

Does legislation improvement alleviate the decoupling between welfare and wealth in China?

Xi Ji^{a,*}, Guowei Wu^{a,*}, Pinyi Su^a, Xuanyuan Luo^a, Xianling Long^{b,*}

^a School of Economics, Peking University, Beijing 100871, PR China

^b National School of Development and China Center for Economic Research, Peking University, Beijing 100871, PR China



ARTICLE INFO

Keywords:

Legislation improvement

Decoupling trend

Welfare

Wealth

Relative threshold hypothesis

ABSTRACT

With an increasing decoupling trend between welfare and wealth, alleviating the decoupling trend has become a key issue on the agenda of sustainable development. This paper verifies the existence of the decoupling and examines the effects of legislation on the trend. By conducting an analysis on China's 31 provinces from 1986 to 2018, we find that legislation improvement can notably alleviate the decoupling trend. The effects vary across legislation characteristics as well as across socioeconomic circumstances. First, legislations of high legal validity have long-term alleviation effects, and legislations of lower validity have immediate benefits. Second, legislations issued by higher authorities take effect in a larger jurisdiction scope, while those by lower authorities can tailor the legislations to satisfy local needs. Third, the effects of environmental legislations on remedying the decoupling trend are significantly greater than those of non-environmental legislations. Fourth, as an economy develops and the role of law steps up, the marginal effects of legislation on alleviating the decoupling show a generally diminishing trend, so the legislations should give priority to emerging sectors. This study offers the first quantitative evidence of the effects of legislation on human welfare. We offer suggestions on legislation system to improve human welfare.

1. Introduction

Ever since the industrial revolution, wealth has always been an important source of welfare and to pursue economic growth is to ultimately achieve welfare improvement. However, though wealth keeps expanding, welfare does not keep pace with the growth of wealth, and these two are increasingly decoupling (Lawn and Clarke, 2010; Long and Ji, 2019; Max-Neef, 1995; O'Mahony et al., 2018; Posner and Costanza, 2011). The reason behind this phenomenon is that the environmental and social costs of economic development have begun to surpass the benefit it brings about. The relationship between GDP per capita and ecological footprint per capita exhibits a U shape (Dietz et al., 2012), indicating the much pressure placed on our environment for the sake of economic growth. In the meanwhile, the growing inequalities lead to a variety of social ills such as impaired social mobility and increasing mental health problems (Wilkinson and Pickett, 2011). Inequality, natural resources exhaustion, ecological degradation, and global climate change are all serious threats to human wellbeing (Costanza et al.,

2014). If wealth growth cannot bring about expected welfare improvement, then it is an uneconomic growth (Daly, 2014), which fails to meet the requirements of sustainable development. As the decoupling trend draws more and more attention, finding out a way to alleviate the decoupling is important in today's relatively "full world".¹

A natural question is how to narrow the increasing gap between welfare and wealth. It is generally thought that reducing environmental damages (Jorgenson and Dietz, 2015; Zhang et al., 2018), encouraging investments in environmentally sustainable projects (Kassouri and Altintas, 2020) and building an equal society (Howarth and Kennedy, 2016) can help remedy the decoupling trend, while our answer spotlights the improvement of the legal system. Welfare comes from three sources – the economic system, social system, and environmental system. Improving a given system without taking other systems into account benefits the system itself but may lead to an overall negative influence (Ashby, 1978; Chen et al., 2013; Degroot et al., 2021; Gilbert, 2011; Santos-Fita, 2018; Shindell, 2009; Witbooi et al., 2020). Legislation, by contrast, can have holistically positive influences on all the three

* Corresponding authors at: Peking University, Beijing 100871, PR China.

E-mail addresses: jixi@pku.edu.cn (X. Ji), wuguowei@pku.edu.cn (G. Wu), xianlinglong@pku.edu.cn (X. Long).

¹ A "full world" is a world where the scale of the economy exceeds the capacity of the ecosystem. In a "full world", growth is limited, and all improvement must come from efficiency improvement (Daly, 1996).

systems if well designed, thus remedying the decoupling trend.

There have been studies demonstrating that legislations help promote wealth growth (Bilir, 2014; Branstetter et al., 2011; Chankrajang and Vechbanyongratana, 2021), mitigate social issues (Anderson et al., 2020; Gray, 1998; Heggeness, 2020; Law and Marks, 2009) and protect the environment (Eskander and Fankhauser, 2020; Townshend et al., 2013; Walters and Westerhuis, 2013; Zhang et al., 2019). Strong patents laws, for example, could attract multinational activity in sectors with relatively long product life cycles (Bilir, 2014) and lead to an expansion of industrial activity (Branstetter et al., 2011). By quantitatively analyzing historical land rights-related data, Chankrajang and Vechbanyongratana (2021) find that upholding women's de jure land rights helped incentivize agricultural productivity. Moreover, occupational licensing laws play an important role in helping talented minority workers signal quality (Law and Marks, 2009). Laws that require midwives to be licensed reduced maternal mortality and infant mortality (Anderson et al., 2020), and pro-women divorce laws benefited the divorcing women and their children (Gray, 1998; Heggeness, 2020). As for the aspect of protecting environment, climate legislation can contribute to solve climate change (Eskander and Fankhauser, 2020; Townshend et al., 2013), while the establishment of environmental courts can help deliver environmental justice (Walters and Westerhuis, 2013; Zhang et al., 2019). However, these studies only explored one single angle of the big picture of the welfare landscape. The relationship between legislation and the overall welfare, as well as the effects of legislations on the decoupling between welfare and wealth still remain unknown. This paper fills these gaps and contributes to the legislation literature.

This paper also adds to the literature on human welfare. Many studies have noticed the decoupling trend based on welfare accounting work (Easterlin et al., 2010; Fox and Erickson, 2018; Kenny et al., 2019; Kubiszewski et al., 2015; Lawn and Clarke, 2010; Long and Ji, 2019; Max-Neef, 1995; Moran et al., 2008; O'Mahony et al., 2018; Posner and Costanza, 2011), but most only provided a description of this trend and few have quantitative analysis on the mechanisms behind the decoupling. In none of the welfare studies have the effects of legislation mentioned to explain the decoupling between welfare and wealth, either. In these senses, this study is the first among its peers that offers a statistical verification of the decoupling trend and a quantitative study on the mechanisms behind the decoupling trend.

We leverage the Genuine Progress Indicator (GPI) to measure the welfare level. GPI is a variant of the Index of Sustainable Economic Welfare (ISEW) that was proposed by Daly and Cobb (1989), which was designed to replace or supplement GDP. Not only embodying the economic growth, but also taking environmental and social factors into account, GPI attempts to depict the real increase in welfare. This indicator has been widely used by researchers and governments around the world to assess the welfare level (Bagstad and Shammin, 2012; Costanza et al., 2004; Kubiszewski et al., 2013; Posner and Costanza, 2011). The ratio of GPI to GDP is the proxy for the decoupling degree between welfare and wealth. A low GPI-to-GDP ratio indicates a big decoupling.

In this paper, we use the increment of the stock of legislations to reflect the level of legislation improvement. The data are derived from the PKU Law database that records around 2.21 million local legislations since 1950, and it is known as the most comprehensive database on China's legislation.

We identify the effects of legislation on the welfare-wealth decoupling using a panel regression model. The comprehensive data sample shows significant advantages in identifying the correlation. First, it allows us to study the heterogeneous effects across provinces with different economic levels, economic structures, welfare levels or legislation development levels. Such heterogeneity analysis provides insights for policymakers on how to improve the legislation while adapting to the provincial characteristics. Second, it allows us to investigate how the validity level and the law-issuing authority influence the effects of legislation, which gives us an in-depth understanding of the mechanism

Table 1
GPI index system.

| Account | Positive/negative | Component |
|-----------------------|-------------------|---|
| Economic account | Positive welfare | Personal consumption expenses Services of durables Net capital growth Income inequality Cost of durables Cost of underemployment |
| | Negative welfare | Net capital decline Value of domestic labor Value of volunteer work Increase in leisure time Non-defensive public expenses on education and health |
| | Positive welfare | Services from public infrastructure Cost of family breakdown Cost of crime |
| | Negative welfare | Decrease in leisure time Defensive private expenditure on education and health Cost of commuting Cost of auto accidents |
| | Positive welfare | Increase in wetlands Increase in forests Decrease in wetlands Decrease in forests |
| | Negative welfare | Cost of water pollution Cost of air pollution (CO ₂ , SO ₂ , PM) Cost of solid waste pollution Long-term environmental damage Depletion of non-renewables Cost of natural disaster |
| Social account | | |
| Environmental account | | |

Every item in positive welfare parts of each account is expressed as a positive number, and the items in negative welfare parts are expressed as a negative number.

of the effects. Third, the panel regression on the large sample eliminates the confounding effects in a certain province or a certain period, because it captures the overall impacts of legislation. Fourth, we conduct thorough robustness checks to demonstrate the validity of the results.

The results verify that legislations indeed play a significant role in alleviating the decoupling between welfare and wealth, but the effects vary across legislation characteristics as well as across socio-economic circumstances. First, legislations of high validity alleviate the decoupling in the long run, and legislations of lower validity have benefits in the short run. It can be explained by their different purposes. High-validity legislations set fundamental principles that have long-term impacts, and lower-validity legislations focus on a specific area and make specific enforcement rules, so it takes effect quickly. Second, the impacts of the legislations issued by provincial authorities happen to have similar magnitudes as the legislations issued by municipal or lower authorities due to two opposing factors. On the one hand, provincial legislation involves larger jurisdiction scope. On the other hand, the municipal or lower authorities can tailor the legislations to accommodate the local needs and have specific enforcement powers. Third, the target area of the legislations also matters. The effects of environmental legislations on remedying the decoupling trend are significantly greater than those of non-environmental legislations. Fourth, the alleviation effects of legislations on the decoupling trend are mostly only significant in less developed regions, in terms of economic level, legislation development level, industrial level, or technological level. Based on these results, we offer policy implications in the conclusion section.

The remainder of this paper is organized as follows. Section 2 explains the methods. Section 3 describes the data. Section 4 presents the results. Section 5 offers discussions and conclusions.

2. Empirical methodology

2.1. Measurement of the decoupling between welfare and wealth

We use GPI as the proxy for welfare and GDP as the proxy for wealth. The ratio of GPI to GDP reflects the decoupling between welfare and wealth. The lower the ratio, the severer the decoupling between welfare and wealth. GPI consists of 28 welfare components across three accounts – economic, social, and environmental accounts. The welfare components are shown in Table 1.

2.2. Testing the existence of the decoupling

Many studies have observed the decoupling trend (Costanza et al., 2004; Fox and Erickson, 2018, 2020; Kubiszewski et al., 2013), but there is not any statistical evidence to support it.

There are two hypotheses concerning the decoupling trend between the welfare and wealth – the “Threshold Hypothesis” and the “Relative Threshold Hypothesis”. We examine which hypothesis holds in China.

We first examine the “Threshold Hypothesis” that was originally proposed by Max-Neef (1995):

There seems to be a period in which economic growth (as conventionally measured) brings about an improvement in life quality, but only up to a point - the threshold point - beyond which, if there is more economic growth, quality of life may begin to deteriorate.

The “Threshold Hypothesis” is tested using this panel data regression model (Arellano, 1991; Balestra and Nerlove, 1966; Mundlak, 1978):

$$GPI_{it} = \alpha_0 + \alpha_1 GDP_{it} + \alpha_2 GDP_{it}^2 + \sigma_i + \tau_t + \varepsilon_{it} \quad (1)$$

where GPI_{it} denotes province i 's GPI per capita in year t . GDP_{it} and GDP_{it}^2 denote province i 's GDP per capita in year t and its quadratic term respectively, and thus the coefficients α_1 and α_2 reflect the impact of GDP per capita and the square of GDP per capita on GPI per capita. Province fixed effect and year fixed effect are controlled by σ_i and τ_t respectively. α_0 is the constant term and ε_{it} is the error term.

If the “Threshold Hypothesis” holds, α_1 should be positive and α_2 is expected to be negative.

Then we examine the existence of the “Relative Threshold Hypothesis” proposed by Long and Ji (2019). The “Relative Threshold Hypothesis” states that, though welfare level still increases along with wealth growth, the progress of welfare improvement can be slower than the growth rate of wealth; thus the gap between welfare and wealth widens – the GPI decouples from GDP.

We use the following regression to test the decoupling between welfare and wealth.

$$\ln GPI_{it} = \beta_0 + \beta_1 \ln GDP_{it} + \lambda_i + \delta_t + \theta_{it} \quad (2)$$

Since the explanatory and explained variables are both in logarithmic form, the coefficient β_1 represents the estimated percent change in GPI per capita for a percent change in GDP per capita. Province fixed effect and year fixed effect are controlled by λ_i and δ_t respectively. β_0 is the constant term and θ_{it} is the error term.

If the “Relative Threshold Hypothesis” holds, or in other words, the growth rate of welfare is smaller than the wealth, we expect the estimated coefficient β_1 to be positive and smaller than one.

2.3. Identification strategy for the effects of legislations

After verifying the decoupling trend between welfare and wealth, we explore the effects of legislation on the decoupling trend using the following panel regression model:

$$\left(\frac{GPI}{GDP} \right)_{it} = \varphi_0 + \varphi_1 Legislation_{it}^N + \varphi_2 Legislation_{it}^O + \gamma X_{it} + v_i + \omega_t + u_{it} \quad (3)$$

where $\left(\frac{GPI}{GDP} \right)_{it}$ measures the welfare intensity per unit of wealth. $Legislation_{it}^N$ is the stock of legislations issued in the year ($t-1$), which captures the short-term effects of newly issued legislations, and $Legislation_{it}^O$ is the stock of older legislations that were issued from $t=1$ through the end of year ($t-2$). X_{it} represents the vector of control variables encompassing industrial structure, population characteristics, technological progress, and climate factor. Industrial structure comprises the shares of secondary (Sec) and tertiary industries ($Tert$) in GDP. Population characteristics (Pop) are expressed by population density (the number of people per square kilometer, counted in thousands), technological progress ($Tech$) is measured by the number of authorization letters of patent application per 100,000 people, and climate factor ($Temp$) is represented by the average air temperature. Provincial fixed effect v_i controls the fixed factors of each province, such as geographical features, natural resources, and culture. Year fixed effect ω_t controls the factors that are common to all provinces each year, such as national policies and national financial conditions. φ_0 is the constant term and u_{it} is the error term.

3. Data

The data span from 1986 to 2018. There are two primary datasets used in this paper. For GPI, we have constructed a database for China's GPI, and this paper bases on the GPI data in our database, which covers 31 provinces in China over the 1986–2018 period. See the detailed results in Appendix Table A1. The legislation data come from the PKU Law database compiled by Law School, Peking University. The database has recorded about 2.21 million legislation documents since 1950. All the laws and regulations have been recorded in the database, regardless of their current status, so long as they have been enacted.

We classify the legislations based on three dimensions, respectively. The first dimension is legal validity. We classify legislations (all at the provincial level or below) into six groups: 1) local regulations, 2) local government rules, 3) local regulatory documents, 4) local judicial documents, 5) local work documents, and 6) official replies on administrative licensing.² According to The Legislation Law of the People's Republic of China, we categorize these legislations to high, medium, and low validity legislations. The category of high-validity legislations includes only local regulations. The category of medium-validity legislations consists of local government rules and local regulatory documents. The rest belongs to the category of low validity.

The second dimension is law-issuing authority. We classify legislations into two groups, one issued by provincial authorities, including provincial people's congress, provincial government and other provincial organizations, and the other issued by municipal authorities, including municipal people's congress, municipal government and other municipal organizations.

The third dimension is the target area. We classify legislations to environmental and non-environmental legislations.

The temperature data are obtained from the National Meteorological

² These six types of legislation documents are categorized in the dataset (www.pkulaw.cn). The local regulations are normative documents with legal effect and enforceability, which are formulated by the local people's congresses and their standing committees according to the specific conditions and practical needs of the administrative region. The local government rules generally refer to the administrative regulations made by local governments within the scope of their authority and issued to the society, in which the content is specific to a certain matter and offers policy orientations and principles. The local regulatory documents are similar to government regulations, referring to non-legislative documents with binding effect. The local judicial documents, local work documents, and official replies on administrative licensing generally are documents for how to implement one policy in detail pointing to one specific socioeconomic issue, and they are outside the scope of narrow-meaning legislation.

Table 2
Descriptive statistics.

| Variables | Description | Obs. | Mean | St. Dev. | Min | Max |
|--------------------------|--|------|-------|----------|-------|-------|
| GPI/GDP | The ratio of GPI to GDP | 996 | 0.575 | 0.657 | 0.001 | 8.307 |
| Legislation ^N | The stock of legislations issued in the year ($t-1$) | 996 | 1.82 | 2.645 | 0 | 16.4 |
| Legislation ^O | The stock of older legislations that are issued from $t=1$ through the end of year ($t-2$) | 996 | 10.61 | 18.07 | 0.001 | 120 |
| Sec | The share of secondary industry in GDP | 996 | 0.442 | 0.087 | 0.129 | 0.685 |
| Tert | The share of tertiary industry in GDP | 996 | 0.384 | 0.089 | 0.194 | 0.81 |
| Pop | Population density | 996 | 0.386 | 0.54 | 0.002 | 3.826 |
| Tech | Number of authorization letters of patent application | 996 | 0.31 | 0.694 | 0 | 5.733 |
| Temp | Average temperature | 996 | 13.05 | 5.626 | 0.978 | 25.36 |

Information Center of China. The raw data are the monthly temperature collected by 613 ground meteorological observation stations in China. We calculate the annual average temperature by year and by province based on the raw data.

The data sources of GDP per capita, the shares of the secondary industry and tertiary industry in GDP, population density, and technological progress (the number of authorization letters of patent application) are China Statistical Yearbooks, provincial statistical yearbooks, and China Science and Technology Statistical Yearbooks.

We report the descriptive statistics of the variables in Table 2. The average welfare intensity per unit of wealth, i.e., GPI/GDP , is 0.570 with a large standard deviation of 0.656, reflecting varying decoupling situations in different regions in different years. On average, each province issues 1.806 thousand legislations every year during 1985–2017, with a standard deviation of 2.639, which also indicates a big heterogeneity in the number of laws and regulations. The average proportion of the secondary industry records a relatively high ratio at 0.443, while the proportion of the tertiary industry is relatively low at 0.383. The number of patents per 100,000 people is 0.308. All these reflect the typical features of China as a developing country.

4. Results

4.1. The existence of the decoupling trend

Table 3 reports the results for the tests of the existence of the

Table 3
Test of the existence of decoupling trend.

| Variables | Dependent variable: GPI | | | Dependent variable: $\ln GPI$ | | |
|------------------------|---------------------------|----------------------|---------------------|-------------------------------|----------------------|----------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| GDP | 0.596*** (0.020) | 0.628*** (0.013) | 0.391*** (0.033) | | | |
| GDP^2 | -0.008*** (0.001) | -0.006*** (0.001) | 0.001 (0.001) | | | |
| In GDP | | | | 1.059*** (0.020) | 1.189*** (0.016) | 0.784*** (0.102) |
| Constant | -0.001 (-0.02) | -0.189*** (-5.62) | 0.513*** (5.50) | -0.820*** (0.026) | -0.929*** (0.019) | -0.589*** (0.087) |
| Province fixed effects | | Y | | | Y | |
| Year fixed effects | | Y | | | Y | |
| #Observations | 996 | 996 | 996 | 996 | 996 | 996 |
| R-squared adj | 0.806 | 0.924 | 0.932 | 0.737 | 0.872 | 0.879 |

Note: Standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

decoupling trend. Columns (1)–(3) show the changes in GPI per capita associated with the changes in GDP per capita. When controlling for both province and year fixed effects, the coefficient for GDP is significantly positive, and the coefficient for GDP^2 is insignificantly positive (Column (3)). Since both coefficients are positive, there is no evidence of a threshold beyond which the welfare measured by GPI starts to decline, implying that the “Threshold Hypothesis” does not hold in China.

Columns (4)–(6) show the percent changes in GPI per capita associated with the percent change in GDP per capita. When controlling for both province and year fixed effects (Column (6)), the coefficient is 0.784, which indicates that for a 1% increase in GDP per capita, GPI per capita only increases by 0.784%; thus GPI relatively decoupling from GDP. Therefore, the “Relative Threshold Hypothesis”, or equivalently the decoupling trend between welfare and wealth, is supported by Chinese data.

4.2. The effects of legislation

Given the evident existence of the decoupling trend, we first apply the regression to estimate the overall effects of legislation on the decoupling trend. Then we examine how the effects change with the characteristics of legislation.

4.2.1. Overall effects

The results shown in Column (3) of Table 4 suggest that for every 1000 increase in the number of newly issued legislations, the welfare intensity per unit of wealth (i.e., GPI/GDP) increases approximately by 0.081. This correlation shows that the legislations play a significant role in alleviating the decoupling between welfare and wealth. Quite unexpectedly, the stock of older laws has insignificant effects on the welfare

Table 4

Overall effects of legislation on the decoupling between welfare and wealth.

| Variables | Dependent variable: GPI/GDP | | |
|--------------------------|-------------------------------|---------------------|---------------------|
| | (1) | (2) | (3) |
| Legislation ^N | 0.113*** (0.019) | 0.103*** (0.015) | 0.081*** (0.018) |
| Legislation ^O | -0.009*** (0.003) | -0.004 (0.002) | -0.001 (0.003) |
| Constant | 2.986*** (0.207) | 2.304*** (0.349) | 7.489*** (0.595) |
| Control variables | Y | Y | Y |
| Province fixed effects | | Y | Y |
| Year fixed effects | | | Y |
| #Observations | 996 | 996 | 996 |
| R-squared adj | 0.246 | 0.624 | 0.671 |

Note: Standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 5
Effects of legislation across validity levels.

| Variables | Dependent variable: <i>GPI/GDP</i> | | | |
|---|------------------------------------|---------------------|---------------------|---------------------|
| | (1) | (2) | (3) | (4) |
| <i>Legislation^N</i> of High Validity | 1.058 (0.812) | | 1.157 (0.806) | |
| <i>Legislation^O</i> of High Validity | 0.753*** (0.124) | | 0.393** (0.171) | |
| <i>Legislation^N</i> of Medium Validity | | 0.255*** (0.062) | 0.128 (0.082) | |
| <i>Legislation^O</i> of Medium Validity | | 0.013 (0.009) | 0.004 (0.016) | |
| <i>Legislation^N</i> of Low Validity | | | 0.102*** (0.023) | 0.058* (0.030) |
| <i>Legislation^O</i> of Low Validity | | | -0.003 (0.004) | -0.005 (0.006) |
| Constant | 6.590*** (0.622) | 7.510*** (0.596) | 7.471*** (0.597) | 6.957*** (0.625) |
| Control variables | Y | Y | Y | Y |
| Province fixed effects | Y | Y | Y | Y |
| Year fixed effects | Y | Y | Y | Y |
| #Observations | 996 | 996 | 996 | 996 |
| R-squared adj | 0.668 | 0.673 | 0.669 | 0.676 |

Note: Standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 6
Effects of legislation across legislation-issuing authorities.

| Variables | Dependent variable: <i>GPI/GDP</i> | | |
|---|------------------------------------|---------------------|---------------------|
| | (1) | (2) | (3) |
| <i>Provincial Legislation^N</i> | 0.126*** (0.030) | | 0.088*** (0.033) |
| <i>Provincial Legislation^O</i> | 0.002 (0.005) | | 0.003 (0.005) |
| <i>Municipal Legislation^N</i> or Below | | 0.128*** (0.029) | 0.072** (0.033) |
| <i>Municipal Legislation^O</i> or Below | | -0.004 (0.004) | -0.004 (0.004) |
| Constant | 7.435*** (0.597) | 7.621*** (0.600) | 7.478*** (0.596) |
| Control variables | Y | Y | Y |
| Province fixed effects | Y | Y | Y |
| Year fixed effects | Y | Y | Y |
| #Observations | 996 | 996 | 996 |
| R-squared adj | 0.670 | 0.666 | 0.672 |

Note: Standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

intensity per unit of wealth. We offer more analysis and explanations in the following subsections.

4.2.2. Effects of legislations with different legal validity

There are six categories of local legislations, which are 1) local regulations, 2) local government rules, 3) local regulatory documents, 4) local judicial documents, 5) local work documents, and 6) official replies on administrative licensing. Category 1 is legislations of high validity. Categories 2 and 3 are legislations of medium validity. The other three categories are legislations of low validity.

Table 5 presents the results. As shown in Column (1), legislations of high-validity exhibit significantly positive long-term effects on *GPI/GDP*, which is captured by the coefficient for *Legislation^O*, thus alleviating the decoupling between welfare and wealth. Columns (2) and (3) show that the legislations of medium-validity and low-validity have positive short-term effects on *GPI/GDP*, as reported in the coefficients for *Legislation^N*. In sum, legislations of high validity (i.e., local regulations) play a role in alleviating the decoupling in the long run, and legislations of lower validity (e.g., local government rules, regulatory documents) have benefits in the short run. Results in Column (4) support

Table 7
Effects of legislation across target areas.

| Variables | Dependent variable: <i>GPI/GDP</i> | | |
|--|------------------------------------|---------------------|---------------------|
| | (1) | (2) | (3) |
| <i>Environmental Legislation^N</i> | 0.356 (0.324) | | -0.260 (0.338) |
| <i>Environmental Legislation^O</i> | 0.261*** (0.076) | | 0.207** (0.094) |
| <i>Non-environmental Legislation^N</i> | | 0.083*** (0.018) | 0.091*** (0.019) |
| <i>Non-environmental Legislation^O</i> | | -0.001 (0.003) | -0.006 (0.004) |
| Constant | 7.560*** (0.603) | 7.490*** (0.596) | 7.496*** (0.595) |
| Control variables | Y | Y | Y |
| Province fixed effects | Y | Y | Y |
| Year fixed effects | Y | Y | Y |
| #Observations | 996 | 996 | 996 |
| R-squared adj | 0.662 | 0.671 | 0.672 |

Note: Standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

the main findings.

The results can be explained by the different purposes of high-validity and lower-validity legislations. Legislations of high validity set fundamental principles and govern lower-validity legislations. The principles can have long-lasting effects. Lower-validity legislations focus on a specific area and make specific enforcement rules which can take effect very soon.

4.2.3. Effects of legislations with different legislation-issuing authorities

We also examine the effects of legislation with different legislation-issuing authorities. We group local legislations into legislations that are issued by provincial authorities and those issued by municipal authorities or below.

Table 6 shows that the legislations issued by provincial authorities have similar effects as the effects of the legislations issued by municipal authorities or below. On the one hand, provincial legislation involves larger jurisdiction scope. On the other hand, the municipal or lower authorities know the local situation better and can design legislations more tailored to suit the local situation. Also, municipal or lower authorities have specific legislation enforcement powers. The two opposing factors make the provincial and municipal legislations happen to exert influences on the decoupling trend to a similar extent.

4.2.4. Effects of legislations with different target areas

Since one significant missing component in *GDP* is the benefits from ecosystem and the environmental costs, we divide local legislations into environmental legislations and non-environmental legislations, to investigate how the effects of legislations vary across target areas.

As shown in Table 7, non-environmental legislations have significant alleviation effects on the decoupling trend in the short run, while environmental legislations take effects in the long run. It implies that the environmental legislations take time to make a difference in practice. In terms of magnitude, environmental legislations have bigger impacts than the non-environmental legislations. Therefore, local environmental legislations can greatly increase welfare at relatively small economic costs in the long run, by regulating pollutant discharge and ecosystem protection.

4.3. Robustness check

We conduct a series of robustness checks. First, we check the results with alternative definitions of “new” legislations. We hypothesize that the degree of the decoupling between welfare and wealth is affected by legislative history, i.e., the number of legislations issued so far. In the main regression above, we classify the legislations into new and old

Table 8

Robustness check: alternative definitions of “new” legislations.

| Variables | Dependent variable: GPI/GDP | |
|------------------------|-------------------------------|---------------------|
| | (1) | (2) |
| $Legislation^{N2}$ | 0.045*** (0.009) | |
| $Legislation^{O2}$ | -0.002 (0.003) | |
| $Legislation^{N3}$ | | 0.032*** (0.006) |
| $Legislation^{O3}$ | | -0.003 (0.004) |
| Constant | 7.513*** (0.596) | 7.521*** (0.597) |
| Control variables | Y | Y |
| Province fixed effects | Y | Y |
| Year fixed effects | Y | Y |
| #Observations | 996 | 996 |
| R-squared adj | 0.671 | 0.670 |

Note: Standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 9

Robustness Check: different GPI measurements & sample selection.

| Variables | Dependent variable: | | | | |
|------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| | GPI_1/GDP | GPI_2/GDP | GPI_3/GDP | GPI_4/GDP | GPI/GDP |
| | (1) | (2) | (3) | (4) | (5) |
| $Legislation^N$ | 0.080*** (0.018) | 0.081*** (0.018) | 0.079*** (0.018) | 0.083*** (0.018) | 0.080*** (0.019) |
| $Legislation^O$ | -0.001 (0.003) | -0.001 (0.003) | -0.001 (0.003) | -0.002 (0.003) | -0.000 (0.003) |
| Constant | 7.361*** (0.595) | 7.388*** (0.594) | 7.457*** (0.594) | 7.809*** (0.584) | 8.173*** (0.609) |
| Control variables | Y | Y | Y | Y | Y |
| Province fixed effects | Y | Y | Y | Y | Y |
| Year fixed effects | Y | Y | Y | Y | Y |
| #Observations | 996 | 996 | 996 | 996 | 944 |
| R-squared adj | 0.676 | 0.673 | 0.680 | 0.683 | 0.683 |

Note: Standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

legislations to test the short-term and long-term impacts of legislations, respectively. The new legislations are defined as the legislations issued in year $t-1$, and the old legislations are those issued from $t=1$ through the end of year $t-2$. In the robustness check regressions, we use two alternative definitions – $Legislation_{it}^{R2}$ as the stock of legislations issued in years $t-2$ and $t-1$, and $Legislation_{it}^{O2}$ as the stock of legislations issued by the end of year $t-3$; Similarly, the $Legislation_{it}^{R3}$ are the stock of legislations issued in years $t-3$, $t-2$ and $t-1$, and $Legislation_{it}^{O3}$ the stock of legislations issued by the end of year $t-4$.

The results are shown in Table 8. Same as the main results, the new legislations have significantly positive impacts on GPI/GDP , and the old legislations have insignificant impacts, regardless of the criterion for classifying new and old legislations.

Second, we test whether the GPI measurement method influences the results. As any other welfare indicator, the measurement of welfare is subject to arbitrariness problems. In our GPI data, we have included all the welfare components that were considered in ISEW or GPI literature and have good data quality for Chinese provinces, so there is little arbitrariness in component selection. However, we cannot eliminate all the arbitrariness and subjectivity in GPI measurement. For example, income inequality can be estimated by both Atkinson and Gini indices, and the cost of non-renewable resource depletion is subject to the choice of the parameter values used in the replacement cost method. In this set of robustness check, we select four key welfare components that suffer

from arbitrariness problems, which are income inequality, cost of non-renewables depletion, cost of commuting, and cost of water pollution. We alter the estimation method or the parameter value for each of them to get four sets of GPI data and use the four sets of GPI data in regressions, respectively (see Appendix A for details). The four regression results, as shown in Columns (1)–(4) of Table 9, yield consistent results with the main regression.

Third, we check the potential observation errors. Since Chongqing Municipality and Hainan Province were established in 1997 and 1988 respectively, and our study period is from 1986 to 2018, the data on their legislations might be inaccurate in the first few years of their establishments. In the robustness check regression, we remove Chongqing and Hainan from the sample. As shown in Table 9 Column (5), the findings from the main regression, that legislations have significant short-term but insignificant long-term effects on alleviating the decoupling, still hold.

Fourth, we conduct placebo tests by randomly assigning the legislation variables to provinces, following the similar practices in Cantoni et al. (2017); Chetty et al. (2009); Li et al. (2016) and Cai et al. (2016). Randomization eliminates the effects of legislation, so any significant findings would indicate misspecification, such as the existence of omitted variables (Cai et al., 2016). Since only the new legislations $Legislation_{it}^N$ show significant effects presented in Table 4 Column (3), we only conduct the placebo test for $Legislation_{it}^N$.

In the placebo test, we randomly reorder the values of $Legislation_{it}^N$ to form a new variable $RandomLegit_{it}^N$, and then replace $Legislation_{it}^N$ by $RandomLegit_{it}^N$ in the regression. This procedure is repeated 1000 times.

$$\left(\frac{GPI}{GDP} \right)_{it} = \phi_0 + \phi_1 RandomLegit_{it}^N + \phi_2 Legislation_{it}^O + \zeta X_{it} + \pi_i + \eta_t + \mu_{it} \quad (4)$$

Fig. 1 reports the mean values of the estimates of the coefficients ϕ_1 for $RandomLegit_{it}^N$ from the 1000 random assignments. We find that in the 1000 regressions, the estimated coefficients are distributed around zero, and the p -values for the coefficients in the pseudo-sample are mostly larger than 0.1. The truly estimated coefficient of $Legislation_{it}^N$ from Table 4 is significantly higher than the 99th percentile of the 1000 estimated coefficients.

This finding rules out the possibility that the significant coefficients in Table 4 are due to misspecification, such as omitted variables.

4.4. Heterogeneity

The effects of legislation may vary across provinces with different socioeconomic characteristics. We study the heterogeneity from multiple dimensions, including wealth level (measured by GDP per capita), welfare level (GPI per capita), legislation development level (the stock of legislations), economic structure (the respective shares of secondary and tertiary industries in GDP), and technological level (the number of authorization letter of patent application per capita).

Fig. 2 depicts the results. The alleviation effects of legislation on the decoupling trend are mostly only significant in less developed provinces, which are the provinces with low GDP levels, low GPI levels, low legislation development levels, low technological levels, or low shares of secondary industry in GDP. The only exception is with the share of tertiary industry in GDP. Specifically, legislation shows a significant short-term effect on narrowing the decoupling not only in the provinces with low shares of the tertiary industry but also in the provinces with high share of the tertiary industry.

We offer our interpretations of the results. As the wealth grows in volume, welfare and technological levels rise, or the scale of secondary industry expands, the economy, industries, and technologies get more complicated and refined. In this process, the local legislations tend to be increasingly dedicated to specific areas. These dedicated legislations have smaller effects than general and high-level legislations. It implies

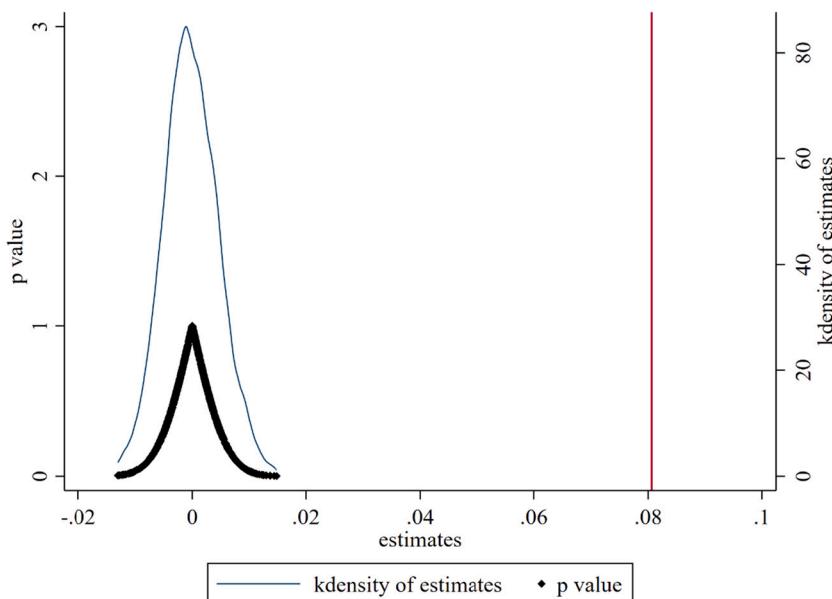


Fig. 1. Placebo Test. The blue curve is the kernel density distribution of 1000 estimates from the placebo test using the pseudo-samples, whereas the black diamonds are the associated p-values. The red line shows the true estimate of the coefficient using the real data, presented in Column (3) of Table 4. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

the decreasing marginal benefit of legislation improvement. Therefore, improving legislation in the field with a deficient legal system can evidently raise the welfare intensity per unit of wealth. The effects will gradually decrease as the legislation matures in the field.

As for the tertiary industry, new sectors emerge as this industry develops, such as communication technology, computer services, scientific research, and entertainment. For these new sectors, establishing new legislations has a high marginal benefit, which partially offsets the diminishing effects of legislation improvement in traditional sectors. Hence, in provinces with high shares of tertiary industry, legislations still have significant alleviation effects on the decoupling trend.

5. Discussion and conclusion

Our findings have important implications for alleviating the decoupling between welfare and wealth. We have statistically verified that the gap between welfare and wealth is rising, as proposed in Long and Ji's "Relative Threshold Hypothesis" (Long and Ji, 2019). More importantly, we have located a promising solution for alleviating the decoupling trend, that is, to improve legislation. The sticking point of addressing the decoupling is that the economic, social, and environmental systems making up the whole human welfare picture are an interconnected whole. The improvement of one system may damage other systems. For example, exploiting natural resources on one hand accelerates economic development, but on the other hand, damages the environmental system. Similarly, regulating pollution on one hand improves the environmental system, but on the other hand it goes against the welfare generated by the economic system. However, legislation, when designed properly and adjusted accordingly, can improve the efficiency of each system and coordinate their relations. Our empirical results show that the local legislations remedy the decoupling level. Various robustness tests support this conclusion.

Moreover, the results that different legislations show varying effects offer us insights on the prioritization of different legislations. First, given the long-term effects of high-validity legislations, the primary priority should be to issue proper high-validity legislations to provide fundamental guidelines for lower-validity legislations. Second, the legislations issued by municipal authorities or below, although applied to a smaller area than those issued by provincial authorities, play a key role as they

involve direct law enforcement. These legislations should be designed to suit local circumstances. Third, the effects of environmental legislations on remedying the decoupling trend are significantly greater than those of non-environmental legislations. It suggests the grim situation of environmental pollution in China, and the urgency and significance of improving the environmental legislation in China.

We also find that the alleviation effects of legislations on the decoupling trend are significant in mostly only underdeveloped regions, in terms of economic level, legislation development level, industrial level, and technological level, with the exception for developed regions with emerging advanced tertiary sectors. This finding has policy implications for both developing and developed economies. In developing countries and regions, legislations can generally boost welfare intensity per unit of wealth. In developed countries and regions, legislation improvement should give priority to emerging sectors, such as communication, computer services, logistics, health, education, and entertainment in the tertiary industry.

Lastly, we provide our suggestions of the prospective future research directions. First, China's legal system is mainly a civil law system. Whether the conclusions, especially the varying effects brought by the characteristics of the legal system, can be applied to countries and regions under the common law system is worth further investigation. Second, we only analyze the effects of legislations, but how legislations interact with other governance approaches still needs exploration. Third, we use the stock of legislation as the indicator for the legislation development level. The force and effectiveness of law enforcement would also influence the decoupling trend, which deserves more research.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

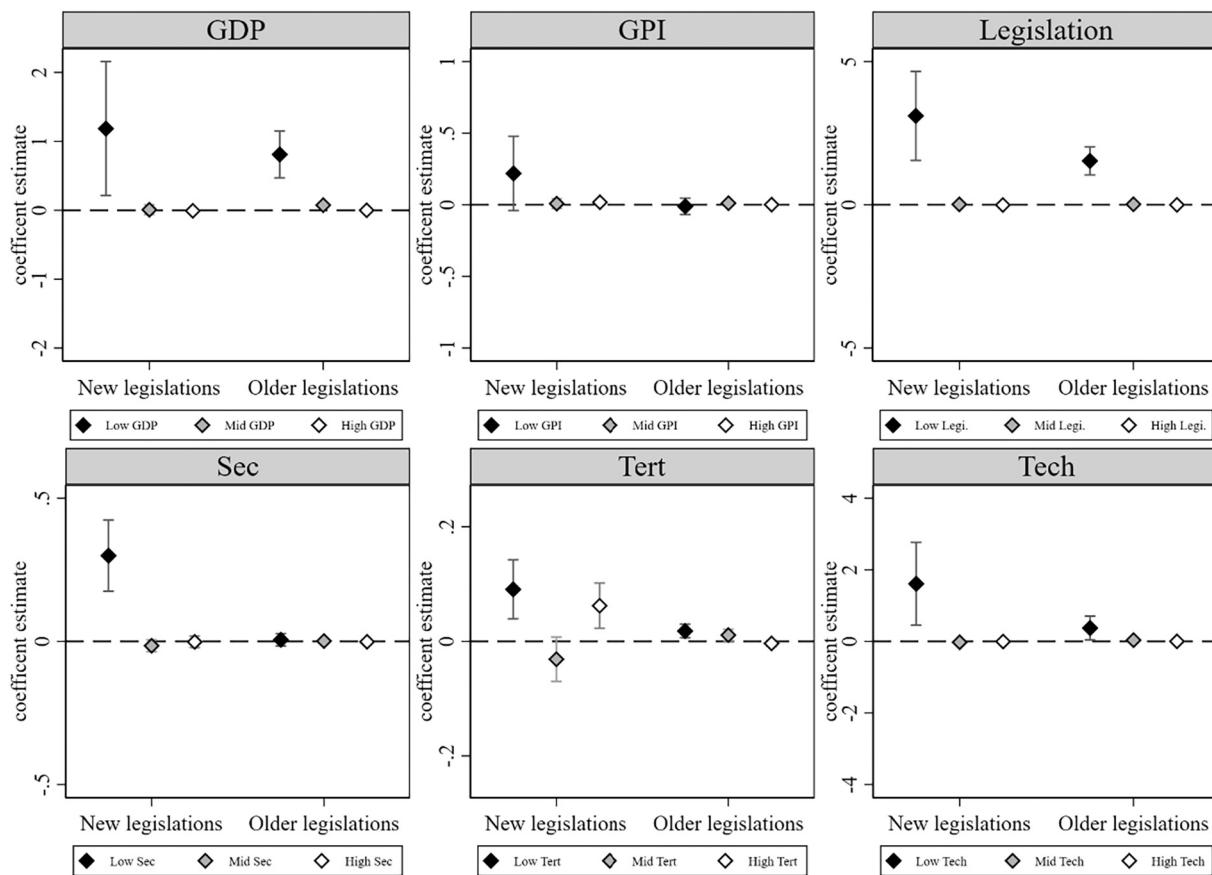


Fig. 2. Heterogeneity. Diamonds mark the estimated coefficients for legislations on GPI/GDP, and the black lines show 95% confidence intervals. A positive coefficient indicates a positive effect on GPI/GDP, and thus an alleviation effect on the decoupling trend. Some confidence intervals are too narrow to be readable. Each cell represents a separate regression. The “GDP” cell (the upper left cell) presents the heterogeneity across GDP per capita levels (low, mid and high GDP per capita levels). The “GPI” cell presents the heterogeneity across GPI per capita levels. The “Legislation” cell presents the heterogeneity across the legislation development levels measured by the stock of legislations. The “Sec” and “Tert” cells present the heterogeneity across different shares of secondary industries and tertiary industries in GDP respectively. The “Tech” cell presents the heterogeneity across technological levels measured by the number of authorization letter of patent application per capita. In the x-axis, “New legislations” represents the variable of $Legislation^N$, and “Older legislations” the $Legislation^O$. We divide the samples into the low (Low) group, the middle (Mid) group and the high (High) group based on tri-sectional quantiles for each of the heterogeneity dimension. For example, in the GDP cell, if a province's GDP is higher than the second tri-sectional quantile, it falls into a high GDP group, and falls into a low group if its GDP is lower than the first tri-sectional quantile. In all regressions, controls variables, province fixed effects, and year fixed effects are all included. The detailed results of heterogeneity analysis are displayed in Appendix Tables A2-A4.

Acknowledgments

This research is supported by the Natural Science Foundation of China (grant No. 71973008).

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ecolecon.2022.107592>.

References

- Anderson, D.M., Brown, R., Charles, K.K., Rees, D.I., 2020. Occupational licensing and maternal health: evidence from early midwifery Laws. *J. Polit. Econ.* 128, 4337–4383.
- Arellano, M., 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Rev. Econ. Stud.* 58.
- Ashby, E., 1978. Alternatives to growth-economy. *Nature* 273, 475–476.
- Bagstad, K.J., Shammin, M.R., 2012. Can the genuine progress indicator better inform sustainable regional progress? - A case study for Northeast Ohio. *Ecol. Indic.* 18, 330–341.
- Balestra, P.N., Nerlove, M.L., 1966. Pooling cross-section and time-series data in the estimation of a dynamic economic model: the demand for natural gas. *Econometrica* 34, 585–612.
- Bilir, L.K., 2014. Patent laws, product life-cycle lengths, and multinational activity. *Am. Econ. Rev.* 104, 1979–2013.
- Branstetter, L., Fisman, R., Foley, C.F., Saggi, K., 2011. Does intellectual property rights reform spur industrial development? *J. Int. Econ.* 83, 27–36.
- Cai, X., Lu, Y., Wu, M., Yu, L., 2016. Does environmental regulation drive away inbound foreign direct investment? Evidence from a quasi-natural experiment in China. *J. Dev. Econ.* 123, 73–85.
- Cantoni, D., Chen, Y., Yang, D.Y., Yuchtman, N., Zhang, Y.J., 2017. Curriculum and ideology. *J. Polit. Econ.* 125, 338–392.
- Chankrajang, T., Vechbanyongratana, J., 2021. Land, ladies, and the law: a case study on women's land rights and welfare in Southeast Asia in the nineteenth century dagger. *Aust. Econ. Hist. Rev.* 74, 138–163.
- Chen, Y.Y., Ebenstein, A., Greenstone, M., Li, H.B., 2013. Evidence on the impact of sustained exposure to air pollution on life expectancy from China's Huai River policy. *P. Natl. Acad. Sci. USA* 110, 12936–12941.
- Chetty, R., Looney, A., Kroft, K., 2009. Salience and taxation: theory and evidence. *Am. Econ. Rev.* 99, 1145–1177.
- Costanza, R., Erickson, J., Fligger, K., Adams, A., Adams, C., Altschuler, B., Balter, S., Fisher, B., Hike, J., Kelly, J., Kerr, T., McCauley, M., Montone, K., Rauch, M., Schmedeskamp, K., Saxton, D., Sparacino, L., Tusinski, W., Williams, L., 2004. Estimates of the Genuine Progress Indicator (GPI) for Vermont, Chittenden County and Burlington, from 1950 to 2000. *Ecol. Econ.* 51, 139–155.
- Costanza, R., Kubiszewski, I., Giovannini, E., Lovins, H., McGlade, J., Pickett, K.E., Ragnarsdóttir, K.V., Roberts, D., De Vogli, R., Wilkinson, R., 2014. Time to leave GDP behind. *Nature* 505, 283–285.
- Daly, H.E., 2014. From Uneconomic Growth to a Steady-State Economy. Edward Elgar Publishing.
- Daly, H.E., Cobb, J.B., 1989. For the Common Good: Redirecting the Economy toward Community, the Environment, and a Sustainable Future. Beacon Press.
- Degroot, D., Anchukaitis, K., Bauch, M., Burnham, J., Carnegie, F., Cui, J., de Luna, K., Guzowski, P., Hambrecht, G., Huhtamäki, H., Izdebski, A., Kleemann, K.,

- Moesswilde, E., Neupane, N., Newfield, T., Pei, Q., Xoplaki, E., Zappia, N., 2021. Towards a rigorous understanding of societal responses to climate change. *Nature* 591, 539–550.
- Dietz, T., Rosa, E.A., York, R., 2012. Environmentally efficient well-being: is there a Kuznets curve? *Appl. Geogr.* 32, 21–28.
- Easterlin, R.A., McVey, L.A., Switek, M., Sawangfa, O., Zweig, J.S., 2010. The happiness-income paradox revisited. *Proc. Natl. Acad. Sci. U. S. A.* 107, 22463–22468.
- Eskander, S.M.S.U., Fankhauser, S., 2020. Reduction in greenhouse gas emissions from national climate legislation. *Nature. Climate Change* 10, 750.
- Fox, M.J.V., Erickson, J.D., 2018. Genuine economic Progress in the United States: a fifty state study and comparative assessment. *Ecol. Econ.* 147, 29–35.
- Fox, M.J.V., Erickson, J.D., 2020. Design and meaning of the genuine progress indicator: a statistical analysis of the US fifty-state model. *Ecol. Econ.* 167.
- Gilbert, N., 2011. Local benefits: the seeds of an economy. *Nature* 474, S18–S19.
- Gray, J.S., 1998. Divorce-law changes, household bargaining, and married women's labor supply. *Am. Econ. Rev.* 88, 628–642.
- Heggeness, M.L., 2020. Improving child welfare in middle income countries: the unintended consequence of a pro-homemaker divorce law and wait time to divorce. *J. Dev. Econ.* 143.
- Howarth, R.B., Kennedy, K., 2016. Economic growth, inequality, and well-being. *Ecol. Econ.* 121, 231–236.
- Jorgenson, A.K., Dietz, T., 2015. Economic growth does not reduce the ecological intensity of human well-being. *Sustain. Sci.* 10, 149–156.
- Kassouri, Y., Altintas, H., 2020. Human well-being versus ecological footprint in MENA countries: a trade-off? *J. Environ. Manag.* 263, 110405.
- Kenny, D.C., Costanza, R., Dowdley, T., Jackson, N., Josol, J., Kubiszewski, I., Narulla, H., Sese, S., Sutanto, A., Thompson, J., 2019. Australia's genuine progress indicator revisited (1962–2013). *Ecol. Econ.* 158, 1–10.
- Kubiszewski, I., Costanza, R., Franco, C., Lawn, P., Talberth, J., Jackson, T., Aylmer, C., 2013. Beyond GDP: measuring and achieving global genuine progress. *Ecol. Econ.* 93, 57–68.
- Kubiszewski, I., Costanza, R., Gorko, N.E., Weisendorf, M.A., Carnes, A.W., Collins, C.E., Franco, C., Gehres, L.R., Knobloch, J.M., Matson, G.E., Schoepfer, J.D., 2015. Estimates of the Genuine Progress Indicator (GPI) for Oregon from 1960–2010 and recommendations for a comprehensive shareholder's report. *Ecol. Econ.* 119, 1–7.
- Law, Marc T., Marks, Mindy S., 2009. Effects of occupational licensing laws on minorities: evidence from the progressive era. *J. Law Econ.* 52, 351–366.
- Lawn, P., Clarke, M., 2010. The end of economic growth? A contracting threshold hypothesis. *Ecol. Econ.* 69, 2213–2223.
- Li, P., Lu, Y., Wang, J., 2016. Does flattening government improve economic performance? Evidence from China. *J. Dev. Econ.* 123, 18–37.
- Long, X.L., Ji, X., 2019. Economic growth quality, environmental sustainability, and social welfare in China - provincial assessment based on Genuine Progress Indicator (GPI). *Ecol. Econ.* 159, 157–176.
- Max-Neef, M., 1995. Economic growth and quality of life: a threshold hypothesis. *Ecol. Econ.* 15, 115–118.
- Moran, D.D., Wackernagel, M., Kitzes, J.A., Goldfinger, S.H., Boutaud, A., 2008. Measuring sustainable development — nation by nation. *Ecol. Econ.* 64, 470–474.
- Mundlak, Y., 1978. On the pooling of time series and cross section data. *Econometrica* 46, 69–85.
- O'Mahony, T., Escardo-Serra, P., Dufour, J., 2018. Revisiting ISEW valuation approaches: the case of Spain including the costs of energy depletion and of climate change. *Ecol. Econ.* 144, 292–303.
- Posner, S.M., Costanza, R., 2011. A summary of ISEW and GPI studies at multiple scales and new estimates for Baltimore City, Baltimore County, and the state of Maryland. *Ecol. Econ.* 70, 1972–1980.
- Santos-Fita, D., 2018. Subsistence hunting in rural communities: incompatibilities and opportunities within Mexican environmental legislation. *J. Ethnobiol.* 38, 356–371.
- Shindell, D., 2009. Protecting the environment can boost the economy. *Nature* 459, 321.
- Townshend, T., Fankhauser, S., Aybar, R., Collins, M., Landesman, T., Nachmany, M., Pavese, C., 2013. How national legislation can help to solve climate change. *Nat. Clim. Chang.* 3, 430–432.
- Walters, R., Westerhuis, D.S., 2013. Green crime and the role of environmental courts. *Crime Law Soc. Chang.* 59, 279–290.
- Wilkinson, R., Pickett, K., 2011. *The Spirit Level: Why Greater Equality Makes Societies Stronger*. Bloomsbury Publishing USA.
- Witbooi, E., Ali, K.-D., Santosa, M.A., Hurley, G., Husein, Y., Maharaj, S., Okafor-Yarwood, I., Quiroz, I.A., Salas, O., 2020. Organized crime in the fisheries sector threatens a sustainable ocean economy. *Nature* 588, 48–56.
- Zhang, S., Zhu, D., Shi, Q., Cheng, M., 2018. Which countries are more ecologically efficient in improving human well-being? An application of the index of ecological well-being performance. *Resour. Conserv. Recycl.* 129, 112–119.
- Zhang, Q., Yu, Z., Kong, D.M., 2019. The real effect of legal institutions: environmental courts and firm environmental protection expenditure. *J. Environ. Econ. Manag.* 98.