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The Value of a Valuation Perspective for Theorizing about Social Change and Climate Change: A Study on Carbon Pricing in China

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Abstract

This study combines three purposes: to advance a valuation perspective for theorizing about social change and climate change; to contribute to the general debate on pricing as the dominant policy to meet climate mitigation goals; to improve our understanding of potential decarbonization processes in China. We apply a valuation perspective to an in-depth case study of an emerging carbon market in Hubei Province in Central China. The study builds on original data collected during field trips to Hubei (2014, 2015) and additional documents covering recent developments in the Chinese carbon market. It shows how putting a price on carbon in China emerges as the outcome of a long-term cultural and institutional process in which China's high-carbon growth model is increasingly contested. We emphasize the work that was required before a carbon price could emerge as a market price, and focus on the uncertainty that needed to be overcome in the complex multi-level Chinese system. We suggest that China's introduction of low-carbon policies are a side effect of other political, economic and social pressures, and that it is largely facilitated because such policies are consistent with many other changes that are occurring simultaneously both in the Chinese context and globally.

Key words: climate change; social change; carbon pricing; China; decarbonization; valuation perspective

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Introduction: What Is It Good for?

Analyzing carbon pricing in China from a valuation perspective is a highly elucidating endeavor for several reasons. First, it can help theorize about social change and climate change. It offers ways to overcome sociology's deeply rooted realist–constructivist split and suggests new ways to deal with theoretical challenges posed by anthropogenic climate change (Antonio and Clark 2015). This study recommends analyzing valuation processes to show how society assigns value to climate protection. We will demonstrate that and how valuation is a key process through which meaning—economic, political, environmental, scientific meaning—is assigned to climate change. In this process, CO_2 is created as an asset, material production is organized, and societal responses to climate change become possible and even likely. The valuation perspective shows the processes through which climate change becomes a consequential social and material reality. We thus use a case study to theorize[1] about how society changes *with* climate, in ways more complex than deterministic or linear assumptions about the impacts of climate change *on* society would suggest.

Second, such a study can contribute to the general discussion on the *role of pricing* as a means of producing desirable outcomes, particularly with respect to carbon pricing as a trigger for low-carbon development (Aldy and Stavins 2012). Carbon markets have proliferated worldwide in the past ten years (Stephan and Lane 2015). Many powerful players argue that carbon pricing, particularly through the creation of carbon markets, is the most promising way to curb global carbon emissions and, in the long run, to develop a low-carbon society. In particular, economic sociology and valuation studies can enable critical reflection on these assumptions because they guide researchers' attention toward the complex societal prerequisites for pricing carbon and the often unexpected (side) effects of such processes. China is also a critical test case as a state-led economy in which central planning still plays an important role; at first glance, therefore, pricing through carbon markets seems like a surprising policy option.

Third, the theoretical perspective suggested in this study is helpful in analyzing the *societal dynamics underlying* decarbonization processes in high-emission contexts. This sociological study allows us to explore the ways in which the world's largest emitter of CO_2—China—is or is not moving toward low-carbon development (Tyfield and Urry 2009). This subject has extremely far-reaching implications for the likelihood of stabilizing greenhouse gas (GHG) concentrations at the level

[1] By theorizing we mean the creative practice of observing, naming, conceptualizing, building analogies and typologies, and developing a tentative theory suggesting an explanation (Swedberg 2016).

requested by the UN Framework Convention on Climate Change and its current amendments (UNFCCC 1992; UNCoP21 2015).

The goal of this study is thus threefold: to advance the valuation perspective for theorizing about social change and climate change; to contribute to the general debate on pricing as the dominant policy to meet climate mitigation goals; and to improve our understanding of potential decarbonization processes in China, today's world's largest single emitter of GHG. We apply a theoretical framework to an in-depth case study of an emerging carbon market in Hubei Province, and we discuss the wider research implications of this case study.

Theorizing about Social Change and Climate Change from a Valuation Perspective

Sociology and neighboring disciplines have developed a renewed interest in theorizing about the interconnections between human activities and the dynamics of the global climate system. This theorizing is motivated by the possibility that global climate change will have catastrophic impacts on vulnerable groups around the world and, in the long run, on the social fabric of life as we know it (Beck 2015; Dunlap and Brulle 2015). The most far-reaching assumptions about the interlocking of climate change and social change are found under the term "Anthropocene," which is meant to designate a new geological era in which the human species influences the vital dynamics of earth systems on a planetary scale (Hamilton et al. 2015). The French anthropologist and philosopher Bruno Latour has used the concept of the Anthropocene as a starting point for re-establishing political theory on new grounds (Gertenbach et al. 2016; Latour 2016). Others have suggested that the dominant interpretation of the Anthropocene needs to be challenged because it naturalizes nature and downplays social diversity (Lövbrand et al. 2015). The late sociologist Ulrich Beck suggested the concept of "metamorphosis" to describe the depth of the societal changes he observed and anticipated with regard to global ecological risks such as climate change (Beck 2015). He stated that such global risks violate fundamental values of human existence and that the recognition of these violations has caused an anthropological shock that enables wide-ranging social change. The changes that climate change would bring could be so deep that we must expect a metamorphosis: not just a change, but a change in the mechanisms of change. However, in his last book, Beck refrained from more concretely designating the forms of these changes or the directions they might take.

From a theoretical point of view, this approach remains unsatisfactory, particularly because the observation and anticipation of far-reaching deep changes is accompanied by the experience that many things simply stay the way they are. An agreement on global climate

targets obviously does not automatically lead to the implementation of these targets, and we are currently witnessing the persistence and inertia of societal structures, institutions and routines (Unruh 2000; Unruh and Carrillo-Hermosilla 2006; Bertram et al. 2015). The standard methods of economic production and consumption remain largely intact, and the rise of populist governments accompanies increasingly open denial of anthropogenic climate change among government officials and key administrations. Despite the fact that many new policy instruments have been implemented, many technological innovations have been introduced, and high levels of climate-friendly attitudes have developed, at least in some parts of society, the dominant growth model based on burning fossil fuels continues to create massive volumes of GHG emissions every year (UNEP 2016).

Climate change is a wicked social problem because there are no permanent fixes but rather continuous shifts and reframings (Grundmann 2016), and we only have very limited steering capacity over our complex, conflict-ridden globalized society (Urry 2003). So how can we account for the deep, ongoing changes that Beck referenced in his work while acknowledging that there is also immense structural inertia?

We think that approaching the problem of climate change from the theoretical perspective of valuation processes helps us understand and systematize this complex multi-level situation. The term "valuation perspective" is used here to delineate a body of work that addresses the overarching question of how the value of a thing is socially constituted. This theoretical perspective has a strong hold in economic sociology because it covers the basic question of how economic worth emerges in a world in which there is contingency in the value of products, considering that goods have no intrinsic value (Beckert and Aspers 2011). However, this question surpasses the economic sphere: valuation is performed in almost every sphere of social life (Helgesson and Muniesa 2013). Therefore, valuation is considered the basis for creating, maintaining, rearranging and changing social order (Lamont 2012; Stark 2011). A valuation perspective thus offers a way to analyze how the social world is constructed, why it develops in a particular way, and what its consequences are (Fourcade 2011).

We are currently witnessing a fundamental re-evaluation of the relationship between human beings and the earth's atmosphere. Whereas the atmosphere used to be a free-of-charge dump for human exhausts, it is increasingly acknowledged that it also functions as a priceless protective layer that maintains the earth's radiative budget within the range in which human life can flourish. This transformation of the atmosphere is an ongoing process that is multilevel and nonlinear. Although this transformation involves cultural change in the sense of new meanings and worldviews, it is also intimately linked to

the re-evaluation of "hard" economic aspects such as investments, costs and profits. Anthropogenic climate change is increasingly recognized as a risk factor that is caused by core economic activities and therefore requires the gradual buildup of a carbon-constrained business future. These processes of recognition involve extensive sense-making in complex multilevel societal settings (Weingart et al. 2000; Bäckstrand and Lövbrand 2006). One of the central questions in this assessment is how the social construction of climate change becomes a consequential social and material reality (MacKenzie 2009; Bansal and Knox-Hayes 2013). In the following paragraphs, we will show how we expect a valuation perspective to offer much-needed contributions to theorizing social change within the scenario of anthropogenic climate change. Even though the publications summarized here under the term "valuation perspective" do not necessarily form a single coherent body of literature, we believe that four aspects of the literature in this area describe these authors' common insights. We take them as helpful starting points for shedding more light on the metamorphoses that Ulrich Beck anticipated in the context of anthropogenic climate change. These four aspects are as follows: valuation involves long-term cultural and institutional processes; these processes are typically prone to conflict and contestation; a basic problem that must be overcome in valuation processes is fundamental uncertainty; and valuation does not occur automatically but is the outcome of work.

Valuation is a long-term cultural and institutional process

How do we come to assign values to things, persons, events, experiences and many other societal categories? From the valuation perspective applied here, no one would expect that an answer to this question could be found by referring only to individual preference formation. Several authors have shown that valuation involves cultural and institutional processes that often unfold over many decades. In her seminal work on the changing sentimental and economic value of children in the United States, Viviana Zelizer has shown that a multilayered process occurred in which the meaning of having children was redefined and re-categorized with respect to labor relations and family life. In this process, children were culturally transformed from an object of utility to an object of sentiment (Zelizer 1985). In the context of our own study, the valuation of the earth's protective atmospheric layer is of central importance. Marion Fourcade analyzed how over a period of more than three decades, people in both the U.S. and France attempted to establish procedures through which the value of nature could be monetarized to create a calculative basis for compensation for oil-spill damages (Fourcade 2011). She has demonstrated convincingly how cultural redefinitions of society's relationship to nature, scientific conceptions and institutional changes,

especially in the field of law, were combined to generate very specific solutions related to monetary compensation in the two countries. If we apply a valuation perspective to the earth's climate system, we must also consider the long-term, multilayered cultural and institutional process through which the international community came to acknowledge that a stable climate has high value for human society and should therefore be protected. From this perspective, we refer the changing cultural understandings of humankind's position in the universe to several interrelated aspects. Inter alia, photographic representations of the earth in space had deep cultural effects (Poole 2008); decades of negotiations led to the United Nations Framework Convention on Climate Change (UNFCCC) and subsequent agreements (Aykut et al. 2017); a broad spectrum of social movements built up around issues of climate change and development (McAdam 2017); and a plethora of policy instruments to mitigate climate change was developed at all imaginable levels of government and governance (Bäckstrand and Lövbrand 2015). In particular, we must consider the changing role that China has played in this long-term negotiation process. Over the years, China transformed from a low-income developing country that rejected any responsibility for climate change to a country that formally recognizes its responsibility as the world's largest single emitter of CO_2 to curb its carbon emissions in the mid-term future to contribute to the 2°C limitation goal that was adopted by the international community in the 2015 Paris Agreement. This long-term process will serve as the background narrative of our case study, and we will pose the question of how China came to adopt this proactive mitigation position during a process that also occurred over several decades.

Valuation processes are prone to conflict and contestation

Many authors have emphasized that there is never a single principle of valuation or a single social order that defines a single concept of worth (Lamont 2012), but instead that multiple "orders of worth" can usually be found (Boltanski and Thévenot 2006). These orders are often incommensurate, and they can be effective as competing principles even within a single organization (Stark 2009). Others have emphasized that these competing orders must be negotiated locally (Knoll 2013; Engels and Knoll 2014). Typical conflicts emerge in the process of assigning monetary values to hitherto non-monetarized spheres of society (Fourcade 2011; Lamont 2012). In the valuation process associated with climate change and climate mitigation policies, we have witnessed conflict and contestation of many core concepts that define both the problem and appropriate solutions. From the beginning, the basic idea of the climate system as a priceless but threatened entity has been contested by climate change denialists, and it is still contested in some communities (Dunlap 2013). Attempts to

develop a monetary estimation of the potential costs of climate change have been accompanied by protests over the suggestion that industrialized and non-industrialized lives should be assigned different monetary values (CIESIN 1995). The most pertinent conflicts have unfolded over the question of who should be responsible for paying for climate-related damage and bearing the cost of decarbonizing the economy. Several dimensions have served as lines of conflict (Hulme 2009), including North versus South, mitigation versus adaptation priorities, market-based policies versus other types of policies, and climate mitigation versus more pressing development goals. In the context of our own study, we are particularly interested in conflicts over the effectiveness and fairness of various carbon pricing mechanisms. In the past, numerous institutions have stated that transformation to a low-carbon society requires putting a price on carbon and mobilizing the financing of emission reductions. These institutions include governments, supranational entities, banks and other economic actors, and even environmental NGOs (non-governmental organizations) (e.g., World Bank[2] and the Carbon Pricing Leadership Coalition[3]) (EDF and IETA 2016; Lehmann 2015). This proposal is based on the assumption that although technological solutions to enable the transformation to a low-carbon development mode either are available or can soon be made available (Patt 2015), a financing problem impedes the implementation of these solutions (Aglietta et al. 2015). However, these market solutions have been heavily criticized, and they harbor the potential either to create perverse incentives or to bring about substantial negative side effects (MacKenzie 2009; Bansal and Knox-Hayes 2013; Ehrenstein and Muniesa 2013). Therefore, we will examine conflicts over alternative options for the valuation of climate change, CO_2, and a decarbonized future in our Chinese case study.

Valuation processes need to find solutions to fundamental uncertainties

The problem of fundamental uncertainty is key not only to our understanding of decision making in economic and non-economic situations but also to our understanding of valuation processes. There is neither an intrinsic value of objects nor a fixed societal order of preferences to which valuation can refer (Aspers and Beckert 2011). This notion relates to many aspects of the process. One example of uncertainty in valuation processes for market goods arises out of the fact that the quality of many objects cannot be known directly and is revealed only during their use. Alternatively, quality can be signaled by

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[2] http://www.worldbank.org/en/programs/pricing-carbon, accessed 10 October, 2016.

[3] http://www.carbonpricingleadership.org/, accessed 10 October, 2016.

the type of user—e.g., the good is also a status symbol. A plethora of mechanisms is typically created to provide potential buyers with indicators of a product's quality (Beckert and Musselin 2013). The problem, however, also refers more generally to the fundamental uncertainty of the future (Dequech 2003). People are creative, they do unexpected things, and for these and many other reasons the world can change dramatically within a short period of time, as can the basis for evaluating the worth of things. Therefore, one problem that must be solved in relation to valuation processes is the unstable expectations of the future that guide practices in the present, e.g., investment decisions. Various techniques involving prospection, visions and scenarios are used to overcome this problem (Andersson 2012; van Lente 2012; Tavory and Eliasoph 2013; Beckert 2016). These imagined futures are also contested, and there is an interesting process related to how such futures are coordinated between various actors, particularly in complex multilevel societal arrangements (Beckert 2016). The process is especially pertinent in the field of climate change (Hall 2016) and for translating the goal of decarbonization into investment opportunities (Ehrenstein and Muniesa 2013). We will apply this perspective to the complex multilevel situation in which carbon markets are created in China. Moreover, we will focus on how common visions of the future are created to stabilize future expectations, thus making carbon pricing possible.

Valuation is work

Valuation is not simply a readily available outcome; it requires extensive work (Vatin 2013; Helgesson and Muniesa 2014). In exploring the application of specific market or valuation devices (Callon et al. 2007; Kornberger et al. 2015), this is emphasized to an even greater extent. In the case of climate change, most obviously, the scientific work of thousands of researchers was necessary to establish that anthropogenic climate change poses a risk to societal well-being. In addition, when we look more closely at how value is assigned to specific "solutions," we see the work that is required. Because we are particularly interested in market solutions, we apply this valuation-as-work perspective to the process of "putting a price on carbon." The formulation evokes an image of someone attaching a price tag to a material object. In one sense, this image conveys an appropriate message because "putting" implies that pricing is "done" instead of miraculously emerging from a market. In other respects, however, the image of placing a price tag on an object is grossly misleading because it obscures the complex processes through which "carbon" is created as a tradable object that first must "be" before a price can be attached to it. Furthermore, the use of this image obscures the tremendous amount of work entailed in creating a market in the sense of developing an infrastructure (legal, technical, political, etc.) that allows

units of "carbon" to be traded between "market participants" (Levin and Espeland 2002). With respect to pricing, this is an important shift in perspective. The standard economic representation depicts pricing as the most efficient and cost-saving mechanism that can be used to achieve a certain outcome. By applying a valuation perspective to the process of pricing, the analysis highlights the major investment needed to make all of this possible (Levin and Espeland 2002; Callon et al. 2007; Beckert 2011). Once this is made clear, it is possible to compare it with the investments needed for alternative forms of valuation. This is of particular importance if we want to engage in a critical debate about different pathways to decarbonization. A valuation perspective will help us make these complex processes visible and in particular, to visualize the creation of a carbon market from scratch in China's centralized, state-led economic system. We will show how the actual pricing in such a market only becomes possible after many other types of work have been performed.

We will use these four insights into valuation processes to theorize about the relation of social change and climate change in China through the lens of a case study on carbon pricing in Hubei Province.

Conceptual Thoughts, Methodology and Data: Conducting Research on Carbon Pricing in China

Chinese society, with its specific political economy, differs in many respects from other regions of the world. We aim to identify the features of the Chinese system and the concrete processes that we must examine to open the black box of carbon pricing in the Chinese context. The topic is of central importance to global carbon-mitigation efforts. Because Chinese carbon emissions represent a very large portion of global carbon emissions, the price of carbon in China might become influential as a global reference price (Wang 2013). A great deal of theorizing about economic dynamics in China is taking place in relation to an emerging capitalist system, and we will briefly discuss the implications of this debate for our analysis and how we can apply valuation studies in this context.

Scholars around the world are fascinated by how within only a few decades, China's agrarian-based, communist-planned economy, which is controlled by the Communist Party, has been transformed into a "thriving market-oriented economy" (Walder 2014: 40), even though the long-term sustainability of its economic growth model has recently been called into question (Naughton 2014; Schnabl 2017). Beginning with the economic reform processes that occurred under Deng Xiaoping, the Communist Party implemented an export-oriented growth model and achieved two-digit growth rates throughout the late 1990s and mid-2000s (Naugthon 2014). Although the Chinese government officially depicts the Chinese economic system as a

socialist market economy in which central planning remains an important aspect of domestic development, many authors have discussed whether and to what extent China has already become a capitalist economy and what markets mean in its political economy (Fligstein and Zhang 2011; Meyer 2011; McNally 2013; ten Brink 2013). In coming to grips with this question, most authors have highlighted the continued role of the state and identified various concepts of capitalism, including coordinated capitalism (Fligstein and Zhang 2011), centrally managed capitalism (Lin 2011), state-permeated capitalism (ten Brink 2013) and state capitalism (McNally 2013). Others have analyzed the introduction of a capitalist-type accounting system in China (Chiapello and Ding 2005). More skeptical authors have argued that the Chinese system lacks the essential ingredients of capitalism given that state investments ("institutionalized GDP growth") still dominate entrepreneurial dynamics (Meyer 2011). However, others strongly dispute the idea that any coherent model fits the Chinese economy as a whole and propose the concept of internally variegated capitalism with strong regional heterogeneity (Mulvad 2015; Zhang and Peck 2016). Our aim, which is to analyze valuation processes by examining the pricing of carbon through carbon markets, does not require a conceptual decision about whether or not to categorize the Chinese system as a capitalist economy. However, two features that have been emphasized in the conceptual debates about China's political economy are important in the context of our study.

First, the state remains the backbone of China's economic dynamics and plays a strong enabling role. This refers both to the state's share of overall investments and to the guiding role of the Communist Party in establishing the institutional frameworks for market mechanisms. Given that they are promoted in the Chinese system, markets are often scientifically planned under the guidance of strong state institutions such as the National Development and Reform Commission (NDRC). The state thus remains a strong coordinating actor with heavy intervention, ownership and control in many areas (Fligstein and Zhang 2011; ten Brink 2013). Walder et al. plausibly argued that the continued strength of the Communist Party and the state's control over property rights have helped smooth the transition to a more market-like political economy and have been instrumental in preventing an economic recession (Walder et al. 2015). Consequently, economic reform and the introduction of market mechanisms occur in an incremental and selective manner (Overholt 2011), especially in our field of study. Most energy providers and heavy industries are still state-owned entities (SOEs). Even in listed firms, the state or a state-owned holding company is often a majority shareholder (Feinerman 2007; Ataçay 2016). Because the price of energy is subject to regulation, one cannot speak of strong market systems in a liberal

sense on either the production side or the consumption side of the energy system.

Second, even though the Chinese system remains authoritarian, there is room for policy experimentation, especially at the city and provincial levels (Raynard et al. 2013; Yi and Liu 2015; Young et al. 2015). This refers not only to how economic activities are organized into special economic zones but also to experimentation with various environmental policies such as the introduction of eco-cities or low-carbon cities (Khanna et al. 2014). This approach has been analyzed as an adaptive mode of governing in a complex multilevel system (Heilmann and Perry 2011; Noesselt 2014). Thus, this process takes the form of systematic interregional or interprovincial competition for support and attention from the central government (Xie 2016), whereas the outcome is "experimental heterogeneity" (Zhang and Peck 2016: 65).

We will see how this mechanism of policy experimentation through competition at the provincial level also plays out in the construction of carbon markets and the pricing of carbon. Beginning in 2013, the introduction of emission trading pilot schemes was allowed in seven cities and provinces: Beijing, Chongqing, Guangdong, Hubei, Shanghai, Shenzhen, and Tianjin. In our case study of Hubei Province, we will see how competition requires the provincial government to create a position for itself and how the creation of this position allows its pilot emissions trading system (ETS) to be acknowledged as a more successful experiment than other pilot systems.

This is an original research study of an ongoing process in a country in which in-depth studies in a number of societal and economic fields are known to be difficult to approach (Roy et al. 2001; Heimer and Thøgersen 2006). Other authors have discussed in detail the difficulties of field access (Lee and Zhang 2013), contextual and conceptual problems (Child and Marinova 2014; Rugman et al. 2016), and numerous questions regarding the reliability and quality of the available data.[4] We are aware of these pitfalls and have attempted to avoid them or, if they are unavoidable, to minimize their effects. Our own analysis is based on collaborative work on Chinese ETS; this work was conducted over a period of more than two years and includes 29 interviews conducted from 2014 to 2016 during field trips that lasted several weeks (see Appendix) and more than 50 documents in both English and Chinese from various actors who have been involved in or have commented on the emerging carbon markets in China and the wider field of energy policy. Typically, we either were not permitted to record the interviews or did not ask to record them to

[4] See, for example, "Strong China property data masks big problem: unsold homes" by Xiaoyi Shao and Clare Jim, BEIJING/HONG KONG. http://reut.rs/1SYjb9r, accessed 10 October, 2016.

avoid overcautious response behavior. Instead, we always attempted to conduct the interviews using teams of two or three people and to take extensive written notes throughout the interview. After each completed interview, the team met to compose a written document. Most interviews were conducted orally and in person; in a few cases, however, interviewees were re-contacted via email with follow-up questions. The documents in our database contain policy statements, market analyses, and several related types of reports. We combined our own data with an extensive literature review of recent social and policy changes in China. Our analysis was checked and tested in intensive debates between the research teams from Hamburg University and Wuhan University. A deeper understanding of the field was also gained during a three-month internship completed by the second author at a third-party verification organization, during which she visited different companies to verify China's reported CO_2 emissions data. Acknowledging that the acquisition of more extensive data would provide an even more reliable basis for our analysis, we remain convinced that our methodological approach ensured the generation of valuable and plausible answers to our research questions.

In the next section we will apply a Valuation Perspective to Carbon Pricing in Hubei Province. We start with considering the long-term process in which the growing international criticism of China's role as the world's largest emitter of CO_2 coalesced with domestic re-evaluations of the dominant economic growth model. This provides a background narrative for the second part of this work, in which we will present our main results showing how Hubei Province attempted to achieve carbon pricing through the creation of ETS. We will focus our analysis on the problem of uncertainty in this complex multilevel process and the enormous work that went into this pricing process.

Questioning the High-Carbon Growth Model as Part of the Long-Term and Conflictual Process of Redefining the Value of the Climate System

At least at the rhetorical level, China is undergoing a remarkable shift toward a new low-carbon growth model and a commitment to reduce its carbon emissions in absolute terms by 2030 (Li and Wang 2012). Economic growth in China was accompanied by a massive growth in CO_2 emissions that has transformed China into the world's largest emitter. However, China, along with other developing countries, shielded itself for many years against any binding reduction targets by invoking the historical responsibility that developed countries accumulated during their industrialization phases (Christoff 2010). UN negotiations were heavily influenced by a North–South framing, leading to agreements that provided financial support mechanisms for developing countries to at least experiment with low-carbon

development on a voluntary project-based level. The most important financial support mechanism, the Clean Development Mechanism (CDM), was founded upon a market-based concept, and China became the largest CDM recipient (Wang 2010). However, positioning itself as a developing country became increasingly more difficult with time: in approximately 2007, China became the world's largest single emitter.[5] Increasingly, China changed its negotiation position from that of a defensive developing country to that of a proactive global player. On the one hand, there was a great deal of pressure on China as it became obvious in all future scenarios that without substantial CO_2 reductions in this country, all attempts to achieve a global reduction sufficient to prevent dangerous levels of climate change would be in vain (Zeng et al. 2008). On the other hand, the perceived stalemate in the negotiations that occurred around 2009 (Aykut and Dahan 2015) also provided an opportunity to adopt a position that would grant China much more positive recognition as an emerging power. The Chinese government seized that opportunity to engage in a number of bilateral declarations with the US that expert commentators have called "game changers" for the negotiations (Adler 2014; Sinclair 2014). China surprised the negotiation community by placing a cap on absolute targets in its Intendent Nationally Determined Contributions (INDC) that were submitted in preparation for the Conference of the Parties (CoP) 21 in Paris in 2015. After Donald Trump was elected U.S. President, this move was even reinforced, as the U.S. is increasingly leaving a void in global leadership on climate protection that China is hastening to fill (Biesecker and Watt 2017; Zhao 2017). China also became involved in a World Bank initiative that supports the creation of carbon markets, and it received both initial funding and technical support from that initiative. The context of international climate negotiations thus provided both an opportunity and a pro-market framing of policy options.

Notwithstanding, we think that domestic factors lend even more plausibility to the question of why China has become a more active global player in climate negotiations. These factors have no direct connection to climate change; instead, they result from growing domestic pressure related to environmental, health, energy security and economic issues. In the past, the Chinese public has been exposed to a large number of severe health risks stemming from industrial accidents and environmental pollution (Young et al. 2015). In particular, problems with local air quality have become aggravated in the vast urban areas of East and Central China. Local air pollution is largely attributed to the operation of a large number of coal-fired power

[5] http://data.worldbank.org/indicator/EN.ATM.CO2E.PC, accessed 7 November, 2016. http://www.climateactiontracker.org/countries/china.html, accessed 7 November, 2016.

plants with low efficiency standards (IETA 2013) and to the transportation sector, with its ever-growing number of automobiles that consume gasoline. The public has become more outspoken on these issues. To an extent, members of the Chinese elite are leaving the country because of China's accumulating environmental and health problems, and thousands of active NGOs are addressing environmental matters in China (Nederveen Pieterse 2015). Unlimited pollution is seen as a direct threat to social peace and has seriously challenged the legitimacy of the ruling Chinese Communist Party (Li-Wen 2010). State agencies are continuously monitoring industrial processes for acute symptoms of environmental crises (Young et al. 2015). There is also growing opposition to the construction of a large number of new coal-fired power plants (Leung et al. 2014: 91). In addition, government actions have been motivated by energy security concerns. China's demand for oil cannot be met domestically, and the country's dependence on imported oil has become a major concern of the government (Leung et al. 2014). Therefore, China is experiencing domestic pressure to improve air quality and reduce energy security risks. The central government has reacted to these pressures by developing policies aimed at improving energy efficiency, conserving energy, investing in clean coal technology and replacing fossil fuels with renewable energy and nuclear energy (IETA 2013; Mathews and Tan 2014; interview NDRC 17 October, 2016). Health, environmental and energy security issues can all be viewed as side effects of the economic growth model. However, this growth model has also recently come under scrutiny for directly economic reasons as both external commentators and analysts of the highest political ranks in China have begun to question the country's economic sustainability in light of its overinvestment and financial fragility (Naughton 2014). Pressures unrelated to climate change are thus driving environmental and energy policies in a direction that also generates benefits in terms of either improved carbon intensity or reduced carbon dioxide emissions. The current growth model is being critically re-evaluated for numerous reasons, and an alternative growth model that also emphasizes strengthening the financial sector might be attractive to Chinese leaders (Kuhn 2016). Accordingly, the shift toward renewable energy and improved energy efficiency could also be part of China's global climate mitigation strategy, because it is completely consistent with (at least some) domestic priorities, although not primarily driven by concerns about climate change.

In facilitating this shift, the Chinese government uses a broad mix of policies and instruments (for an overview, see Sternfeld 2017). This mix ranges from the actual closing and even demolishing of heavily polluting factories to providing financial incentives and public funding for energy efficiency and energy conservation programs, accompanied by strong support for the rapid development of renewable energy

sources. Additionally, numerous market-style policies have been developed since the early 2000s. Furthermore, experts anticipate that a carbon tax may also be proposed in the next few years (Neslen 2017). Therefore, as part of a wide variety of policies, market-style instruments have long been present (Shin 2013; Engels et al. 2015). Making use of market-style policies in the fields of environment and energy is thus at least not at odds with the overall reform process or the broader institutional framework. Introducing ETS along with various non-market policy approaches and allowing various provinces to experiment in a competitive setting is indicative of the typical approach of adaptive governance that we mentioned in the Section Conceptual Thoughts, Methodology and Data. From the valuation perspective, we gain a non-instrumental understanding of carbon pricing: the links between the priceless worth of the climate system and the monetary value of (avoided) carbon emissions is far from straightforward; pricing and market instruments are not simply a solution to the climate problem but are connected by multiple links to all kinds of other societal problems. Through this contested process in a multilevel setting, the market form is now available as a means of dealing with carbon emissions; however, it is not obvious which form of control will emerge from China's carbon pricing activities and carbon markets.

How is Carbon Pricing Achieved in the Hubei ETS Pilot?

"Putting a price on carbon is considered a crucial step for China's endeavor to harness market forces to reduce its energy consumption and carbon emissions and genuinely transform into a low-carbon economy" (Zhang 2015a: S5). This claim is often repeated and has been adopted by many proponents of a carbon market (Lo and Yu 2015). How, though, is a price actually put on carbon? More precisely, which problems need to be solved (Fourcade 2011) and what work is required (Levin and Espeland 2002) before a monetary value can be assigned to an allowance for 1 metric ton of CO_2 emissions? What is required for this assigned monetary value to emerge as a market price? In the Chinese context, as discussed in the preceding section, obtaining answers to these questions involves an enormous multilevel coordination task, reflecting fundamental uncertainties for all involved actors in a fluid economic and political environment (Beckert 2016). One fundamental uncertainty concerns future economic development itself and how the reform process will frame the future space for economic action in China (Naughton 2014). Especially in the context of emission targets, questions emerge regarding how economic growth can be reconciled with low-carbon strategies and how the Chinese government can strike a balance between these potentially conflicting

goals in practice (Liu et al. 2013). Another major source of uncertainty for the seven ETS pilots stems from the complex relationship between the central government and the provincial governments, where competition among pilot schemes is encouraged. The outcome of this competition has been the development of an enormous variety of designs in the early phase (Yotzo and Löschel 2014) and the provision of incentives to deliver the best-functioning ETS pilot that will serve as a model for the nationwide scheme, thus preventing the need for substantial rearrangements at the provincial level following the introduction of the national ETS.[6] Nevertheless, uncertainties abound not only for those who create the ETS and choose its design features but also for those who are actors *in* the future ETS, i.e., companies whose participation in the ETS is defined as mandatory and other future market participants such as (financial) service providers and investors. Finally, one major source of uncertainty that might be even more pertinent in China than in countries with a current ETS relates to a basic data problem and the credibility of the reported emission data. Knowledge of the volumes and origins of CO_2 emissions is essential to constructing an effective ETS and monitoring emission outcomes; however, it has been reported that the CO_2 data in China are chronically flawed (Guan et al. 2012; Wang 2013; Korsbakken et al. 2016).

To overcome this multilayered set of fundamental uncertainties, it is extremely important to build and stabilize expectations. We will now look in more detail at how imagined futures (Beckert 2016) were coordinated at various levels in the valuation process and how the valuation process involved conflicting conceptions of long-term economic development.

"Ecological civilization" and the "low-carbon economy" as reference points for central planning

Central planning still occupies a pivotal place in China's economy. In particular, China's five-year plan (5YP) is the most important instrument for setting priorities and providing an orientation to and guidelines for economic development. Within this plan at the level of general priority setting, various concepts are introduced to define the models of growth and development that China should strive to create. The importance of concepts such as a "harmonious society" and the "Chinese dream" lies not in any direct programming of decision challenges. Most importantly these concepts are empty signifiers that serve to ensure the pragmatic resilience of the Chinese one-party system (Noesselt 2015). Together with the concept of a "low-carbon economy," the concept of "ecological civilization" was introduced by the 17th Party Congress in 2007. The latter concept is used to

[6] Interview economist, Wuhan University, 24 September, 2015.

harmonize ecological and economic goals and thus serves at the ideational level as a visible indicator of China's shift to a more sustainable growth model. Chinese commentators relate ecological civilization closely to a new "green growth" or low-carbon development model (Zhang et al. 2011; Wang et al. 2013). At a more concrete level, the 5YP also sets specific targets for production and investment in renewable energy, energy efficiency, carbon efficiency and even carbon reductions for each province (Engels et al. 2015). Moreover, the twelfth 5YP (2011–2015) includes the task of introducing a pilot carbon ETS, and the thirteenth 5YP (2016–2020) includes the introduction of a national ETS. Carbon reduction goals and reliance on the ETS as a way to achieve them have thus been firmly established in the central planning process. We suggest interpreting the effect of these concepts in the planning process as top-down attempts to provide a general future orientation. In terms of valuation processes, the 5YP is important in creating a vision of an alternative low-carbon growth model for China insofar as it provides a broader temporal landscape (Tavory and Eliasoph 2013). The concept of "ecological civilization" recognizes the need to balance two conflicting orders of worth: economic growth versus environmental integrity and the country's beauty.

Creation of a carbon market vision for Hubei Province

When the seven pilot schemes were chosen, most observers expected two or three of them to become the most influential, perhaps with Beijing as the capital, Shanghai as the most vibrant economic zone, and Shenzhen as the first special economic zone. Hubei Province is situated in Central China, a region of moderate growth and average problems. The Provincial Development and Reform Commission (PDRC), the administrative body that is responsible for implementing the ETS, therefore was obligated to position the Hubei ETS against the backdrop of other pilots that were perceived as superior. In the pilot phase, the "average" argument was used as a starting point. As one interviewee put it, Hubei was the only ETS pilot in Central China. It had an average industrial structure, an average growth rate, and average carbon emission challenges. The Hubei experience was therefore crucial for the building of a national ETS. If ETS could work in Hubei, it would work in China.[7] However, this averageness was only a starting point. Slowly but surely, the PDRC and other actors began to discuss Hubei's goal of becoming the future hub of China's national carbon market. The China Hubei Carbon Exchange (CHEEX), which was launched in 2014, is a state-owned company with a staff of approximately 40 people and is situated in the central business district of the provincial capital of Wuhan. CHEEX

[7] Interview, economist, Wuhan University, 24 November, 2015.

established an electronic trading platform on which trades can be publicly observed in real time.[8] Additionally, it provided a registry, a necessary component for the transfer of allowances from one account to another. The provincial government had created a vision of its future as the central trading place for the nationwide carbon market. This vision included numerous coordination tasks, including supporting carbon markets in other provinces through training and technical support, supervising certifiers, creating a national carbon finance center in which all financial, organizational and technical services are located, introducing new financial instruments, and initiating carbon futures trading.[9] The vision culminated in a picture of the future central building in Wuhan, where all elements of the carbon markets and carbon finance, including the flow of money, information and services, would be concentrated.[10] To support this vision, several carbon finance instruments had already been created,[11] and representatives of CHEEX were actively looking for foreign service providers to offer their business in Hubei.

Making trading smooth and liquid

When the seven ETS pilots were launched in 2014, huge differences among them became apparent in terms of both trading activities and trading frequency and volume. Shenzhen, for example, reported a high trading volume but had few continuous trades over time. Chongqing, the only ETS pilot in West China, seemed to have a general problem of over-allocation, resulting in a lack of trades. Guangdong required companies covered by the ETS to purchase allowances at a set price of 60 yuan, which is strangely at odds with even basic market principles (Zhang 2015b: S114). In contrast, Hubei prided itself on achieving a liquid market in which allowances were traded with continuous frequency at a relatively stable price; this proved successful from the start.[12] This was achieved through a combination of incentives that included both sticks (to emitters) and carrots (to investors). Achieving active trading behavior in a newly created ETS is not always easy because the emitters' only legal obligation is to return a sufficient amount of carbon allowances at the end of a commitment period.

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[8] http://www.hbets.cn, accessed 7 April, 2017.

[9] Interviews GIZ 2 April, 2014; CHEEX 23 November, 2015; MDRC 3 April, 2014.

[10] Interviews CHEEX 23 November, 2015; CHEEX 26 November, 2015.

[11] "The first allowance futures contracts were traded in the Hubei pilot on March 31 [2016], promoting the diversification of carbon market derivatives and contributing to financial innovation in emissions allowances. The new product is expected to stimulate market liquidity and investment in the Hubei pilot" (PMR 2016: 6).

[12] Interviews CHEEX 23 November, 2015; economist, Wuhan University 24 September, 2015.

Whether or not the emitters engage in trading activity to get to the correct number of allowances is, in theory, left to their own discretion. In the first trading year, the Hubei ETS covered 138 enterprises. To many of these enterprises, the ETS was a new and unknown instrument that was perceived as yet another burden imposed by the government.[13] Other enterprises did not believe that the problem of emission allowances would be relevant to their production and investment decisions. Consequently, the ETS was initially considered a low-priority issue by top management.[14] Some initial training was provided, e.g., by the PDRC in collaboration with the CHEEX and development agencies,[15] but willingness initially remained low, not unlike the situation with companies in the EU ETS during the initial trading period (Engels 2009). The provincial government thus created a heavy stick for covered companies that consisted of several instruments. Although the initial allocation of allowances to companies was free, the government created short positions for some large emitters. The government avoided total over-allocation so that numerous companies would experience demand for additional allowances at the end of the compliance year. Financial sanctions for non-compliance were introduced; a company with an insufficient number of allowances at the end of the compliance year would be fined in an amount triple the carbon price. The non-compliant company would also experience a further allowance cut for the following year. In addition, it would not receive access to funding schemes for energy conservation projects.[16] Using these methods, the government ensured that many companies traded at least once at the end of the compliance year. Many companies were surprised by the costs that they incurred.[17] The impression shared by several interviewees was that emitters paid more attention to the requirements the next trading year. In many cases, the ETS issue had moved to the top management ranks.[18] However, trading only once at the end of a compliance period does not create a "liquid market." Therefore, the PDRC and CHEEX created incentives for other investors. As the first ETS pilot, Hubei allowed both institutional and individual investors to

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[13] Interviews car manufacturing company 2 April, 2014; steel company 24 November, 2015.

[14] Interview economist, Wuhan University 24 November, 2015.

[15] Interviews GIZ 7 March, 2014; car manufacturing company 2 April, 2014; CHEEX 23 November, 2015.

[16] Interviews CHEEX 23 November, 2015; CHEEX 26 November, 2015.

[17] Interview CHCI for ETS 26 November, 2015.

[18] Interviews CHEEX 26 November, 2015; economist, Wuhan University, 24 September, 2015.

trade allowances at the CHEEX.[19] This widened the field of market participants beyond emitters, opening a secondary market. More than 1000 investors were mobilized to trade allowances at CHEEX.[20] These investors engaged in daily trading transactions, although each individual transfer may not have represented a high volume. Following the example of the Hubei ETS, the inclusion of investors was soon adopted by other ETS pilots. Hubei also allowed participation by individual and institutional investors from overseas, a practice that otherwise existed only in the Shenzhen ETS (Environomist 2016: 58–59).

Appearing market-like in market reports and market outlooks

Creating a coordinated vision for the future of Hubei as a hub of the Chinese carbon market also requires that this vision be recognized by important others in addition to immediate market participants. Therefore, marking the Hubei ETS as widely known and increasing its recognition is another aspect of the valuation process. Interviewees often referred to the public attention that they received, e.g., by emphasizing that the opening of the CHEEX received national news coverage or by categorizing its opening as one of the top ten economic events of 2014 in Hubei Province.[21] One particularly consequential type of recognition came from market analysts. The number of market analysts observing carbon markets has increased substantially over the years both in China and internationally, and many of the institutions with which these analysts are associated regularly publish market outlook reports. These institutions and reports include the International Emissions Trading Association (IETA), several units of the World Bank Group, carbon service consultants such as the Environomist, Econet China, and the China Carbon Forum, and the weekly magazine *The Economist*.[22] In a comparison of market reports issued in 2013 and those issued in 2015 and 2016, the growing recognition of the Hubei ETS pilot became apparent. The early assessments merely mentioned Hubei, which is a province of almost 60 million inhabitants in Central China, and they focused on the fact that seven ETS pilots were about to be launched. These assessments raised a number of critical points that would have to be addressed. The outlooks ranged from careful to skeptical, for example, with regard to

[19] Interview CHEEX 23 November, 2015.

[20] Interviews CHEEX 23 November, 2015 and 26 November, 2015.

[21] Interviews CHEEX 23 November, 2015; economist, Wuhan University 24 September, 2015.

[22] It would be an interesting study to examine how these market reports refer to each other and how they use several types of "evidence," "best guesses" and expert translations of documents from Mandarin into English to achieve shared sense-making of the emerging Chinese carbon markets.

the potential for a secondary market to emerge: "… realistically speaking, Chinese ETS pilots will not allow futures or derivatives during the pilot phase" (IETA 2013: 47). The general tone of these early reports was that delays and problems were to be expected: "[a] couple of pilots may fail to meet the deadline this year" (IETA 2013: 45). The early reports sometimes directly mentioned Hubei as a comparatively weak pilot. For example, the China Carbon Pricing Survey 2013 expected a delayed start in Tianjin, Hubei and Chongqing and the second-lowest allowance price in Hubei (Jotzo et al. 2013: 5). In its overall rather negative assessment of ETS pilots in China, *The Economist*'s Intelligence Unit reasoned that "Guangdong and Shanghai are main contenders to house a national hub," whereas Hubei was not mentioned at all (*The Economist* Intelligence Unit 2013: 2). This outlook changed considerably within two years; market outlooks published in 2015 and 2016 have acknowledged and commented on the strong development of the Hubei ETS. Although it did not systematically analyze differences across the seven ETS pilots, the China Carbon Forum positively acknowledged the Hubei ETS in its China Carbon Pricing Survey 2015 (de Boer et al. 2015: 9). The most extensive recognition of the extent to which the Hubei ETS already resembled a market-like ETS can be found in a 180-page report published by the Environomist, a carbon consulting company, in 2016. In a systematic comparison of the seven ETS pilots, it was first mentioned that the "most stable carbon markets were the Hubei and Shenzhen ETSs, and Hubei has the largest domestic market, with a market share that accounts for approximately 43% of the national total" (Environomist 2016: 60). As became clear later in the report, "stability" referred to a relatively high trading volume, low volatility of the carbon price, and frequent trading activity (Environomist 2016: 71). The report assembled comments from various consulting firms and the United Nations Development Program (UNDP). The latter was quoted as commenting at length on Hubei and explaining the relevance of Hubei's success:

> Interestingly, it is Hubei, ranking the lowest in economic terms (GDP per capita around US$7675 in 2014) among the seven, but therefore a region with further growth potential, that has actually realized the highest absolute trading volume at 1.6 million tons, which is more than 6 times the scale of other pilots. The success may owe to the active participation of firms, which with the help of clean technology become progressive credit sellers in the market given the surplus of allowances left from the credits initially allocated for free. The success in delivering strong trading demonstrates the feasibility of implementing carbon trading in less developed but growing countries, particularly when the economy faces a healthier restructuring towards low-carbon growth. (Environomist 2016: 89/90; comment by UNDP)

The Hubei pilot was also featured prominently when the aspects of carbon markets that are most market-like were discussed. For example, some allowances were allocated by auction (ibid.: 148), and Hubei hurried to introduce carbon bonds, carbon investment funds, carbon emissions mortgage financing, and other novel carbon finance instruments (ibid.: 123). Finally, the summary assessment of a Dutch carbon service provider was quoted: "In the past year, we have seen a good development in trading in the seven pilot areas. A few markets are now looking fairly mature (for instance, Shanghai, Guangdong and Hubei)" (Environomist 2016: 167). This view was shared in other reports: "Since January 2016, Shenzhen has become the most active pilot market (36% of the total trading volume), followed by Hubei (34%). […] Hubei was the only pilot to have transactions every day (i.e., it did not close during the Spring Festival)" (PMR 2016: 1, 6). The Hubei vision of a strong and well-functioning carbon market was increasingly recognized by market analysts around the world, and the proven feasibility of ETS in China in general and in Hubei in particular provided another important building block for global policy debates on how best to achieve decarbonization.

Putting an actual price on carbon in the Hubei ETS

The risk of generating a carbon price that is too low to incentivize effectively low-carbon investments was widely discussed in the early phases of the Chinese ETS pilot.[23] However, fears among regulated emitters typically included the possibility that market prices could become too high and threaten their economic viability. Although provincial governments might want a well-functioning ETS, they would not be willing to put their major industries at risk. Consequently, the provincial government needed to avoid a low price that would be meaningless and, thus, a failure. Similarly, price turbulence was unwanted, and an excessively high price would harm Hubei companies that had already begun to suffer from slowing economic growth. The ideal ETS was perceived as one that created a stable business environment for companies in which expectations about future price developments could be built and become reliable.[24] Therefore, the achievement of a CO_2 allowance price falling somewhere between worthlessness and cost containment that remained stable over time became a goal in itself. The PDRC worked toward this goal by orchestrating an integrative consultation process aimed at finding the "right" carbon price and assessing ways of reliably

[23] Interviews GIZ 21 September, 2015; CHEEX 26 November, 2015.

[24] Interviews economist, Wuhan University 24 September, 2015; CHEEX 26 November, 2015.

achieving this price.[25] Whereas 70 percent of the allowances were initially allocated at no cost to the emitters, an auction of 30 percent of the remaining reserve at a set price was organized.[26] The aim of the consultation process was to formulate a price that would signal to market players where the government thought the price *should* be. The consultation process involved the PDRC, CHEEX, foreign experts and several Wuhan-based research institutions. Numerous valuation devices were used, including forecasting exercises on energy demand, general equilibrium models to identify an optimal price for the Hubei market, and careful observation and monitoring of EU price development as well as of price developments in other Chinese ETS pilots. Several interviewees recalled that the price of 20 yuan (a little less than 3 euros at that time) was considered a psychological barrier that should not be crossed, because a lower price would signal that the ETS did not play a meaningful role in the provincial development plans. In addition to this floor price, a cost limit for the covered companies was created.[27] In sum, we suggest interpreting the process of actual price-making as a state-led, scientized consultation process that resulted in a floor price of 20 yuan. The aim was to generate a "rational" price and achieve moderate price increases over time.[28] An auction price of 20 yuan was below the already-low EU ETS price. Nevertheless, in the Chinese context, it was not meaningless. The price increased moderately until mid-2016 without displaying strong volatility. Although some interviewees claimed that companies began to invest in technological improvements during the second compliance year, it is beyond the scope of this article to verify that claim. However, in the second half of 2016, the carbon price dropped substantially below 20 yuan (ChinaCarbonNet 2017), although the trading volumes and frequencies remained high. It now seems that despite great state coordination, it was not possible to create a situation in which the market could establish a higher price over a sustained time period.

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[25] Interviews economist, Wuhan University 23 September, 2015; CHCI for ETS 26 November, 2015.

[26] Interviews economist, Wuhan University 23 September, 2015; CHEEX 11 May, 2016.

[27] Interviews CHEEX 23November, 2015; economist, Wuhan University 24 November, 2015.

[28] Interviews economist, Wuhan University 24 November, 2015; CHCI for ETS 26 November, 2015.

Pricing carbon at the company level?

Officially, the Hubei ETS led to emission reductions of 3.14 percent from 2013.[29] Differentiated by companies and sectors, most of the companies and six of the nine industries reduced their emissions in absolute numbers.[30] In an interview with one of the large emitters, this success story was placed in perspective. The company's allocation of emission allowances represented a 10 percent reduction goal, which initially seemed to require the purchase of additional allowances. However, this goal later proved so easy to achieve that some allowances could be sold on the market. The interviewees acknowledged that 95 percent of the "achieved" reduction came automatically from the slowing economy and a related drop in demand and was not linked to any low-carbon activities. The remaining small fraction of "reduced" emissions came from energy conservation measures. Interviewees associated with a different state-owned company explained that the initial reluctance to begin trading allowances slowly gave way to an acceptance of the trading instrument. The switch was explained not by referring to any calculation based on the monetary value of the allowances but by the moral obligation for state-owned companies to follow state-issued policies. In the interview, active participation in the ETS pilot was compared to the concept of Corporate Social Responsibility (CSR), which was interpreted as an act of alignment with political requirements.[31] Allowance trading was thus interpreted as a political activity, not as a monetary alternative to it. We would like to use this last example to demonstrate that even if carbon market participants deal with a seemingly clear monetary value, they might combine it with alternative valuation options.[32] It may be that the process of "putting a price on carbon" can be shown in later studies to combine monetary and non-monetary valuation aspects in ways that are usually overlooked by market theorists.

Summary of Case Study Results

To address the question of how carbon pricing was achieved in the Hubei ETS, we analyzed the carbon valuation process as an enormous coordinative effort within a complex and fluid multilayer system. To become recognized as a potential prototype for the future nationwide carbon market, market builders had to find ways to manage the many uncertainties that emerged from Chinese politics, economic

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[29] Interviews CHEEX 23 November, 2015; CHEEX 26 November, 2015; economist, Wuhan University 24 November, 2015.

[30] Interview CHEEX 23 November, 2015.

[31] Interview steel company 24 November, 2015.

[32] For a similar argument on the EU ETS, see Knoll 2015.

development, and competition among the seven ETS pilots. We conclude that both central and provincial governments played an important role in all aspects of the valuation process. Central government provided the broader framework and established low-carbon growth as a fixed reference point in central planning. The provincial government was critical to the stabilization of a coordinated imagined future by creating a strong vision of Hubei's future role as a hub of the national carbon market. By applying a broad set of sanctions and incentives, it successfully promoted smooth and frequent trading activity. The Hubei ETS thus succeeded in being market-like, an observation that was increasingly shared by carbon market analysts. The price of carbon in the Hubei ETS was established via a state-led, scientific consultation that generated a reference price that provided an orientation signal to market participants which indicated where the government wanted the price to be. Putting a price on carbon therefore represents the outcome of a long and complex process of valuation *through* expectation building, and recent developments show that even with this state-led process, it is not guaranteed that the price will remain high enough to be effective over longer time periods.

However, the Chinese approach to low-carbon growth does not rely exclusively on carbon pricing through ETS. Instead, it combines a heterogeneous group of alternative policies, including subsidies and state investment, the closing down of factories and power plants, voluntary programs for low-carbon cities and similar concepts, and consideration of the introduction of a carbon tax. This broad experimental approach has become typical of the Chinese mode of adaptive governance (Heilmann and Perry 2011), in which carbon markets are introduced in a pragmatic way.

Discussion: The Value of a Valuation Perspective for Theorizing about Society and Climate Change

In this research study, we presented a case study on carbon pricing in a province in Central China that would contribute to three broader issues: theorizing about society and climate change by applying a valuation perspective; contributing to the debate on policy choices for carbon mitigation; and understanding how and to what extent China is switching to a decarbonized future. We will briefly discuss the implications of our analysis for these three questions.

Adoption of the valuation perspective helped us theorize about the interactions between climate change and social change without buying into deterministic assumptions about the impact of climate change on society. In many instances social change does not occur as a direct reaction or response to climate change but rather indirectly, or in reaction to completely different social dynamics. We have shown the

beginning of a re-evaluation of the Chinese growth model not because of, but in the context of international climate negotiations and in combination with growing domestic crises. New values such as ecological civilization were proposed to harmonize the conflicting orders of economic growth and ecological integrity. In a very complex multilevel setting, this was gradually translated into a national climate mitigation policy that included the creation of competing carbon markets in seven Chinese provinces and cities. The introduction of the ETS in China thus created a specific and very indirect society–climate relationship that produced a consequential social and material reality. New investment opportunities emerged, and new business pressures were established. These valuation processes require a great deal of work and coordinative effort in complex multilayer settings in which uncertainties abound. They are historically contingent, long-term processes, and their outcomes are difficult to predict. In the case of the Hubei ETS, even the greatest amount of work and the most coherent creation of an imagined future could not secure the long-term stability of the carbon price. Furthermore, although the UN's recognition of anthropogenic climate change as a major threat to humankind represents a fundamental shift in the valuation of the earth and its atmosphere, this does not translate easily into coherent changes at all other levels of society. Coming back to Beck's concept of metamorphosis, we can suggest a few of the mechanisms of change that shape the interactions of social change and climate change in the Chinese context. First and foremost, we have seen the efforts of the Chinese government to maintain political stability and therefore to engage in air pollution control. Second, the development of ETS and financial market instruments for low-carbon measures can be seen as one aspect of the wider process of developing and strengthening a financial market in China. And third, the specific form of the Hubei carbon market is the outcome of a politically induced competition between different levels of government and among the seven participating pilot regions, which is a typical way to govern difficult problems in the Chinese political system. None of these examples represents a change in the mechanisms of change (Beck 2015), but they can still open windows for deep transformation. In this sense, the valuation perspective helps us understand how the anticipation of deep change can be completely in accordance with the experience that many things stay the way they are, at least for a long time.

We also contribute to the discussion of policy choices for climate mitigation and the preponderance of carbon pricing initiatives therein. The valuation perspective allows us to closely examine both the actual process of "putting a price on carbon" and the work that is needed before carbon prices can emerge as the outcomes of markets. This perspective provides an understanding of carbon pricing initiatives and carbon markets as real-world phenomena that differ from the cleaner

versions addressed in most of the economic literature. In the case of the Hubei ETS, we have seen how economic actors had to combine the search for profit opportunities with a carefully crafted reaction to political goals declared by the Communist Party through a centralized multilevel government system. We were able to show that the role of the state was crucial to each step of this valuation process. Carbon pricing is essentially a political game and, at least in the Chinese context, ultimately depends on the strictness of the central and the provincial governments in implementing short positions and controlling compliance. One might feel tempted to explain this failure simply by a lack of market forces in the Chinese economic system. However, the experience of the real-world ETS in the European Union has demonstrated that the effectiveness of carbon markets strongly depends on the stable expectation among emitters that the prices for carbon allowances will be higher in the future than in the present, which is essentially an expectation about future carbon policies. The European Union is very different from the Chinese system in many respects, but it is an equally complex multilevel setting that thus far has failed to create a situation in which the resulting carbon price reflects the value of the atmosphere as a protective (and to-be-protected) layer of the earth. More fundamental opposition to carbon pricing and carbon markets has been expressed (Pearse and Böhm 2014). However, we believe that the valuation perspective allows us to recognize that at its core, carbon pricing is a political process of conflict and contestation over the value of established versus alternative growth models. If we keep this in mind, we can overcome the trap of discussing "elegant" market solutions against other, seemingly "clumsier" policy solutions. Climate change is a wicked social problem, and all policies aimed at promoting low-carbon development have problematic aspects. We can then engage in a much more fruitful debate on how each of these policies would have to be designed to be more effective (Patt 2015; Aglietta et al. 2015; Martin et al. 2015; Aykut 2016).

Finally, we contribute to understanding the process of how China is switching to a low-carbon growth model, even if it is too early to estimate whether, how much, and at what pace this process will lead to substantial decarbonization. The valuation perspective prevents us from making sweeping assumptions about the functioning of carbon markets and the linkage between carbon pricing and (de)carbonization outcomes. The manner in which value is produced and appropriated by various actors in the ETS is extremely diffuse. Against that backdrop, the most important insight generated in this case study is that the reasons for China to even consider transforming its energy system are not closely connected to climate change. This consideration instead occurs as a side effect of other political, economic and social pressures. The introduction of low-carbon policies is largely facilitated

because such policies are consistent with many other changes that are occurring simultaneously both in the Chinese context and globally. This is an important lesson that can also be learned from other recent studies (e.g., Anbumozhi et al. 2015). Even though climate scientists and activists may define anthropogenic climate change as the most important human problem, the social reality always consists of numerous other (more) important issues at the same time. Climate change never stands alone as the central social problem that has the ultimate long-term priority over all other issues. However, long-term and conflictual valuation processes can lead to new combinations and re-valuations so that suddenly a new (in this case, a low-carbon) direction becomes possible. This seemingly trivial insight is crucial both for understanding the linkages of climate change and social change and for finding ways to promote low-carbon transformations more effectively. The introduction of the ETS in China might have come as a side effect, but it may still generate decarbonization outcomes. In addition, the switch to a low-carbon growth model will only become a material reality if it aligns with many other priorities.

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Appendix: List of interviews

German Technical Cooperation GIZ, expert 1, technical cooperation, 3 March, 2014, Beijing
GIZ, expert 2, low-carbon policies, 7 March, 2014, Beijing
Greenpeace China, expert, climate policies, 7 March, 2014, Beijing
Wuhan University, lawyer, expert on ETS, 27 March, 2014, Wuhan
National Development and Reform Commission NDRC, expert 1, energy policies, 30 March, 2014, Kaifeng
Car manufacturing company, ETS manager, 2 April, 2014, Wuhan
GIZ, expert 3, ETS, 2 April, 2014, Wuhan
Municipal Development and Reform Commission MDRC, leading position in administration, low-carbon development, 3 April, 2014, Wuhan
NDRC, expert 1, energy policies, 7 April, 2014 (via Email)
Hubei Provincial Development and Reform Commission PDRC, leading position, power grids, 9 April, 2014, Wuhan
Hubei PDRC, leading manager, climate change, 9 April, 2014, Wuhan
China-EU Institute for Clean and Renewable Energy, leading manager, 10 April, 2014, Wuhan
China-EU Institute for Clean and Renewable Energy, engineer, 16 April, 2014, Wuhan
MDRC, leading position in administration, low-carbon development, 22 April, 2014
MDRC, leading position, energy department, 22 April, 2014
Germanwatch, ETS expert, 27 June, 2014, Bonn
GIZ, expert 3, ETS, 21 September, 2015, Beijing
Wuhan University, economist 1, 24 September, 2015, Wuhan
Climate Change and Energy Economics Study Center, Director, 24 September, 2015, Wuhan
GIZ, expert 1, technical cooperation, 7 October, 2015, Beijing
Social Science Research Council, China Environment and Health Initiative, expert, 8 October, 2015, Beijing
Solar manufacturing company, manager, 20 November, 2015
China Hubei Emission Exchange, manager, 23 November, 2015, Wuhan
Wuhan University, economist 1, 24 November, 2015, Wuhan
Steel company, manager, public relations, 24 November, 2015, Wuhan
Steel company, three managers, ETS and energy strategies, 24 November, 2015, Wuhan
Center of Hubei Cooperative Innovation (CHCI) for ETS, economist, 26 November, 2015, Wuhan
China Hubei Emission Exchange, top manager, 26 November, 2015, Wuhan
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