
An empirical investigation of strategic compliance decisions in Argentinean polluting firms

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Abstract: In choosing environmental compliance levels, firms make strategic decisions based on their expectations about how the intensity of the scrutiny they face from enforcement agencies will respond to their own – and perhaps others' – environmental performance. The objective of this paper is to provide insight into those expectations in Argentina – what they are and what influences them – and to interpret the results in the context of compliance incentives in developing economies. We report results based on a large-scale survey of polluting firms in Buenos Aires, Argentina. Amongst other things, we find that industry concentration, the social vulnerability of the surrounding community, and pessimistic attitudes to the general effectiveness of government regulations and/or about society's commitment to the environment weaken expectations of compliance externalities. On the other hand, beliefs in the competitive advantage of green technologies and a strong record of industry-wide compliance help support the development of compliance externalities associated with a responsive regulator.

Keywords: environmental regulation; compliance; enforcement; regulatory response; deterrence; developing economies; Argentina.

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1 Introduction

Environmental protection has increasingly become a major if not controversial area of government activity in Latin American countries (Ribeiro and Kruglianskas, 2012). While much progress has been made in terms of designing potentially effective policies, ensuring reasonable levels of compliance with regulatory requirements is a difficult challenge particularly in decentralised systems with diverse enforcement practices,

expectations and social beliefs about the importance of environmental degradation (Vazquez and Liston-Heyes, 2008; Blackman, 2012; Ribeiro and Kruglianskas, 2012). This is particularly so in Argentina where local officials have much scope to interpret institutional guidelines and rules as they see fit. For this reason, there are wide discrepancies between regulatory intent and actual enforcement outcomes within regions, provinces, and municipalities (Vazquez-Brust et al., 2012).

We argue that such discrepancies hamper the deterrence ability of regulations. If firms do not understand or believe that regulators are able (or willing) to 'respond' in a systematic and consistent manner to environmental infringements, enforcement will be more costly and chaotic. The purpose of this study is to investigate perceptions of regulatory responsiveness amongst Argentinean firms. Identifying and understanding the factors that explain differences in perceptions help us derive policy implications that can improve the deterrence function of a regulatory authority.

Argentina amended its constitution in 1994 (after substantial international economic pressures) to provide people of Argentina with a right to a healthy environment (Constitucion Argentina, 1994). In defining this right, it adopted the international definition of sustainable development – i.e., that the country's resource use and conservation activities should satisfy present needs without compromising those of future generation (Nolon, 1996). Similar environmental reforms can be found throughout Latin America and there are no doubts that they have exerted some profound influences on the environment and on attitudes towards the environment (Blackman, 2012; Ribeiro and Kruglianskas, 2012; Fossgard-Mosser et al., 2012).

Yet, there is strong evidence that the implementation and impact of environmental policies on local environments have varied greatly by Latin American nation as a result of different political, institutional, economic, environmental, and social conditions (Vazquez-Brust et al., 2012). Argentina, Brazil, Colombia, Chile and Uruguay, for instance, have emphasised a regulatory approach based on command and control instruments (Fossgard-Mosser et al., 2012). However, Colombia (Blackman and Guerrero, 2012) and Brazil (Ribeiro and Kruglianskas, 2012) have also experimented with government-supported voluntary programmes in specific regions. In turn, Peru and Mexico have incrementally managed environmental issues through auto-regulatory instruments based on trust and reciprocity between industry and government (Peña-Vinces and Delgado-Márquez, 2013; Vazquez-Brust et al., 2012).

In the case of Argentina, the country is still struggling – two decades after its commitment to provide a healthy environment – to enforce a national strategy for sustainable development. Overlapping jurisdictions and a long history of tensions between federal, provincial and municipal governments makes enforcement difficult and rare (Natenzon et al., 2012). Municipal governments, for instance, are still able to sidestep provincial and federal regulations by extending pollution 'credits' to private corporations (Mutti et al., 2012). There is therefore widespread recognition that Argentina needs to find the proper balance of authority and responsibility among national, provincial and local governments, as well as between the private and public sectors if it is to enforce sustainability-related regulations (Natenzon et al., 2012; Yakovleva and Vazquez-Brust, 2012).

Consequently, Argentinean firms have been operating in a climate of regulatory ambiguity for some time. In such systems, firms strategically choose their levels of environmental care after forming expectations about how the intensity of the scrutiny

they face from local enforcement agencies will respond to their own and perhaps others' environmental performance (Heyes and Kapur, 2009). If they expect the enforcement response to corporate environmental violations will be weak, they are less likely to expand much effort caring for the environment. If however the local enforcement agency is perceived as very responsive to firms' non-compliance, they factor this into their decisions and compliance at the local level is likely to improve. In other words, the nature of enforcement 'shapes' the quality of compliance irrespective of the actual regulations in place.

Various theoretical attempts have been made to explore how enforcement regimes can be designed to manage these expectations in a way that improves compliance-outcomes (e.g., Eckert and Eckert, 2010; Heyes and Kapur, 2009). From these underlying theoretical considerations, we generate six testable hypotheses and interrogate them using data gathered from a purposely designed large-scale survey of polluting firms in the province of Buenos Aires, Argentina.

The objective of this paper is to provide insight into expectations about environmental enforcement in Argentina – what they are and what influences them – and to interpret the results in the context of environmental policy design. More concretely, we explore empirically the perception of 'enforcement spill-overs' by those who are regulated. Do firms in Argentina believe that the intensity of scrutiny to which they will be subject depend upon the compliance behaviour of their peers? If so, what characteristics of the firm, its managers, the market and the community influence these perceptions? In other words, we attempt to empirically assess the compliance externality firms exert on each other through changes in the enforcement response.

The survey approach we take is a very direct one, based on semi-structured interviews with environmental managers at a set of regulated firms. Argentina provides an ideal test-bed for the study of regulatory responsiveness. As we argued enforcement there is significantly less-than-complete so assessing how likely infringements by firms are to be subject to enforcement action is important. The results that we generate are of specific and immediate interest in thinking about the design and development of enforcement regimes in that country, but lead to much more portable policy conclusions for Latin American and developing countries in general.

The plan of this paper is as follow. In Section 2, we provide a brief review of the empirical and theoretical literature on environmental enforcement. Parallels are drawn to the literature on tax evasion. In Section 3, we identify and motivate six hypotheses. In Section 4, we detail the survey methodology and other data sources. In Section 5, we interrogate the data and use logistic-regression methods to test the hypotheses. The results are also discussed in this section. Section 6 concludes and draws out policy implications.

2 Perceptions of enforcement – theoretical and empirical evidence

The standard model used by economists to think about firm-level compliance decisions is that of the 'rational polluter'. In the crudest version of it the profit-maximising firm is assumed to compare the expected benefit – in terms of reductions in future penalties – of reducing its infractions, with the additional operating or other costs associated with achieving those reductions. In recent years, the stripped-down version of the rational

polluter model has been extended and enriched in a number of directions, capturing some of the subtleties of the compliance decisions noted by economists and scholars in other disciplines. Notwithstanding, the various shortcomings of the rational polluter model, it is useful in highlighting that regulated firms take into account the expected financial costs and benefits of their compliance decisions. These may not be the only considerations that go into determining the care with which firms approach complying with regulatory requirements, but there is overwhelming evidence that they are very important ones. Heyes (2009) provides a detailed survey of many of these developments.

Of course, when thinking about compliance-incentives, it is widely-recognised by policy practitioners that the regulatory scrutiny to which a firm is subject to will be sensitive not just to its current choice but also to past decisions – i.e., its compliance choices and record of success, failure and cooperation in previous contacts with the regulator (Spence, 2001). Bergman (2003) makes a similar argument in the context of Argentinean and Chilean tax-payers decisions to comply or evade tax authorities. More concretely, he suggests that the decisions to comply or not depends on a weighed calculation of costs and benefits, the weights of which are determined by an iterative game between individuals, the authorities and the wider tax environment. The author, using existing survey data, provides compelling evidence that audits negatively affect the perceptions of the probability of underreporting detection and that recurrent tax amnesties accentuate non-compliance behaviour by rewarding violators for non-complying in the first place (Bergman, 2003).

A calculating non-complier (whether polluter or tax-evader) must therefore ask himself how a misdeed now may attract not only immediate penalty, but also increase the likelihood that future misdeed will be detected and penalised (Harrington, 1988). We can think, therefore, of one feature or characteristic of a well-designed enforcement regime as encouraging the perception of ‘enforcement responsiveness’ defined in this way. It is also important to note that the intensity of scrutiny by enforcers will be sensitive not only to the performance or record of the firm itself, but also to the behaviour of other firms in the same market or locale. In other words, in making their compliance choices, firms impact upon others through a change in enforcement. A responsive regime invariably creates such compliance externalities – i.e., interdependence amongst firms that ‘share’ an enforcement agency or local regulator. Such externalities have come to be referred to as enforcement or regulatory ‘spill-overs’ and have been recognised in empirical work by (for example) Decker and Pope (2005) and modelled formally in a paper by Heyes and Kapur (2009).

Spill-overs can substantially enhance the efficacy of regulatory regimes at relatively low additional costs, an appealing proposition for Latin American countries with limited enforcement resources (Blackman, 2012). Our study empirically documents these spill-overs effects in a sample of Argentinean firms and identifies the factors that help explain differences in firm perceptions.

3 Research hypotheses

The perceptions of the costs and benefits of compliance is subjective and likely to differ from firm to firm depending on their respective assessments of markets and other non-markets (labour, social and institutional) benefits of compliance. A critical question

is how authorities in charge of policy design can enhance perceptions of regulatory responsiveness in order to reduce non-compliance. More precisely, what factors about firms or the environment in which they operate are likely to determine their perception of enforcement spill-overs?

Let us think first about the possible role of competition. The stylised facts that emerged from a review of development studies suggest a positive relationship between market concentration and the likelihood of regulatory capture (Dal Bo and Rossi, 2007). Capture occurs when the regulator comes under the influence or even control of the industry that it is appointed to regulate. In our setting, capture could be expected to work in the direction of laxer enforcement and hence low levels of responsiveness and spill-overs effects.

H1 Other things equal, the probability of enforcement spill-overs is lower in concentrated markets than in less concentrated ones.

We also hypothesise that greener industries will work more closely with the regulator to promote good compliance. The success of industry self-regulation schemes often relies on the ability of the system to impose sanctions on those who shirk or perform below par. In such cases, the industry itself may be more than happy to inform and encourage the regulator to clamp down on such firms as a ‘punishment’ (Delmas, 2002). We aim to develop evidence in favour of this conjecture by testing the following hypothesis:

H2 Other things equal, the probability of environmental regulation spill-overs is higher in industries with high environmental compliance than in industries with low environmental compliance.

It has been recognised that the locality and setting within which a firm operates may have a substantial impact upon its compliance performance. In particular, pressure from a well-educated local community can generate improved performance. Compelling evidence for this has been provided by Pargal and Wheeler (1996) amongst others. Communities with low levels of education may give inappropriately low weight to pollution simply because they are not aware of the consequences and/or are unable to voice their concerns. In particular, poorer communities in Latin America tend to be less informed of risks, have limited capabilities to lobby for a better environment and generally rate the environment as a lower priority than employment (Dasgupta et al., 2000). It is therefore to be expected that such communities are unlikely to pressure regulators into action through complaints, collective action and other channels (Vazquez-Brust et al., 2012). More concretely, we argue that poorer community will be unable to provide sufficiently strong pressures and may be overridden in favour of corporate interests (Vazquez-Brust and Nava-Fisher, 2012). Hence, community vulnerability might be a factor in the creation of compliance externalities as expressed in the following hypothesis:

H3 Other things equal, the probability of environmental spill-overs is higher in less vulnerable communities.

Our next subset of hypotheses tests the relationship between enforcement spill-overs and three factors that measure the firm’s (i.e., its managers’) attitude/stance towards the environment and environmental regulations.

The first of these tests the relationship between spill-overs and the extent to which the firm adheres to the win-win paradigm of environmental management, i.e., whether

environmental improvements can be a source of competitive advantage (Plaza-Ubeda et al., 2009; Peña-Vinces and Delgado-Márques, 2013). One channel through which this advantage can be derived arises when regulatory response is actively favourable to good behaviour (for instance, by reducing the burden of inspections and other administrative tasks). We test the conjecture that firms that are optimistic about the competitive benefits of green practices will tend to perceive more responsive regulation:

H4 Other things equal, the probability of environmental spill-overs is higher in firms whose managers adhere to the view that ‘green’ practices can generate a competitive advantage.

In a less developed country setting such as Argentina, managers often perceive environmental concerns to be transitory, a fad that is likely to subside through time with no genuine political or social backing (Berchicci and King, 2007). We conjecture that both managers and regulators may be subject to such biases, reducing actual regulatory responses and anticipated ones. We attempt to provide evidence in favour of the conjecture by testing the following:

H5 Other things equal, the probability of environmental regulation spill-overs is higher in firms that believe in the growing importance of environmental issues than in firms who think it is a passing phase.

Our final hypothesis focuses on firms’ beliefs about the general ability of governments to design and implement effective regulatory regimes. Henriques and Sadorsky (1996) recognise that regulatory stakeholders can be a powerful influence on the firm’s environmental behaviour. There is also evidence that trust, legitimacy and compliance with tax and other laws are intrinsically linked, particularly in Latin America (Bergman, 2003). Firms that are cynical about the power and purpose of government regulations may not have faith in their ability to detect and react to the deterioration in compliance and performance of other firms. For this reason, firms may not expect a regulatory reaction and consequently will not experience enforcement spill-overs. Moreover, general optimism about government efficacy may shift norms and social expectations and harness pressures from the local community, employees and investor pressures (Lo and Fryxell, 2005) thereby increasing the likelihood of regulatory response and compliance externalities.

H6 Other things equal, the probability of environmental spill-overs is higher in firms where government regulations are construed as effective.

In addition to these variables, we also include five often used firm characteristics as controls including firm size, the environmental impact of its production technology, its environmental performance, whether the firm is publicly traded on the stock market and whether it exports goods to countries with relatively high environmental standards (i.e., Japan, the USA or EU). While there are no empirical studies directly related to compliance externalities (spill-overs), our choice of controls was guided by the neighbouring literature on compliance choice and firm behaviour.

Firm size is a common control variable as it captures competitive benefits associated with average costs and greater bargaining power. The traditional argument for including size in studies of environmental regulation is that pollution control requirements increase the scale of operations needed for efficient production and thereby increase the capital

required for entry. There is lots of evidence that there are economies of scale in both the productive and administrative aspects of compliance with environmental requirements (see for instance, Heyes, 2009). Likewise, bigger firms may find compliance and environmental performance 'cheaper' than smaller firms, and be relatively more pro-active in terms of staying ahead of the enforcement game. Big firms also tend to be the prime target of militant stakeholders and green activists and are hence more likely to be scrutinised than their smaller counterparts (Baron, 2001). If regulators sense that firms in a given sector are underperforming, the clamp down is likely to start with the largest firms in the sector.

Whilst the characteristics of enforcement regimes may differ, the over-arching objective of the regime should be to implement a centrally determined environmental strategy. It is likely to be the case that such policies require regulators to monitor carefully sectors or specific firms that use technologies that potentially have a high impact on the environment. Such firms may be 'good' citizens in an environmental sense but the nature of the technology they use is classified as high impact. High impact technology firms might also expect regulators to keep specific tabs on their own compliance behaviour and that of similar firms. In other words, high impact firms are likely to generate higher compliance externalities than other firms and will thus expect a prompt regulatory response to changes in the environmental compliance and performance of others. In a similar way, the firm's environmental performance may indicate a sound environmental strategy and provide relative protection from the regulator.

Much has been made in recent years about the compliance discipline that comes with being a listed company (e.g., Badrinath and Bolster, 1996). We therefore control for firms traded on the stock market since publicly traded firms are subject to more scrutiny from investors and other stakeholders.

A number of scholars have also examined the link between a producer's export-orientation and its adherence to environmental standards. King et al. (2005), amongst others, suggests that firms comply and self-regulate to signal their superior environmental management in order to overcome information asymmetries that are particularly acute when dealing with distant or foreign exchange partners. Similarly regulators – as government officers – might be expected to promote and uphold standards to protect and foster trade relations. This suggests that the pressure to be environmentally pro-active may be greater for exporting firms (Birdsall and Wheeler, 1993). In Argentina, products destined to the US, European, or East Asian market typically contain higher value added and tend to be subject to higher standards than those sold within Latin America (Toulan et al., 1997). We therefore expect compliance externalities (spill-overs) to be more prevalent in export-intensive settings with developed countries.

4 Sources and methods

We test these hypotheses using an original dataset constructed on the basis of a large-scale survey of managers in Argentinean firms.

The survey was primarily designed to gather information on managers' *perceptions* of environmental pressures and how these impact on their decisions about the environment. Focus groups, pilot testing and training sessions with surveyors were held to explain and

fine-tune the survey instrument. The survey took place in Buenos Aires over 3 years, i.e., between March 2005 and March 2008.¹

The sample included small, medium and large firms operating in sectors known to use processes that (potentially) involve the discharge of polluting substances and wastes in water, air and/or soil and use a lot of energy, water, or non-renewable resources (i.e., metallurgy, food, drinks, chemicals, petrochemicals, pharmaceuticals, non-basic metals, manufacturing, hospitals, treatment plants, petrol stations). The sample was selected using a stratified design technique with industry, size, and geographical location as selection parameters.² A total of 705 firms were contained in the original sample – 338 questionnaires contained all the responses required to test the hypotheses of this study yielding a response rate of 48%.

The survey is composed of two structured questionnaires (and a financial annex). The first questionnaire ('environmental practices' – 60 minutes) was delivered and completed by the manager in charge of environmental affairs or he/she's equivalent. It contained questions that enabled us to characterise managers' perceptions of enforcement spill-overs. Specifically, we asked managers to tell us what they thought would happen to the frequency of inspections at their own firm if other firms increased the environmental violations they committed.³ The responses were converted into a dichotomous variable that can be interpreted as 'the firm expects enforcement spill-overs following a deterioration in the regulatory compliance of other firms' (Yes = 1; No = 0). This variable, referred to as *SPILLOVERS* serves as our dependent variable in a binomial logistic regression that is used to test the 6 hypotheses presented above.

The first questionnaire also generates information about industry environmental compliance levels (H2) as well as firm characteristics used as control variables (i.e., firm size⁴, technology, environmental performance, whether or not its stock is listed on the market and export orientation).

The second ('managers' opinions' – 20 minutes) is shorter and completed by senior managers empowered to take strategic decisions on environmental issues at company level. It contains questions about organisational culture and managers' attitudes and opinions including questions regarding manager adherence to the win-win paradigm (H4), the importance of environmental issues over the next five years (H5) and the efficacy of government regulations (H6). In some cases (small firms), the two questionnaires were completed by the same person. More details of the survey are presented in Vazquez-Brust (2007). The data on the index of social vulnerability (H3) was taken from a municipality-based survey of vulnerable households carried out in 2006 by the Argentinean Institute of Statistics (INDEC). Each firm in the database was matched to the index of social vulnerability corresponding to the municipality where the firm was located.

Data on industrial concentration (H1) was very difficult to access – the Argentinean Government does not keep such records. Instead, we hired a consultancy firm who was instructed to calculate the number of employees in the eight largest firms for each of the industries (3-digit SIC) represented in this survey. These figures were divided by the total number of employees in each industry, producing an index of employee concentration, which we used as a proxy to market concentration. The caveats of doing so are obvious but few alternative measures are available.

Table 1 contains descriptive statistics and frequencies of the variables used to test the hypotheses. (Translations of the survey questions used to gather this information can be obtained upon request.)

Table 1 Descriptive statistics (n = 338)

<i>Numerical variables</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>Std. D.</i>	<i>No (%)</i>	<i>Yes (%)</i>
Dependent: environmental spill-overs	0	1	NA	NA	195 (58%)	143 (42%)
H1 – Market concentration	0.00	0.37	0.05	0.06	NA	NA
H2 – High industry compliance	0	1	NA.	N.A.	299 (88.5%)	39 (11.5%)
H3 – Index of vulnerability	9	45	29.43	6.60	NA	NA
H4 – Green competitive advantage?	0	1	NA.	NA.	113 (33.4%)	225 (66.6%)
H5 – Growing importance of env. issues?	0	1	NA.	NA.	137 (40.5%)	201 (59.5%)
H6 – Gov. regulations effective?	1	5	3.27	1.16	NA	NA
Big firm (n > 500)?	0	1	NA.	NA.	308 (91.1%)	30 (8.9%)
Impact of technology	1	3	2.13	0.61	NA	NA
Firm environmental performance	1	4	2.71	0.67	NA	NA
Publicly traded?	0	1	NA.	NA.	226 (66.9%)	112 (33.1%)
Exports to Japan, USA, EU?	0	1	NA.	NA.	239 (70.7%)	99 (29.3%)

5 Results and discussion

The hypotheses are tested using binary logistic regression analysis, a popular technique to estimate the extent to which a set of predictor variables (either categorical or continuous) explains changes in a dichotomous dependent variable (yes/no coded 0/1). In this study, the dependent variable is ‘SPILLOVERS’ which captures whether the firm is subject to environmental performance spill-overs (a ‘success’) or not (a ‘failure’).

While logistic regressions are a flexible analysis tool (e.g., the predictor variables can take any form since no assumptions are made about their distribution), they are sensitive to high correlations among the predictor variables (Table 2). Multicollinearity diagnostic statistics including the tolerance and variance inflation factor (VIF) were computed for each variable. As Table 3 shows, none of the VIF factors are over the value of 3 which is typically used as the cut-off benchmark for multicollinearity (Tabachnick and Fidell, 1996).

Table 2 Correlation matrix

<i>Pearson correlation Sig. (2-tailed)</i>	<i>(H1) Mkt. conc.</i>	<i>(H3) ISV</i>	<i>(H6) GovtRegs</i>	<i>Technology</i>	<i>Firm performance</i>
(H1) Mkt Conc.	1	-0.087 (0.053)	0.051 (0.258)	0.055 (0.219)	0.008 (0.870)
(H3) ISV	-0.087 (0.053)	1	0.097** (0.029)	0.014 (0.750)	-0.052 (0.250)
(H6) GovtRegs	0.051 (0.258)	0.097** (0.029)	1	-0.011 (0.810)	-0.067 (0.139)
Technology	0.055 (0.219)	0.014 (0.750)	-0.11 (0.810)	1	108** (0.017)
Firm performance	0.008 (0.870)	-0.052 (0.250)	-0.067 (0.139)	108** (0.017)	1

Note: **Correlation is significant at the 0.05 level (2-tailed).

Table 3 Dependent variable: environmental behaviour spill-overs

<i>Variables</i>	<i>B</i>	<i>S. E.</i>	<i>Wald</i>	<i>Sig.</i>	<i>ExpB</i>	<i>Collinearity stats.</i>	
						<i>Tol.</i>	<i>VIF</i>
Constant	0.003	1.034	0.000	0.998	1.003		
H1 – Market concentration	-7.359	2.170	11.497	0.001**	0.001	0.959	1.043
H2 – Industry compliance	1.379	0.401	11.818	0.001**	3.970	0.958	1.044
H3 – Index of Vulnerability (ISV)	-0.141	0.025	32.815	0.000**	0.869	0.926	1.080
H4 – Comp. Advantage?	1.598	0.293	4.175	0.041**	1.818	0.931	1.074
H5 – Importance env. issues?	1.185	0.294	16.257	0.000**	3.271	0.936	1.069
H6 – Govt. regs effective?	0.714	0.131	29.724	0.000**	2.042	0.950	1.053
Size (Big?)	1.766	0.501	12.415	0.000**	5.848	0.887	1.127
Technology	0.486	0.233	4.343	0.037**	1.625	0.910	1.099
Firm env. performance	-0.415	0.216	3.686	0.054**	.661	0.937	1.067
Publicly traded?	0.381	0.347	1.201	0.273	1.463	0.916	1.091
Export US/EU/Japan?	0.589	0.296	3.963	0.047**	1.803	0.966	1.035
Model summary							
-2 log likelihood	339.923						
Cox & Snell R Square	0.297	Nagelkerke R. Square				0.400	
Percentage successfully predicted	74%						
Chi-square (119.324); Df (11); Sig. (.000)							
Hosmer and Lemeshow Test Chi-Square (12.606); Df (8); Sig. (.126)							

Notes: **Coefficient is significant at the 0.05 level (2-tailed); *Coefficient is significant at the 0.10 level (2-tailed).

The usual tests were conducted to assess the performance of the model. The goodness of fit test (i.e., the Omnibus test of model coefficients) suggests that the independent variables are highly predicting membership to the spill-overs – no spill-overs categories. The Hosmer and Lemshow statistic indicates that the model prediction do not significantly differ from the observed. The Cox & Snell and Nagelkerke are pseudo R-square values which provide an indication of the amount of variation in the dependent variable explained by the model. The R^2 statistics do not measure the goodness of fit of the model but indicate how useful the explanatory variables are in predicting the response variable and can be referred to as measures of effect size. The value of 0.40 indicates that the model is useful in predicting spill-overs. Finally, the classification table suggest that the model correctly classifies 74% of cases overall, an improvement over the 54.9% in the original predictor-free model. These tests indicate that the model performed reasonably well and is useful in explaining the probability of environmental performance spill-overs in Argentinean firms located in and around Buenos Aires.

Moreover, as the Wald and significance tests indicate, all 6 hypotheses are supported by the data and only one control variable has a coefficient that is not significant (the publicly traded dummy).⁵

The coefficient on the proxy for market concentration (H1) is negative at -7.359 , suggesting that increases in the market power of firms do indeed lead to a decrease in enforcement spill-overs. In other words, firms in concentrated market structures are less likely to anticipate increases in regulatory stringency following a decrease in the general environmental performance of other firms in the sector – there are much weaker compliance externalities in concentrated markets. Two major factors (there may be others) can explain this result. Firstly, it is possible that firms in concentrated industry are more likely to have ‘captured’ their regulators thereby exerting political influence that impacts upon policy-making and implementation that facilitates corporate activities. For instance, Dal Bo and Rossi (2007) test a simple model for why (Latin American) countries where regulators are more easily ‘captured’ are likely to have more inefficient utilities. When regulators are more likely to be vulnerable to influence and approve price hikes, firm managers do not have incentives to try their best when coordinating and supervising the use of production factors. They find that firms (utilities) are more inefficient in countries and times displaying higher corruption. According to Transparency International, Argentina ranked 109th (out of 180 countries) in its 2008 Corruption Perceptions Index. Our argument here is that firms operating in concentrated industries share many of the characteristics associated with utilities (i.e., market power). Our result may be indirectly uncovering a link between market concentration and regulatory capture (i.e., lenient regulatory responses).⁶ Another major factor may be that firms in less concentrated industries lack the competitive pressures that are useful in propagating best practice and acceptable norms in environmental behaviour (Baron, 2001). *Ceteris paribus*, firms in concentrated market structures have fewer incentives to innovate, legitimate their behaviours, and stay in touch with recent developments, whether regulatory or others. This lack of interest in rival performance may lead firms to downplay regulatory threats.

On the other hand, (H2) is associated with a positive and statistically significant coefficient, implying that firms operating in industries with a strong compliance record are more likely to anticipate regulatory responses to environmental performances elsewhere. Perhaps in such industries the regulator has established a reputation for toughness and/or firms encourage regulatory responses as sanctions that help enforce and protect the industry's reputation (King and Lenox, 2000). Our third hypothesis – that firms will experience less spill-overs when located in poorer areas populated by socially vulnerable individuals H3 – is supported by the data. This finding lends support to those working in the areas of environmental justice, for example, Dasgupta et al. (2000), and Vazquez et al. (2012) who argue that firms operating in poorer communities are less likely to be pressured by citizens or government officials responding to citizen pressures than their counterparts in wealthier settings. These communities are effectively marginalised and yet they tend to be the principal victims of environmental degradation.

The next set of variables (testing hypotheses H4, H5, and H6) focuses on attitudinal and belief factors. The coefficient linked to the competitive advantage dummy (H4) is significant and positive suggesting that the odds of a firm experiencing spill-overs is higher if the firm's managers adhere to the notion that environmental investments can improve the profitability of a firm. As discussed above, one of the ways in which a competitive advantage in environmental performance arises is through a belief in the responsiveness of regulators. This result suggests that those who believe in the competitive advantage potential of environmental performance also think that regulators respond to firm behaviour.

The hypothesis testing whether a belief that those environmental issues will grow in importance over the next five years is also supported by the data (H5). Many Argentinean managers believe that concerns about the environment will disappear either because they are somewhat faddish or because societies will find scientific and other solutions to deal with the problem [see the discussion of 'Prometheans' in Vazquez and Liston-Heyes (2008)]. In our sample, 41% of managers do not think that environmental concerns will become more prominent. Such beliefs are associated with an absence of compliance externalities – i.e., the environmental concern of politicians lack credibility and firms are dismissive about their commitment to monitor and enforce sanctions.

The coefficient associated with the variable assessing beliefs in the efficacy of government regulations (H6) is also positive and significant. This is an interesting result as it shows that firms associate efficient regulatory practices with responsive regulators and compliance externalities. Within Latin America, Argentineans demonstrate a relatively lower level of trust in public institutions and government agencies. For instance, Bergman (2003) reports that Chilean taxpayers are generally willing to pay more taxes to alleviate poverty than their Argentinean counterparts. The author links this difference directly to the divergence of trust and legitimacy public institutions in the two countries.

As expected, the coefficient on the control variable firm size is also positive and statistically significant as is the coefficient on the dummy controlling for high impact technologies. Our results also confirm that a good performance at the firm level weakens regulatory spill-overs. The coefficient on the dummy variable capturing whether the firm is publicly traded is not significant but the coefficient on the export dummy is positive and statistically significant as expected.

We conclude that while adverse economic conditions and instability may potentially reduce compliance with the law (whether in paying taxes, protecting the environment or other), there are other important factors at play. To emphasise this point, Bergman (2003) explains that Argentina and Chile – during periods of comparable economic growth – experienced significantly different success rates in tax collection. While acknowledging that economic variables are instrumental in the enforcement function, they emphasise the point that tax policies that rely less on regulation and more on self-enforcing compliance are likely to be more efficient. Well-designed reforms should capitalise and enhance compliance externalities of the type discussed here.

6 Conclusions

While ensuring reasonable levels of compliance with environmental regulatory requirements is a difficult challenge at the best of time, compliance is particularly poor in Argentina. Its enforcement system is decentralised and characterised by diverse enforcement practices and expectations. In other words, regulatory responses are idiosyncratic as local regulators' interpretation of their mission is influenced by the behaviours and attitudes of managers in charge of the firms under their jurisdiction as well as community and industry pressures. This widespread diversity in enforcement practices across different local areas creates disparities between actual and perceived enforcement amongst local authorities who have much scope to interpret institutional guidelines and rules as they see fit.

Firms typically trade-off the benefits of compliance against the costs of non-compliance. When they witness a weak enforcement response following an environmental violation, they are subsequently less likely to expand much effort caring for the environment. On the other hand, if they observe consistent strong regulatory responses to such violations they will adjust their expectations of the costs of compliance accordingly and limit future violations. In the first scenario, there are no compliance externalities or spill-overs while in the later spill-overs are substantial. We argued that well designed environmental policy should endeavour to enhance enforcement spill-overs so as to reduce discrepancies between regulatory intent and actual enforcement outcomes.

This paper reports the results of a large-scale survey specifically designed to collect information on the attitudes and perceptions of environmental pressures experienced by managers working in a sample of polluting firms located in and around seven municipalities in the province of Buenos Aires, Argentina. It uses binary logistic regression to identify the factors influencing the perceptions of enforcement spill-overs. Since expectations of the consequences of not complying are at the heart of a firm's decision to improve its environmental performance, a more detailed understanding of enforcement spill-overs can potentially contribute to the design of more effective environmental policies. Enhancing the ability of a regulatory system to generate

compliance externalities (of the sort discussed here) are an effective way of enforcing environmental regulations at a relatively low cost.

We formulated six hypotheses and identified five further control variables and tested them in using our database. Table 4 synthesises the results of this paper.

Notwithstanding, the many caveats involved in a study of this kind, the results are encouraging in that they show how general improvements in the perceived efficacy of government authorities, long-term commitments to the environment and improved market based mechanisms that provide competitive advantage to green firms are likely to improve perceptions of regulatory responsiveness. Enhanced public participation and voluntary industry compliance schemes – through their impact on regulator incentives – are also likely to accentuate firm perceptions of regulatory spill-overs. We also note that responsive regulation may be less effective in concentrated industries where there are important risks of regulatory capture. Such cases may warrant less discretionary inspection policies.

Table 4 Results synthesis: determinants of environmental behaviour spill-overs

<i>Hypotheses</i>	<i>Our analysis show the following:</i>
Market concentration H1 Other things equal, the probability of spill-over effects is lower in concentrated markets than in less concentrated ones.	There are weaker compliance externalities in concentrated markets. Plausible explanations include regulatory capture and lack of competitive pressures. (B = -7.359; Sig. = 0.001)
Industry compliance H2 Other things equal, the probability of spill-over effects is higher in industries with high environmental compliance than in industries with low environmental compliance.	Firms operating in industries with a strong compliance record are more likely to face a responsive regulator and/or spill-over effects. Plausible explanations include regulatory reputation for 'toughness' and/or compliance through industry sanctions. (B = 1.379; Sig. = 0.001)
Index of vulnerability H3 Other things equal, the probability of spill-overs effects is higher in less vulnerable communities.	Firms will experience less spill-overs effects when located in areas populated by socially vulnerable individuals. A plausible explanation may be that firms operating in poorer communities are less likely to be pressured by citizens or government officials responding to citizen pressures. (B = -0.141; Sig. = 0.000)
Competitive advantage H4 Other things equal, the probability of spill-over effects is higher in firms whose managers adhere to the view that 'green' practice can generate a competitive advantage.	The odds of a firm experiencing spill-overs effects are higher if the firm's managers believe that environmental investments can improve the profitability of a firm. One plausible explanation is that those who believe in the competitive advantage potential of environmental performance also think that regulators respond to firm behaviour. (B = 1.598; Sig. = 0.041)
Importance of environmental issues H5 Other things equal, the probability of spill-overs effects is higher in firms that believe in the growing importance of environmental issues than in firms who think it is a passing phase.	Managers who think environmental issues are a 'fad' will be subject to fewer compliance externalities. A plausible explanation is that politicians lack credibility and firms are dismissive about their environmental commitment to monitor and enforce sanctions. (B = 1.185; Sig. = 0.000)

Table 4 Results synthesis: determinants of environmental behaviour spill-overs (continued)

<i>Hypotheses</i>	<i>Our analysis show the following:</i>
Are government regulations effective? H6 Other things equal, the probability of spill-over effects is higher in firms where government regulations are construed as effective.	Firms that perceive regulations as effective are more likely to display compliance externalities. A likely explanation is that firms associate efficient regulatory practices with responsive regulators. (B = 0.714; Sig. = 0.000)
<i>Control variables:</i>	
‘Size of firm’: Positive and significant coefficient indicating that larger firms are more likely to anticipate regulatory spill-overs. The literature suggests that larger firms are more likely to be targeted by regulators and militant stakeholder groups.	
‘High impact technologies’: Positive and significant coefficient indicating that firms with activities that are known to have a high impact on the environment will be more prone to spill-over effects. The literature suggests that regulators will monitor such firms more carefully and firms anticipate this.	
‘Firm environmental performance’: Positive and significant coefficient indicating that a good environmental performance at the firm level weakens spill-over effects. The literature suggests that firms with high compliance records may rely on absolute rather than relative standards of behaviour.	
‘Publicly traded’: The coefficient is not statistically significant. Few firms are publicly traded in Argentina.	
‘Exports to USA, Europe or Japan’: Positive and significant coefficient indicating that exporters are more prone to compliance externalities. The literature suggests that openness encourages cleaner industry through the importation of developed-country pollution standards.	

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Notes

- 1 The Ministry of Public Works and the InterAmerican Development Bank (IDB) in Argentina supported the delivery, administration and collection of the survey. Linkages to these two institutions facilitated access and enhanced participation and goodwill from managers. The municipalities provided access to restricted databases as well as fees and stipends for the surveyors operating in their jurisdictions.
- 2 Firms were first stratified under the SIC Revision three classification and, subsequently, by plant size as measured by number of employees (small, medium, large). Within these strata, firms were ranked by their level of environmental impact as measured by the NCA or 'level of environmental complexity' which ranges between 20 and 80. For details of the sampling method see Vazquez-Brust (2007).
- 3 The exact question (translated from Spanish) is: 'What do you expect to happen to the number of inspections at your firm if other firms increased the frequency of their regulatory violations.'
- 4 Number of employees was used as a proxy of firm size. Unfortunately, in Argentina taxes are levied according to the number of employees at the firm. This increases the occurrence of non-response items and introduces a risk of under-reporting. In the absence of an alternative, we used the more general categories (small, medium, large) to improve the reliability of this variable.
- 5 Few companies are traded in Argentina. In our particular sample, 13% of firms are traded – this is much higher than the economy-wide figure of 0.08%. As of 2007, only 100 companies listed their shares in the Buenos Aires Stock Exchange – 45 are contained in our sample.
- 6 According to Bergman (2003) Chile was much more willing and able than Argentina in its political capacity to neutralise rent seeking and predatory pressures. In Chile, it is almost impossible to bribe auditors but in Argentina, taxpayers doubt the ability of auditors in detecting evasion and realise that bribes are a credible alternative if detection occurs. Our findings suggest that a similar story emerges in other areas of enforcement.