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FROM THE EDITOR

Sustainability?!

There is strongly voiced support for the concept of sustainability, despite a divergence of opinion on whether it is the natural stock of resources that is to be sustained, the cash flow from these resources, or whether it is a fixed or a relative level of production or consumption that is to be sustained ... and how to get there. Perhaps it is this diversity of opinion, together with the reality that every industry—be it insurance and reinsurance, animal husbandry, or car manufacturing—has its specific challenges to/from sustainability that fuel the growth of sustainability-specific journals. This issue, therefore, provides just a glimpse of sustainability for its multidisciplinary readership. The hope is that some of the journal's readership seeks overlap in the topics that populate sustainability-specific journals with their own scholarship.

This issue is possible by the generous support of Munich Re (Group), one of the world's leading providers of reinsurance, primary insurance, and insurance-related risk solutions. Munich Re is a founding signatory to the United Nations' Principles for Sustainable Insurance (<https://www.unepfi.org/psi/>). According to Munich Re, the firm's objective is to create value both for its investors and for society as a whole. Achieving this shared value objective, for Munich Re, involves systematically integrating sustainability criteria when striving for value in its core business, and applying a firm-wide Code of Conduct for responsible and sustainable decision-making in line with the ten principles of the United Nations Global Compact.

Munich Re, and the insurance industry in which it belongs, are a positive force for change. Consider for example, global climate change. Stahel (2008)¹ suggests that insurers through their underwriting and investment processes can penalize man-made actions that increase atmospheric carbon dioxide and encourage actions that reduce it. Castellano (2010)² further suggests that insurers, in cooperation with governments, have a role in creating a resilient system to fund emerging perils, including those from the unpredictable effects of climate change. Examples of such products and actions by insurers are easy to find in the press. For example, Munich Re offers insurance products that provide payments to the owners of solar panels or batteries if these devices do not perform within a margin of their stated capacity over time. Such insurance products, by offering a way to reduce the uncertainty associated with the long-term performance of a sustainable technology, encourage its adoption.

Another way of transitioning to a meaningful practice on sustainability is to develop a way to quantify the value of sustainability-related actions firms take. By measuring such value it becomes possible to hold managers accountable for capturing it. Quantification of sustainability has been, and still is, in develop-

¹Stahel, W. 2008. "Global Climate Change in the Wider Context of Sustainability." *Geneva Papers on Risk and Insurance* 33, no. 3: 507–29.

²Castellano, C. 2010. "Governing Ignorance: Emerging Catastrophic Risks—Industry Responses and Policy Frictions." *Geneva Papers on Risk and Insurance* 35, no. 1: 391–415.

ment (as, for example, the works of Montiel and Delgado-Ceballos 2004³ and Pryshlakivsky and Seary 2017⁴ suggest). The lead article in this issue, by demonstrating how a firm can quantify the value of its sustainability initiatives in its core business practices, clearly extends the frontier of knowledge. The next article in the issue starkly shows how quickly issues of sustainability are becoming mission-critical. Following that, the article on privatization of flood insurance provides a tangible example of how issues of policy, traditionally argued solely in terms of economic efficiency or political ideology, are now interconnecting with sustainability concerns.

Nicos A. Scordis

³Montiel, I., and J. Delgado-Ceballos. 2004. "Defining and Measuring Corporate Sustainability: Are We There Yet?" *Organization and Environment* 27, no. 2: 113–39.

⁴Pryshlakivsky, J., and C. Seary. 2017. "A Heuristic Model for Establishing Trade-offs in Corporate Sustainability Performance Measurement Systems." *Journal of Business Ethics* 144, no. 2: 323–42.

The Return on Sustainability Investment (ROSI): Monetizing Financial Benefits of Sustainability Actions in Companies

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Abstract

Practitioners and researchers struggle with valuing the return on sustainability investment (ROSI). We apply a five-step methodology that systematically monetizes sustainability actions to answer a key question: Do sustainable practices lead to a positive financial return for the business? We demonstrate the versatility of this methodology by monetizing potential and realized financial benefits via *mediating factors* (i.e., financial drivers) across two types of industries: Brazilian beef supply chains that committed to deforestation-free beef and the automotive industry, where companies were working to make manufacturing operations more sustainable. The companies participating in our cases found substantial value from implementing sustainability strategies. The beef supply chain yielded a potential net present value (NPV) between 0.01 percent to 12 percent of annual revenue, depending on the supply chain segment. For one automotive company, the five-year NPV based on realized benefits was 12 percent of annual revenue. Our ROSI methodology guides managers to better value sustainability's financial benefits. Ultimately, monetizing sustainability can lead to a competitive advantage and shared value for multiple stakeholders.

This paper has been selected to receive an honorarium underwritten by Munich Re, a leading advocate of sustainable business strategies.

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INTRODUCTION

Managers struggle with how to assess the financial return on their own sustainability-centered business decisions, despite wide-ranging evidence showing that solving sustainability challenges can lead to higher corporate financial performance (CFP) (Orlitzky, Schmidt, and Rynes 2003; Peloza and Yachnin 2008; Margolis, Elfenbein, and Walsh 2009; Fulton, Kahn, and Sharples 2012; Clark, Feiner, and Viehs 2014; Friede, Busch, and Bassen 2015). Our return on sustainability investment (ROSI) methodology aims to close that gap and support researchers, managers, or those evaluating companies (investors, analysts, insurers, etc.) to quantify potential and realized financial benefits of sustainability strategies and practices. Indeed, the business case of corporate sustainability (Reed 2001; Salzmann, Ionescu-Somers, and Steger 2005; Steger 2006) is critical within organizations to overcome organizational inertia or the perception that sustainability does not pay off (Garavan et al. 2010). In a survey with 60,000 respondents from companies around the world, Kiron et al. (2017) found that only a fourth have developed a clear business case for sustainability, even though 90 percent of the executives viewed sustainability as important.

We apply our methodology to two industries. First, we assessed potential benefits of deforestation-free beef for two Brazilian supply chains (with a forward-looking view). Second, we worked with three automotive companies and developed a financial model to monetize sustainable practices in manufacturing operations, using data from 2015 to 2016 (realized cash earnings). Through ROSI, we focus on the mediating factors or drivers of financial performance such as customer loyalty that drive profitability, company valuation, and/or lower cost of capital (Figure 1). Including mediating factors in our framework is essential for analyzing the business case of sustainability because we can:

1. Explain conceptually how sustainability drives intermediate state CFP measures (e.g., improved cash flow, reduced cost, or higher revenue)
2. Capture benefits beyond tangible outcomes (e.g., car manufacturers saved money by reducing water use and pollution, but also lowered their risk of a reputational scandal)
3. Focus on metrics that are more practical than end state measures such as stock price because the results of sustainability investments may get lost across different business units or are “owned” by different managers.

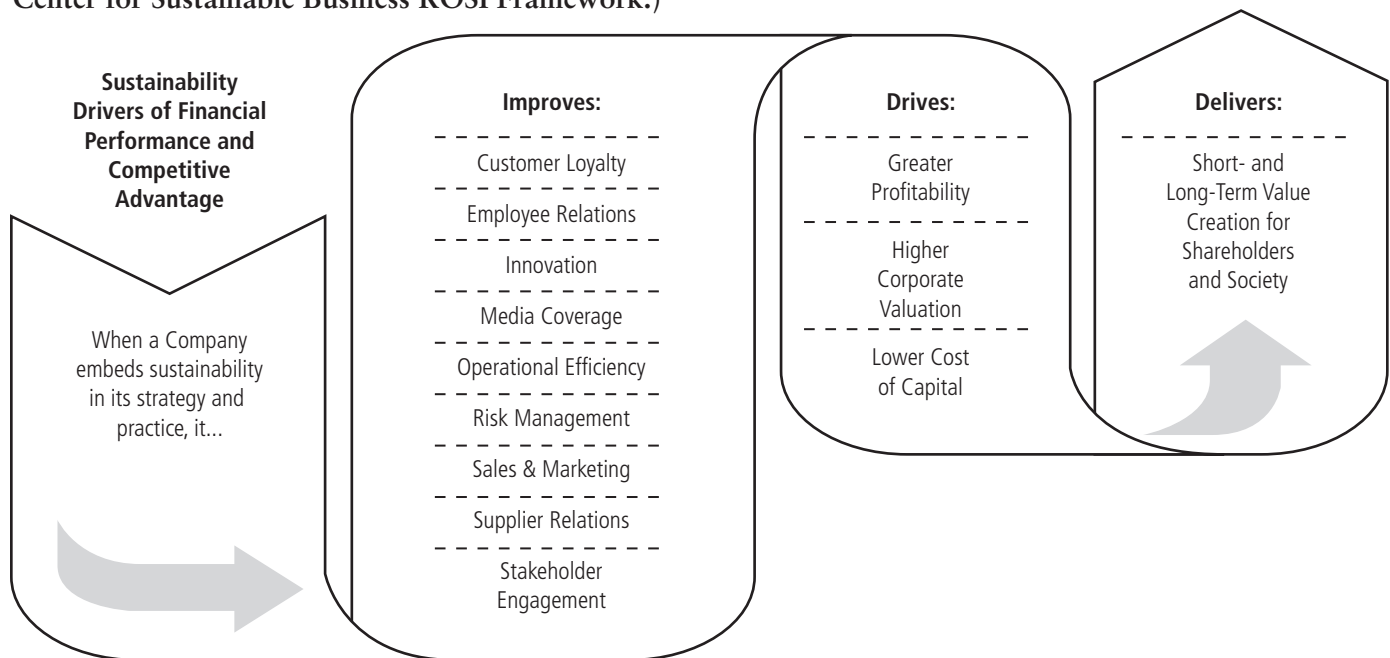
Our overall objective is to develop a methodology that supports researchers, managers, and practitioners by helping them formulate the business case for sustainability through a framework, tools, and concrete examples of how to monetize sustainability benefits. First, we provide an integrative literature review; second, we outline the steps conceptually; and third, we apply the methodology in the two industries.

LITERATURE REVIEW

Corporate Financial Performance

Review studies and meta-analyses from academia and industry have shown a positive relationship between corporate financial performance (CFP) and sustainability measures (Orlitzky, Schmidt, and Rynes 2003; Peloza and Yachnin 2008;

FIGURE 1. Benefits emerge when companies embed sustainability. The mediating factors can be identified, quantified, and monetized to assess financial benefits of sustainability actions. (Adapted from the NYU Stern Center for Sustainable Business ROSI Framework.)



Margolis, Elfenbein, and Walsh 2009; Fulton, Kahn, and Sharples 2012; Clark, Feiner, and Viehs 2014; Friede, Busch, and Bassen 2015). This relationship appears robust, as similar findings are reported considering national cultures (del Mar Miras-Rodríguez, Carrasco-Gallego, and Escobar-Pérez 2015), supply chains (Golicic and Smith 2013), and firm performance in developing countries (Desai, Kharas, and Amin 2017), as well as studies that consider nonlinear relationships (Barnett and Salomon 2012), materiality (Khan, Serafeim, and Yoon 2016), and causality (i.e., whether there is a bidirectional relationship between CFP and sustainability) (Endrikat, Guenther, and Hoppe 2014). These efforts build on earlier work where the relationship was considered “ambiguous” (Wood and Jones 1995), “mixed” (McWilliams and Siegel 2000), “contradictory” (Albertini 2013), or depended on the measure of CFP (Griffin and Mahon 1997).

The more than 2,000 empirical studies (Friede, Busch, and Bassen 2015) that exist today have elevated the discussion of CFP beyond market-based measures. For example, in a meta-analysis, Clark, Feiner, and Viehs (2014) showed that 90 percent of the reviewed studies found firms with high sustainability enjoyed lower cost of capital; 88 percent had a positive correlation between sustainability and operational performance; and 80 percent had a positive correlation between sustainability and superior financial market performance. Further research found that accounting-based measures may have a larger positive correlation with sustainability and CFP than market-based measures (Peloza and Yachnin 2008; Margolis, Elfenbein, and Walsh 2009). However, conventional accounting has also been criticized for keeping up poorly with the rise of intangibles (Lev 2001; Lev and Gu 2016; Haskel and Westlake 2017) such as reduced risk, improved customer loyalty, or the long-term value of better infrastructure. Market-based measures alone are therefore likely not enough, and monetizing intangibles needs to be at the forefront when making the business case for sustainability.

Factors That Mediate Financial Performance

Additional work on corporate financial performance and sustainability has focused on mediating factors, which are essentially drivers of CFP: Peloza and Yachnin (2008) found only 15 such studies in total. This work builds on academic research that evaluates how sustainability efforts may drive financial value in corporations (e.g., Steger 2006; Schaltegger and Figge 2000; Rappaport 1986). The positive relationship between CFP and sustainability is explained through, for example, *instrumental stakeholder theory* (Freeman 1984; Cornell and Shapiro 1987; Orlitzky, Schmidt, and Rynes 2003) which suggests that CFP is driven by the satisfaction of various stakeholder groups because their implicit claims can have costs and benefits that are larger than direct cash impacts. Others have introduced the idea of a *virtuous circle, where sustainability is both a predictor and consequence of CFP* (Waddock and Graves 1997). More recently, the concept of *shared value* (Porter and Kramer 2006, 2011) defined value as benefits relative to cost and moved beyond Milton Friedman's profit maxim (Friedman 1970) as the firm's prime responsibility because profit alone does not meet fundamental societal needs nor enhance competitive advantage.

Some mediating factors are easier to monetize, establish causal linkages, and conceptualize than others. Operational efficiency (similar to eco-efficiency [United Nations ESCAP 2009]) aims to reduce the use of materials, water, and energy to operate sustainably. It can drive profitability directly, for example, through energy savings in green buildings (Eichholtz, Kok, and Quigley 2010) or lower the cost of capital (Schneider 2011; Chava 2014). Better employee relations, on the other hand, are difficult to associate with a sustainability initiative because companies are often not collecting data on its relationship with employee engagement. There is, however, much cross-sectional research that explains how sustainability and employee relations are related. In general, sustainability makes an organization more attractive to prospective employees (Turban and Greening 1997), reduces voluntary turnover (Vitaliano 2012), and increases productivity (Delmas and Pekovic 2013, 2018). Studies also show how specific actions such as diversity programs improve sales and profits (Herring 2009; Hunt et al. 2018), or how nondiscrimination spurs innovation (Gao and Zhang 2017). Studies have also tried to investigate whether firms with greater sustainability were less likely to be sued (Barnett, Hartmann, and Salomon 2018), because sustainability efforts may act as a buffer from harm (Godfrey 2005).

Our approach applies conventional accounting to sustainability practices and monetizes tangible and intangible assets (see Lev 2001; Lev and Gu 2016). Others are also working to monetize sustainability. For example, the *PRI-UN Global Compact LEAD's Value Driver Model* (Lubin and Krosinsky 2013) monetizes sustainability benefits according to growth, productivity, and risk management categories. We propose nine mediating factors that explain when companies solve sustainability challenges, financial performance may change. They include: customer loyalty, stakeholder engagement, employee relations, innovation, operational efficiency, risk management, sales and marketing, media coverage, and supplier relations (Figure 1). Which of these factors drive corporate financial performance is chiefly an empirical question depending on industry and firm. When we interviewed sustainability professionals and coded 251 sustainability actions in the automotive industry according to mediating factors, for

example, we found that all nine mediating factors were mentioned at least four times. We empirically tested how these factors are related to corporate financial performance in this research.

FIVE STEPS TO MONETIZE SUSTAINABILITY ACTIONS

We propose to monetize the benefits of sustainability by examining the potential effects and interactions of sustainability actions through *mediating factors* (Figure 1). This methodology requires an iterative five-step process that reflects inputs from multiple stakeholders. For example, what we learn in step 4, documenting assumptions, may influence step 2, generating a comprehensive list of benefits.

Step 1: Identify Material Sustainability Strategies and Actions

Sustainable business practices (similar to corporate social responsibility [CSR]) at minimum do not harm people or the planet and at best create value for stakeholders (Whelan and Fink 2016). A company's sustainability strategy and actions may correspond to material environmental, social, and governance (ESG) issues outlined in accounting standards such as the Sustainability Accounting Standards Board (SASB), the Global Reporting Initiative (GRI), or the UN Global Compact framework which almost 10,000 companies subscribe to the principles (Voegtlin and Pless 2014). Information on sustainability actions can be gathered from the company's own assessment, rankings, or sustainability report, as well as interviews across the organization to generate a comprehensive list of actions, benefits, and metrics.

Step 2: List Potential Benefits That Might Drive Financial and Societal Value from Sustainability Actions

Identify the sustainability benefits that emerge from sustainability actions or practices through the lens of mediating factors (Figure 1), which include greater customer loyalty, better employee relations, more innovation, better media coverage, higher operational efficiency, better risk management, improved sales and marketing, improved supplier relations, and more value-adding stakeholder engagement. Depending on the sustainability action, supply chain target area, business units, or materiality, different benefits will emerge. Some benefits may relate to more than one mediating factor.

Step 3: Quantify Costs and Benefits Associated with Sustainability Actions

Gather specific data, inputs, and assumptions for each benefit (step 2). Each benefit may be project specific or company specific. Individual benefits, however, should not be treated in isolation because this increases the possibility of double-counting the financial benefits and could inflate the aggregate figures. Calculating net benefits also requires an estimate of the cost (sometimes these costs are investments) of the sustainability action.

Step 4: Build Scenarios, Document Assumptions, and Iterate Research

In reality, data are often incomplete, missing, or rely on future value projections. Practitioners must come up with a credible set of assumptions guided by aca-

demic publications, business reports, and specialist interviews. All assumptions should be transparent and clearly documented. Even where estimates rely on assumptions, we argue that any valid measurement reduces uncertainty (Hubbard 2014). Scenarios or sensitivity analyses may help mitigate some of the inevitable uncertainty. This may be done from the outset (e.g., as a simulation model) or as an intermediate step with different input values. The project scope should allow time to include learnings during the monetization process.

Step 5: Monetize and Calculate the Value for All Benefits

We do not prescribe using a specific economic or accounting measure so long as they show the benefits impact or impacted financial results. For a corporation, this could be, for example, proxies for cash flow such as earnings before interest and taxes (EBIT). Valuing future benefits can be shown through a net present value (NPV) model. We recommend weighting uncertain benefits, such as reducing the risk of regulatory fines, by probability. A further step could be to estimate probability-based outcomes with a Monte-Carlo simulation, as does a valuation tool developed by the International Finance Corporation for extractive companies (IFC and Deloitte 2014). This requires users to be highly confident in their assumptions. Like most budgeting, forecasting, and analysis, it is often more art than science, but findings at the least ought to be directional and proximate, assisting managerial and investor decision-making.

METHODS

Case Selection

Within the Brazilian beef supply chain, we focused on ranches, slaughterhouses, and retailers. One large ranch, Fazendas São Marcelo (FSM) and Projeto Novo Campo (PNC), a group of smaller ranches, invested heavily in more sustainable ranching. These ranches supplied the cattle to Marfrig and JBS slaughterhouses, which supplied meat to retailers Carrefour and McDonald's, respectively. In the automotive case, three international companies of different sizes and complexity agreed to participate. The monetization model was generated through discussions with the three companies, a survey of 15 senior executives, and a detailed exchange of financial and non-financial data. We provide the financial outcomes for one company in the results section.

We relied on extensive interviews in both cases. In the beef case, we developed a model and relied on published literature for many data points; for the automotive work, we developed the model and asked the companies to gather the appropriate data for a given year. The goal of the interviews was to ensure our methodology generated a comprehensive list of costs and benefits of sustainability actions, as well as input on how best to monetize benefits.

In the beef case, we conducted over 20 interviews, including field visits to gather primary data on the benefits and assumptions for applying our methodology. With the help of the consulting firm A.T. Kearney, we interviewed people in non-governmental organizations (Imaflora, The Nature Conservancy [TNC], Instituto Centro de Vida [ICV], organizations part of the Grupo de Trabalho da Pecuária Sustentável [GTPS], Antea Group, Sustainable Agriculture Network

[SAN] and Peca Pecuaría Sustentável da Amazônia), public institutions devoted to agricultural research and development (Empresa Brasileira de Pesquisa Agropecuária [Embrapa]), large retailers (Carrefour, Arcos Dourados [McDonald's franchisee], and McDonald's) and small retailers (Gran Beef), slaughterhouses (Marfrig and JBS), and ranches (Fazenda do Bugre, São Marcelo, São Matheus, and CMA) about their business practices. We completed the data collection between November 21 to December 20, 2016 and between January 10 to January 20, 2017.

For the automotive case, we developed a semi-structured questionnaire to guide the telephone interviews with the respondents of two companies; the third company opted to respond to the questionnaire in writing. People interviewed in each company included CFOs, sustainability officers, and other middle and senior management professionals ($N = 13$ total). Among the questions we asked were:

- Which environmental, social, and governance factors are most material to the company and its stakeholders?
- How does the company address these issues in its business strategies?
- What product, process, or service innovation occurred?

We also asked them to provide examples of investments in sustainability initiatives and information on their approach to track and calculate the return on investment.

In both cases, we asked respondents to identify sustainability strategies and how they were linked to mediating factors as described in the *Harvard Business Review* article “The Comprehensive Business Case for Sustainability” (Whelan and Fink 2016) and in Figure 1.

Monetization Methodology

In both industries, we applied the framework and followed the proposed steps on how to derive the financial benefit of sustainability actions. We allowed the companies to identify which actions they viewed as addressing sustainability challenges in their business, and placed no value judgment on whether these actions were the most appropriate or effective. Notable differences exist in the scope and financial metrics that were used in step 5 (monetize and calculate the value for all benefits). For example, in the beef project, we were predominantly interested in the potential benefits over a 10-year horizon and in comparisons across the three main stakeholders in the supply chain. Therefore, we calculated and analyzed the respective net present values. In contrast, for the automotive project we estimated the cash earnings contribution from all sustainability actions for a given year. Our analysis calculated the EBIT value related to the respective margin increase from 2015 to 2016. For a comprehensive view of how the financial benefits impact overall company value, we also calculated a net present value. In most cases, we assumed the 2016 results could be replicated for a five-year period. In reality, the benefits may be achievable over longer periods, at either an accelerating or decelerating pace. We reviewed these assumptions with participating companies, which confirmed this to be a reasonable forecast period. In both cases, the financial benefits were “net” figures, meaning we took into account all direct costs. Further details follow in the next section.

APPLYING THE METHODOLOGY TO MONETIZE THE BENEFITS OF SUSTAINABILITY ACTIONS

Deforestation-Free Beef

Material Sustainability Actions

The material sustainability actions for ranches at FSM and PNC were required for Rainforest Alliance and EMBRAPA's (Brazilian Agricultural Research Corporation) Good Agricultural Practices (GAP) certification. Examples of changed practices included cattle intensification (moving from 2 to 10 head of cattle per hectare), pasture rotation, management of water sources, conserve biodiversity and forestlands, and to reduced use of agrichemicals. The slaughterhouses JBS and Marfrig committed to deforestation-free beef: they monitored suppliers with satellite imaging tools to track forest cover and excluded suppliers that had violations for environmental, labor, and indigenous rights. Different organizations and government agencies generate such lists: The Ministry of Labor (Ministério do Trabalho) collects information for farms that have been associated with slave labor conditions; Fundação Nacional do Índio (FUNAI) and/or Instituto Nacional de Colonização e Reforma Agrária (INCRA) record farms associated with indigenous issues; and the Ministry of the Environment (Ministério do Meio Ambiente) records farms associated with deforestation. McDonald's and Carrefour selected or black-listed suppliers and promoted sustainable products (e.g., via certification logos).

Potential Benefits

We first identified the benefits associated with the changed practices, and then classified benefits according to the mediating factors (Table 1). In total, we gathered 21 benefits across the three supply chain levels for the beef industry associated with sustainable agriculture and deforestation-free beef. Not all benefits applied to all levels of the supply chain. Sustainable ranches may benefit, for example, from greater customer loyalty because ranches with GAP or Rainforest Alliance certification had higher quality beef because of the sustainable agriculture practices and therefore were able to sell more beef at full price. In periods of excess supply, slaughterhouses were buying higher quality beef first and generally purchased uncertified, often low-quality beef at a discount (Table 1, benefit 2.2). Slaughterhouses that worked with sustainable ranches benefited because they had better quality beef, better risk management, and avoided deforestation-focused fines (Table 1, benefit 3.3). Slaughterhouses must comply with the regulation or face fines if they are caught sourcing from suppliers associated with deforestation. By commercializing and tracking sustainably sourced beef, slaughterhouses likely avoided fines. Of the 21 potential benefits, one-third were incremental revenue (31 percent), one-quarter reduced cost (25 percent), 44 percent were avoided cost, and five benefits were excluded from the monetization model.

Quantify Costs and Benefits Associated with Sustainability Actions

To quantify costs and benefits, we (1) gathered inputs on cost; (2) estimated inputs for benefits; (3) modeled future market behavior; and (4) assigned proba-

TABLE 1. The Material Benefits for Sustainability Actions in Two Brazilian Beef Supply Chains Categorized According to ROSI's Mediating Factors

The numeric classification references the monetization spreadsheet in Whelan et al. (2017) and is available for download.

| Mediating Factors | Benefits in the Beef in Brazil Case Study | Monetization Method (Listed Examples Apply to Ranches Only) |
|---|--|---|
| Greater customer loyalty | 2.2. Selling at full price (no discounts) | Avoided total sales loss based on the current percentage of sales of low-quality beef sold at a discount, weighted by probability. |
| Better employee relations | 5.1. Talent attraction | Incremental revenue that top-performing employees generate and potential to attract top-performing employees. |
| | 5.2. Talent retention | Turnover reduction and costs associated with turnover (e.g., training cost). |
| More innovation | 1.2. Innovation and better agricultural techniques | Cost reduction per kg of beef derived from better technology by comparing average cost per kg before and after sustainable practices are implemented. |
| Better media coverage | 3.4. Reputational risk avoidance | Revenues at risk after 5 years, weighted by probability (avoided revenue loss from reputational damage, e.g., activist campaign, scandals). |
| Higher operational efficiency | 1.1 Better cost management (inputs) | Production input costs before and after implementing sustainable agricultural initiatives (to calculate NPV, costs were weighted per kg of beef produced, and applied to expected forecasts). |
| | 1.3. Higher land productivity | Total rented area that no longer needs to be rented, multiplied by cost of rental. |
| Better risk management | 3.1. Operational risk avoidance | Revenues at risk after 5 years, weighted by probability (avoided revenue loss from operational complications that reduce production and sales—e.g., pasture exhaustion, water shortage, cattle diseases). |
| | 3.2. Market risk avoidance | Revenues at risk after 5 years, weighted by probability (avoided revenue loss from a decreasing market demand for unsustainable beef). |
| | 3.3. Regulatory risk avoidance | Revenues at risk after 5 years, weighted by probability (avoided revenue loss from future changes in regulation that disqualify producers). |
| Improved sales and marketing | 2.1. Price premiums | Revenue increase from premiums paid by slaughterhouses for sustainable beef (i.e., price increase multiplied by total expected production). |
| | 2.3. Increase in demand for sustainability | Revenue increase from a forecasted increase in consumer demand of sustainable beef over the medium- and long-term. |
| | 2.5. New revenue stream—additional land | Percentage of ranch that can be reallocated to other activities (e.g., planting soy), and estimated revenue from new activity per ha. |
| Improved supplier relations | 5.4. Corporate ecosystem: Reduced volatility | Avoided revenue loss from missing economy of scale (applied to forecasted purchases, weighed by probability—slaughterhouse and retailer only. They may buy beef from a large number of suppliers, but some concentrate a significant part with volatile suppliers resulting in higher procurement costs). |
| More value-adding stakeholder engagement | 5.5. Environment: Emission avoidance | Reduced greenhouse gas emissions (GhG) per ha from sustainability based on a cost per ton of GhG, weighted by probability (for a future carbon tax based on Mexico's benchmark). |
| | 5.6. Environment: Carbon sequestration | Carbon sequestration by forest or pasture recuperation based on a cost per ton of GhG, weighted by probability (for a future carbon tax based on Mexico's benchmark). |

bilities to certain events occurring. Productivity data for ranches were obtained from previous studies. For example, Marcuzzo (2015) found that the GAP at the PNC ranch yielded 161 kg/ha with sustainable ranching compared to 68 kg/ha for traditional ranching. We used proxies when data were not available, such as using PNC ranch's values for FSM's investment cost for sustainable infrastructure. From an interview with ICV, we learned that PNC's infrastructure investment was approximately \$635 per ha. Overall, based on the size of the ranches, we estimated that PNC ranches invested \$4.9 million and FSM ranches invested

\$20 million in infrastructure. The estimated cost to monitor deforestation by slaughterhouses and retailers was derived from the cost to license monitoring software priced at \$320,000 per year for JBS. Also, since fewer suppliers provided deforestation-free beef, with less competition, the increased cost per kg of deforestation-free beef was higher.

We collected all inputs and assumptions, market estimates, costs, and benefits in a spreadsheet, and quantified them separately for each benefit and company. Broman and Woo (2018) guide practitioners on how to best organize spreadsheets. For example, we separated input data and calculations, and, for inputs, we tracked where each assumption originated. The final spreadsheet included over 300 inputs of assumptions and metrics as basis for our calculations. Table 1, column 3 lists examples of how we operationalized the benefits, net of costs.

Build Scenarios, Document Assumptions, and Iterate Research

From academic publications, business reports, and interview with specialists, we gathered information such as forecast values for the inflation rate. We continued to refine our estimates of these model parameters. For example, our initial value for the discount rate was set at 8 percent based on the market standard. We revised this to 15 percent after consulting with our project partner, The Nature Conservancy, which had on-the-ground experience. This meant that the revised estimates of financial benefits were considerably lower. We addressed uncertain benefits, such as a future revenue increase from premiums paid by slaughterhouses for sustainable beef, using probability weighting, to reflect an expected NPV. We considered two scenarios: For each benefit with uncertainties attached, we estimated a low (conservative) and high (aggressive) probability of occurrence. The two different scenarios presented us with a range in outcomes. To reduce complexity, we chose to report the low scenario in the results section because it is the more conservative scenario.

Monetize and Calculate the Value for All Benefits

Since most of this work concerned potential benefits, we calculated overall costs and benefits as the NPV of estimated future values with a 10-year horizon using a discount rate of 15 percent, minus any upfront investment.

$$\text{Net Present Value} = \sum_{i = \text{year } 1}^{10} \frac{\text{Future value for year } i}{(1 + \text{discount rate})^i}$$

Tangible benefits were relatively straightforward: to monetize the benefit of cost reduction from the sustainability investments, for example, we compared the total cost per kg of beef on land with and without higher productivity. ICV estimated the PNC ranch pilot saved \$1 per kg of meat as a result of improvements to ranching practices. We multiplied the total cattle production with that cost difference and arrived at how much potential savings the sustainability investment created.

Intangible benefits, such as reduced employee turnover, required additional work to monetize. To quantify turnover for JBS, for example, we estimated the number of new employees per year needed to replace turnover. This value was based on the average number of employees, the turnover percentage, and the

expected reduction in turnover. We also included the time and cost to train an employee. To monetize this, we multiplied the total training time avoided with the cost of training. In the final monetization calculation, we weighted the expected reduction in turnover by probability (50 percent likelihood of occurring) and calculated the net present value. We expected that employees were more likely to stay with an operation that produced sustainable and good quality beef as a result of better operations and overall better working conditions.

The Automotive Industry

Material Sustainability Actions

In the automotive case, we used SASB as a guide to gather information on company-specific sustainability strategies that were material to the company's financial performance. In contrast to the beef case, we focused on the auto manufacturers, rather than on the supply chain. The material sustainability strategies identified for automotive companies by SASB were materials efficiency and recycling, product safety, labor relations, fuel economy and use-phase emissions, and materials sourcing. In the interviews, the three companies described 18 sustainability strategies, of which 16 were feasible to monetize.

Potential Benefits

The automotive companies identified 34 benefits derived from the 16 strategies (Table 2 through Table 5). Operational efficiencies from sustainability actions included benefits from reducing resource consumption, improving waste management, reducing carbon emissions, reducing VOC emissions, and recycling and recovering materials from end-of-life products. Benefits that reduced risks included reducing dependency on critical materials, avoiding the use of conflict minerals, and minimizing recalls. Benefits that emerged from innovations stemmed from increasing sustainable product presence, long-term improved sustainability technologies, engaging consumers with sustainability through services, and incorporating more sustainable materials into product design. Other benefits from stakeholder engagement included: increasing the percentage of suppliers that are compliant with sustainability standards, efficacy of marketing spend on sustainable products, and improving employee retention. Of the 34 potential benefits, two-thirds (23) were classified as cost savings, 15 percent (5) as increased revenues, and 18 percent (6) as avoided cost.

Quantify Costs and Benefits Associated with Sustainability Actions

From the monetization methods (Table 2 through Table 5, column 4), we saw that benefits emerged in various financial accounts and across different cost centers. For each benefit, we developed formulas to calculate the financial impact for a single year, between 2015 and 2016. We created a spreadsheet to collect the required data inputs (with over 400 inputs in total) from the companies. We made a concerted effort to capture data across all cost centers by organizing the data input tool by department (R&D, sales, HR, manufacturing, etc.).

An example of a benefit that was relatively straightforward to calculate was lower resource consumption. Automotive companies often report cost savings from

TABLE 2. Operating Performance Strategies to Achieve Operational Efficiencies and Generate New Revenues

| Strategies | Benefits | Mediating Factor | Monetization Methods |
|--|---|-------------------------------|--|
| Reduce Resource Consumption | Reduced electricity or water cost | Higher operational efficiency | The reduced per unit cost of energy or water on current year production. Subtract any costse to achieve the benefit for operating income impact. Calculate NPV assuming 5-year forecast of net operating income benefits and upfront investments. |
| Improved Waste Management | Revenue from selling recycled materials | Improved sales and marketing | Average selling price per ton of solid waste on amount sold less the cost to recover (calculated as \$/per ton) less cost per ton to recycle. |
| | Savings from using recovered waste | Higher operational efficiency | Savings from using less virgin material and lower disposal costs associated with the recovery and reuse of solid materials (weighted average per price per metric ton). |
| | Savings from using recycled water | | Savings from reduced spend on fresh water due to using recycled water net of costs to recycle plus the savings unless waste water disposal cost using average disposal price per M ³ . |
| | Cost avoided from traditional waste disposal | | Per unit disposal cost per ton of waste to the amount of material recovered/reused or recycled. |
| | Energy savings in manufacturing | | Energy savings by comparing the weighted average energy intensity per ton using virgin material to the energy intensity using recovered/recycled material. |
| Reduce Emissions—Carbon | Savings from reduced need for carbon credits | Higher operational efficiency | Reduced spending on carbon credits due to the reduction in emissions in manufacturing subtract costs incurred to achieve the reduction for net operating income benefit. |
| Reduce Emissions—VOC | Savings from reducing/recycling solvent | Higher operational efficiency | Savings from the overall reduction in solvent used. Amount of solvent recovered and reused and multiplied by the weighted average virgin solvent unit cost. Reduce savings cost of recovery by multiplying the amount of solvent recovered by the cost of recovery per kg. |
| | Savings from using substitutes for solvent | | Amount of substitute solvent multiplied by the difference in weighted average cost of virgin solvent per kg versus substitute solvent cost per kg. |
| | Savings from avoided treatment costs | | Percentage reduction in VOC emissions per metric ton, per car produced multiplied by total treatment cost to derive treatment cost savings. |
| | Savings related to reduction in other costs | | Saving in employee related health and safety expenses and the savings related to the reduction in average number of fines received times the average regulatory fine for VOC emissions incidents. |
| Recycle and Recover from End of Life Products | Savings from using recovered materials from EOL vehicles versus virgin material | Higher operational efficiency | Savings in virgin materials by multiplying the weighted average value of virgin materials by the amount of material weight reused from treated material form captured at the end of the vehicle's useful life. Process savings (energy, logistics, etc., using recovered material/components from EOL vehicles). Cost of recovery (recycling) derived from multiplying the per unit cost of recovery (recycling) by the amount recovered (recycled) and net against the savings for the net benefit. |
| | Revenue from selling EOL materials to recyclers | Improved sales and marketing | Revenues from selling EOL vehicle materials derived from multiplying the product weight of material sold by the weighted average price of recycled EOL materials sold. |
| | Reduction in disposal cost from reusing/recycling materials from EOL vehicles | Higher operational efficiency | Savings in disposal costs related to amounts reused/recycled. |

reduced energy consumption in their sustainability reports; data on the amount and per unit cost of energy or water use and amount consumed are readily available.

Automotive companies also track annual waste reduction, but rarely report on financial impact. Data to capture the benefits were difficult to collect, given there are various forms of waste (water, raw materials, packaging waste, paper

TABLE 3. Risk Reduction Strategies to Reduce Susceptibility to Resource Scarcity, Natural Disasters, and Regulatory Non-Compliance as Well as Reduce Quality Errors and Improve Safety Features

| Strategies | Benefits | Mediating Factor | Monetization Methods |
|--|--|-------------------------------|---|
| Reduce Dependency on Critical Materials | Savings from reduced use of critical materials | Higher operational efficiency | Reduction in spending on critical materials derived from multiplying the percent of reduction in amount of critical material per vehicle by the annual volume of critical materials used. Amount of reduction due to less use of critical materials multiplied by the weighted average price of critical materials. |
| | Savings from substituting critical materials with other products | | Reduction in critical materials due to substitute product and multiplied by the conversion rate and by the cost differential in price of material. |
| | Savings related to lower energy consumption using substitute materials | | The sum of: i) Savings from a reduction in use of critical materials derived from multiplying the reduced material used by the weighted average spend on energy used in manufacturing using critical materials per ton; and ii) The savings from substituting materials derived from multiplying the material substituted by the differential in the weighted average cost of energy per ton using critical materials and the weighted average cost of energy per ton using substitute materials. |
| | Savings related to lower water consumption using substitute materials | | The sum of: i) The savings from a reduction in use of critical materials derived from multiplying the reduced material used by the weighted average spend on water used in manufacturing using critical materials per ton; and ii) The saving from substituting materials derived from multiplying the material substituted by the differential in the weighted average cost of water per ton using critical materials and the weighted average cost of water per ton using substitute materials. |
| | Avoided costs related to supply shortages | Better risk management | Cost of a short supply incident by the average annual incidents of short supply. |
| Avoid Use of Conflict Materials | Savings from reduced use of conflict minerals | Higher operational efficiency | Spending reduction on conflict minerals derived from multiplying the percent reduction in amount of conflict minerals per vehicle by the annual volume of conflict minerals used. Reduction due to less use of conflict minerals multiplied by the weighted average price of conflict minerals. |
| | Lower costs associated with substitute materials | | Reduction in conflict minerals due to substitute product multiplied by the conversion rate and by the cost differential in price of material. |
| | Savings related to lower energy consumption using substitute materials | | The sum of: i) The savings from a reduction in use of conflict minerals derived from multiplying the reduced material used by the weighted average spend on energy used in manufacturing using conflict minerals per ton; and ii) The saving from substituting materials derived from multiplying the material substituted by the differential in the weighted average cost of energy per ton using conflict minerals and the weighted average cost of energy per ton using substitute materials. |
| | Savings related to lower water consumption using substitute materials | | The sum of: i) The savings from a reduction in use of conflict minerals derived from multiplying the reduced material used by the weighted average spend on water used in manufacturing using conflict minerals per ton; and ii) The saving from substituting materials derived from multiplying the material substituted by the differential in the weighted average cost of water per ton using conflict minerals and the weighted average cost of water per ton using substitute materials. |
| | Avoided costs related to supply shortages | Better risk management | Estimated cost of a short supply incident by the average annual incidents of short supply. |
| Minimize Recalls | Avoided costs related to regulatory fines | | Estimated cost from multiplying the average annual number of incidents of conflict mineral related fines by the average fine per incident less additional compliance costs incurred. |
| | Avoided cost of recalls | Better risk management | Estimated average cost of avoided recalls related to reduced number of recalls by using the average cost of repair per vehicle times the average number of vehicles per recall plus the average legal and image repair costs (PR, advertising, etc.), net of costs incurred to improve quality, use premium parts (COGS), and additional spend on quality training. |

TABLE 4. Innovation to Develop New Sustainability Products, Services, or Processes

| Strategies | Benefits | Mediating Factor | Monetization Methods |
|---|---|-------------------------------|---|
| Increase Sustainable Product Presence | Incremental sales from new sustainable products | Improved sales and marketing | Incremental sales from the number of zero-emission and low-emission models sold using the weighted average price per unit. Incremental margin on zero-emission and low-emission vehicles, sold assuming an average cost of goods sold (COGS). |
| Innovate to Provide Long-term Improved Sustainability Technologies | Increased pricing on products with enhanced sustainability features | More innovation | Differential in average price per vehicle with and without innovative sustainability features, minus the sales weighted average COGS of sustainability features and multiplied by the number of non-zero and low-emission vehicles sold that include the added sustainability features. |
| Engage Consumers with Sustainability through Innovative Services | New revenue streams | Improved sales and marketing | Annual revenue stream from sustainable services (e.g., car sharing, in-vehicle security, or emergency services) less wages and other SG&A costs associated with the services. |
| Incorporate More Sustainable Materials into Product Design | Savings from substituting sustainable materials in product design (i.e., recycled and renewable materials) | Higher operational efficiency | Raw material purchased that is renewable/recycled/lightweight materials in tons multiplied by the differential in weighted average price of traditional versus renewable/recycled/lightweight materials per ton, less any additional operating costs required. |
| | Lower costs on energy and resources used in manufacturing when using renewable/recycled lightweight materials | Higher operational efficiency | Differential in weighted average spend on energy and resources in traditional manufacturing versus the weighted average spend on energy and resources in manufacturing using renewable/recycled/lightweight materials multiplied by the amount of substituted sustainable material, less any additional amount of operating costs incurred on using the substitute materials. |

TABLE 5. Other Stakeholder Engagement Strategies

| Strategies | Benefits | Mediating Factor | Monetization Methods |
|---|--|-----------------------------|--|
| Increase Percent of Suppliers/Carriers/Dealers That Are Compliant with High Sustainability Standards | Savings from closed-loop recycling | Improved supplier relations | Savings from closed-loop recycling by adding rebates and discounts from suppliers to the decrease in spending due to reduced volume of material needed lower operating costs associated with closed-loop recycling. |
| Efficacy of Marketing Spend on Sustainable Products | Savings from incremental sales and operating income from dedicated marketing spend on sustainable products | Greater customer loyalty | Estimated annual sales attributable to dedicated marketing from annualized marketing spend ROI (sales over one dollar of marketing spend, or any internal metric to evaluate marketing/PR returns) and the marketing/advertising spending on zero-emission and low-emission vehicles (including internal person-hours and third-party fees such as agencies, production, and media distribution fees). Average gross margin on zero- and low-emission vehicles used for profit impact. |
| Improve Retention | Cost avoidance related to reduced voluntary turnover | Better employee relations | Reduction in number of employees lost to voluntary turnover versus a historical average and multiplied by number and margin on lost sales per person plus the average new worker training cost per person. Operating income impacted by reducing the saving of annual SG&A costs to improve working conditions and annual wage increase for existing workers. |

products) and waste exists throughout all company locations (administrative, factories, and warehouses). Savings related to reduced waste disposal costs or revenues gained by selling waste to recyclers were easy to track and quantify. However, more efficient material use not only reduces waste but also results in lower raw materials that need to be purchased. Without a process in place, it is difficult to track this benefit by material. We therefore used the weighted average unit price of

comparable virgin materials and applied it to the increase in amount of materials recovered and reused in the manufacturing process to estimate the benefit. Similarly, we also calculated the difference in energy intensity using untouched versus recovered and reused material to capture the full benefits of waste reduction.

Build Scenarios, Document Assumptions, and Iterate Research

We incorporated the ability to provide sensitivity analysis for the growth in units and unit prices of electric and hybrid vehicles. For instance, if volume and prices vary by 10 percent from the forecast, we found an impact to company operating margins of plus or minus five basis points. Similarly, we sensitized the NPV model for growth in sustainable services, namely car sharing and subscription-based services such as car communications, security and emergency services, and navigation systems.

For changes in regulations, we also included calculations that tested sensitivities. When evaluating disposal of end-of-life vehicles (EOLV), European regulations mandate that the original manufacturer bears this responsibility, but this is not the case in the United States. As a result, car companies with European manufacturing operations have agreements in place with third parties to handle much of the process. To assess the savings in using EOLV materials in current production volumes, we used the weighted average cost of pristine materials along with the weighted average selling price of EOLV materials to recyclers, less the costs associated with recovering and recycling materials. The amount today of EOLV materials used in new car manufacturing and amounts sold to recyclers was small (2.5 percent and 10 percent respectively of the actual weight of treated materials—and only related to European operations where this is tracked). At some point, these regulations could arrive in the United States. Hence, if the same percentages of weight were applied to total metric tons of cars sold in a given year (proxy for the material available from EOLVs), the benefits would have increased by a multiple of 20. The large range of financial value showed us that if manufacturers decide to invest in improving EOLV value, there might be potential for substantial net revenues.

Monetize and Calculate the Value for All Benefits

The benefits we assessed fell into three main categories: cost savings, avoided cost, and incremental revenues, which were netted against cost and investment to achieve the benefits. Primarily, we monetized the impact on operating earnings (EBIT) as a proxy for cash savings. This is because our analysis of actual company outcomes included only one year and because cash flows are of immediate relevance to managers.

In addition, to estimate the financial benefit on company value, including investments, we calculated a NPV for each strategy using the company's assumed cost of capital as the discount rate (ranging from 10 percent to 12.5 percent). Using the company's cost of capital versus a risk-adjusted or sustainability-adjusted one is a simplifying assumption given we did not have this information available.

$$\text{Net Present Value} = \sum_{i = \text{year } 1}^5 \frac{\text{Future value for year } i}{(1 + \text{cost of capital})^i}$$

For electric and hybrid vehicles, we included five years of forecasted sales, costs, and investments (conservatively assumed to accrue every year) to derive the ben-

efits. For all other benefits, we assumed the annual benefit identified in 2016 accrued for five years because this simplified the calculations and established a reasonable estimate of company valuation. While some of the benefits, such as waste reduction, will have diminishing returns over time, we believe they are likely to extend beyond five years. For instance, as the company makes progress in reducing waste, the opportunity for savings may decline over time. But as the company expands into new technologies, material use may change, creating new challenges, such as a need for EV battery disposal or refurbishing.

In Table 2 through Table 5 we provide a comprehensive list of the benefits and monetizing methods used for the reviewed strategies and benefits for the automotive sector.

RESULTS

Potential Net Benefits in the Deforestation-Free Beef Supply Chains

We found that the potential net benefits from sustainable ranching practices for ranches ranged from \$1.4 million (9 percent of revenues) for PNC to \$16.6 million (12 percent) for FSM (Figure 2). For slaughterhouses and retailers (Brazilian operations), the net benefits ranged from \$1.3 million (0.01 percent revenues) for Marfrig, \$18 million (0.02 percent) for JBS, \$6.8 million (0.01 percent) for Carrefour, to \$5.7 million (0.13 percent) for McDonald's (Whelan et al. 2017).

We can understand the benefits better if we look at them through the lens of the framework, that is, by mediating factors (Figure 3). It now is apparent that the benefits for ranches (PNC and FSM) accumulated through *more innovation* and *higher operational efficiency*. Cost reduction came because of innovation and better agricultural techniques, such as pasture recuperation, water distribution system, and fencing and rotation of pastures.

The slaughterhouses (Marfrig and JBS) and the retailers (Carrefour and McDonald's) accrued potential benefits mostly through *better risk management* and *improved sales and marketing*. We can operationalize market risk for slaughterhouses, for example, by estimating the decreased market demand for unsustainable beef and its potential impact on revenues. Given the size of the

FIGURE 2. Net benefits in USD million for sustainability actions across the Brazilian beef supply chain based on the net present value projected over 10 years. Note that for ranches, the cost of sustainability actions are investments in infrastructure, while for slaughterhouses and retailer/restaurant the estimates are an increased cost of working with deforestation-free beef suppliers.

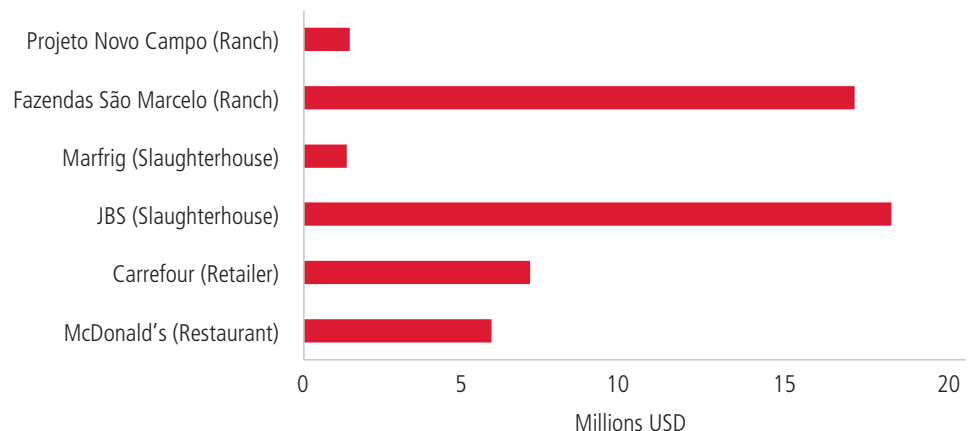
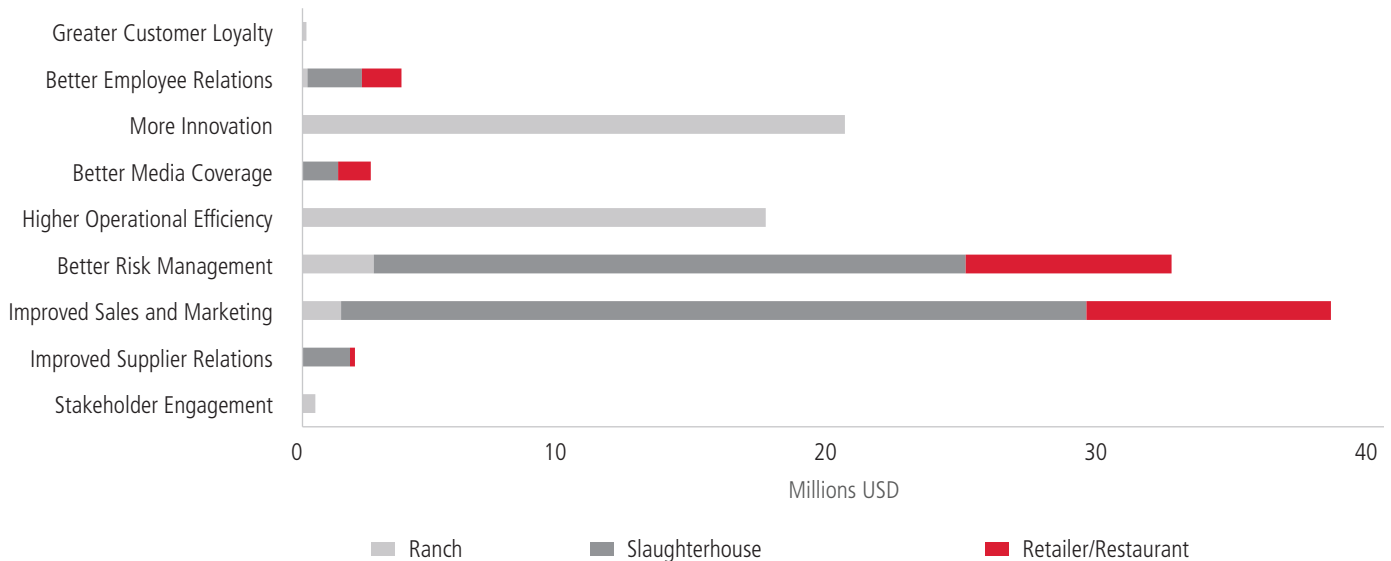


FIGURE 3. Total benefits (in USD million) across the Brazilian beef supply chain based on a net present value projected over 10 years and split by mediating factor from the ROSI framework. Total benefits do not account for the different amounts of cost and investments.

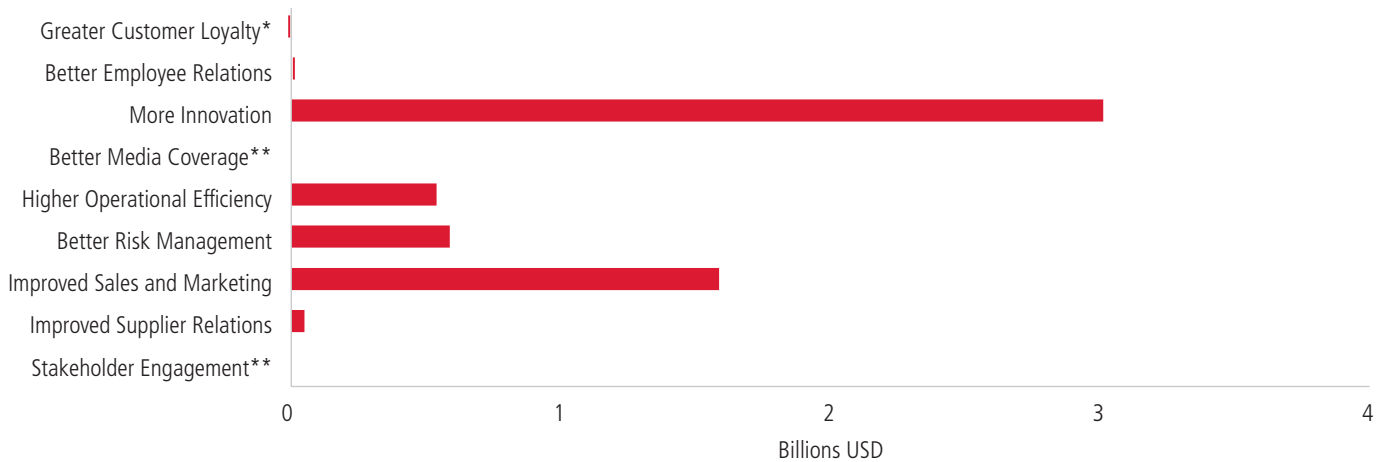


companies, even small risks can have a large financial ramification. Note that in comparing total benefits, we did not account for the different amounts of cost and investments that occurred in the different stages of the supply chain (nor the size in revenue).

Realized Net Benefits in the Automotive Industry

In the automotive example, we estimated that sustainability actions between 2015 and 2016 led to incremental revenues, cost savings, and avoided cost and a positive impact of \$5.7 billion (or 3.6 percent of annual revenue) on EBIT for one company. Only direct costs were included in the net figures. Since these earnings estimates were a proxy for cash savings net of costs, we did not count depreciation and allocated overheads. By examining the benefits by their mediating factor (Figure 4), we found that the benefits, unlike in the beef case, did not accrue predominantly through operational efficiency and risk management. The largest financial benefit came from *more innovation*, more specifically, increased pricing on products with enhanced sustainability features (Table 4, row 2). The total EBIT increase for more innovation was \$3.0 billion, which represented 1.7 percent of annual revenue. In one mediating factor, greater customer loyalty (operationalized as efficacy of marketing spend), calculating net benefits meant that the impact on EBIT was actually negative (–\$6 million). The cost of marketing spend on sustainable products (electric vehicles and hybrids), outweighed earnings in 2016, but the net benefits would turn positive in year five as volumes ramp up. That is why we also calculated NPVs over five years (Figure 5). As innovation here was the most material mediating factor, we split the associated strategies into three categories: product (zero emission, hybrids), product safety features, and services (e.g., car sharing). We identified none of the potential benefits (Tables 2 through 5, column 2) as better media coverage or stakeholder engagement because they were either not salient to manufacturing or there was no proxy measure available from traditional accounting measures. Thus, these two mediating factors remained at \$0.

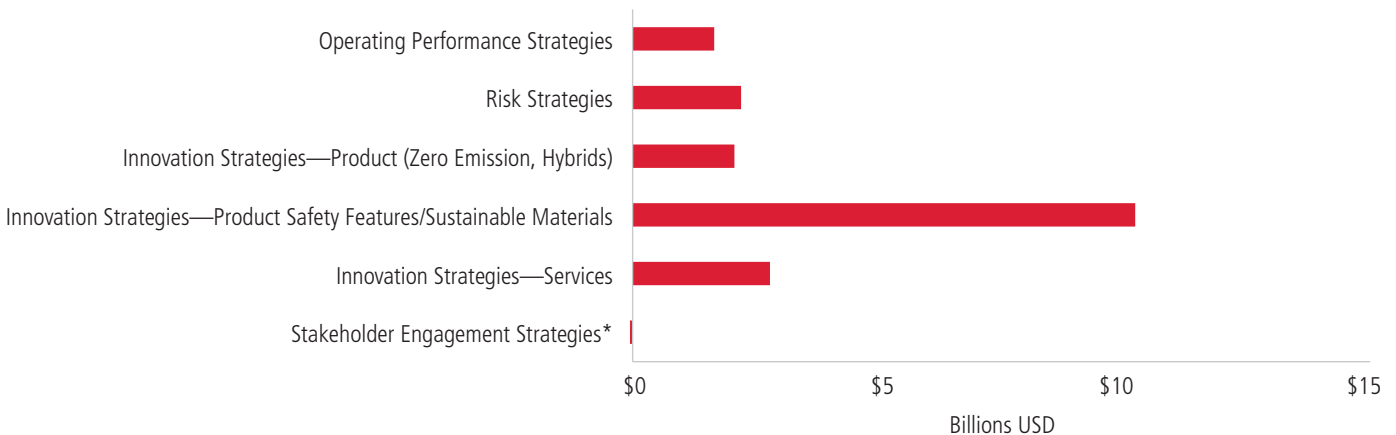
FIGURE 4. Total net benefits (in USD billion) for one automotive company based on EBIT as proxy for cash flow from 2015 to 2016 and split by mediating factor from the ROSI framework.



* Greater customer loyalty was -\$6 million because earnings would outweigh cost only over a period of five years.

** Operationalizing better media coverage and stakeholder engagement was not feasible and benefits are hence not available (\$0).

FIGURE 5. Total net benefits (in USD billion) for one automotive company based on an NPV over five years split by the most salient sustainability strategies.



* Sustainable stakeholder engagement strategies (suppliers, employees, customers) were negative with -\$45 million because for all benefits we conservatively assumed investment cost accrue every year.

DISCUSSION

When Sustainability Improves Corporate Financial Performance

We introduced a novel methodology, ROSI, that emphasizes nine mediating factors when monetizing tangible and intangible benefits of sustainability actions such as innovative sustainable agricultural techniques or innovation in electric vehicles. We showed empirically which factors likely drove corporate financial performance in our two cases. In the deforestation-free beef example, efficiencies and innovation provided financial benefits for the ranches, whereas higher up in the supply chain the greatest potential benefits came from better risk management and improved sales and marketing. In the automotive example, innovation drove much of the financial benefit, with improved sales and marketing, reduction in risk, and operational efficiencies capturing a smaller portion of the value. In all cases, we were able to quantify the financial benefits, potential or realized. Using the mediating factors allowed us to capture tangible and intan-

gible benefits for a diverse range of sustainability actions that otherwise can be ignored. Drivers that captured the least value included greater customer loyalty and stakeholder relationships, in part because there were no systems in place to collect data on these measures. Our findings show that these nine factors should be considered in research that monetizes the benefits of sustainability efforts so we can begin to understand mechanistic linkages better. We also show that focusing on operational efficiency alone, for example, tells an incomplete story.

Not everyone agrees that we should monetize sustainability actions in the first place. Some academics argue that monetizing sustainability simplifies diverse values into a single metric, lacks academic rigor, or is difficult to interpret because there are too many assumptions. In public decision-making these issues may be even more prominent (Anderson et al. 2015). Others argue that monetizing sustainability enables decision-making to be focused on data, not opinions, and to be more transparent (Bebbington, Brown, and Frame 2007). We assert the latter: Making the financial case for sustainability speaks the language of business managers and is necessary (yet not sufficient in itself) to change their mindsets.

Considerations for Practitioners

We encourage companies to use this approach as a tool to better incorporate sustainability into corporate business strategy. With the financial case in hand, it becomes easier to embed sustainability into daily business operations. Managers could focus on a single sustainability strategy or action, identify and monetize corresponding benefits, and use that learning process to then analyze additional sustainability strategies. It is possible to evaluate all concurrently, but the effort needed to monetize many benefits across many strategies is substantial. In addition, managers will find that in the case of missing or incomplete data, they will need to work with proxy estimates. Providing a range of estimates may mitigate uncertainty and give directional guidance.

We have found that sometimes simply listing the full set of benefits stimulates a different understanding of why sustainability actions are valuable. Often sustainability efforts start out with operational efficiencies and end there. Additional benefits under different mediating factors, such as lower risk or better employee relations, are often not acknowledged. Our monetization methodology shines a light on those neglected and intangible benefits and allows a richer discussion of the return on sustainability investment.

Managers may also use the methodology to encourage a systems-thinking approach and encourage departments to work together. For example, in the automotive case, we gathered and analyzed information pertaining to the disposal of vehicles at end of life. While in some ways this is a basic question (number of vehicles, percentage of material recycled, etc.), it also became a technical question (how are vehicles designed, who sources materials), and a strategic one (what happens if a new regulation is introduced into the United States). Critical data are typically sequestered in multiple departments. Without a systematic way to collect data and monetize it, managers may not be able to justify investment expenses, higher procurement costs, or strategic changes to pursue sustainability actions. As a result, actors in a supply network or within one company may not invest in sustainability, even if the benefits are positive for all stakeholders. Especially for sustainability actions that span a supply chain or require

collaboration, we hope that our framework introduces a shared vocabulary and a deeper understanding of how sustainability leads to short- and long-term value creation. We encourage practitioners to continuously test inputs, assumptions, and outcomes of quantifying and monetizing the benefits in order to maintain credibility. Common pitfalls include:

1. Double-counting the benefits from a single sustainability action
2. Missing a substantial benefit, cost, or action
3. Technical errors in working with complex spreadsheets
4. Omitting the opinions of important stakeholders
5. Not documenting critical assumptions such as the discount rate, among other issues.

Mainstream Adoption

The ROSI methodology has been successfully field tested in two complex industries, complete with examples of benefits and monetization methods. We will continue this work with further case studies in other sectors to make the research even more rigorous, valid, and applicable in other industries. Researchers and practitioners are typically faced with a simpler scenario, perhaps looking at one sustainability action or investment. Therefore, we expect that the ROSI methodology can be applied in different industries and domains. This flexibility carries a limitation: We are not able to, nor could we, prescribe specific benefits or monetization methods as each industry will have different material ESG factors and thus different sustainability strategies and actions.

While some researchers provide highly generalized requirements for measuring corporate sustainability (Searcy 2012, 2016), we emphasize the current lack of using company-internal financial data and a misalignment of sustainability and financial disclosure (The World Business Council for Sustainable Development 2017, 2019). External data and analytics providers are tracking the performance of corporations on ESG. ESG metrics range from greenhouse gas emissions to board-member diversity to human-rights efforts, depending on what is material for an industry—yet these efforts are rarely monetized. And even when ESG efforts are monetized, the information generally is not publicly available (Douglas, Van Holt, and Whelan 2017). Sustainability is more, though, than disclosing on some ESG indicators. Voluntary and self-referential reporting has been criticized as insufficient (Milne and Gray 2013), ignoring wider thresholds such as climate targets, that is, the “sustainability context” (McElroy and Engelen 2012; Haffar and Searcy 2018), and being irrelevant or counter-productive (Gray 2010; Joseph 2012). ESG indicators, moreover, miss monetizing how sustainability actions affect, for example, employee or supplier relations because these data are difficult to monetize or are not available.

Tools to monetize sustainability actions can help those interested in evaluating opportunities and risks in a company. For example, insurance agencies may focus on the financial impacts of risk; investors may be interested in the value of strategic innovations; and sell-side analysts may evaluate cash wrung from operational efficiencies. Corporate managers can use monetization tools to understand

the value of sustainability actions, guide strategy, recognize risks, and explore how solving sustainability challenges can create new revenue streams. Beyond identifying potential or realized benefits, monetization efforts may foster cross-departmental collaboration, through gathering and assessing relevant data, for example. In the ideal scenario, the methodology gets embedded within an organization and leads to changes that incorporate sustainability into long-term strategic planning. In fact, there is already evidence that sustainability is a long-term corporate strategy *and* common practice (Ioannou and Serafeim 2019).

CONCLUSION

Our research aims to support researchers, practitioners, and investors who want to monetize the tangible and intangible benefits that companies obtain (or may obtain) when implementing sustainability strategies and practices. The framework systematically examines opportunities for reducing costs, increasing revenues, and avoiding risks among other benefits through what we call *mediating factors*. We presented and applied a monetization methodology, ROSI, and its five steps on how to calculate the return on sustainability investment.

In our two Brazilian case studies of the beef supply chain, the material sustainability actions for ranches, slaughterhouses, and retailer/restaurant were fundamentally different, but we were able to cover them in one unifying methodology. Projeto Novo Campo and Fazendas São Marcelo ranches invested to make their operations more sustainable; Marfrig, JBS, Carrefour, and McDonald's set commitments to buy deforestation-free beef. Being able to value an investment is crucial for decision-making, and cattle ranchers in Brazil are no exception. As one rancher said: "We might take loans in the future now that we know it pays back."

In the automotive industry, across three companies, we identified 16 sustainability strategies that included strategies to achieve operational efficiencies and generate new revenues; risk reduction strategies to reduce exposure to resource scarcity, natural disasters, and regulatory non-compliance; innovation to develop new sustainability products, services, or processes; and other stakeholder engagement strategies such as improving retention. Sustainability-driven innovation was the greatest source of financial benefit for the companies, though operational efficiencies, reduction in risk, and improved sales and marketing also produced value.

Using the ROSI methodology can help managers champion sustainability investments, improve decision-making, and foster a culture that embeds sustainability core to business strategy. Actors in a supply network or across departments may not invest in sustainability, even if the benefits are positive for each step of the value chain due to the lack of financial information. By monetizing the tangible and intangible benefits of sustainability actions, companies may overcome one of the barriers for scaling up sustainability and trigger a virtuous circle.

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Appendix A: Implementing Monetization Methods Illustrated with an Example

The details of all calculations for the first case study (beef supply chain) are available in a spreadsheet for download (Whelan et al. 2017).¹ For the automotive industry, we released only the spreadsheet template² because of the confidential nature of internal company data. To guide practitioners further on how to implement their own ROSI analysis, we walk through one example, conflict materials, from Table 3, Risk Reduction Strategies (Table A1).

The U.S. Securities and Exchange Commission (SEC) had required publicly traded companies to annually report use of conflict minerals (tin, tantalum, tungsten, and gold) in their products (the rule was suspended in April 2017). Regardless, SASB, who standardizes voluntary disclosure, identifies the management of risks associated with critical materials in their materiality map. Automotive companies have worked toward this goal by, for example, signing a declaration of support for the Responsible Raw Materials Initiative or using algorithms to ensure tier 3 and 4 supplier compliance. In the manufacturing process, using less material for achieving the same output has obvious implications for improved resource consumption and using substitute materials may also lead to efficiencies. However, the latter is a less clear financial benefit as the substitute material may cost more or be required in larger quantities.

When companies avoided sourcing and using conflict minerals, they generated value through two mediating factors: operational efficiency and risk management. Operational efficiency benefits were a combination of savings from: (1) reduced use; (2) using cheaper substitute materials—both of which led to (3) lower energy consumption and (4) lower water consumption, according to the companies. On the risk side, the benefits were: (5) avoided cost related to supply shortages and (6) avoided regulatory fines. Above, the monetization method (last column) describes the following calculations. The calculations in Table A2 and Table A3 follow a similar logic: We gathered the realized inputs for 2015 and 2016, adjusted for vehicle production (so that a change is independent of how many cars were produced), and monetized the changes with average weighted cost.

Table A2 and Table A3 show how we simplified calculations by using aggregate data. Other benefits, for instance managing manufacturing material waste, were also included as a total category (by using the average weighted cost of disposal instead of breaking it down). Some analyses may require an even more granular level of data. If the mix of manufactured vehicles were to have an impact on year-on-year changes, including it would yield more precise estimates. Regardless of the level, however, the framework provides solid directional guidance for forecasting investments and likely outcomes.

Table A4 takes a simplified approach to assessing risk because of the overall complexity resulting from many sustainability strategies. The companies provided estimates for the incident rate and average cost for supply shortage and regulatory fines related to conflict minerals. We postulated that the sustainability

¹The download link is at the bottom of the page: <https://hbr.org/2017/09/how-to-quantify-sustainabilitys-impact-on-your-bottom-line>.

²The Excel download link is available at <http://bit.ly/roshi-auto> and on the CSB website.

TABLE A1. Excerpt from Table 3, Risk Reduction Strategies

| Strategy | # | Benefits | Mediating Factors | Monetization Methods |
|---------------------------------|---|--|-------------------------------|---|
| Avoid Use of Conflict Materials | 1 | Savings from reduced use of conflict minerals | Higher operational efficiency | Spend reduction on conflict minerals derived from multiplying the percent reduction in amount of conflict minerals per vehicle by the annual volume of conflict minerals used. Reduction due to less use of conflict minerals multiplied by the weighted average price of conflict minerals. |
| | 2 | Lower costs associated with substitute materials | | Reduction in conflict minerals due to substitute product multiplied by the conversion rate and by the cost differential in price of material. |
| | 3 | Savings related to lower energy consumption using substitute materials | | The sum of: i) The savings from a reduction in use of conflict minerals derived from multiplying the reduced material used by the weighted average spend on energy used in manufacturing using conflict minerals per ton; and ii) The saving from substituting materials derived from multiplying the material substituted by the differential in the weighted average cost of energy per ton using conflict minerals and the weighted average cost of energy per ton using substitute materials. |
| | 4 | Savings related to lower water consumption using substitute materials | | The sum of: i) The savings from a reduction in use of conflict minerals derived from multiplying the reduced material used by the weighted average spend on water used in manufacturing using conflict minerals per ton; and ii) The saving from substituting materials derived from multiplying the material substituted by the differential in the weighted average cost of water per ton using conflict minerals and the weighted average cost of water per ton using substitute materials. |
| | 5 | Avoided costs related to supply shortages | Better risk management | Estimated cost of a short supply incident by the average annual incidents of short supply. |
| | 6 | Avoided costs related to regulatory fines | | Estimated cost from multiplying the average annual number of incidents of conflict mineral related fines by the average fine per incident less additional compliance costs incurred. |

strategies would mitigate the potential cost in the long-term. For a risk assessment approach, an extended analysis may choose to model the incident rate and cost as a distribution with, for example, a truncated lognormal distribution. The simulation outputs based on such parameters might then provide more than a point estimate and inform the analyst further on extreme values.

Table A2 through Table A5 provided the information required to calculate the net financial benefit of the sustainability strategy. The annual additional operating income was \$35,944,801 (that is, \$36,865,873 minus the cost of \$921,072). Lastly, we wanted to know the value of these benefits if they were to continue over the next five years and calculated the NPV as shown in Table A6.

TABLE A2. Reduction and Substitutes for Conflict Materials Sourcing (1, 2)

Shaded cells are company inputs. Note that substitution was a net loss and so the overall benefit resulted in \$14,950,952. Figures were obscured with a random perturbation term to preserve confidentiality that maintained the scale in magnitude.

| Benefits | Unit | Value | Explanation |
|---|-------------------------|----------------------|--|
| 2016 | | | |
| Total Raw Materials Weight | Metric tons | 4,266,909 | |
| Percent of the Raw Materials That Confirmed Conflict Materials, by Weight | Percent | 2.0% | |
| Total Annual Volume of Conflict Materials Used in Manufacturing | Metric tons | 84,911 | Multiply two rows above |
| Per Vehicle Total Annual Volume of Conflict Materials Used in Manufacturing | Metric tons per vehicle | 0.0084 | Above divided by annual vehicle count |
| 2015 | | | |
| Total Raw Materials Weight | Metric tons | 4,525,901 | |
| Percent of the Raw Materials That Confirmed Conflict Materials, by Weight | Percent | 2.1% | |
| Total Annual Volume of Conflict Materials Used in Manufacturing | Metric tons | 96,402 | Multiply two rows above |
| Per Vehicle Total Annual Volume of Conflict Materials Used in Manufacturing | Metric tons per vehicle | 0.0100 | Above divided by annual vehicle count |
| Compare improvement from 2015 to 2016 | | | |
| Percent Reduction of Conflict Materials Used in Manufacturing | Percent | 16.4% | Percent change 2015–2016 based on per vehicle total annual volume |
| Reduction of Conflict Materials Used in Manufacturing | Metric tons | 15,841 | Delta 2015–2016 adjusted for vehicle production |
| Reduction as a Result of Reduced Use of Materials | Percent | 34% | |
| Reduction as a Result of Substituting Conflict Materials with Others | Percent | 25% | |
| Weighted Average Price of Conflict Materials, 2016 | USD/metric ton | \$3,590 | Includes materials, logistics, handling, and taxes |
| Weighted Average Price of Substitute Materials, 2016 | USD/metric ton | \$3,443 | Includes materials, logistics, handling, and taxes |
| Weighted Average Substitute to Conflict Material Weight Conversion Constant | # | 1.34 | For example, 1 ton tin may require 1.2 tin alternatives to replace |
| <u>Savings from Reduced Use of Material</u> | <u>USD</u> | <u>\$19,059,657</u> | Multiply reduction of conflict materials, reduced use of materials, and weighted average price of conflict materials |
| Amount of Substitution | USD | 4,015 | Multiply reduction of conflict materials with percent of substitution |
| Savings from Substitution Before Cost of Substitute Materials | USD | \$14,413,351 | Multiply amount of substitution with weighted average price of conflict materials |
| Cost of Substitute Including Conversion | USD | \$18,522,056 | Multiply amount of substitution with weighted average price of substitute materials and conversion factor |
| <u>Savings from Using Substituted Materials</u> | <u>USD</u> | <u>\$(4,108,705)</u> | Delta two rows above |

TABLE A3. Savings for Energy and Water Consumption Impact (3, 4)

Shaded cells are company inputs. The overall benefit resulted in \$593,181. Figures were obscured with a random perturbation term to preserve confidentiality that maintained the scale in magnitude.

| Benefits | Unit | Value | Explanation |
|--|----------------|------------------|--|
| Weighted Average Spend on Energy in Manufacturing for Conflict Materials per Ton | USD/metric ton | \$52 | |
| Weighted Average Spend on Energy in Manufacturing for Substitute Materials per Ton | USD/metric ton | \$29 | |
| Energy Savings from Reduced Use of Material | USD | \$276,055 | Multiply amount of reduction (from Table A1) with spend above |
| Energy Savings from Using Substituted Materials | USD | \$92,336 | Multiply amount of reduction (from Table A1) with delta of spend above |
| Weighted Average Spend on Water in Manufacturing for Conflict Materials per Ton | USD/metric ton | \$31 | |
| Weighted Average Spend on Water in Manufacturing for Substitute Materials per Ton | USD/metric ton | \$16 | |
| Water Savings from Reduced Use of Material | USD | \$164,571 | Multiply amount of reduction (from Table A1) with spend above |
| Water Savings from Using Substituted Materials | USD | \$60,219 | Multiply amount of reduction (from Table A1) with delta of spend above |
| <u>Savings from Changes in Energy and Water Consumption</u> | <u>USD</u> | <u>\$593,181</u> | Sum all four rows with savings |

TABLE A4. Avoidance of Short Supply and Regulatory Fines (5, 6)

Shaded cells are company inputs. The overall benefit resulted in \$21,321,739. Figures were obscured with a random perturbation term to preserve confidentiality that maintained the scale in magnitude.

| Benefits | Unit | Value | Explanation |
|--|------------|---------------------|--------------------------|
| Avoidance of Short Supply | | | |
| Historic Average Annual Incidents of Conflict Material Short Supply | # | 0.95 | 2011–2016 annual average |
| Average Cost of Conflict Material Short Supply Per Incident | USD | \$21,039,489 | 2011–2016 annual average |
| <u>Total Impact of Short Supply</u> | <u>USD</u> | <u>\$20,049,647</u> | Multiply rows above |
| Avoidance of Regulatory Fines | | | |
| Historic Average Annual Incidents of Conflict Material Related Fines | # | 0.35 | 2011–2016 annual average |
| Average Fines for Conflict Material Issues per Incident | USD | \$3,682,211 | 2011–2016 annual average |
| <u>Annual Potential Fines</u> | <u>USD</u> | <u>\$1,272,093</u> | Multiply rows above |

TABLE A5. Annual Costs and Investments for Avoid Use of Conflict Materials

Shaded cells are company inputs. Figures were obscured with a random perturbation term to preserve confidentiality that maintained the scale in magnitude.

| Costs | Unit | Value |
|--|------------|---------------------|
| Additional Annual Operational Costs for Reducing Use of Material | USD | \$ 448,744 |
| Additional Annual Operational Costs for Using Substitutes | USD | \$ 238,220 |
| Additional Compliance Costs | USD | \$ 234,108 |
| <u>Total Costs</u> | <u>USD</u> | <u>\$ 921,072</u> |
| Investments | Unit | Value |
| Total Existing Equipment/Hardware Modification Investment | USD | \$ 2,115,220 |
| Other One-Time Capitalizable Spends | USD | \$ 131,237 |
| <u>Total Investments</u> | <u>USD</u> | <u>\$ 2,246,458</u> |

Appendix B: How the Return on Sustainability Investments (ROSI) Framework May Be Applied in the Insurance Industry

Companies that focus on a sustainable business model and related risk management might incur short-term costs and investments, but benefit from mid- and long-term benefits. Some of the benefits materialize right away in reduced insurance premiums as underwriters ought to take the risk management of companies into consideration. Companies and their insurance coverage have similar interests to prevent potential losses, to mitigate losses, and to find innovative solutions. Investments in sustainable solutions have therefore a direct monetary impact as they will be reflected in reductions of insurance premiums. ROSI and its associated data can be used to provide transparency, and can be applied in the underwriting process. Identifying, quantifying, and monetizing the value of these sustainability strategies can help insurers further understand how a company is mitigating material risks such as recalls for the automotive industry, which may be used, for example, in assessing price premiums (Table B1).

In Table B1, we list three sustainability benefits that were monetized in our study based on the automotive industry:

- *Water use reduction:* Insurance companies are already modeling the growing risk of water, its cost implications, and how droughts and floods can both affect operations. We showed how to monetize the automotive companies' efforts to improve water consumption, which affected the amount of water used, recovered and reused, and disposed.
- *Critical materials:* The automotive companies aimed to reduce their dependency on critical and conflict minerals (e.g., tin, tantalum, tungsten, and gold, which have been regulated in the past). The ROSI metrics we used show how companies are either reducing or substituting critical materials, the scale of these efforts, and how they generated a positive net return because of reduced costs associated with the new approaches and the reduced risk from supply chain disruptions (see Appendix A).
- *Recalls:* Recalls have been increasing in the automotive industry, and addressing recalls are material to the automotive industry (see the SASB materiality map). The ROSI metrics we used show the scale of the recalls and the associated cost for a recall. For example, in one company, recalls were reduced likely because they incorporated more systems thinking into the manufacturing process, so that the design process spanned multiple departments that were previously isolated in their sustainability efforts. The company's ability to improve quality in manufacturing along with working closer with their supply chain partners, ought to mitigate the number of recalls. Insurers, during their due diligence, can ask clients about their manufacturing improvements, request that companies begin to track and monetize necessary information, or engage in a collaborative discussion on sustainability strategies that reduce risk exposure.

When a company monetizes its sustainability actions, others can evaluate how they are innovating and investing to minimize risk. People can see, and quantitatively value, robust contingency plans to mitigate future losses, and they can create opportunities for procuring cost-effective insurance coverage. Insur-

ers may be able to capture insights into the long-term prospects of a company that are otherwise hidden. This is useful for assessing risk, gaining customer loyalty, and improving underwriting performance.

Insurance underwriting performance depends on appropriately assessing the risk profile of a company (and industry). The ROSI framework and associated data can enhance analyzing a company's exposure to risks and the potential impacts of events that they are underwriting, such as catastrophe (floods, hurricanes), business interruption (supply chain disruptions), or product liability (recalls, accidents) losses. These analyses may also open the dialogue on what companies are doing to mitigate these challenges. For example, public company information on manufacturing and other critical locations can be mapped to drought-prone regions. Select ROSI data in our analysis, such as historical incidents in production disruptions or number of recalls along with the associated costs, can be the basis of forecast models that assess the likelihood and severity of losses under various future assumptions. Better assessments of probable outcomes and losses improves underwriting practices for insurers. Measuring the return of sustainability investment can contribute toward these improved practices and more sustainable businesses.

TABLE B1. Examples of How Metrics Captured in the ROSI May Be Used by Insurers for Underwriting and Asset Management

| Data from ROSI Framework | Interest to Insurers | Potential Use to Underwriters | Potential Use to Asset Managers |
|--|--|---|---|
| Water Use Reduction | | | |
| Per unit cost of water | Trends over time Comparison to peers Investment in new technologies to reduce water use Forecast future impacts | Pricing on property and business interruption insurance—for drought and/or flooding | In assessing relative value of investment versus alternatives |
| Water usage per unit of production | | | |
| Amount of water recovered and reused | | | |
| Per unit cost of wastewater disposal | | | |
| Critical Materials | | | |
| Amount of critical materials per unit | Trends over time Comparison to peers Investment to reduce critical material use Forecast future impacts | Pricing on business interruption insurance coverage | In assessing relative value of investment versus alternatives |
| Amount of substitute materials used | | | |
| Differential in price of critical and substitute materials | | | |
| Number of incidents of supply shortage | | | |
| Estimated cost of a supply shortage | | | |
| Recalls | | | |
| Number of recalls | Trends over time | Pricing on coverage related to recalls and assessing manufacturers management of the supply chain | In assessing relative value of investment versus alternatives |
| Average cost of recalls | Comparison to peers | | |
| | Investment to improve quality or reduce defects | | |
| | Forecast future impacts | | |

Unsustainable Future: The Mathematical Frame in Which We Live

Franz W. Peren

Abstract

Humankind, it can be argued, lives beyond its means and often at the expense of future generations. This paper starkly demonstrates, with the aid of a mathematical model, the imperative for a sustainable existence. In the model, consumption of resources is represented as a closed system, just like our planet. Long-term survival is only possible if consumption is below the ability of the system to regenerate.

CURRENT CONSUMPTION LEVELS AT CURRENT TECHNOLOGY CANNOT BE CONTINUED

Humans consume the planet faster than the planet can heal. According to the Global Footprint Network (2017), the Earth Overshoot Day in the year 2017 took place on August 2, eleven days earlier than the year before. Renewable resources consumed after each Earth Overshoot Day cannot be replenished in the same year in which they were consumed, and thus consumption past the Overshoot Day reduces the endowment of resources. The Living Planet Report 2012 of the World Wide Fund for Nature (WWF) shows that roughly up to the year 2030 humans would require the resources equivalent to two planets in order to cover our hunger for natural resources if we continue to live as we do. Figure 1 offers a visual representation of our most recent global ecological footprint.

UNSUSTAINABLE FUTURE

When those within a closed system use the system's resources beyond the system's ability to replenish, in time, the system will collapse.

For a closed system, stability is¹:

$$R_T \leq R_{\text{regen}} \quad (1)$$

¹Stability is to be understood here as emancipatory in its meaning, i.e., if within a well-defined, temporal interval the inequation $R_T \leq R_{\text{regen}}$ is temporarily violated, then it is nevertheless valid altogether during this period. The scope and location of such a time period are to be selected in such a way that they contain the respectively current point in time so that the strategic aim of a stable balance between consumed and regenerated natural resources is achieved not only over the longer term, but also for the benefit of those directly affected within the system taken into consideration.

$$\text{where } R_T = R_H + R_O \quad (2)$$

$$\text{and } R_H = \sum_{I=1}^N r_I = r_H N \quad (3)$$

$$\Leftrightarrow r_H = \frac{\sum r_I}{N} = \frac{R_H}{N} \quad (4)$$

where

R_T = consumption of natural resources as a whole

R_{regen} = regeneration of natural resources as a whole

R_H = human consumption of natural resources

R_O = consumption of natural resources not caused by humans

r_I = individual per capita consumption of natural resources by humans

r_H = average per capita consumption of natural resources by humans

I = human individuals who access the planet's natural resources (in their individual quality and quantity)

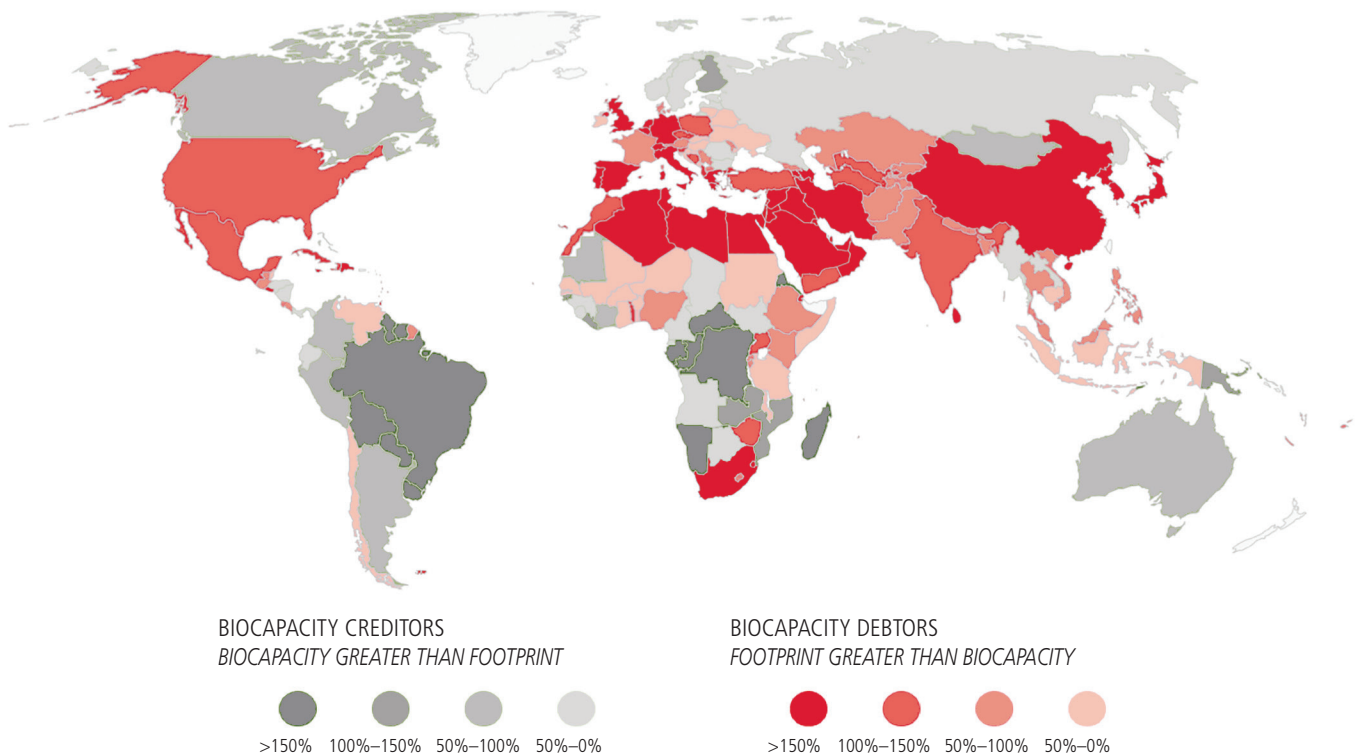
N = number of humans who access the planet's natural resources

Then, to maintain equilibrium in the closed system that is our planet, we can choose one of the following relations:

Relation 1. Continue to exterminate habitat and push species to extinction until our consumption again destabilizes the equilibrium,

Relation 2. Reduce our numbers and adjust consumption for those that remain to maintain the equilibrium,

FIGURE 1. Ecological Footprint Atlas



Relation 3. Balance our consumption against our growing numbers to sustain the planet's equilibrium.

While ideally, one fine day soon, humankind voluntarily commits to choice relation 3, we are more likely to preserve life if we marshal both the disciplinary forces of the market and the transformative abilities of technology.

A lot is written on the economic unfairness, and the moral depravity of the markets. Nevertheless, the evidence does suggest that the economic incentives established by markets do alter human behavior. Such incentives can range from allocating property rights for resources we now undervalue (such as clean air, fresh water, the aesthetics of biodiversity, the choice for solitude and privacy), to pricing that reflects more of the externalities in the production process, to a trade system for consumption units. Perhaps, however, a more likely course of action is one brought about by technological innovations to establish a highly developed circular system. In such a system, the assumption is that increases in efficiency or gains from technical progress will not fuel new consumption.

INDIVIDUAL PROSPERITY EFFECTS

Peren (2018) formulates, in indisputably rational terms, the stark choices facing humankind. While the growth rate of the global population is declining according to data reported by the U.S. Census Bureau, the number of people is increasing. The increase in the total number of people on the planet, unless accompanied with a proportionate reduction in the average per-person consumption of resources, will violate relation 2.

Given a percent increase in the global population (p), and unchanged average per-person consumption, and all other conditions being equal, humanity's consumption (R_H) will need to be proportionately scaled by factor $(1 + \frac{p}{100})$, so that

$$R_H (1 + \frac{p}{100}) = r_H N (1 + \frac{p}{100}). \quad (5)$$

Under the assumption that human consumption is fixed at current levels as the global population is increasing, then relation 2 becomes²

$$R_H = r_H N (1 + \frac{p}{100}) \quad (6)$$

which then suggests average per-person consumption

$$r_H = \frac{R_H}{N} (1 + \frac{p}{100})^{-1}. \quad (7)$$

In equation (7) the ratio R_H/N conveys the idea that human consumption of natural resources remains unchanged from the time before the increase in the population. However, in the case where human consumption changes with changes

²The aim is that human consumption of natural resources altogether, R_H , remains unchanged despite world population growth. Therefore R_H is to be equated with $r_H N (1 + \frac{p}{100})$, whereby average human per-person consumption of natural resources, r_H , is ultimately reduced by the growth factor of the world population $(1 + \frac{p}{100})^{-1}$ within the period under consideration.

in the population, to maintain relation 2, average per-person consumption will need to be reduced by factor $1/(1 + \frac{p}{100})$.

IMPLICATIONS

The fact that our planet is a closed system, absent ground-breaking technology, those of us who live in the biocapacity creditor parts of Figure 1 will be unable to continue subsidizing the ecological footprint of those of us living in the biocapacity debtor parts of Figure 1. Thus, the issue of living sustainably is not only a matter of survival, but also a matter of moral fairness in the way we currently allocate resources among those on top and those at the bottom. And what do we benefit if we gain the whole world, but lose our soul?

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Arguments on a Hybrid Privatization of the U.S. Flood Insurance Program: A Debate Driven by Issues of Sustainability

Patricia H. Born

Robert W. Klein

Abstract

All arguments considered, we suggest that expanding the sale of private flood coverage would be welfare enhancing and in the public interest. While there are several forms of “privatization” that are advocated for the National Flood Insurance Program (NFIP), we advocate here a form of privatization that reflects elements of both market competition and public-sector support. Our proposed “hybrid” privatization of the NFIP involves legislative and regulatory measures that would make it easier for private companies to offer flood insurance on their own paper. Our proposals are consistent with the developing interest for public-private partnerships to tackle thorny issues of community vulnerability and economic sustainability. Our suggestions provide insights into devising a scheme that would be efficient, equitable, and more politically palatable to all stakeholders.

INTRODUCTION

The continuing escalation of severe flooding in the United States and the consequent damage to residential and commercial properties have drawn increasing public attention to the provision and purchase of flood insurance. Currently, the National Flood Insurance Program (NFIP)—subject to policy limits prescribed by the program’s enabling legislation—underwrites most flood insurance for residential properties. As the number and severity of floods have continued to rise, the NFIP has been beset by a number of problems and become a target for substantial criticism. Additionally, its sustainability in its current form is in question. Further, as more communities and homes become vulnerable to flooding, the NFIP is falling far short of its public mission to promote good flood risk management.

Recent legislation to reform the NFIP—the Biggert-Waters Act of 2012 and the Homeowners Flood Insurance Affordability Act of 2014 (HFIAA)—have produced only mixed results in fixing the program’s problems and achieving

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better flood risk management. Hence, there has been increasing interest in the provision of private flood insurance as a complement to or substitute for federal flood coverage.¹ Most recently, the House passed H.R. 2874—the 21st Century Flood Reform Act (FRA)—on November 14, 2017 that contained a number of provisions that would facilitate the sale of private flood insurance.²

As reflected in the FRA, what was proposed is not the full replacement of the NFIP by the private sector per se, but rather a set of measures that would enable private insurers to underwrite flood insurance on a much broader scale. Among the motivations spurring the interest in private flood insurance is the belief that private insurers can employ innovations in underwriting, pricing, and coverage provisions that will enable them to offer flood insurance to some property owners at an “attractive” price.³ There is also the view that laying off more flood risk to the private sector is a good thing and will reduce the fiscal pressures on the NFIP and its propensity to incur debt.

One can argue that private insurers can offer various welfare-enhancing innovations in flood risk assessment and the pricing and design of flood insurance policies, and there is some anecdotal evidence of such innovations already being employed. This said, private insurers seeking to offer flood insurance at a primary level face a number of challenges. These challenges include competing with the NFIP for properties that receive subsidies or that are otherwise underpriced (by the NFIP). Additionally, private insurers currently face certain restrictions in how they can modify flood insurance coverages in their policies relative to what the NFIP offers.⁴

To date, legislative efforts have sought to reduce some of these obstacles to significantly increasing the sale of private flood insurance. Importantly, the FRA would have required lenders and government sponsored enterprises (GSEs) to accept private flood insurance policies as an adequate substitute for NFIP policies if these policies are approved by state insurance regulators. Additionally, the FRA would have allowed non-admitted (surplus lines) insurers as well as mutual aid associations to offer flood insurance to homeowners and commercial buyers.

Such provisions, if enacted, would provide a substantial boost to private flood insurance. There are, however, concerns that such provisions could poten-

¹Opinions differ among experts as to how the NFIP should be further reformed (see for example, Brannon and Blask 2017; and Kousky 2017).

²The FRA incorporates many provisions of the S. 563—the Flood Insurance Market Parity and Modernization Act (FIMPPA)—which previously was the vehicle that would have been used to increase the sale of private flood insurance.

³An analysis by Michel-Kerjan, Czajkowski, and Kunreuther (2015) demonstrated that the NFIP, subsidies aside, underprices some properties and overprices others due to the antiquated methodology that it uses. Consequently, they infer that private insurers could offer lower prices to some homeowners than what the NFIP charges or would charge them. Most recently, FEMA has proposed new rules (Risk Rating 2.0), effective as of October 2020, that would provide for more accurate and property-specific pricing of flood insurance; this would likely raise the premiums for many homes but could also lower the premiums for others (See “Climate Advocates Cheer Trump Policy Shift on Flood Insurance.” *Bloomberg*, March 18, 2018, <https://www.bloomberg.com/news/articles/2019-03-18/climate-advocates-cheer-trump-policy-shift-on-flood-insurance>).

⁴The Office of the Comptroller of the Currency and the Federal Deposit Insurance Corporation has recently promulgated new regulations that ease some of the current restrictions on lenders with respect to their ability to accept private flood policies as an alternative to NFIP coverage ([https://www.occ.gov/news-issuances/news-releases/2019/nr-ia-2019-15.html](https://www OCC.gov/news-issuances/news-releases/2019/nr-ia-2019-15.html)). The implications of the proposed changes are somewhat unclear. Nonetheless, these changes appear to fall short of what has been proposed in the FRA and similar legislation.

tially result in some homeowners purchasing inadequate coverage or securing insurance from non-licensed carriers or mutual aid associations that are subject to less regulation than licensed insurers and for which there would be no state guaranty association protection should they become insolvent.⁵ There are also concerns that rather than helping the NFIP, private flood insurance as contemplated under the FRA and similar proposals would undermine the program and compromise its ability to achieve its objectives.⁶

While there is a rich stream of academic literature on flood risk management and flood insurance, there has been relatively little discussion in this literature on the proper role of the private sector vis-à-vis the public sector in providing flood insurance with a few exceptions.⁷ There have been some recent practitioner articles and government reports on privatizing flood insurance.⁸ Generally, many of those who have written on this subject tend to favor increasing the role of the private sector in underwriting flood insurance. This article extends the current literature and, in particular, examines the potential benefits and costs of a significant expansion of private flood coverage. This examination includes a discussion of the potential benefits and costs of broadening the sale of private flood insurance in the United States as contemplated in the most recent legislative proposals.

OVERVIEW OF FLOOD RISK AND INSURANCE

To understand the motivation for and implications of private flood insurance it is helpful to briefly review flood risk and its significant rise within the last several decades. As flood risk and losses increase, there has been greater pressure on the NFIP, but this also opens up opportunities for private flood companies. We also provide a brief overview of the NFIP to provide readers with a better understanding of what private companies are offering or might offer as an alternative.

Increasing Flood Risk and Damages

The evidence suggests and a number of studies indicate that risk of floods and their costs are increasing in the United States. The incidence of damaging floods has increased significantly over the last several decades and more and more com-

⁵For a discussion of some of the problems with legislative proposals that would facilitate greater privatization of flood insurance that some perceive, see for example, Consumer Mortgage Coalition (2017).

⁶Among these concerns is the worry that private insurers would “poach” or “cherry pick” certain properties from the NFIP that it overprices (i.e., the NFIP charges them premiums higher than what it costs to insure them). For this reason, some legislators were opposed to the FRA (see “In Capitol Hill Debate Over Future of Flood Insurance, Role of Private Market Disputed,” *The Advocate*, January 13, 2018 http://www.theadvocate.com/baton_rouge/news/politics/article_65a077ee-f857-11e7-bfbc-7bf9154d2b30.html). From an economic perspective, it is problematic to justify inter-program subsidies in the NFIP. Nonetheless, this is one of several issues in the public debate over efforts to encourage the sale of private flood insurance.

⁷Two recent studies that have examined the potential for private flood insurance in the United States are Michel-Kerjan, Czajkowski, and Kunreuther (2015) and NAIC (2017). Brannon and Blask (2017) also advocate the privatization of flood insurance in the United States. Additionally, Kousky, Kunreuther, Lingle, and Shabman (2018) examine the emerging private market for residential flood insurance in the United States. Born and Klein (2019) provide a detailed examination of the issues concerning the expansion of private flood insurance.

⁸See, for example, GAO (2014), Deloitte (2014), and NAIC (2017).

munities face substantial flood risk. Born and Klein (2019) discuss the factors contributing to this trend. In some respects, the NFIP has helped to decrease flood risk, but we argue that certain provisions of the program have increased flood risk. Regardless of one's opinion on how the NFIP has affected flood risk, the fact that it has been increasing has imposed significant pressure on the program and has contributed to the issues that it faces and problems with the program as well as the interest in increasing the role of the private sector in financing flood risk.

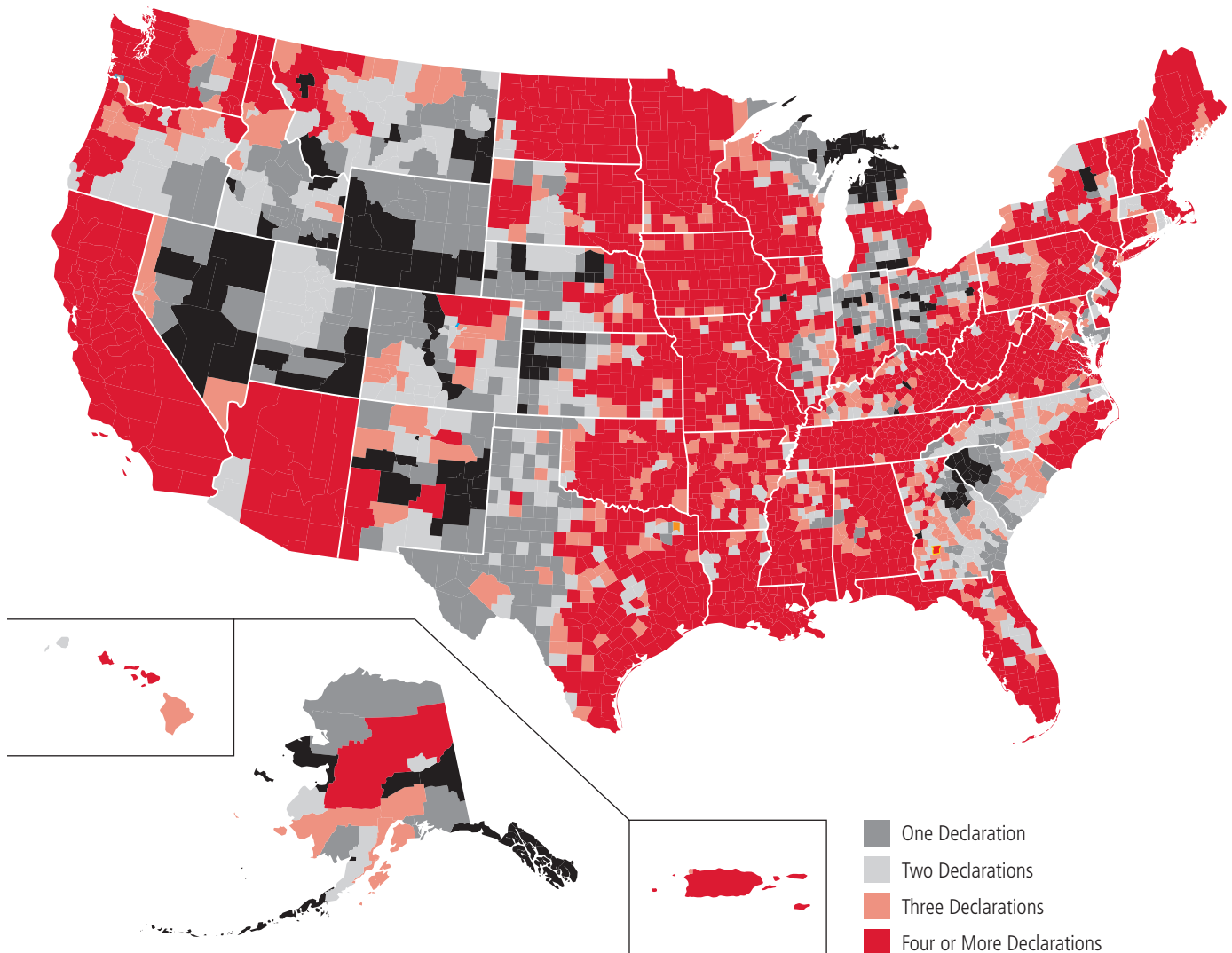
Recent events (e.g., Hurricanes Florence, Harvey, Irma, and Maria) underscore the growing risk of severe flooding in the United States and the problem of uninsured flood losses. Table 1 shows annual flood losses for the period 1965–2017 that are adjusted for inflation and exclude losses from coastal storm surges.⁹ Over the years

TABLE 1. Annual Flood Losses (in Millions USD) in the United States, 1965–2017* (Source: NOAA)

| Year | Amount | Year | Amount |
|------|--------|------|--------|
| 1965 | 7,958 | 1992 | 1,500 |
| 1966 | 1,126 | 1993 | 30,811 |
| 1967 | 3,426 | 1994 | 2,031 |
| 1968 | 2,882 | 1995 | 9,160 |
| 1969 | 6,975 | 1996 | 10,682 |
| 1970 | 1,601 | 1997 | 14,695 |
| 1971 | 1,783 | 1998 | 4,136 |
| 1972 | 24,977 | 1999 | 8,829 |
| 1973 | 9,803 | 2000 | 2,110 |
| 1974 | 2,787 | 2001 | 11,300 |
| 1975 | 6,088 | 2002 | 1,817 |
| 1976 | 12,252 | 2003 | 3,636 |
| 1977 | 4,949 | 2004 | 19,255 |
| 1978 | 2,473 | 2005 | 55,326 |
| 1979 | 11,429 | 2006 | 4,737 |
| 1980 | 4,544 | 2007 | 2,936 |
| 1981 | 2,774 | 2008 | 6,748 |
| 1982 | 6,409 | 2009 | 1,099 |
| 1983 | 9,647 | 2010 | 5,616 |
| 1984 | 8,869 | 2011 | 9,102 |
| 1985 | 1,169 | 2012 | 522 |
| 1986 | 13,699 | 2013 | 2,211 |
| 1987 | 3,214 | 2014 | 2,861 |
| 1988 | 489 | 2015 | 1,449 |
| 1989 | 2,297 | 2016 | 12,078 |
| 1990 | 3,391 | 2017 | 62,900 |
| 1991 | 3,445 | | |

* Excludes losses from coastal storm surge.

⁹Data for flood losses from coastal storm surges are not publically available.

FIGURE 1. Flood Disaster Declarations in the United States, 1965–2003 (Adapted from USGS)

1965–1994 annual flood losses averaged \$6.5 billion. Annual flood losses averaged \$8.6 billion over the years 1995–2004 and \$12.9 billion over the years 2005–2017.¹⁰ These figures would be much higher if they included losses due to coastal storm surges. Several factors have contributed to rising flood losses, including but not limited to, increasingly volatile weather, economic development in flood-prone areas, compromised flood plains, and coastal erosion. We also note that many areas throughout the United States face significant flood risk and have experienced significant flood events (see Figure 1).

CoreLogic estimated that residential flood losses from Hurricane Harvey were \$25 to \$37 billion, of which approximately 70 percent will be uninsured (CoreLogic 2017a).¹¹ It estimated that residential flood losses from Hurricane Irma were \$25 to \$38 billion, of which about 80 percent were uninsured

¹⁰The Congressional Budget Office (2019) estimates annual average economic losses from floods to be approximately \$20 billion.

¹¹This analysis was issued shortly after Harvey occurred and has not been updated.

(CoreLogic 2017b).¹² There have been no estimates of flood losses from Hurricane Maria issued, but even if only one-third of the total estimated damages from Maria (roughly \$100 billion) were caused by flooding, they would amount to over \$30 billion (AIR Worldwide 2017). It is also reasonable to surmise that most of the flood damages from Maria were uninsured. CoreLogic also estimates that flood losses from Hurricane Florence will be \$19 to \$28.5 billion, of which about 85 percent will be uninsured (CoreLogic 2018). These recent events and estimates of flood damages highlight the problem of increasing flood risk in the United States.

The National Flood Insurance Program

Overview

The NFIP has three principal objectives: (1) to provide a source of flood insurance coverage; (2) reduce the demand for federal disaster assistance for uninsured flood losses; and (3) integrate flood insurance with floodplain management (Pasterick 1998; Moss 2002). These objectives complement each other in some respects and compete with each other in others. This relatively broad public mission has contributed to the issues and problems facing the program.

The NFIP was established in 1968 to address a perceived lack of availability of flood insurance in the private market (Pasterick 1998; and Moss 2002). We note that, at that time, there was considerable concern that uninsured flood losses arising from large events put substantial pressure on the federal government to provide disaster assistance. The belief then, rightly or wrongly, was that if flood insurance could be made readily available at a reasonable cost, it would reduce the demand for federal disaster assistance for uninsured flood losses.¹³ There also was the view that it would be better for property owners to at least pay for part of their flood losses through buying insurance rather than relying on the government to bail them out.¹⁴ A third objective of the NFIP was to integrate flood insurance with floodplain management.¹⁵ Over time, the program has grown in size and scope and it has been modified in an attempt to remedy problems that have arisen and strengthen the program.

As of January 31, 2018, the NFIP had a little over 5 million policies in force and \$1.3 trillion in insurance coverage in force (Figure 2 shows historical statistics on the number of NFIP policies and the amount of coverage in force respectively).¹⁶ Of the policies in force, 1.5 million were building coverage only, 80,397 were contents coverage only, and the remainder provided both building

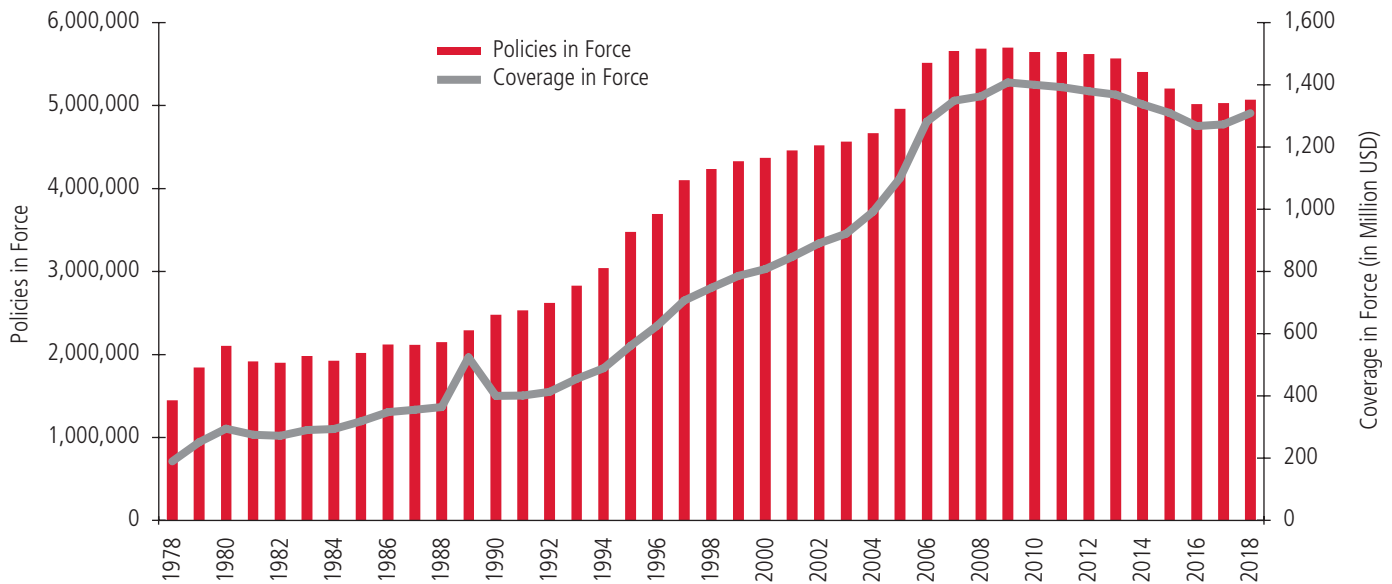
¹²As was the case with its analysis of flood losses from Harvey, CoreLogic's analysis of flood losses from Irma was issued shortly after it occurred and has not been updated.

¹³The extent to which the purchase of flood insurance has reduced the demand for disaster assistance is debatable. Clearly, the NFIP has provided a source of recovery for property owners that have incurred flood losses; claims payments by the NFIP have averaged approximately \$4 billion annually. Nonetheless, many flood losses are not insured and the demand for disaster assistance following major floods has continued to increase at a fast pace (Husted and Nickerson 2014).

¹⁴It should be noted that at that time there were proposals for a broader natural disaster insurance program that would have covered losses from floods, hurricanes, and earthquakes (Moss 2002).

¹⁵See Hayes and Neal (2011) for a discussion of these multiple objectives for the flood insurance program.

¹⁶All of these figures were obtained from FEMA's website at <https://www.fema.gov/policy-claim-statistics-flood-insurance>.

FIGURE 2. NFIP Policies and Coverage in Force (Adapted from NOAA)

and contents coverage. Approximately 95 percent of NFIP policies are some form of residential policy. The number of NFIP policies has dropped from a high of 5.6 million in 2011. The decrease in policies is largely due to increasing premium rates, but other factors may also have contributed to this decline (Klein 2017a).

Structure of the Program

COVERAGES

The NFIP provides flood policies for both residential and non-residential properties. The maximum limits available on residential policies are \$250,000 for a dwelling and \$100,000 for its contents; the maximum limits available on non-residential policies are \$500,000 for a structure and \$500,000 for its contents (see Table 2).¹⁷ The policies provide replacement cost coverage on a dwelling and

TABLE 2. NFIP Coverages (Source: FEMA)

| Building Coverage | Emergency Program | Regular Program |
|-------------------------------|--------------------------|------------------------|
| Single-family dwelling | \$35,000 | \$250,000 |
| 2–4 family dwelling | \$35,000 | \$250,000 |
| Other residential | \$100,000 | \$250,000 |
| Non-residential | \$100,000 | \$500,000 |
| Contents Coverage | | |
| Residential | \$10,000 | \$100,000 |
| Non-residential | \$100,000 | \$500,000 |

¹⁷Renters may also buy flood coverage for their personal property up to \$100,000. The same is the case for condominium unit owners who may also purchase coverage for damage to their unit that is not covered by their association.

actual cash value coverage on its contents. Unlike homeowners insurance, NFIP policies do not provide any coverage for loss of use. Deductibles typically start at \$1,000 and can range up to \$10,000. By comparison, hurricane/wind deductibles in homeowners insurance policies can range from 2 to 15 percent of the dwelling limit. The NFIP's policy limits have not been updated since 1994. Property owners may be able to purchase excess coverage above the NFIP limits from private insurers. Property owners also may be able to purchase full flood insurance from private carriers that may offer broader coverage than the NFIP in certain areas.

RISK ASSESSMENT AND PRICING

Flood risk assessment and pricing by the NFIP begin with flood insurance rate maps (FIRMs) that indicate a given area's vulnerability to flooding as designated by its flood zone. Special Flood Hazard Areas (SFHAs) are areas where the annual probability of a flood is 1 percent or greater; these are commonly known as 100-year flood plains, although this terminology can be misleading. Areas designated as having moderate flood risk have an annual probability of flooding ranging from 0.2 to 1 percent, and areas designated as having minimal flood risk have a probability of flooding of less than 0.2 percent.

A rate per \$100 of coverage is used to determine a base premium for a given property that reflects its zone and other factors, including its structural characteristics, occupancy, contents, and elevation. The premium for a given property is further adjusted by several factors to account for loss adjustment expenses, the policy deductible, underinsurance, other expenses, and some other things. The cost of flood insurance for a given home can vary from as little as \$200 to \$8,000 or more depending on its location and other characteristics; the average NFIP premium is about \$700.¹⁸

Certain homes qualify for subsidized or discounted rates. Properties built before FEMA had mapped flood risk in their community receive a subsidy that can result in a premium substantially below what they would otherwise be charged—these are known as *pre-FIRM properties*. Properties that were built to code and are subsequently mapped into a higher risk zone—these are termed *grandfathered properties*—do not receive a rate increase with one exception. Properties moving into a SFHA receive a subsidized premium the first year and annual rate increases of 5 to 18 percent after the first year. Discounted rates are also available through a Preferred Risk Policy (PRP) and the Community Rating System (CRS).

MANDATORY PURCHASE REQUIREMENT

Certain property owners in SFHAs are “required” to purchase and maintain flood insurance. Essentially, this mandatory purchase requirement (MPR) applies to properties for which there is a mortgage loan from a federally regulated financial institution or that has been purchased by Fannie Mae or Freddie Mac.¹⁹ Under the MPR, a homeowner must purchase coverage equal to the lesser of the

¹⁸An analysis performed by ValuePenguin based on rate quotes from The Flood Insurance Agency revealed that the premiums charged by private insurers for a sample policy (\$250,000 in dwelling coverage, \$100,00 in contents coverage, \$5,000 deductible) ranged from \$13,576 to \$14,315 in the V Zone in three states (Florida, Texas, and New Jersey).

¹⁹Additionally, owners who receive federal financial assistance for acquisition or construction purposes in communities that participate in the NFIP are also subject to the MPR.

outstanding loan balance on their mortgage or the maximum NFIP policy limit. Lending institutions are responsible for enforcing the MPR.²⁰

The MPR was established in 1973 to increase the take-up rate for flood insurance as well as to help protect the collateral on home loans. However, there are several issues with the MPR. One issue is that it only applies to homes meeting the criteria listed above; it does not apply to homes located outside of an SFHA or even homes within an SFHA that do not have mortgage or have not received federal assistance for acquisition or construction purposes. Additionally, a homeowner can meet the MPR by buying a NFIP policy with a policy limit that is substantially below the replacement cost of their property. A third problem is lax enforcement of the MPR; it is estimated that only about 50 percent of the homes subject to the MPR actually are covered by flood insurance.²¹

THE WRITE YOUR OWN PROGRAM

Most of the flood coverage underwritten by the NFIP is sold and serviced through what are known as Write Your Own (WYO) companies. These are insurers that are authorized to sell and service policies on NFIP's behalf. Generally, these are insurers that also sell homeowners insurance and other property coverages. There are 60 WYO companies currently operating. These companies receive an expense allowance, incentive bonuses, and reimbursement of their claims adjustment expenses; the NFIP underwrites the cost of the claims incurred on WYO policies. Hence, WYO companies bear no risk on the policies that they write on behalf of the NFIP.

OTHER NFIP FUNCTIONS

The NFIP performs other functions beyond just providing flood insurance that some view as essential to its mission. In addition to its flood risk assessment activities, the NFIP assists communities in flood risk management and flood risk education and outreach. With respect to flood risk mitigation, FEMA provides guidance, standards, and grants to communities to assist them in their floodplain management activities. In order to participate in the NFIP, communities must meet minimum requirements established by FEMA for flood risk mitigation and the adoption and enforcement of ordinances (e.g., building codes) for new construction and structures that are rebuilt after a flood event. FEMA also provides guidance and resources to communities that wish to adopt standards that are more stringent than FEMA's minimum requirements. Communities that adopt regulations that are more stringent can become eligible for discounts under the NFIP's CRS. Education and outreach is another critical function performed by the NFIP and FEMA. Education is provided primarily through FEMA's website (<https://www.floodsmart.gov/>).

Issues and Problems Facing the Program

The issues facing the program and its problems have periodically attracted the interest of the Congress and other stakeholders and have increased the interest

²⁰Benton and Schiraldi (2015) provide a more detailed explanation of lenders' obligations and authorities in enforcing the MPR.

²¹"Hurricanes Highlight Failure to Enforce Flood Insurance Rules," *Bloomberg Business Week*, September 17, 2017.

in privatizing flood insurance as one option among others to increase its efficiency and potentially lead to better flood risk management. Understanding these issues and problems helps to lay a foundation for assessing proposals to increase the role of the private sector in providing flood insurance among other options. These issues and problems are summarized here and discussed in some detail by Born and Klein (2019). Most of these issues and problems are chronic in that they have been afflicting the program for many years and have yet to be resolved.²² Many, if not most, of these problems could be fixed with appropriate reform legislation, but there has not been the political will to make the hard choices that have to be made.

SUBOPTIMAL FLOOD RISK MITIGATION

As discussed above, flood risk and damages have been increasing substantially over the last several decades in the United States and many factors behind this trend are under human control. While the NFIP is engaged in various activities to promote good floodplain management and flood risk mitigation, some experts question whether it does enough in this regard. Further, it could be argued that certain aspects of the NFIP encourage rather than discourage floodplain management and flood risk mitigation, i.e., these aspects create or increase moral hazard. More specifically, when the NFIP underprices certain properties, it decreases the incentives of the owners of those properties to reduce their flood risk. Additionally, the NFIP's willingness to underwrite properties in very high-risk areas (e.g., coastal barrier islands) encourages rather than discourages development in these areas. Moreover, the availability and underpricing of flood insurance diminishes the incentives of communities to be more aggressive in their management of floodplains and establishing and enforcing strict flood risk mitigation standards.

LOW TAKE-UP RATES FOR FLOOD INSURANCE

Too few property owners who arguably should buy flood insurance choose to do so (Klein 2017b). Additionally, some property owners who do buy flood insurance do not buy enough of it (we can call this the *underinsurance problem*). Consequently, when property owners without flood insurance (or who are underinsured) suffer flood damages, at the very least, they will suffer a large financial hit when seeking to finance the repair or rebuilding of their homes. In the worst-case scenarios, some uninsured homeowners may be unable to rebuild their homes and may consequently default on their mortgages.

As discussed by Born and Klein (2019), there are several reasons why homeowners at risk fail to purchase or maintain flood insurance on their homes:

1. Due to information problems and perception and decision-making biases, many homeowners either underestimate their risk or choose to ignore it when deciding to have flood coverage or not.
2. According to the Insurance Information Institute (2017), approximately 40 percent of homeowners incorrectly believe that their homeowners insurance covers flood losses.

²²Michel-Kerjan (2010) identifies several of these problems and what could be done to address them.

3. Only about 50 percent of homes subject to the MPR are covered for flood (FEMA, 2014).
4. The “affordability” of flood insurance may be a problem for some homeowners.
5. There is some evidence that indicates that some homeowners believe that state or federal governments will bail them out if they have uninsured flood losses although, in fact, this is rarely the case (Kousky, Michel-Kerjan, and Rasky 2018).²³

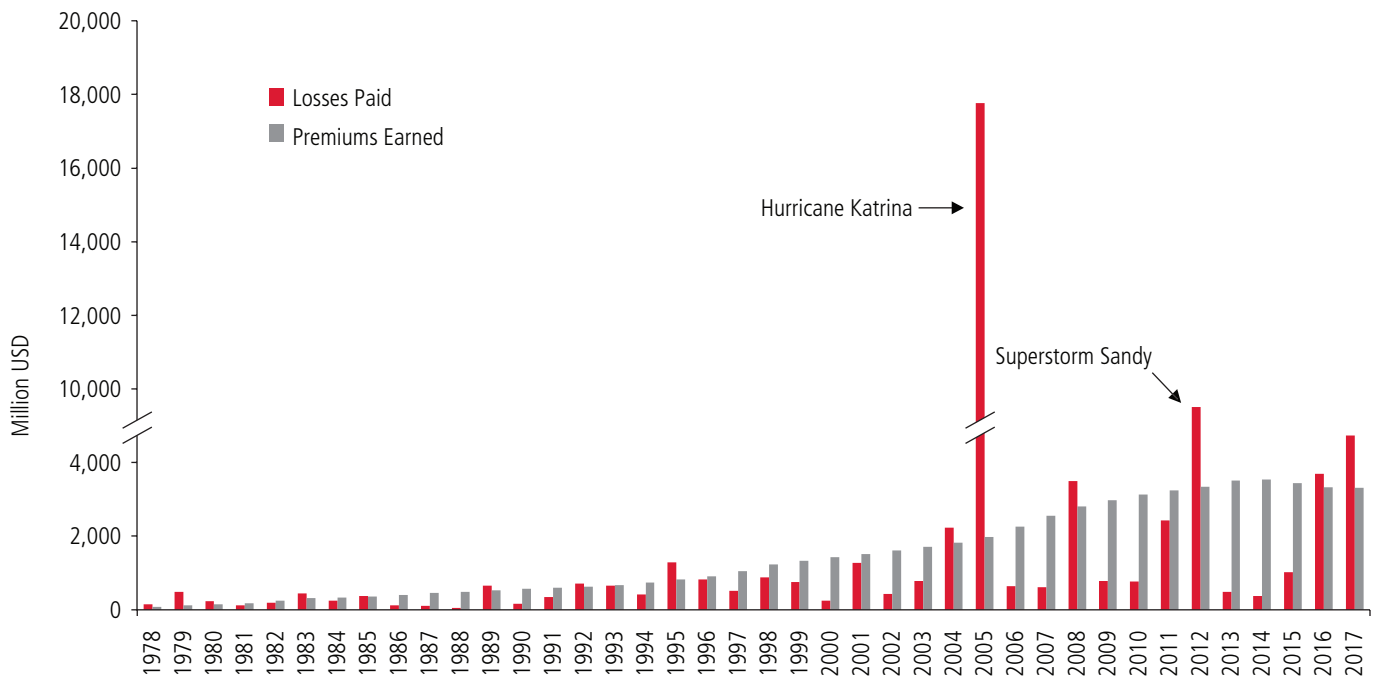
PROBLEMS WITH FLOOD RISK ASSESSMENT AND PRICING

Accurate risk assessment is essential to securing the viability and competitiveness of any insurance program. Some experts who are familiar with the NFIP have been critical of the accuracy and timeliness of its flood risk assessment and mapping (see, for example, Michel-Kerjan, Czajkowski, and Kunreuther 2015). There also is a concern that flood maps do not exist for certain areas of the United States. Regarding the accuracy of the NFIP’s flood risk assessment, one criticism is that its use of flood maps fail to reflect the actual flood risk of a specific property. There are technology and methods available to determine a specific property’s flood risk that are much more accurate than the flood maps used by the NFIP. Indeed, private flood insurers are already employing these technologies (e.g., LIDAR) and methods in their pricing of coverage for a specific property. The NFIP has been working on developing more accurate flood risk assessment, but its efforts in this regard have lagged behind what it could be doing and what private insurers are doing.

POLICY PROVISIONS

The NFIP has not updated the limits on its policies since 1994. This contributes to an underinsurance problem for properties with replacement costs that exceed the NFIP limits. If the \$250,000 residential dwelling limit had been adjusted for inflation, it would now be \$420,000 and the \$500,000 limit on non-residential structures would be \$840,000. The limits for contents coverage for residential (\$100,000) and non-residential (\$250,000) structures would now be \$170,000 and \$420,000 respectively. Raising these limits consistent with inflation or the increase in the cost of repairing or rebuilding flooded homes could make flood insurance more attractive to some property owners and help to address the underinsurance problem. This said, raising these limits could also increase adverse selection and moral hazard and increase the claims payouts by the NFIP if its rates are not adjusted accordingly. Other aspects of the NFIP’s policy provisions that fall short of the coverages typically provided in homeowners insurance policies include the option of covering contents on a replacement cost basis, loss of use coverage, and the option to elect higher deductibles than currently allowed.

²³The issue of whether and to what extent federal disaster assistance should be used as a means to finance flood losses is part of a broader discussion on the use of such assistance to finance losses from various catastrophic perils. Most economists believe that it is preferable to use true insurance mechanisms for financing catastrophic losses rather than ex post disaster assistance as insurance. Insurance would provide greater certainty and create incentives for homeowners to mitigate their risk. From a public policy perspective, it would be desirable to develop a coordinated government strategy to secure the sustainability of communities at risk that employs an efficient mix of private and public risk financing and management schemes.

FIGURE 3. NFIP Losses Paid and Premiums Earned, 1978–2017 (Adapted from FEMA)

Private companies can and do offer these additional coverages and options, tempered by underwriting and pricing considerations. Private insurers have flexibility here that the NFIP does not currently have.

PROGRAM DEFICITS AND DEBT

The NFIP, since 2005, has incurred significant deficits in some years and accumulated a substantial debt to the Treasury. Figure 3 shows premiums earned by the NFIP and the losses it paid for the years 1978–2016; Table 3 shows its borrowing and debt for the years 1980–2018.²⁴ The NFIP’s accumulated debt as of December 31, 2018 was \$20.5 billion (FEMA 2018). This figure would be much higher absent legislation enacted by Congress and signed by President Trump in October 2017 that forgave \$16 billion of this debt.²⁵ The bottom line is that the NFIP has not generated sufficient income to cover all of its costs. Any insurer that underwrites catastrophic risk exposures will have many “good” years and a few very “bad” years. When the Treasury writes off NFIP debt, it creates a subsidy from taxpayers to those who have NFIP coverage.

Private insurers address this problem through various measures that include charging premiums that will be sufficient to cover their costs over an ex-

²⁴As can be seen in Figure 3, the NFIP’s premiums exceed its losses in most years but, in some years, the opposite is true. Indeed, 2005 (Hurricane Katrina and other storms) and 2012 (Superstorm Sandy) were particularly bad years for the NFIP with total losses paid of \$17.8 billion for 2005 and \$9.5 billion for 2012. Adjusted for inflation, these figures would be \$22.3 billion and \$10.1 billion respectively. Note also that Figure 4 only shows the NFIP’s claims payments and not its total costs.

²⁵“Trump Signs Bill Forgiving \$16 Billion in NFIP Debt,” *Business Insurance*, October 27, 2017, <http://www.businessinsurance.com/article/20171027/NEWS06/912316843/Trump-signs-disaster-relief-bill-forgiving-16-billion-dollars-NFIP-debt>. We surmise that the Congress and the Administration approved forgiving \$16 billion in the NFIP debt so that program would not exceed its \$30 billion limit in borrowing authority.

TABLE 3. NFIP Borrowing and Debt (in Millions USD), 1980–2018
(Source: FEMA Congressional Affairs)

| Year | Borrowed | Repaid (or Cancelled*) | Cumulative Debt | Year | Borrowed | Repaid (or Cancelled*) | Cumulative Debt |
|------|----------|------------------------|-----------------|------|----------|------------------------|-----------------|
| 1980 | 917 | 0 | 917 | 2000 | 345 | 541 | 80 |
| 1981 | 165 | 625 | 457 | 2001 | 600 | 345 | 335 |
| 1982 | 14 | 471 | 0 | 2002 | 50 | 640 | 0 |
| 1983 | 50 | 0 | 50 | 2003 | 0 | 10 | 0 |
| 1984 | 200 | 37 | 213 | 2004 | 0 | 0 | 0 |
| 1985 | 0 | 213 | 0 | 2005 | 300 | 75 | 225 |
| 1986 | 0 | 0 | 0 | 2006 | 16,600 | 0 | 16,825 |
| 1987 | 0 | 0 | 0 | 2007 | 650 | 0 | 17,475 |
| 1988 | 0 | 0 | 0 | 2008 | 50 | 225 | 17,300 |
| 1989 | 0 | 0 | 0 | 2009 | 1,988 | 348 | 18,940 |
| 1990 | 0 | 0 | 0 | 2010 | 0 | 500 | 18,440 |
| 1991 | 0 | 0 | 0 | 2011 | 0 | 750 | 17,690 |
| 1992 | 0 | 0 | 0 | 2012 | 0 | 0 | 17,690 |
| 1993 | 0 | 0 | 0 | 2013 | 6,250 | 0 | 23,940 |
| 1994 | 100 | 100 | 0 | 2014 | 0 | 1,000 | 22,940 |
| 1995 | 265 | 265 | 0 | 2015 | 0 | 0 | 22,940 |
| 1996 | 424 | 62 | 362 | 2016 | 0 | 0 | 22,940 |
| 1997 | 530 | 240 | 652 | 2017 | 7,425 | 0 | 30,365 |
| 1998 | 0 | 395 | 257 | 2018 | 6,100 | 16,100* | 20,465 |
| 1999 | 400 | 381 | 276 | | | | |

*Congress cancelled \$16 billion of NFIP's debt (P.L. 115-72, Title III, 308).

tended period, properly managing their exposures, and using reinsurance and other instruments (e.g., catastrophe bonds) to help finance their catastrophe losses.²⁶ The NFIP did purchase a significant amount of reinsurance for the first time for the 2017 calendar year and also purchased it for 2018 and 2019. Additionally, under its 2018 reinsurance agreement, the NFIP issued catastrophe bonds providing up to \$500 million in coverage for the period between August 1, 2018 and July 31, 2021.

More specifically, the catastrophe bond arrangement is divided into two tranches. In the first tranche, Hannover Re (the transformer) will reimburse the NFIP for 3.5 percent of its qualifying losses from one event between \$5 billion and \$10 billion. In the second tranche, the NFIP will be reimbursed for 13 percent of its qualifying losses from one event between \$7.5 billion and \$10 billion. The arrangement employs an indemnity trigger, meaning that any reimbursement made will be based on the NFIP actual losses and not some other index. The NFIP paid \$62 million for the first year of coverage. Unlike its traditional reinsurance purchases, this arrangement applies only to flooding resulting directly or indirectly from a named storm and only covers the 50 states, the District of Columbia, Puerto Rico, and the U.S. Virgin Islands.

²⁶A private insurer will not expect to generate a profit in every year, but it will seek to be profitable over the long term. The NFIP bases its premiums on its average historical losses, but does not include a loading in its premiums for catastrophic losses.

Looking forward, catastrophe bonds could prove to be an efficient means for the program to lay off more of its risk to the private sector. Generally, catastrophe bonds allow an insurer to use the financial markets to access capital absent the capacity limits of the conventional reinsurance market (Klein and Wang 2009). The NFIP has the advantage of possessing geographically diverse exposures for which an indemnity (non-parametric) trigger should work well.²⁷ Time will tell, but if there is a strong appetite among investors for taking on some flood risk through catastrophe bonds, the NFIP should be able to issue them at a reasonable price. The important point here is that the more that the NFIP can lay off its catastrophe risk to reinsurers and other investors, the more fiscally sound the program should be. This said, the cost of reinsurance and the issuance of catastrophe bonds will need to be reflected in what policy holders pay for flood insurance.²⁸

REPETITIVE LOSS PROPERTIES

Properties for which there have been multiple claims—“repetitive loss” properties—have become a significant problem for the NFIP. These properties account for only about 1 percent of the properties insured by the NFIP but have accounted for approximately 25 to 30 percent of its losses and \$12.5 billion of its debt as of year-end 2011 (See Pew 2016; and King 2013). Private insurers would be (are) unwilling to insure these properties as they would deem them uninsurable. However, the NFIP is effectively constrained in denying coverage for these properties. Further, some of these properties still receive subsidized rates that compound the moral hazard and adverse selection problems associated with insuring them. It is likely that under any privatization scheme there would need to be some form of residual market mechanism for properties that would still be considered to be insurable but for which private insurance would be unavailable.

SUPPLY OF FLOOD INSURANCE

Born and Klein (2019) discuss the demand for, and problem of low take-up rates for flood insurance. While this is a significant problem and one that private companies may be able to help remedy, our focus here is on the factors that affect private companies’ ability and willingness to underwrite flood insurance on their own paper.²⁹ When the NFIP was established in 1968, very few insurance companies were willing to take on flood risk. The evidence suggests that this has dramatically changed as many private carriers are now offering private flood policies and the amount of private flood insurance written has been increasing. Nonetheless, there are questions as to how much flood risk private companies

²⁷Simply stated, an indemnity trigger is based on an insurer’s own losses. There are also parametric triggers that are based on some index of industry losses or storm location and intensity. The effective price of issuing a catastrophe bond (the risk premium over LIBOR) will tend to be higher as it minimizes basis risk but involves more moral hazard. Catastrophe bonds with parametric triggers tend to be less pricey for issuers as they involve little or no moral hazard, but the issuer retains significant basis risk.

²⁸We view this as a good thing as it contributes to risk-based pricing by the NFIP.

²⁹As we discuss in Born and Klein (2019), private companies may induce more homeowners to buy flood insurance by offering them lower premiums and better coverage than what the NFIP offers. Additionally, private companies could be more effective in their marketing efforts than the NFIP. Private companies may be the most effective in getting more low- and moderate-risk homeowners to buy flood coverage.

would be willing to underwrite and whether they would be unwilling to insure some properties.

Private Companies Ability and Capacity to Underwrite Flood Coverage

There has been only one study (Kousky, Kunreuther, Lingle, and Shabman 2018) of which we are aware that bears on questions regarding private companies appetite for writing flood insurance. This study found that while there appears to be a considerable appetite among some private carriers to write flood coverage on their own paper, they also have some concerns. These concerns include the potential concentration of their catastrophic risk in their portfolios when flood is added and how they will be treated by state regulators, among other potential challenges. Here we focus on private carriers' ability and capacity to underwrite flood insurance.

With respect to ability, it is our sense that many carriers either already have, or are rapidly acquiring, the expertise needed to properly underwrite and price flood coverage. It may not be much of a leap for companies that already write homeowners insurance in areas subject to catastrophic perils such as hurricanes to apply their knowledge and tools to flood risk. There is some evidence that, given the relatively rapid expansion of the private flood market, many carriers believe that they have the requisite expertise and tools. Insurers can also lean on the expertise of the companies that provide catastrophe modeling services and reinsurers.³⁰ Consequently, ability should not be problem that would greatly constrain the supply of private flood insurance.

Capacity could be more of an issue for some companies. Small companies with low amounts of surplus and/or that are not geographically diversified would not be in a position to write large amounts of coverage without large amounts of reinsurance. Even larger companies may still be concerned about assuming too much catastrophic exposure. For example, a company that already writes a large amount of homeowners insurance in areas subject to severe hurricanes may be reluctant to underwrite large amounts of flood coverage in these areas given that many hurricanes create both high winds as well as significant flooding. As is the case with small companies, large companies also could purchase the requisite amount of reinsurance or use other catastrophe loss financing devices, e.g., catastrophe bonds. Hence, capacity also should not be a problem that would constrain the supply of private flood coverage.

The Developing Private Flood Insurance Market

There is little doubt that private companies' appetite for selling flood insurance on their own paper has increased significantly in recent years. Many private companies now have the financial resources and are developing the expertise to offer flood coverage. These companies can now access data and use advanced technologies and methods to accurately assess the flood risk of specific properties. Accurate flood risk assessment allows insurers to perform the functions associated with writing flood insurance with the potential for catastrophic losses.

³⁰It is our understanding that at least some of these firms do perform modeling of flood losses.

TABLE 4. Summary Statistics on Private Flood Insurance
(Source: NAIC data; authors' calculations)

| | 2016 | 2017 | 2018 |
|--------------------------------|---------|---------|---------|
| Number of Companies | 42 | 79 | 112 |
| Number of Groups | 18 | 29 | 33 |
| Direct Premiums Written (000s) | 345,432 | 570,153 | 622,263 |
| Average Number of States* | 26.9 | 29.4 | 30.1 |
| CR4 (Group Level) | 91.3% | 78.4% | 77.2% |
| HHI (Group Level) | 4,002 | 2,248 | 2,257 |

* This figure is the average number of states in which each group had direct premiums written (DPW).

These functions include policy design, underwriting, pricing, managing their risk portfolios (including purchasing reinsurance), and adjusting and paying claims.

Because the market for private flood insurance is still fairly nascent, the data on private flood insurance sales publicly available is limited.³¹ Table 4 provides summary statistics on private flood insurance for insurance companies selling this coverage that reported their data to the NAIC for the calendar years 2016 through 2018; most licensed carriers would be expected to file their data with the NAIC, but this would probably not be the case for non-licensed carriers. As revealed in Table 4, there was a significant increase in the premiums written and the companies/groups writing private flood coverage from 2016 to 2018 based on the data filed with the NAIC. From 2016 to 2018, the amount of direct premiums written for private flood insurance increased from \$345.4 million to \$622.3 million.³² For this same period, the number of companies selling private flood insurance increased from 42 to 112, and the number of groups (including stand-alone companies) selling private flood coverage increased from 18 to 33.

Additionally, as shown in Table 4, the degree of market concentration in the private flood insurance market measured at the countrywide level decreased significantly from 2016 to 2017 but then leveled off in 2018. The four-firm concentration ratio (CR4) decreased from 91.3 to 78.4 percent from 2016 to 2017 and decreased a little further to 77.2 percent in 2018. The Herfindahl-Hirschman Index (HHI) dropped from 4,002 to 2,248 from 2016 to 2017 and then increased slightly to 2,257 in 2018. We see a similar pattern with respect to the average number of states in which a group had direct premiums written; this figure increased from 26.9 to 29.4 from 2016 to 2017 and then increased a bit more to 30.1 in 2018. These data indicate not only a significant increase in amount of private flood insurance written by licensed carriers but also indicate substantial entry of new companies into this market and broader geographic diversification with respect to their portfolios. This said, the market for private flood insurance may be reaching a point of maturation under current conditions.

Table 5 shows the private flood direct premiums written, the market shares, and the number of states these premiums are written in by group for CY 2018 at

³¹Annual statutory financial reports filed by insurers with the NAIC and state insurance departments only began providing a breakout of private flood insurance starting with the 2016 calendar year.

³²We note that the greatest increase was from 2016 to 2017. This may be indicating that the growth and development of the private flood insurance is tapering off as companies are tapping out their opportunities to write business and possibly running into the obstacles presented by the NFIP.

TABLE 5. Insurer Groups Writing Private Flood Insurance, 2018
(Source: NAIC and authors' calculations)

| Group | DPW (000s) | Market Share | Number of States |
|-------------------------------|------------|--------------|------------------|
| FM Global | 262,082 | 42.1% | 51 |
| Assurant | 82,586 | 13.3% | 51 |
| Zurich | 75,778 | 12.2% | 51 |
| AIG | 59,759 | 9.6% | 50 |
| Swiss Re | 34,753 | 5.6% | 51 |
| Liberty Mutual | 19,329 | 3.1% | 51 |
| Alleghany | 17,567 | 2.8% | 49 |
| Berkshire Hathaway | 15,797 | 2.5% | 43 |
| Allianz | 15,155 | 2.4% | 51 |
| Chubb | 8,135 | 1.3% | 47 |
| Tokio Marine | 7,854 | 1.3% | 48 |
| Progressive | 6,070 | 1.0% | 3 |
| Munich Re | 5,020 | 0.8% | 37 |
| Nationwide | 2,561 | 0.4% | 49 |
| Palomar | 2,255 | 0.4% | 9 |
| Cincinnati | 1,934 | 0.3% | 49 |
| Bankers | 1,749 | 0.3% | 20 |
| Markel | 1,144 | 0.2% | 22 |
| Hanover | 615 | 0.1% | 37 |
| Universal | 500 | 0.1% | 1 |
| Axa | 360 | 0.1% | 34 |
| Hartford | 262 | 0.0% | 40 |
| MS & AD | 259 | 0.0% | 25 |
| Sompo | 194 | 0.0% | 6 |
| West Ben | 169 | 0.0% | 7 |
| Philadelphia Contributionship | 116 | 0.0% | 4 |
| CNA | 77 | 0.0% | 38 |
| Centauri | 70 | 0.0% | 2 |
| WR Berkley | 65 | 0.0% | 17 |
| Sentry | 38 | 0.0% | 51 |
| Heritage | 7 | 0.0% | 1 |
| Arch | 2 | 0.0% | 6 |
| Wayne Cooperative | 1 | 0.0% | 1 |

a countrywide level. We note that approximately 64 percent of the private flood insurance written in 2017 was for commercial properties; Table 5 combines private flood insurance for both residential and commercial properties (*Insurance Journal* 2018). The top four groups in 2018 were FM Global, Assurant, Zurich, and AIG. These four groups accounted for 77.2 percent of the private flood insurance written by companies reporting their data to the NAIC. Table 6 shows

TABLE 6. Insurer Groups Writing Private Flood Insurance, 2017
(Source: *Insurance Journal* 2018)

| Residential | | Commercial | |
|----------------|------------|--------------------|------------|
| Group | DPW (000s) | Group | DPW (000s) |
| Assurant | 89,827 | FM Global | 263,282 |
| AIG | 58,246 | Zurich Re | 63,829 |
| Swiss Re | 41,571 | Berkshire Hathaway | 27,603 |
| Chubb | 9,878 | RSUI | 13,225 |
| Liberty Mutual | 8,850 | Allianz | 11,705 |
| Munich Re | 5,299 | Tokio Marine | 9,388 |
| United Surety | 5,007 | Western World | 77,556 |
| ASI | 1,778 | Liberty Mutual | 66,111 |
| Other | 1,483 | | |

the breakdown of residential and commercial flood insurance written by the major groups.

Reflected in the groups shown are a number of prominent writers of property insurance in the United States as well as less-familiar names. This indicates that writers of other property coverages are at least testing the waters with respect to the private flood insurance market and we would expect them to do so if they see opportunities to do so profitably.³³ In the underlying data used to produce these tables, we see that some of the large groups are using a number of subsidiary companies to offer private flood coverage. A cautionary note to both of these tables is that the data used and the calculations performed only reflect companies filing their data with the NAIC and hence would not reflect private flood insurance written by companies not filing their data with the NAIC.

It is also interesting to see the breakdown of private flood insurance by state in relation to the total amount of flood insurance (private plus federal) in each state for 2018, as shown in Table 7. Table 7 shows the direct premiums written for private flood insurance, federal flood insurance, and sum of the two, by state as well as private flood insurance as a percentage of the combined amount. For all states, combined, private flood represented 18 percent of the total amount of flood insurance sold in 2018.³⁴

While the figures in this table do not include data from companies not filing with the NAIC nor the U.S. territories, they are interesting nonetheless. For one, they suggest that private flood coverage represents a much larger percentage of the total amount of flood insurance written than has been suggested by previous studies (e.g., Kousky, Kunreuther, Lingle, and Shabman 2018). Secondly, our calculations indicate that private flood coverage tends to account for a much greater percentage of the total amount of flood insurance written in states where

³³Writers of other property coverages may be seeking to take advantage of economies of scope by offering both other forms of property insurance as well as flood insurance to some of their policyholders.

³⁴If we use the premiums earned by the NFIP in 2017 (2018 data are not yet available) as the amount of federal flood insurance written, this percentage only falls to 17.2 percent.

TABLE 7. Private and Federal Flood Insurance Premiums Written (000s), 2018
(Source: NAIC and authors' calculations)

| State | Private | Federal | Total | Percent Private | State | Private | Federal | Total | Pct. Private |
|---------------|---------|---------|---------|-----------------|----------------|---------|-----------|-----------|--------------|
| Alabama | 4,717 | 28,299 | 33,016 | 14.3% | Montana | 1,108 | 2,781 | 3,888 | 28.5% |
| Alaska | 726 | 1,535 | 2,261 | 32.1% | Nebraska | 3,428 | 6,498 | 9,927 | 34.5% |
| Arizona | 13,616 | 15,800 | 29,416 | 46.3% | Nevada | 4,599 | 6,382 | 10,981 | 41.9% |
| Arkansas | 2,919 | 10,260 | 13,179 | 22.1% | New Hampshire | 1,579 | 7,396 | 8,975 | 17.6% |
| California | 83,604 | 143,540 | 227,144 | 36.8% | New Jersey | 33,571 | 177,710 | 211,281 | 15.9% |
| Colorado | 6,815 | 13,852 | 20,667 | 33.0% | New Mexico | 2,026 | 8,160 | 10,185 | 19.9% |
| Connecticut | 8,556 | 45,603 | 54,159 | 15.8% | New York | 47,240 | 171,710 | 218,950 | 21.6% |
| Delaware | 1,874 | 14,754 | 16,628 | 11.3% | North Carolina | 10,486 | 91,274 | 101,760 | 10.3% |
| DC | 2,023 | 1,350 | 3,374 | 60.0% | North Dakota | 1,809 | 5,239 | 7,048 | 25.7% |
| Florida | 79,716 | 819,393 | 899,109 | 8.9% | Ohio | 15,402 | 25,375 | 40,777 | 37.8% |
| Georgia | 13,823 | 40,208 | 54,031 | 25.6% | Oklahoma | 3,078 | 8,012 | 11,089 | 27.8% |
| Hawaii | 3,511 | 36,705 | 40,217 | 8.7% | Oregon | 6,248 | 16,950 | 23,198 | 26.9% |
| Idaho | 1,686 | 3,382 | 5,067 | 33.3% | Pennsylvania | 22,142 | 52,748 | 74,889 | 29.6% |
| Illinois | 15,571 | 28,012 | 43,584 | 35.7% | Rhode Island | 2,317 | 16,312 | 18,630 | 12.4% |
| Indiana | 9,754 | 16,284 | 26,038 | 37.5% | South Carolina | 13,703 | 114,511 | 128,215 | 10.7% |
| Iowa | 9,262 | 10,138 | 19,400 | 47.7% | South Dakota | 834 | 2,359 | 3,193 | 26.1% |
| Kansas | 5,620 | 6,020 | 11,640 | 48.3% | Tennessee | 12,190 | 19,775 | 31,965 | 38.1% |
| Kentucky | 5,563 | 12,279 | 17,842 | 31.2% | Texas | 63,227 | 344,755 | 407,983 | 15.5% |
| Louisiana | 20,534 | 221,064 | 241,598 | 8.5% | Utah | 2,712 | 2,193 | 4,905 | 55.3% |
| Maine | 1,826 | 7,760 | 9,586 | 19.0% | Vermont | 699 | 4,469 | 5,167 | 13.5% |
| Maryland | 6,161 | 30,153 | 36,314 | 17.0% | Virginia | 9,476 | 60,787 | 70,263 | 13.5% |
| Massachusetts | 17,036 | 67,346 | 84,382 | 20.2% | Washington | 12,061 | 24,955 | 37,016 | 32.6% |
| Michigan | 7,287 | 15,329 | 22,616 | 32.2% | West Virginia | 1,805 | 12,343 | 14,148 | 12.8% |
| Minnesota | 6,072 | 5,949 | 12,022 | 50.5% | Wisconsin | 5,896 | 9,402 | 15,298 | 38.5% |
| Mississippi | 5,402 | 33,815 | 39,217 | 13.8% | Wyoming | 900 | 1,173 | 2,073 | 43.4% |
| Missouri | 10,054 | 16,764 | 26,818 | 37.5% | All States | 622,263 | 2,838,865 | 3,461,129 | 18.0% |

flood risk overall should be relatively low. This suggests that companies writing private policies may be targeting more low-risk areas than high-risk areas.

One promising trend in the data on private flood insurance is the appearance of well-established and prominent personal lines writers. At the very least, this indicates that these companies are dipping their toes in the private flood insurance market. The name recognition of these companies as well as their ability to offer other personal lines coverages could be attractive to many consumers. This bodes well for the continued expansion of this market.

SHOULD THE GOVERNMENT BE INVOLVED IN FLOOD INSURANCE?

Fundamentally, from an economic perspective, government involvement in a market or some area of human activity might be justified when there is a market failure and the government can remedy or ameliorate this failure (Skipper

and Kwon 2007; Klein 2018). There are various types of market failures that could justify government provision of flood insurance. Potential candidates for such failures could include private insurers' inability or unwillingness to supply flood coverage, information problems, the existence of public goods, and externalities.³⁵

As explained above, the perceived lack of availability of private flood insurance was one of the principal motivations for the establishment of the NFIP in 1968. Prior to the NFIP's establishment, there had been several major floods in prior years with large losses for insurers. Hence, at that time, many insurers may have viewed flooding as an uninsurable risk because of its catastrophic nature and, possibly, due to their difficulty in developing reasonable estimates of their potential flood losses going forward which would be necessary for accurate underwriting and pricing. Whatever may have the case back then, private insurers have shown an increasing appetite for underwriting flood insurance on their own paper. They appear to have the information and technology they need to accurately assess flood risk and set appropriate prices. It also appears that private insurers can purchase adequate reinsurance to help cover their catastrophic flood losses. Hence, the unavailability or infeasibility of private flood insurance is no longer an argument for the need for a government flood insurance program.

Would positive externalities associated with homeowners having flood insurance (or negative externalities stemming from uninsured flood losses) justify government-provided flood insurance? A strong argument can be made that such externalities exist. When homeowners do have adequate insurance to cover their losses from flood, this helps economic recovery after a flood event with benefits extending beyond the affected homeowners. For example, when flooded homeowners can repair or rebuild their properties, this helps to restore a community and preserve property values in flooded areas. On the other hand, when flooded homeowners are unable to repair or rebuild their homes after a flood event, this can hamper economic recovery and diminish property values in the affected areas. Additionally, if uninsured (or underinsured) flood losses cause some homeowners to default on their mortgages, this has negative effects on lenders.³⁶

If one accepts the proposition that there are externalities associated with flood insurance, do these externalities justify the government providing it? Here again, making such an argument is problematic. There are externalities associated with many types of insurance, but they have not been used to justify a government role in providing these coverages. For example, most states require car owners to carry liability insurance on their vehicles. These requirements are intended to help ensure that drivers who cause an accident will have some source of funds to at least pay part of the damages they cause. However, no state has

³⁵There are some analogues to government-provided flood insurance in the United States. These include the federal crop insurance program, state workers' compensation funds, and the California Earthquake Authority (CEA). Regardless, these insurers coexist with private insurance (monopolistic state workers' compensation funds excepted) and questions could also be raised regarding whether there is a compelling economic justification for their existence.

³⁶In an extreme scenario, such defaults could lead to the failure of one or more banks with the costs of such defaults shifted to the Federal Deposit Insurance Corporation (FDIC). To our knowledge, this has not occurred to date, but it still could be an issue going forward.

taken the step to set up a government auto insurer.³⁷ Instead, concerns about the availability and affordability of auto liability insurance have been addressed through regulation of insurance rates and the establishment of state residual market mechanisms.³⁸ The same could be done for flood insurance if it were moved to the private sector.

Further, aside from any positive externalities associated with flood insurance, it does not meet the criteria for a public good: non-excludability and non-rivalrous consumption. However, the NFIP does provide a service that does have the attributes of a public good. We argue that this is an important function of the NFIP even if its activities in this area have fallen short in terms of promoting an optimal level of flood risk management. Specifically, this service is the assistance it provides to communities for flood risk management. All property owners benefit from this service to varying degrees whether they help to pay for it or not. Since premiums charged to homeowners who buy flood insurance from the NFIP currently fund much of this assistance, moving more flood insurance to the private sector would undermine the funding for floodplain management.

However, if floodplain management is a public good, there are other ways to fund it. To the extent that private coverage reduces the NFIP's premium revenues, private insurers could be required to pay fees or assessments to the NFIP to help support this funding. The cost of these assessments could be passed through to buyers of flood insurance. Hence, anyone who has flood insurance, regardless of its source, would be required to pay for at least a portion of these services. Further, because others (e.g., other property owners) who do not have flood insurance benefit from floodplain management, there is an argument for using taxpayer funds (local, state, and/or federal) to also help pay for these services.

Even if these additional services provided by the NFIP are public goods, this does not provide a rationale for public provision of flood insurance. It is true that under the current system, the United States has chosen to use flood insurance premiums paid to the NFIP as a primary source of funding for these services, but this does not have to be the case. If flood insurance was fully privatized, other mechanisms could be used to finance these services. In sum, it can be argued that there is no economic rationale for the public provision of flood insurance.

THE BENEFITS AND COSTS OF PRIVATIZING FLOOD INSURANCE

We now turn to the primary focus of this paper, which are the potential benefits to, and the costs of, increasing the role of the private sector in the provision of flood insurance in the United States. It is also beneficial to discuss how greater privatization might be accomplished. We can use the scheme proposed in the

³⁷There are state government insurers for other lines of insurance such as state funds for workers' compensation, the California Earthquake Authority, the Louisiana Citizens Property Insurance Corporation, and the Citizens Property Insurance Corporation (Florida). The existence of these government insurers stems from a concern that private insurers have either failed to be a viable source of insurance coverage or the belief that these entities are needed to augment private insurance coverage.

³⁸Most states have established residual market mechanisms (RMMs) to provide coverage for owners of vehicles that are unable to obtain coverage in the "voluntary market," but these are not the same as government insurers.

FRA as a point of reference but, to provide some context, it is helpful to review other possible arrangements. We note that the FRA, if enacted, would not fully replace the NFIP with private insurance. Rather, it would make it easier for private insurers to sell flood insurance and would potentially move a substantial amount of the NFIP's book of business to the private market.

Potential Benefits of Privatization

There are several potential benefits to privatizing flood insurance. Proponents of privatization argue that it will benefit consumers as well as alleviate fiscal pressures on the NFIP. Benefits to consumers could include lower premiums for some, enhanced incentives for risk mitigation, and coverage more specifically tailored to meet a particular homeowner's needs. Both lower premiums and better coverage could increase take-up rates among homeowners who could obtain less expensive and/or better coverage. Additionally, the more coverage that moves to the private market, the greater the pressure will be on Congress to adopt needed reforms of the NFIP. Of course, how these benefits might play out would depend on the specific details of the privatization scheme adopted.

More Accurate Pricing

Proponents of privatization believe that private carriers can substantially lower the cost of flood insurance for some (perhaps many) property owners (see, for example, NAIC 2017). As demonstrated by Michel-Kerjan, Czajkowski, and Kunreuther (2015), private companies can offer lower rates for properties overpriced by the NFIP for the same amount of coverage. Indeed, more accurate risk assessment and pricing could lower rates for some homeowners and raise the rates for others. In essence, more accurate pricing should reduce adverse selection and moral hazard and promote more optimal levels of risk mitigation. Additionally, more accurate pricing could promote greater equity in pricing from an actuarial perspective.

Better Coverage

If private insurers can adjust the provisions of their policies to reduce coverage in ways that make sense (e.g., offering higher deductibles than available from the NFIP), they can further lower their prices for some property owners. Some innovations in policy design may truly work to the benefit of some policyholders. Such innovations could include offering higher policy limits than what are available through the NFIP as well as additional coverages (e.g., loss of use coverage, replacement cost coverage of contents, etc.).

Implications for the NFIP

There is also the view that privatization will reduce the fiscal pressures on the NFIP and possibly ameliorate other problems it is having. Clearly, the less coverage the NFIP underwrites, the lower will be its claims payments, all other things equal. However, how moving properties from the NFIP to the private market will affect its fiscal condition depends on the types of properties that are moved. If private companies are good at "cherry picking" properties that are overpriced by the NFIP, this will worsen rather than improve its financial condition. It is possible that competition from private insurers will increase the pressure on the

NFIP to improve its risk assessment and pricing as well as decrease its subsidization of pre-FIRM and grandfathered properties. Such pressure could force the NFIP to take steps that would improve its fiscal condition even with the movement of some of its policies to the private market.

Options

There are several options with respect to increasing the role of private companies in providing flood insurance. Here we briefly review these options with the exception of what was proposed in the FRA and similar proposals which we will use as our “straw man”; Born and Klein (2019) discuss these options in greater detail. We divide these options into two categories: (1) partial privatization; and (2) all other options. We provide a short discussion of three possible schemes in the second category before we turn back to the first.

Other Options

We can start with the status quo, possibly with some reforms of the NFIP, as a baseline with which we can compare options in which the private sector would play a much greater role in providing flood insurance. The market for private flood insurance is already expanding under the NFIP’s current framework. If the NFIP no longer subsidized pre-FIRM and grandfathered properties, private companies could more effectively compete for these properties, which would give a further boost to the private market as well as help to alleviate the NFIP’s financial problems. We could take this idea to its full extent by designing and administering the NFIP so that it functions like a private company.

Full privatization is another option. Under full privatization, flood insurance would be fully assumed by the private sector.³⁹ Under this scenario, either the NFIP would be eliminated or function as a residual market mechanism (RMM) to cover properties that private companies would not want to insure. If the NFIP became an RMM, its pricing structure would need to be reconsidered; if its revenues failed to cover its claims payouts and other expenses, then its funding would need to be supplemented by assessments on insurers and/or general fund appropriations.⁴⁰ If the NFIP did not serve as an RMM, it is likely that the various states would need to establish RMMs for flood insurance.⁴¹ Additionally, the NFIP’s non-insurance services could be assumed by FEMA and funding sources procured for these services.

There is another potential scheme for increasing the role of the private sector in providing flood insurance that could be structured in a manner similar to the federal crop insurance program. Under this scheme, private compa-

³⁹Full privatization has not received serious consideration by Congress, but this has been proposed by conservative writers (see, for example, Brannon and Blask 2017). Further, there a number of developed countries that rely on the private sector to provide flood insurance, including Australia, France, Germany, Japan, and the United Kingdom (Michel-Kerjan, Czajkowski, and Kunreuther 2015).

⁴⁰State RMMs for auto, home, and workers’ compensation insurance generally rely on assessments on private insurers to fund any deficits they incur.

⁴¹Using state RMMs for flood insurance could be problematic due to the catastrophic losses that can be caused by flood events that could strain the assessment capacity of these mechanisms in smaller states.

nies would issue flood policies at a primary level and the federal government would either fully reinsure or partially reinsure these policies.⁴² To the extent that private insurers bear part of the risk through partial reinsurance, they have “skin in the game” that should give them incentives to carefully underwrite and service the policies they sell. However, given that the Risk Management Agency of the Department of Agriculture essentially governs all aspects of the crop insurance program, as currently structured, it is subject to some of the same problems that afflict the NFIP, among others. For example, taxpayers heavily subsidize the crop insurance program. It is conceivable that if the NFIP’s role changed to that of a reinsurer, it could be structured in a way that would mitigate at least some of the problems it currently faces (and avoid the problems of the crop insurance program).⁴³

Partial Privatization

The scheme that warrants the most serious consideration is what we refer to as *partial privatization* given that this is what is in play. To focus our discussion, we use what was proposed in the FRA as our model with the understanding that it could be modified to address at least some of the concerns that it has raised. As previously noted, this bill contained several provisions that would make it easier for private companies to sell flood insurance, but it would not have eliminated the NFIP or altered its mission. It is helpful to summarize the most important provisions pertaining to partial privatization. These provisions are contained in Section II of the Bill entitled “Increasing Consumer Choice Through Private Market Development” and are as follows.

- The bill revised the financial requirements that apply to flood insurance for home loans or loan guarantees by the GSEs. Private flood insurance would be required to meet any financial strength requirements set forth by these GSEs. According to the bill, private flood insurance would include policies issued by non-admitted insurers as long as the insurer is eligible to provide insurance in the home state of the insured and complies with the laws and regulations of that state. Currently, private flood insurance must provide coverage at least as broad as coverage provided by NFIP. Hence, what constitutes acceptable coverage for the purpose of protecting the collateral on home loans and any other purposes would be determined by state insurance regulators.
- Mutual aid societies also would be allowed to sell private flood insurance, subject to state law. The bill defines a mutual aid society as an organization of members who share a common set of ethical or religious beliefs. This coverage would be deemed to satisfy the MPR.
- FEMA would be required to allow WYO companies to sell private flood insurance.
- FEMA would be required to provide data related to NFIP risks and pre-

⁴²The concept of the NFIP serving as a reinsurer is discussed in GAO (2014a).

⁴³Private insurers could be required to bear a significant portion of the risk at a primary level, but they would only be willing to do so if they were allowed to charge adequate premiums or received subsidies from the NFIP.

miums, including community-level data, through a publicly available data system.

The FRA would have removed several obstacles to the sale of private flood insurance. Importantly, it would have enabled private insurers (licensed or non-admitted) to sell policies that are not substantially similar to NFIP policies and would require GSEs to accept any policy approved by state regulators as meeting the MPR or their own requirements. Allowing WYO companies to offer flood insurance on their own paper is also a significant provision in that it would make it easier for these companies to cherry pick the properties for which they could offer a lower premium than the NFIP. Requiring the NFIP to fully share its data with private companies is also something that has been pushed by the industry, but something that the NFIP has been reluctant to do.

Challenges

While private companies face several challenges in writing flood coverage, we focus here on the obstacles currently created by government policies.⁴⁴ We begin with the challenges created by the NFIP's pricing of its policies. To the extent that the NFIP underprices certain properties, it makes it difficult for private companies to offer lower premiums for these properties and remain profitable (GAO 2014a). Underpricing by the NFIP occurs through the subsidies of pre-FIRM and grandfathered properties, its underestimation of the risk of certain other properties, and the lack of a catastrophe loading in its pricing structure. All of these are problems that could be remedied through reforms of the NFIP and its use of the most advanced technologies and methods available to accurately price properties. While the pre-FIRM subsidies are being phased out, the subsidies of grandfathered properties remain as well as the other inefficiencies in the NFIP's pricing methods. Hence, as long as NFIP underpricing continues, private companies will be hampered in their efforts to sell coverage to some property owners.

Another challenge faced by private insurers is the constraint on their ability to innovate in policy design. Currently, policies that meet the MPR must provide coverage similar to that provided in NFIP policies. How private insurers could design their policies to differ from NFIP policies is complicated. Clearly, there are some modifications that would be beneficial to consumers. Such modifications could include offering higher limits than the NFIP does, providing loss of use coverage, and offering replacement cost coverage on contents.⁴⁵ Another modification could be offering higher deductibles than are currently available through the NFIP. Higher deductibles could be dollar amounts or set as a percentage of the dwelling limit (e.g., 1 to 15 percent). Greater coverage would require higher premiums, and higher deductibles would lower the premium for a given property, all other things equal. Private policies could also exclude coverage for losses that are covered under NFIP policies. Offering greater coverage would not conflict with the MPR, but higher deductibles as well as additional exclusions could do so.

⁴⁴See GAO (2014a), Deloitte (2014), and Kousky, Kunreuther, Lingle, and Shabman (2018) for a discussion of the opportunities for and the challenges to private flood insurance.

⁴⁵Private flood policies could (and already do in some cases) cover things that are not covered in NFIP policies, e.g., personal property in a basement.

Another challenge faced by private flood insurers is their ability to access good information on the flood risk of properties. While private companies can readily obtain the NFIP's FIRMs, the inaccuracy of these maps and the fact that many are outdated is a problem. What private companies would like to have is full access to all of the information that the NFIP has on the policies they have issued and the properties they have insured. For example, it would be helpful to a private company to be able to obtain the claims history for a property. This kind of information is available to all companies for homeowners insurance through the Comprehensive Underwriting Loss Exchange (CLUE). However, the NFIP has been reluctant to provide full access to its databases because it is concerned that such access will be used to its disadvantage. More specifically, NFIP administrators likely believe that if private companies do gain access to these data, they will use it to further cherry pick properties for which they can offer a lower rate than what the NFIP charges them. This would subject the NFIP to even greater adverse selection.

A fourth potential challenge that private insurers may face would be the constraints or mandates that could be imposed by state insurance regulators. We are not aware that this has yet become a problem, but it could become a problem in some states if private companies sought to substantially expand their sale of flood insurance. We note that regulators have sought to impose constraints on insurers offering homeowners insurance in some states, especially those that have a high exposure to hurricanes. We can only speculate as to whether state regulation would unnecessarily impede the sale of private flood insurance. All other things equal, we would not expect state regulators to prevent private companies from charging lower rates than the NFIP absent any solvency concerns. However, some state regulators could attempt to constrain the rates for high-risk properties. Additionally, some state regulators may not allow private companies to offer policies that provide less coverage than NFIP policies.

Potential Costs of Partial Privatization

Depending on how it is constructed, a privatization scheme for flood insurance could have several drawbacks or pitfalls. Here we focus on the possible drawbacks or pitfalls of the FRA's approach to expanding the sale of private flood insurance. The provisions of this bill that warrant the greatest concern from a public policy perspective are its requirements that lenders accept any private policy approved by state regulators as meeting the MPR, that they accept policies issued by non-admitted insurers and mutual aid societies, and that WYO companies be allowed to sell flood insurance on their own paper. There is also the issue of how expanding the sale of private flood coverage will affect the NFIP's ability to serve its broader public mission.

The FRA's requirement that the NFIP share its data with private companies is a concern to some, but may be difficult to condemn on an economic basis. Many legislators are also concerned that the expansion of the private flood insurance would increase adverse selection against the NFIP and undermine its ability to subsidize certain properties. However, this is not a concern that most economists would find compelling.

Requiring lenders to accept private flood policies approved by state insurance regulators as meeting the MPR could be problematic. Although there is

nothing equivalent to an MPR for homeowners insurance, lenders face no statutory restrictions on the standards they set for what they will accept as sufficient coverage for protecting the collateral on home loans. For private flood insurance policies, there would not be a problem if any policies sold for the purpose of meeting the MPR provide what would be deemed adequate coverage. If this determination is left to state insurance regulators, then this a legitimate concern. Some state regulators may be more concerned about keeping the price of flood insurance low than ensuring that property owners have adequate coverage. This is more likely to be the case in states where there is a high risk of floods.

There is a similar concern with respect to allowing non-admitted insurers to sell flood insurance and requiring lenders to accept their policies as meeting the MPR and/or protecting the collateral on home loans. Many, perhaps most, non-admitted companies are financially sound and would be able to meet their claims obligations after a major flood event. The concern lies with non-admitted carriers that are not financially sound or would choose not to honor their claims obligations following a major flood. Each state determines the standards that non-admitted companies must meet to write coverage for a specific line of insurance within their jurisdiction. Some states (perhaps many) may establish fairly strict standards for these companies but some may not. As with the approval of policy provisions, there will be temptation for regulators in states with high flood risk to be more lenient with respect to the non-admitted companies they will allow to operate within their jurisdictions. Further, regulators do not have the same authority to regulate the policies, practices, and solvency of non-admitted insurers that they have with licensed carriers. Additionally, there is no guaranty association protection for the unpaid claims of insolvent surplus lines companies.

Requiring lenders to accept coverage written by mutual aid associations is also a concern. A mutual aid association essentially functions in some respects like a mutual or reciprocal insurer with some important differences. Typically, they are associated with a particular religious denomination or organization (e.g., Lutheran) and can provide various kinds of insurance coverage (e.g., home, auto, farm, etc.). The extent to which they are regulated by state insurance regulators appears to vary by state. Importantly, some of these associations operate on an assessment basis, i.e., if the premiums they collect are insufficient to cover their claims, they can assess their members to cover the shortfall. As with many non-admitted carriers, many of these associations may be viable providers of flood insurance. The concern lies with associations that may be established to provide a cheap source of flood coverage without adequate regulatory protections. Additionally, some of these associations are relatively small and would not have a large and broad pool of exposures to diversify the risk they assume.⁴⁶

The FRA's provision that would have allowed WYO companies to sell flood insurance on their own paper raises issues. It could be argued that this would work to the benefit of some flood insurance buyers when a WYO company can offer them better coverage and/or a lower premium than what it can when it

⁴⁶Additionally, we do not know the extent to which such associations purchase reinsurance. To determine this, we would need to be able to review their financial statements; many of these associations may not file reports with the NAIC although they would be expected to do so with their domiciliary states.

underwrites a policy on behalf of the NFIP. This said, WYO companies acquire information on their NFIP policyholders that is not available to other companies. Hence, WYO companies could exploit this information to their advantage and to the disadvantage of other insurance companies and the NFIP. This could exacerbate adverse selection against other companies and the NFIP. One way to address this issue would be to prohibit WYO companies from moving properties out of the NFIP to offer these properties their own coverage. This would still allow WYO companies to offer their own coverage to property owners who do not have coverage through the NFIP and alleviate the concerns discussed above.

The concern regarding how privatization will affect the NFIP's ability to achieve its broad public mission arises from several potential developments. One, a property owner's ability to obtain private coverage is not tied to his/her community's participation in the NFIP, which requires meeting its floodplain management requirements. Two, the loss of premium revenues to support the NFIP's activities in flood risk mapping and management would undermine its ability to support these services. However, these are problems that could be remedied through legislation and the use of other funding sources.

We then come to the issue of requiring the NFIP to share its information on its policyholders with private companies. All other things equal, such a requirement should work to the benefit of homeowners who buy or could be induced to buy flood insurance as private companies would have better information for the purposes of underwriting and pricing. We note that private insurers carefully protect the data they acquire on their policyholders as proprietary information. If enacted, this provision of the FRA will increase adverse selection against the NFIP, which will push it further into the role of serving as an RMM. Nonetheless, such a provision could work to the advantage of property owners who obtain flood coverage from a private carrier at a lower price and/or with better terms.

Additionally, there are availability and affordability concerns with full or partial privatization. With respect to availability, assuming that private companies will be unwilling to insure certain properties, there will be a need for some form of RMM. Affordability problems would be a tougher nut to crack. Some homeowners already pay high premiums for NFIP coverage and these premiums could go even higher with full privatization or reforms of the NFIP that would eliminate its subsidies and underpricing of other properties. Of course, what is deemed "affordable" is a matter of circumstance as well as debate.⁴⁷ Some would argue that high premiums for wealthy owners of high-value homes in risky areas should not be a public concern. The public concern lies with low-income owners of homes in high-risk areas. This is a concern that could be addressed through some form of taxpayer-funded subsidies for such homeowners.⁴⁸

SUMMARY AND CONCLUSIONS

The interest in expanding the sale of private flood insurance is understandable and, in some respects, justifiable. While we have identified legitimate concerns

⁴⁷Using some standard for what would be considered affordable, this becomes a calculation of a homeowner's premium in relation to their income.

⁴⁸This is a topic that was addressed by a committee under the auspices of the National Research Council that issued a report that examined different options that could be employed to address affordability concerns (NRC, 2015).

with respect to some of the provisions that were in the FRA, we believe that these concerns could be addressed in a manner that will serve the public interest and benefit consumers.⁴⁹ It will be important to ensure that private companies offer policies that provide adequate coverage and are appropriately priced. This would depress the sale of private flood insurance to some extent and “faux” coverage should not be enabled. It is quite possible that the NFIP could ultimately be relegated to the role of a residual market mechanism, which will make it more dependent on some form of assessments on private insurers and/or taxpayer funding for the public services that it provides. Finally, the non-insurance functions of the NFIP need not be compromised by private flood insurance if appropriate sources of funding for these activities are secured.

The challenge is to construct a scheme that provides adequate consumer protections, secures the collateral on home mortgages, continues beneficial flood risk mitigation services, and addresses affordability and availability concerns while enabling private companies to offer good coverage at risk-based prices. In such a scheme, there will need to be an administrative and regulatory structure that achieves these objectives. Simply delegating the regulation of private flood insurance and the determination of what constitutes adequate coverage to state insurance regulators could be problematic in some jurisdictions. FEMA and other agencies (e.g., bank regulators) could set standards for coverage as well as safety and soundness standards for companies that would be allowed to sell flood insurance. The NAIC also could play a role in setting such standards and monitoring their enforcement by the states. There will also need to be some form of an insolvency guaranty mechanism administered at the state or federal level that will cover the claims of bankrupt non-admitted carriers and mutual aid associations.

Affordability concerns could be addressed through some form of means-tested vouchers funded by general tax revenues. Availability problems could be addressed by using the NFIP as a residual market mechanism. There will also need to be mechanisms that provide adequate funding of FEMA's risk mitigation activities. Such mechanisms could be supported by a combination of assessments on flood insurance premiums, property taxes, and general revenues. All of this will need to be accomplished in a politically charged environment. There are a number of issues and questions regarding privatizing flood insurance that warrant further research and analysis.

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⁴⁹One caveat here is that some property owners that currently pay premiums that are less than their cost of coverage may not find reforms that we and others would support as being advantageous to them. As discussed earlier, there are ways to address the affordability of properly priced flood insurance for low-income households.

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*Using Media to Teach Economics and Finance**

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Abstract

This article overviews the potential to employ media in the classroom to enhance learning in economics and finance classes. Empirical research illustrates how students learn differently utilizing different sources of information. Textbook publishers have been moving in the direction of increasing supplemental resources that accompany the standard textbook, highlighting the fact that our students are obtaining and retaining information from sources outside the standard lectures that instructors provide. This paper provides a rationale for instructors to use alternative media sources to accompany a lecture format with widely available sources that are reputable and reliable.

INTRODUCTION

Instructors of economics and finance courses in higher education share the desire to effectively engage students in the classroom and encourage student learning. Individual instructors may find that different practices yield different results regarding student learning based on student preferences, instructor preferences, available resources, and numerous other factors. Additionally, there are no definitive guidelines on the specific combination of lecture and other pedagogical practices to best support student learning. However, recent research regarding the impact of learning environments on student learning is difficult to ignore. Bain (2004) emphasizes that effective teaching includes understanding how students learn and the creation of a critical learning environment both within and outside the classroom. While Bain (2004) also cites the importance of being a subject matter expert, carefully preparing for classes, setting high expectations, treating students fairly, and engaging in meaningful assessment as critical to student learning, the focus on the learning environment is the newest factor considered helping student success.

The views regarding the effectiveness of different teaching methods and the ideal learning environment vary across instructors of economics and finance

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in higher education. Recent research from Goffe and Kauper (2014) helps to highlight the varying views on effective learning environments in the discipline. Through survey results from the 2012 Allied Social Science Association annual meeting, the authors found that instructors essentially fit into one of three categories regarding teaching methodology. One-third of all instructors surveyed stated that the delivery of class lectures is the ideal method for student learning. Another one-third of the instructors surveyed stated that alternative learning environments are better options to enhance student learning. The final one-third of instructors surveyed believed that alternatives to the lecture class format achieve better student learning, but viewed lecture as a more cost-effective method to deliver course content. These results suggest that two-thirds of economic instructors believe that alternatives to the standard lecture class format are preferable options in encouraging student learning. However, other recent studies suggest that the majority of instructors of introductory economics classes continue to rely exclusively on the lecture class format (Becker and Watts 2001; Watts and Becker 2008).

The use of instructional approaches aside from the traditional lecture class format is not a new concept. Instructors of economics and finance in higher education have been exploring methods to enhance student learning in their classrooms for many years. However, the creation and exploration of new educational methodologies to enhance student learning may be more important now than ever. Higher education as an industry is under increasing pressure to show that students are learning and gaining valuable knowledge at college. Some recent research has questioned the effectiveness of higher education and suggested that colleges are not helping students to significantly improve important skills such as writing and critical thinking (Arum and Roksa 2012). Other research specifically addresses learning in economics classes. Allgood et al. (2004) find that students majoring in subjects aside from economics perceive little value in economics classes. Additionally, Walstad and Rebeck (2002) find that students do not comprehend economic concepts any better after the completion of an economics course. While there is evidence to counter these findings, the results highlight some of the perceived challenges in the industry and discipline.

The good news is that instructors of economics and finance in higher education have responded by identifying a number of methods to improve the classroom learning environment and encourage student learning. The use of popular media in the classroom is a potentially rewarding method to improve the learning environment. Recent research suggests that using media for instruction purposes can help generate interest in classes and assist students in comprehending complex concepts (Ferrarani and Mateer 2014). This is particularly important in economics and finance as researchers have identified economics as a subject that students fear due to the reputation that the topic has for involving difficult and complex subjects (Benedict and Hoag 2002). Furthermore, the use of media in the classroom can generate interest for the instructor in addition to the students (Luccasen and Thomas 2010).

The challenge in locating media for the classroom often involves finding the time to sort through the plethora of available media in search of ideal content. Fortunately many instructors of economics and finance have identified many useful media sources for the classroom, although these ideas are dispersed across

publications, websites, and numerous other resources. This article provides an overview of the major resources that researchers and instructors have identified to assist in the instruction of economics and finance through the use of media. The goal is to provide instructors with easy access to many media sources so that instructors can incorporate media to enhance their classroom environment without spending a great deal of time attempting to locate resources. The next section highlights the use of media in the classroom, followed by a section presenting media sources for classroom instruction.

MEDIA IN THE CLASSROOM

Instructors in economics and finance courses have struggled for years trying to find new ways to better connect with their students in the classroom. The use of media is not new to most instructors, as in the past the *Wall Street Journal*, *Financial Times*, and other media outlets have commonly provided ample examples of current news and highlights available to everyone. However, as times have changed, so has the landscape of how new learners get the news.

New students in economics and finance are becoming more adept at learning about news and events from different sources, diverging dramatically from the traditional sources where most economics and finance instructors get their news.

How does this translate to the classroom? If an instructor brings up an article just recently published in a widely accepted news source, is it likely that students are aware of this article or topic? Generally, the answer is no. The instructor is left with the question of why and how an important topic, relevant to the class, has evaded the landscape where students gather current news.

Perhaps, the outlets that students are using for information do not highlight or emphasize the recent economic and financial news that correlates to the course material? How can an instructor in an economics or finance class address this? The answer may seem easy—but difficult to implement. Can an instructor change the behavior of economics and finance students to better acquire important and relevant economic and financial information—or just adapt to how students are receiving information?

Trying to change behavior or anchors of information is the goal of every instructor in every course. However, if we, as instructors of economics and finance courses, can change our information delivery style to better adapt to how current students of economics and finance attain their information, perhaps we can change student attitudes on important and relevant economics and finance information.

The logical question then is, how are current student in economics and finance receiving information which they deem relevant and trustworthy? Anecdotal evidence points to the random Twitter or Facebook announcements students receive on their homepage. This is an impossible form of media for instructors to keep up with and maintain, as there are so many random people, bloggers, and organizations posting news to their followers.

As instructors in a higher-education field, part of our responsibility is to inform our students about trustworthy news and information—which means we require our students to use reputable sources of information when they write papers or post comments in a course discussion. We continually inform students

that wiki sites and blogs are not acceptable forms of information to utilize when writing a paper, nor generic Google search results. As we pursue this goal, another strategy is to inform students about current media sources that are trustworthy and provide accurate information.

The sources of information for economics and finance is so diverse that it can be hard for even seasoned instructors to decide which media outlet to use and emphasize in their classroom. Should instructors utilize print media articles, magazines, internet sources, or something else? The options seem endless even if an instructor chooses just one outlet. But a blend of resources can be pulled together from multiple sources of information. This can help overcome information biased by a particular publisher and their philosophical beliefs on politics.

Each instructor in an economics and finance course must decide on which source of media best matches their philosophical view on an idea, concept, or theory. There are outlets that provide opinions and statements from the far left and the far right. Is it the goal of an instructor to provide these extreme positions as a counter-example to where most people in the population are? Or should an instructor give more moderate examples, closer to most people? The pedagogy for teaching varies from instructor to instructor, but utilizing media in this fashion can be advantageous to instructors. For example, some blogs point out how we should cut government spending to balance the budget—which may seem reasonable—but others point out how some important government spending programs will get cut as a result, and that shouldn't happen. These examples of differing media viewpoints can be utilized in the classroom to show our students how drastically viewpoints can differ from one media source to another.

MEDIA SOURCES FOR INSTRUCTION

While there are many media-related resources available to instructors of economics, finance, and business classes, it can be difficult for instructors to identify the best options to assist in instruction due to the sheer number of resources available and time constraints. This section seeks to introduce instructors to a number of valuable media resources that can assist in classroom instruction. However, it is important to note that this section does not discuss every available resource as there are many sources available for use in the classroom.

A list of resources that are available to assist in the instruction of economics, finance, and business courses in higher education is included in Table 1. Television programs provide one valuable source of media to assist in the instruction of higher education courses. A number of articles in recent years highlight television programs that can be used. Table 1 highlights several unexpected sources of television programs that can be used in the classroom including *Seinfeld* (Ghent, Grant, and Lesica 2015), *The Simpsons* (Hall 2014), *The Office* (Kuester n.d.), and *The Colbert Report* (Randolph 2016). Each resource includes episodes that can be employed to highlight concepts in the classroom. Additionally, Mateer (2004) provides a number of movie clips that can be used to introduce and explain economics concepts. Television and movies can help students to understand economics, finance, and business concepts while providing entertainment value as well.

Music presents another potential source of media for use in the classroom. Hall, Lawson, and Mateer (2008) provide an overview of how to use music

TABLE 1. Media Resources for Teaching Economics and Finance

| Media Type | Brief Description | Citation/Authors |
|--------------------|---|--|
| Television | Links to episodes of <i>Seinfeld</i> | Ghent, Grant, and Lesica (2010) |
| Television | Ideas for using <i>The Simpsons</i> in class | Hall (2014) |
| Television | Ideas for using <i>The Office</i> in class | Kuester |
| Television | Ideas for using <i>The Colbert Report</i> in class | Randolph (2016) |
| Movies | Links to numerous movies for use in class | Mateer (2004) |
| Music | Using music to teach economics | Hall, Lawson, and Mateer (2008) |
| Current events | Popular media: <i>Wall Street Journal</i> , <i>New York Times</i> , <i>Businessweek</i> | <i>Wall Street Journal</i> , <i>New York Times</i> , <i>Businessweek</i> |
| Current events | Stossel in the Classroom | stosselintheclassroom.org |
| Current events | Freakonomics Podcast | Levitt and Dubner |
| Blogs | Popular economics blogs: Krugman and Mankiw | Krugman, Mankiw |
| Blogs | Others: Thoma, Cowen, and DeLong | Thoma, Cowen, DeLong |
| Textbook resources | Connect, Aplia, MyLab Economics | McGraw-Hill, Cengage, Pearson |
| All-encompassing | Media resources for economics | Pedagogic Service Project |

in the classroom and identify a number of songs that are useful in introducing economic concepts to students. In addition to television and movies, instructors and students of economics, finance, and business have always enjoyed discussing current events in the classroom. While there are many sources of current events for discussion, the *Wall Street Journal*, *New York Times*, *Businessweek*, and the *Economist* often provide an excellent source of current events for discussion to assist instructors in educating students.

A number of other current events resources exist that can assist in the instruction of courses. The available resources from the Stossel in the Classroom website provide one option for instructors. The topics discussed provide an excellent opportunity to have students consider economics, finance, and business concepts from alternative viewpoints. Additionally, the Freakonomics podcast by Steven J. Levitt and Stephen J. Dubner provide an opportunity to discuss many interesting applications of economics and finance.

A number of insightful and well-read blogs related to economics and finance exist that can help engage students in the classroom. While Paul Krugman and Greg Mankiw operate two of the most viewed blogs, Mark Thoma, Tyler Cowen, and Brad DeLong offer popular blogs that include somewhat different perspectives to business students. These blogs often present material in both casual and technical manners, which can assist students in learning about economics, finance, and business topics.

Other useful options include the valuable content available from textbook publishers. While many options are available, Connect from McGraw-Hill Education, Aplia from Cengage Learning, and MyLab Economics from Pearson Education provide three of the most popular options that include practice questions and media sources for students. For a comprehensive summary of many of the options available on the web to assist instructors in teaching economics, finance, and business classes, the Pedagogic Service Project provides links to a number of excellent resources.

CONCLUSION

The goal of an educator is to educate, which seems simplistic. However, the dilemma that educators continually face is how best to achieve that outcome. Administration at universities and colleges are charged with ensuring that the students who graduate with a degree receive an education and can demonstrate that they have learned the necessary outcomes proscribed by the courses directed in their field of study. Administrators look at the grades that students receive and determine whether or not they can receive the degree. From an administrator's perspective, they are not concerned with how students are doing in their arts and sciences courses or business courses. Rather, their concern is whether or not the students have passed the courses with a grade high enough to give them credit for the course. While many students will pass a course with a C or better and move on, the issue that we face as instructors is how to best reach all of our students in a way that helps them be better prepared for their lives and future careers. This paper illustrates how instructors can utilize different forms of media to better achieve learning outcomes for students, regardless if they are an A or C student.

Pedagogy differs from instructor to instructor, but the empirical evidence shows that students learn in different ways and by utilizing different media/technology sources. If instructors can incorporate alternative sources of information into their courses that are reputable and reliable, this may have a broader impact on the information our students retain. The three major publishers in economics and finance courses (McGraw-Hill, Cengage, and Pearson) are developing new tools to accompany their standard textbook material for these specific courses. They have recognized that students learn material, perhaps more efficiently, by utilizing videos, animated slides, graphical analysis, and external resources. Thus, it is now typical to see a hardcopy textbook that offers a plethora of additional resources to help students learn the material in a course.

The landscape for teaching economics and finance courses is already changing, simply because of how the textbooks and their supplemental material is changing. Whether or not we, as instructors, incorporate this material into our courses is a personal decision. The evidence is there to show that incorporating this material can help our students, and this paper shows that there are simple ways available to us to do so. Textbook publishers have adapted to help students perform better on assessments; now it is up to us as instructors to incorporate new resources to better reach our students in a way that prepares them for their future career.

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