – as many already do – seek data at other levels of analysis. By doing so, greater attention can be granted to studying how the impact of protecting property rights varies by context. A distinction can be drawn, for instance, between protecting rights of urban slum dwellers to land they have squatted on, and the rights for pharmaceutical research companies to enforce their patents. It is only through a more nuanced research strategy that meaningful insights, and by effect appropriate policy, can be drawn.

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Notes

1. Chang (2011) argues that both very high and low levels of property rights protection could lead to an inefficient use of resources in a variety of domains: for example, patent protections increase the cost of inputs to drug development, pricing researchers out of the market; absentee landlords can evict productive squatters, reducing output and increasing poverty.
2. Taken from the Heritage Foundation's website (http://www.heritage.org/about).
3. We do not include the risk of expropriation indicator from the PRS Group's International Country Risk Guide IRIS-3 Dataset frequently used in earlier studies because it has since become outdated – observations do not extend beyond 1997 and the dataset has not been updated in over a decade.
4. While econometric studies uniformly show a positive relationship, several case studies cast doubts on the certainty of the relationship (see Benjaminsen et al. 2008; Gilbert 2002; Hunt 2004; Manji 2006; Neuwirth 2006).
5. A notable exception is a study by Bose, Murshid, and Wurm (2012), who find a nonlinear relationship between property rights and growth. They conclude that stronger enforcement of property rights raises growth up to a point before growth begins to decline.
6. The list of countries used is United Nations' 'Western European and Others' group. It includes the following countries: Andorra, Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Liechtenstein, Luxembourg, Malta, Monaco, Netherlands, New Zealand, Norway, Portugal, San Marino, Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States.

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Appendix 1. Correlation matrix of property rights levels

	Heritage	Fraser	World Economic Forum
Heritage	1		
	(1768)		
Fraser	0.783***	1	
	(1329)	1353	
World Economic Forum	0.837***	0.865***	1
	(1172)	(1029)	(1189)

Note: Based on observations between 2000 and 2010. Number of observations in parenthesis.
*$p < 0.05$;**$p < 0.01$;***$p < 0.001$.

Appendix 2. F-test of varying lag specifications of Granger causality, controls model

	Depth of lag in years		
	One	Two	Three
Heritage	1.40	0.41	2.35
Fraser	10.46**	4.41*	2.92*
World Economic Forum	65.24***	25.95***	21.78***

Note: Based on observations between 2000 and 2010. Three separate regressions were performed per index (nine in total). The values of the F-statistic for joint significance on the lags of growth are reported for each of the nine regressions.
*$p < 0.05$;**$p < 0.01$;***$p < 0.001$.

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Appendix 3. Granger causality coefficients with additional variables, one-year lag

	Dependent variable: Change in property rights								
	Heritage			Fraser			World Economic Forum		
	1	2	3	4	5	6	7	8	9
Previous Year's Coding Change	−0.161***	−0.165***	−0.160***	−0.187***	−0.203***	−0.188***	−0.285***	−0.285***	−0.285***
	[0.029]	[0.028]	[0.029]	[0.031]	[0.031]	[0.031]	[0.034]	[0.034]	[0.034]
Previous Year's Growth	0.026	0.047	0.027	0.011**	0.012**	0.011**	0.027***	0.028***	0.027***
	[0.040]	[0.040]	[0.040]	[0.004]	[0.004]	[0.004]	[0.003]	[0.003]	[0.003]
Log GDP per capita	0.020		0.019	0.008		0.008	−0.004		−0.004
	[0.100]		[0.100]	[0.009]		[0.009]	[0.011]		[0.011]
Investment	0.537	1.073	0.552	−0.177	−0.206	−0.177	−0.359	−0.351	−0.359
	[1.549]	[1.564]	[1.550]	[0.178]	[0.177]	[0.178]	[0.185]	[0.183]	[0.185]
Log inflation	0.089*	0.090*	0.089*	−0.010*	−0.009	−0.010*	−0.001	0.000	−0.001
	[0.044]	[0.044]	[0.044]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]
Education	−0.162	−0.177	−0.164	0.037	0.030	0.037	−0.028	−0.034	−0.028
	[0.227]	[0.228]	[0.227]	[0.021]	[0.021]	[0.021]	[0.022]	[0.022]	[0.022]
Democracy	1.445**	1.069	1.448**	0.061	0.069	0.063	0.057	0.045	0.057
	[0.559]	[0.559]	[0.559]	[0.064]	[0.063]	[0.065]	[0.069]	[0.068]	[0.069]
Left-wing Executive		−0.366	−0.584		−0.028	−0.024		0.004	0.001
		[0.604]	[0.603]		[0.049]	[0.049]		[0.047]	[0.048]
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	−21.143*	−22.160*	−21.362*	1.246	1.397	1.223	2.560*	2.585*	2.562*
	[10.636]	[10.762]	[10.639]	[1.194]	[1.191]	[1.196]	[1.219]	[1.210]	[1.224]
Observations	1270	1313	1270	911	946	911	762	781	762
Overall R-squared	0.121	0.118	0.121	0.110	0.116	0.111	0.218	0.221	0.218

Note: Based on observations between 2000 and 2010. Standard errors in brackets. GDP per capita is at PPP constant 2005 international dollar; investment is gross fixed capital formation as a share of GDP; inflation is the annual change in consumer prices, where rates less than 1% are recoded to 1% before taking the log; education is the average number of years of schooling in the over-15 population, where some interpolations are used since observations are only available for every five years; democracy is the change in the revised combined polity democracy index; left-wing executive is the change in a dummy variable for a left-wing party orientation of the party in power. All controls are lagged one year. The education variable is taken from Barro and Lee's (2013) Education Attainment in the World dataset; the democracy variable is taken from Marshall, Gurr, and Jaggers' (2013) Polity IV dataset; the left-wing executive variable is taken from Beck et al.'s (2001) Database of Political Institutions, 2012 edition; remaining controls are from the World Bank's World Development Indicators, April 2013 edition.
*$p < 0.05$;**$p < 0.01$;***$p < 0.001$.