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Public Opinion on Hydraulic Fracturing in the Province of Quebec: A Comparison with Michigan and Pennsylvania

a report from the National Surveys on Energy and Environment

Key Findings:

1. Relative to residents of Michigan and Pennsylvania, those living in Quebec are much more likely to oppose the extraction of natural gas from shale deposits in their province.

2. The general aversion to hydraulic fracturing in Quebec is shared across the province, and appears to be driven less by a 'not in my backyard' (NIMBY) reaction than by 'not in anyone's backyard' (NIABY) attitudes.

3. Despite the dominant view that experts are divided on risks related to fracking, residents of Quebec are more likely than residents of Michigan and Pennsylvania to view risks as being high.

4. Residents of Quebec are much less likely to perceive the development of shale resources as being important for the economy, and a majority of Quebecers perceive that drilling for natural gas in their province will cause more problems than benefits in the future.

5. The prevalence of egalitarian values in Quebec helps explain this particular reticence toward hydraulic fracturing in the province.

6. More egalitarian and less individualistic than the public in Michigan and Pennsylvania, residents of Quebec perceive greater risks in the extraction of natural gas from shale, and tend to be less convinced of economic benefits.

7. Information is associated with greater opposition to fracking in Quebec, though it has no effect in Michigan and Pennsylvania. Rather than mitigate risk perceptions, information can reinforce concerns related to risks.

8. Provided with new scientific information, individuals adjust their perceptions of risk, however, even a strong signal from credible experts is unlikely to alter attitudes in Quebec to such an extent as to produce overall support.

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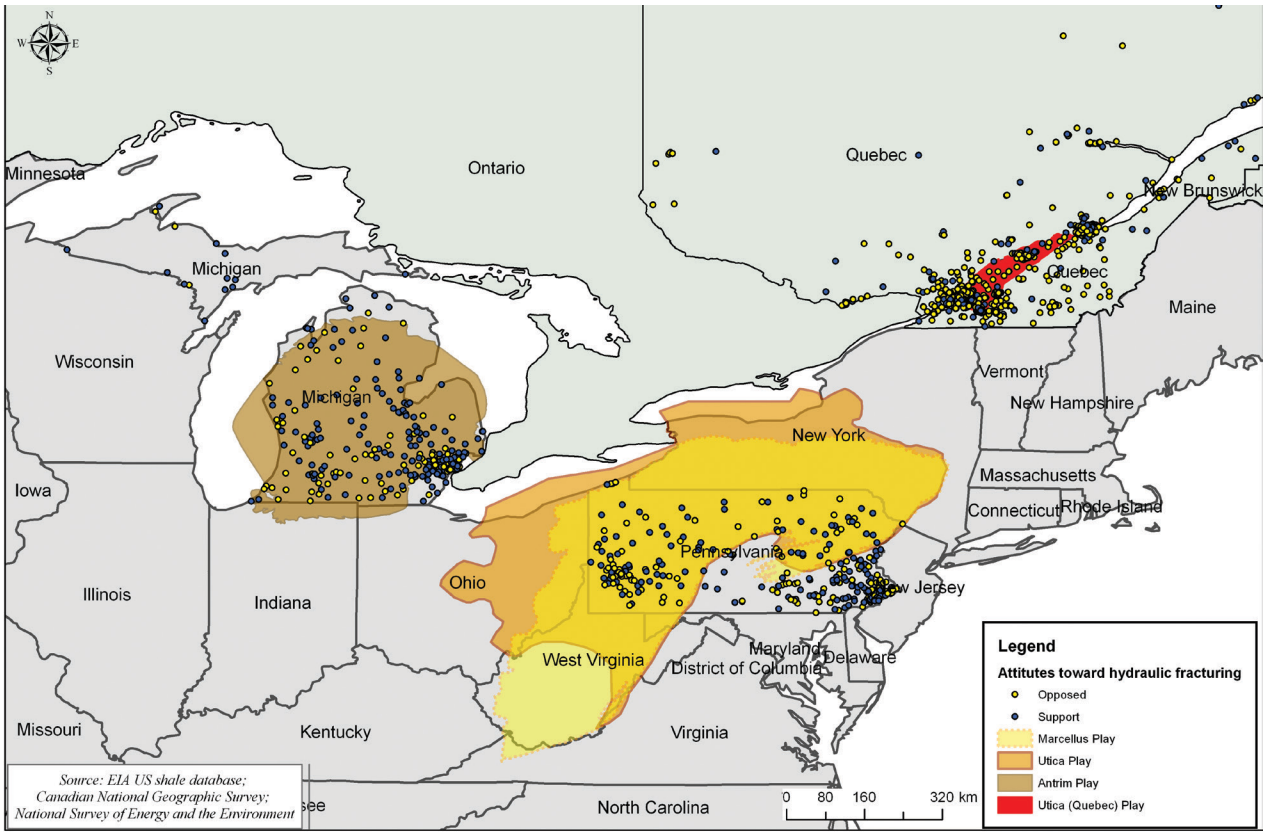
Introduction

Controversy associated with hydraulic fracturing (HF), or "fracking" in the Canadian province of Quebec is a relatively recent phenomenon. In 2006, commercial drilling on Quebec's Utica shale largely went unnoticed by a province better known for its vast hydroelectric resources than for the development of its fossil fuels. By 2010, however, mounting public concern over the risks of HF forced the governing *Partie Libéral* to initiate a major public consultation under the aegis of the *Bureau d'audiences publiques sur l'environnement* (BAPE), the provincial government's lead agency dedicated to public information and consultation on matters related to energy development projects and the environment more generally.[a] This high profile consultation made headlines over a sustained period, fueling public debate and scrutiny over the issue of how to proceed with an economic opportunity that also carried substantial risks for a province unfamiliar with the extraction of oil and gas.[1] Ultimately, the commission concluded that the best available science was inconclusive on a number of potential risks, and recommended that HF methods be further investigated in the context of a more comprehensive environmental review. In the meantime, the commission also recommended that all commercial exploration via hydraulic fracturing methods be suspended until such time that the risks were better understood.[2]

During this quasi-moratorium, the government set up a Strategic Environmental Assessment (SEA) on the risks and benefits associated with natural gas extraction in the province, and commissioned a series of studies to be conducted on a range of scientific and social issues related to the application of HF techniques on Quebec soil.[3] As part of this SEA, and in collaboration with the National Survey on Energy and Environment, a survey was designed by researchers at the Université de Montréal, University of Michigan, and Muhlenberg College, and administered to random samples drawn from the Quebec, Michigan and Pennsylvanian populations, simultaneously, in the Fall of 2012. The location of all survey respondents expressing an opinion toward the extraction of natural gas from shale in their state or province are presented in *Figure 1*.

Figure 1
Geographic Distribution of Survey Respondents in Quebec, Michigan, and Pennsylvania



a The *Parti Libéral du Québec* (PLQ) initially greeted the prospect of natural gas drilling on its territory with fervent enthusiasm. Of the major political parties in the province, the PLQ is generally regarded as the most business-friendly, occupying the Center-right of the political spectrum.

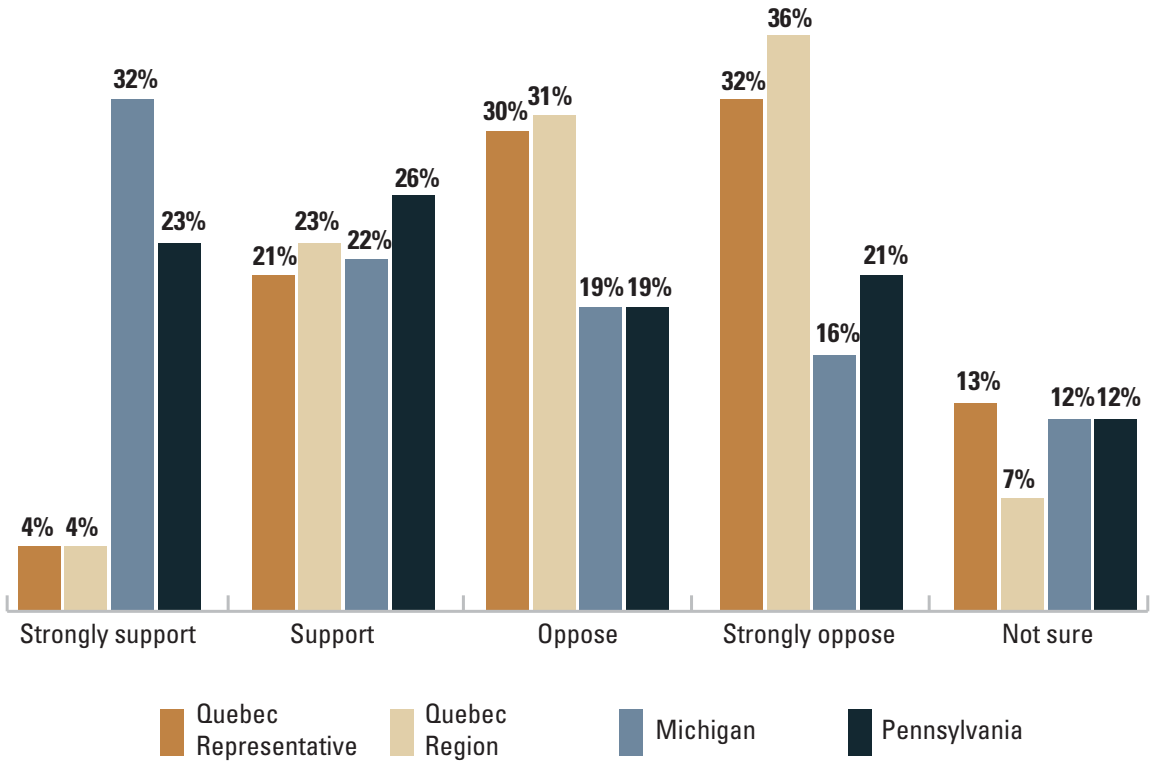
As shown in *Figure 1*, Quebec, Michigan and Pennsylvania represent three sub-federal jurisdictions with substantial shale gas resources that have garnered, to varying degrees, some level of controversy. This opposition, most prominent in Quebec, also reflects varying levels of drilling activity prevailing in the three jurisdictions. While use of HF methods has expanded rapidly in Pennsylvania in 2007, only 18 wells were fracked in Quebec's densely populated St. Lawrence Lowlands region (where its Utica shale play is found) before the government suspended commercial drilling as part of its environmental review.[4] Though relatively less mature in the Canadian province, high profile media coverage of accidents in Pennsylvania have generated a great deal of controversy for the industry in Quebec. In contrast, HF techniques have been used for decades in Michigan, where it only recently emerged as an important policy issue in the state. These differences make for interesting points of comparison.

This report summarizes main findings of this comparative project, with a focus on explaining why attitudes toward fracking in Quebec are markedly different than in Pennsylvania and Michigan (*Figure 1*). The report is divided into three main parts. First the distribution of opinions on shale gas across the three jurisdictions is explored. Next, the role of cultural predispositions is highlighted as a potential explanation for the observed differences in opinion across Quebec, Michigan and Pennsylvania. Finally, the potential for opinion change in light of new information is examined. Overall, evidence suggests that attitudes in Quebec are substantially more reticent than in Michigan and Pennsylvania when it comes to hydraulic fracturing in their province. This reticence is in part a reflection of different cultural orientations (or values) in the three jurisdictions, which are likely to endure. While the public in all three jurisdictions adjust attitudes to expert cues, attitudes in Quebec are unlikely to change to an extent that would lift support for HF to levels found in Michigan and Pennsylvania. To our knowledge, this is the first comparative survey of its kind, providing a comprehensive look at how the public in three jurisdictions with relatively large shale deposits thinks about the issue of hydraulic fracturing in their state or province.

Attitudes toward Hydraulic Fracturing in Quebec, Michigan and Pennsylvania

The survey first asked a series of questions to measure attitudes toward the use of hydraulic fracturing in the three jurisdictions. In one of the first survey questions, respondents were invited to indicate their level of support for shale gas extraction in their province/state. Results are presented in *Figure 1*.

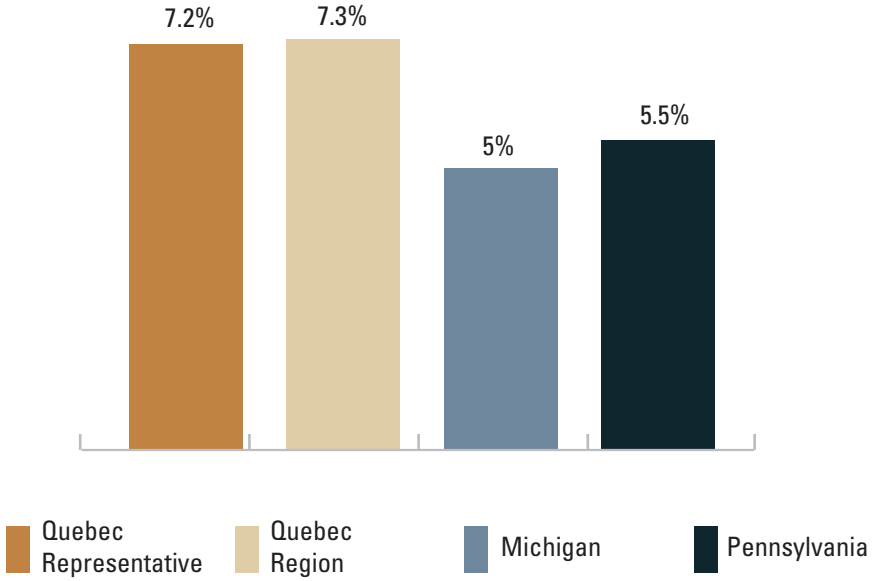
Figure 1
Support for Shale Gas Extraction in Quebec, Michigan and Pennsylvania
Survey Question: In general, would you say that you strongly support, somewhat support, somewhat oppose, or strongly oppose the extraction of natural gas from shale deposits in Quebec/Michigan/Pennsylvania?



As illustrated in *Figure 1*, respondents from Quebec are most likely to oppose (30%) and strongly oppose (32%) the extraction of natural gas from shale deposits in their province. This is true for both the representative provincial sample as well as the regional over sample drawn specifically from the Saint Lawrence Lowlands where the Utica shale play is found (see methodological section for details). Overall, nearly 3 in 5 residents of the province are opposed, compared to about 1 in 4 who are in favor. In contrast, attitudes in Michigan and Pennsylvania are much more favorable, with about 1 in 2 residents supporting the extraction of natural gas from shale. Opinion in Quebec is thus relatively more hostile toward the development of this industry, and this hostility is not just at the local community level, but is shared across the province at large. In contrast, opinion in Michigan and Pennsylvania is much more favorable, so much so that the cross-jurisdictional differences are statistically significant at conventional levels (i.e. $p<0.05$).

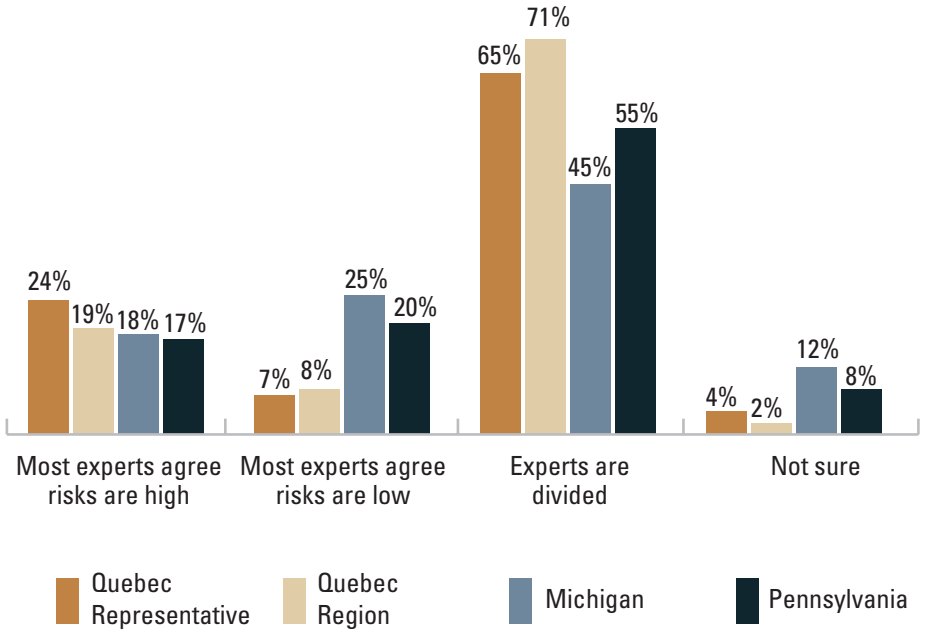
Results on other items provide further support for the idea that people in Quebec are significantly less supportive of the extraction of natural gas from shale, and that such attitudes are shared across the province. For instance, respondents were asked to evaluate, on a scale from 0 to 10, the risks posed by hydraulic fracturing for the health and environment of residents living in close geographic proximity to drilling operations. *Figure 2* presents the mean score for each sample (not sure responses were discarded). As shown, risk perceptions are significantly higher in the Canadian province than in either of the two American states. This is true regardless of whether respondents in Quebec were drawn from either the representative or regional sampling frame.

Figure 2
Perceptions of Risk from HF in Quebec, Michigan and Pennsylvania
Survey Question: On a scale from 0 to 10, where 0 indicates extremely unlikely and 10 indicates virtually certain, how probable is it that hydraulic fracking poses serious risks to the health and environment for residents living near drilling operations?



Linked to this question of risk, the survey also invited respondents to offer views on what they thought scientists believe on the safety of HF methods. Specifically, respondents were asked if they thought most experts agreed risks are high, most experts agreed risks are low, or whether they thought most experts were divided on the question of risks related to HF. *Figure 3* illustrates that more Quebec respondents believe that experts are divided than residents of either Pennsylvania and Michigan. This is especially true of respondents drawn from the regional sample. Residents of Quebec are also much less likely to perceive a consensus among experts who affirm that the risks are low. Roughly equal proportions in each sample perceive most experts agreeing that risks are high.

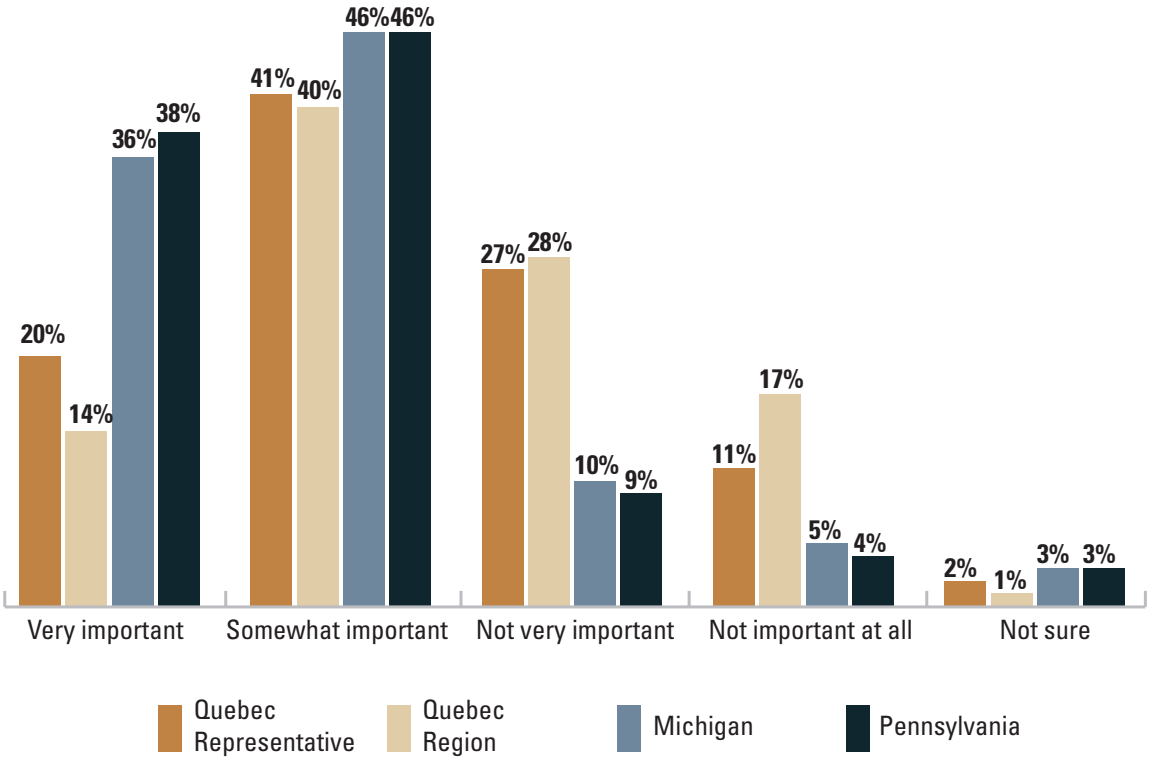
Figure 3
Perceptions of Scientific Consensus in Quebec, Michigan and Pennsylvania
Survey question: Now please tell me which of the following statements comes closest to your views on the state of scientific knowledge regarding the risks associated with fracking. Would you say that: most experts agree that the risks are high, most experts agree that the risks are low, or that most experts are divided on this question?



While individuals may perceive risks, they may also consider that other advantages are important enough to justify the application of HF to extract natural gas from shale. *Figure 4* presents results from a question that probes public attitudes toward the potential benefits from shale. As shown, less than 2 in 5 Quebecers perceive little to no economic benefits from fracking. However, relative to residents in Michigan and Penssylvania, this minority is particularly large, especially for residents living in the densely populated Saint Lawrence Lowlands, who are roughly about twice as likely as residents of Michigan and Pennsylvania to hold this view. Conversely, Quebecers are also much less likely to perceive shale gas as being very important for the provincial economy. This difference in perceptions of economic benefits across the three jurisdictions reflects the relatively marginal status of (and lack of experience with) the oil and gas sector in the Canadian province.

Figure 4
Perceptions of economic importance of HF in Quebec, Michigan and Pennsylvania

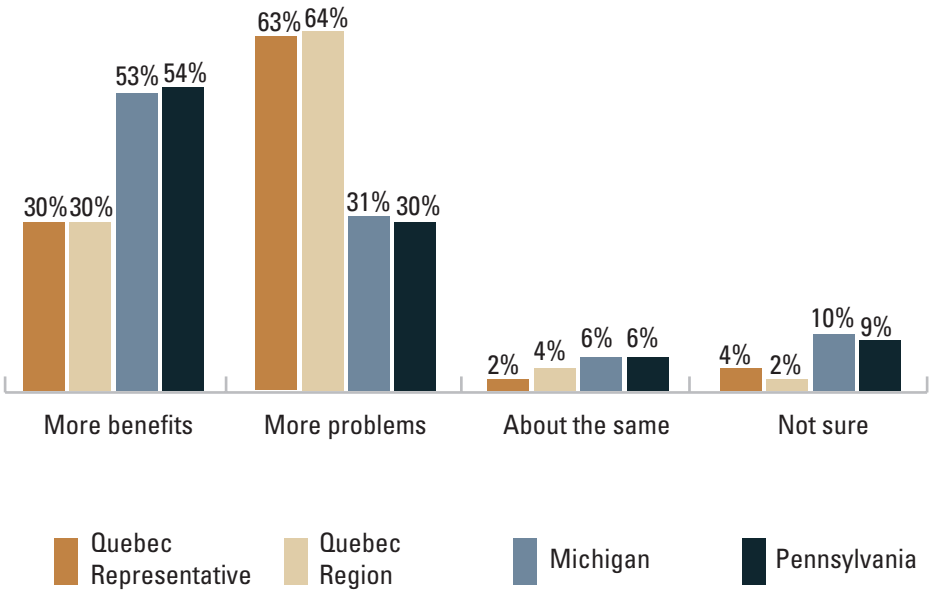
Survey question: Overall, would you say that natural gas drilling is very important, somewhat important, not too important, or not at all important to the economy of Quebec?



Respondents were also asked to comment on the question of risks and benefits by choosing between whether drilling for natural gas will likely cause more benefits or more problems in the future for citizens of their state or province. As *Figure 5* indicates, attitudes in Quebec are remarkably different from what is observed in the two American states. A vast majority of Quebec citizens believe that drilling to extract gas will, in time, cause more problems that come with few advantages. Moreover, as has been consistently the case, attitudes in Quebec are statistically indistinguishable regardless of whether respondents are drawn from a regional or representative sampling frame. Similarly, the two US states are not statistically different from each other, either.

Figure 5
Perception of future impacts from HF in Quebec, Michigan and Pennsylvania

Question wording: In general, do you feel that drilling for natural gas will provide more benefits or more problems in the future for the citizens of Quebec/Michigan/Pennsylvania?



The five measures just presented leave little room for doubt: the controversy over shale gas extraction is much stronger in Quebec than in Michigan and Pennsylvania. This reticence is expressed as a perception that HF as risky, and that drilling for natural gas affords few benefits. Though residents of Pennsylvania sometimes appear slightly more reticent than respondents in Michigan, this difference is not statistically significant and is far from reaching levels observed in Quebec. What accounts for the relatively strong negative reaction to HF among the public in Quebec regarding the extraction of shale gas?

Explaining Public Reticence Toward Fracking in Quebec

The literature in political psychology has shown that, when confronted with a choice between different options, individuals systematically demonstrate a bias toward loss aversion[5]. In other words, individuals tend to be risk averse. An aversion to risk among the public, however, cannot explain why risky decisions are sometimes made. Moreover, a general tendency for individuals to avoid risk fails to explain differences in risk perceptions from one society to another or from one individual to the next. Why do Europeans fear genetically modified organisms more than North Americans do? Why do people fear food irradiation in Canada but not in the United States? Why is Quebec more resistant to shale gas than either Pennsylvania or Michigan? And, what causes one person to fear a new technology whose risks are debated and another to use it regardless of the debate? Researchers interested in these questions have argued that cultural traits may be involved in risk perceptions[6].

According to the cultural theory of risk, individuals possess various cultural traits (or values) that help distinguish one individual from the next. Of course, societies also have cultural traits of their own, but by and large, these ought to reflect the aggregation of traits held by individual members. In other words, following research in the cultural theory of risk tradition, cultural differences can be found even among members of a given public. These traits have been shown to be associated with risk perceptions of various types[7]. In order to assess the cultural theory argument in the area of public perceptions toward HF, the comparative survey included a series of questions designed to identify four cultural traits commonly associated with different risk assessments.

The first is individualism. According to cultural theory, individualists emphasize personal freedom and autonomy over belonging to a group. Individualists see themselves in competition with others, assuming sole responsibility for their fate and leading to the best possible social outcomes. This cultural trait can be seen to attenuate a preoccupation with certain risks. For instance, risk tolerance is often justified on the basis of allowing business and entrepreneurs to pursue private profit. The second trait is egalitarianism, which places a greater value on group belonging and on a concern with the outcome of others. Egalitarians value equality in the distribution of power and wealth. These preoccupations with social justice lead egalitarians to be skeptical of new industries and new technologies, which may threaten social equality by fostering an unequal distribution of benefits and costs. As a result, egalitarians are likely to be less tolerant of risks that may exacerbate inequalities or produce environmental risks borne by society. The third trait is hierarchy, which values order and social hierarchy and is therefore associated with a high degree of deference to experts and other forms of authority. In cases where experts disagree, media coverage may influence perceptions of risk, depending on whether risks are presented as being particularly high or low. Finally, the fatalist trait is associated with a sense of powerlessness in the face of outside forces beyond one's control. This trait may produce perceptions of risk without leading to fervent opposition to its source. With a low sense of self-efficacy, fatalists tend to think they have no control on risks that are imposed.

It should be noted that the four cultural predispositions (or value orientations) are not mutually exclusive. For instance, it is possible that a person may attach a high value to personal freedom and autonomy, and believe that they are primarily responsible for their own fate, while also being somewhat in favor of a more equitable distribution of wealth. To the extent that individuals may adhere more or less to a particular orientation, however, the cultural categories afford the possibility of distinguishing people along these different value dimensions. Individualism was thus measured from a question on the importance of competition among individuals in society; egalitarianism from a question on the importance of the redistribution of wealth; hierarchy from a question on respect held for authority; and fatalism from a question measuring indifference regarding politics and the partisan makeup of government.

Figure 6
Distribution of Cultural Traits in
Quebec, Michigan and Pennsylvania

Question wording: Now I'd like to ask you a few general questions about politics and society. Please tell me whether you strongly agree, somewhat agree, somewhat disagree, or strongly disagree with the following statements: *Individualism:* "Society works best when we compete as individuals." *Egalitarianism:* "Government should redistribute wealth to make society more equal." *Hierarchy:* Society works best when we obey those in authority. *Fatalism*: "No matter which party is in power, it's more of the same."

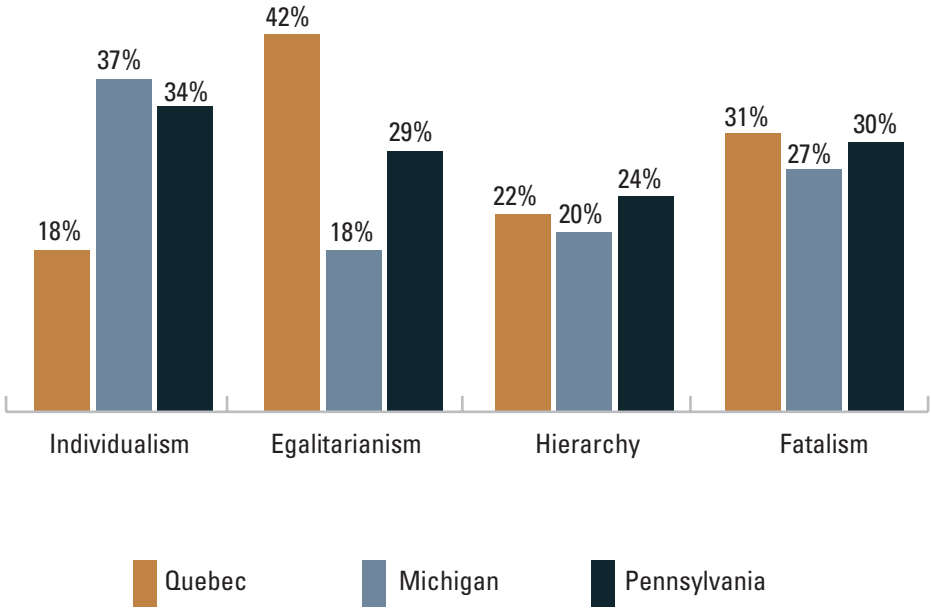
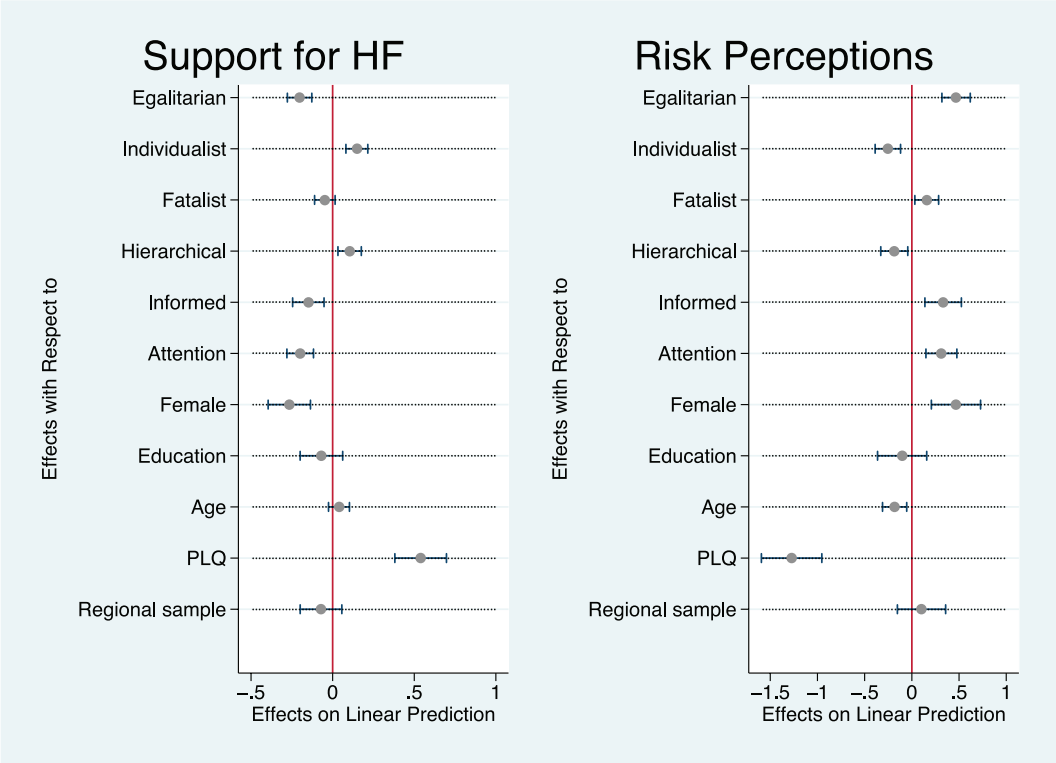


Figure 6 illustrates the distribution of cultural traits across the three jurisdictions. For clarity of presentation, the figure shows the proportion of respondents in strong agreement with the different measures of cultural orientation.[b] The figure clearly shows that, relative to the population of Quebec, a tendency to express a strongly individualist orientation is more prominent among residents of Michigan and Pennsylvania. Conversely, residents living in Quebec are more likely to be strong egalitarians. Variation on the other cultural variables is more limited. From these descriptive statistics, we might expect the higher propensity of residents living in Quebec to express egalitarian values should lead them to be more risk-conscious and thus reticent regarding the use of HF to release natural gas from shale. Conversely, more individualistic attitudes in the two US states should have the opposite effect. Though consistent with expectations, the data presented in *Figure 6* does not allow for a rigorous test to see whether the cultural traits are correlated to risk perceptions and patterns of opposition and support for HF at the individual level.

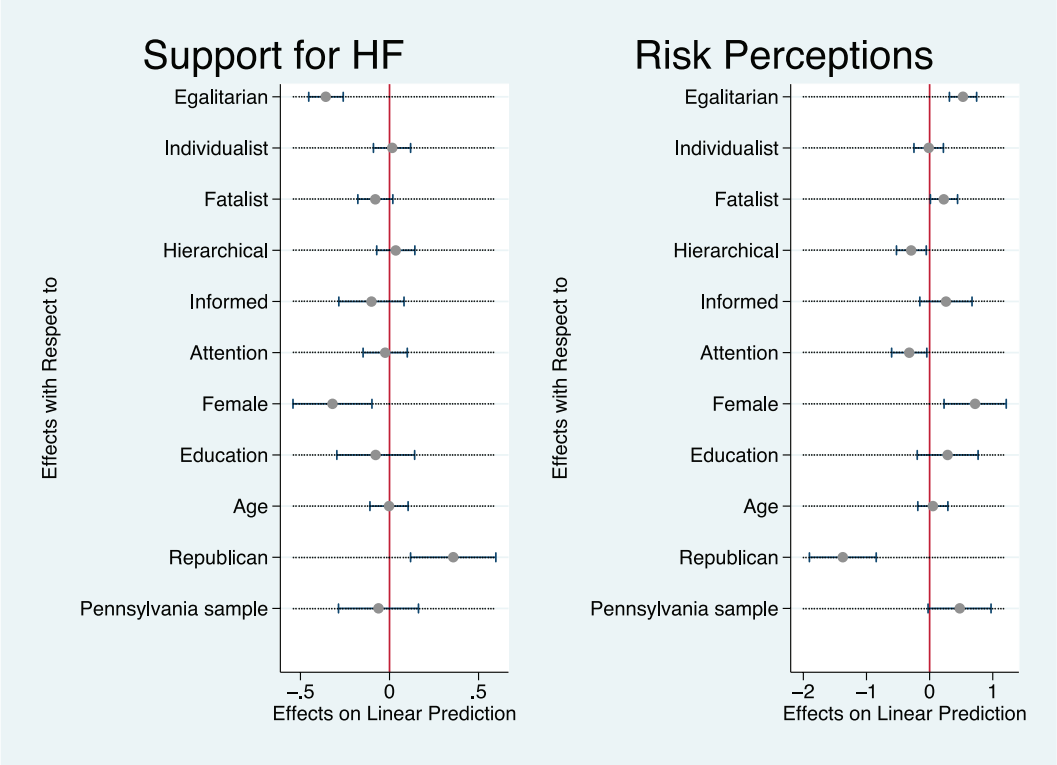
To estimate the relationship between these cultural values and opinions about shale gas, two OLS models are estimated to predict level of support for HF and risk perceptions associated with hydraulic fracturing. Both analyses are based on the same model, which includes seven control variables in addition to the four cultural traits. The models include variables measuring a respondent's level of attention as well as the extent to which they see themselves as informed. Models also include a fixed effect for individuals identifying with the Quebec Liberal Party and the Republican Party of the United States. These are the two parties that most openly favor the extraction of natural gas from shale and it is has been found that partisans follow such elite cues[8]. For Quebec, a dummy variable was created to indicate whether or not an individual lives in a municipality located in Quebec's Utica shale region. In the US models, another dummy variable was created to indicate whether a respondent lives in Pennsylvania (as opposed to Michigan, the reference category). Finally, variables for age, education and gender are included, as is typical in models estimating environmental public opinion[9]. The results of these regressions are presented in *Figures 7* and *8*. Because Michigan and Pennsylvania are drawn from the US, they are grouped together to simplify the presentation of results.

Figure 7
Attitudes toward HF and Risk Perceptions in Quebec



b Unless otherwise noted, all response options are included in the original ordinal measurement during the statistical analyses, so that individuals may demonstrate more or less of a particular cultural predisposition.

Figure 8
Attitudes toward HF and Risk Perceptions in Michigan and Pennsylvania



Figures 7 and *8* plot estimated marginal effects and confidence intervals for each variable in the model with other variables set at their means. Where confidence intervals overlap the zero line, the effects are statistically indistinguishable from zero (i.e. the variable has no effect). Coefficients to the right of the line are positively related to the dependent variable, while those to the left are inversely related. With the exception of egalitarian values, which are significant in all models, results indicate that cultural value orientations are better predictors of attitudes toward shale gas in Quebec (*Figure 7*) relative to the United States (*Figure 8*). For instance, egalitarian values are associated with lower levels of support, and higher perceptions of risk related to HF, in Quebec. In contrast, Quebecers with more individualistic value orientations are more likely to support, and less likely to perceive risks from, HF. A hierarchical predisposition has a similar effect as individualism in Quebec, while fatalism is associated with slightly higher risk perceptions, but has no effect on support. In the US (*Figure 8*), only egalitarian values help predict scores on both support and risk perception variables. Conversely, being female, and vote intention for either the Liberal (Quebec) or Republican (US) party is significant in both models. Of note, residing in Pennsylvania (relative to living in Michigan) has no distinct effect on support or perceptions of HF. Perhaps more surprisingly, respondents drawn from the regional sample in Quebec are no different from other Quebecers in their perception and support for the extraction of natural gas from shale in their province. This result indicates that the aversion toward shale gas in Quebec is driven less by 'not in my backyard' (NIMBY) attitudes than 'not in anyone's backyard' (NIABY). Opposition to shale in Quebec is not just prevalent at the local community level, but appears province-wide.

By themselves, cultural values thus explain at least some of the variation between residents in Quebec and those of Michigan and Pennsylvania as it relates to fracking. More predisposed to egalitarian than individualistic value orientations (*Figure 6*), citizens of Quebec are more likely to perceive the risks associated with the extraction of shale gas as being high, and are less likely to support the use of such methods in their province. The particular role of egalitarian values is consistent with theoretical expectations. Indeed, given their preoccupation with equality, egalitarians fear the potentially negative effects from fracking, likely motivated by a belief that profits are unfairly distributed to the gas industry alone. Consistent with this interpretation, supplementary analyses on the perception of economic benefits reveals that, relative to individualists, egalitarians are much less likely to see any economic benefit from fracking.[c]

c The results of these last analyses are not reported here because they are similar to those presented in Figures 7 and 8.

Comparing models summarized in *Figures 7* and *8*, it also becomes apparent that self-reported levels of attention and information on the issue perform differently as predictors in Quebec, Michigan and Pennsylvania. Specifically, whether one is attentive or informed in the US appears to make no difference, though in Quebec, these variables are significant. In Quebec, the more an individual is informed and/or the more they pay attention to the debate, the more they are likely to believe that the risks of HF are high, and the less likely they are to support the extraction of gas from shale. This result might seem surprising since it goes against the argument that information can reduce bias in risk assessments. Recent research has added considerable nuance to the role of information, with particular emphasis on the interaction effects between the level of information received by an individual and how it is framed by the information source.[10] For example, when the information portrayed in the media strongly emphasizes risk, this may lead to higher risk perceptions among the more informed. Alternatively, it may be that egalitarians who oppose fracking are more motivated to pay attention to the issue and report being "informed." In other words, the significance of being attentive and informed in Quebec may be a function of being egalitarian and engaged.

To get a better handle on why more informed and attentive residents (at least in Quebec) tend to be more squeamish about fracking, further tests were performed. The hypothesis is as follows: if information systematically affects attitudes in a general way, the level of information should make no difference between egalitarians and non-egalitarians. Conversely, if egalitarians are more likely to seek out information that is consistent with their values, then information should play a greater role in shaping perceptions among egalitarians rather than non-egalitarians. In order to test these ideas, an interactive term between egalitarianism and information was computed and included in base models summarized in *Figures 7* and *8*. To simplify interpretation, the variables "egalitarianism" and "information" were re-coded as dichotomous variables to more clearly distinguish egalitarians from non-egalitarians and the informed from the uninformed.[d] Results from the regression models show a significant difference between informed egalitarians relative to informed non-egalitarians, and are presented in *Figures 9* and *10*.[e] As shown in *Figures 9* and *10*, egalitarians that are informed are less supportive, and perceive higher risks, related to the use of HF. Among non-egalitarians, information increases support and has little effect on risk perception. This suggests egalitarians may be more motivated to seek information about risks, leading them to be more informed and more squeamish about fracking.[f] Interestingly, further tests (not shown here in the interest of space) find no similar conditional effect of information on individualists.

Are individuals biased in the information they seek? The survey offers an alternative way of assessing the role of information in shaping attitudes toward HF. For instance, one question asked respondents to identify the most credible source of information on shale gas, from a list containing the federal government, state or provincial governments, municipalities, environmental groups, the gas industry, television, and newspapers, as response options. Again, Quebec stands out: while 1 in 3 Americans express confidence in information from environmental groups, the proportion is 4 in 5 in Quebec. Conversely, residents of Michigan and Pennsylvania are about twice (8%) as likely as respondents in Quebec (4%) to identify the gas industry as the most credible source of information on shale gas. That members of the public imbue information from different sources with more or less credibility is also likely to shape perceptions. For instance, the gas industry has an obvious interest in promoting the development of shale as beneficial and safe, while environmental groups have been among the most vocal opponents of the industry. Depending on who individuals trust as a credible information source, the effect of having read and heard a great deal on the issue may have very different effects.

We test this idea in *Figures 11* and *12*, which illustrate the impact of having heard a lot about fracking, versus having heard a little, for individuals who selected environmental groups as most credible in the list of options, versus those who selected another group as most credible. As is clear, the effect of having heard a lot about the issue is strengthened for those respondents who also assign environmental groups with credibility. Among those who consider environmental groups to be credible as an information source, support (an ordinal measure with 5 gradients), drops by more than half a point among those who are informed. Among those who did not select environmental groups as a credible source of information, whether one has heard a lot or a little about fracking has no effect. This interactive effect is similar for risk perceptions, which increase by nearly 2 points on a scale of 1 to 10 among those who perceive environmental groups as a credible source for information related to fracking. Again, this effect of paying attention is no different among those for whom environmental groups are not seen as most credible. This suggests that its not so much being informed about the issue as what kind of information individuals receive and accept as being credible that matters for shaping risk perceptions and support for fracking in Quebec, Michigan and the US.

d To simplify the presentation of results, all data were pooled, which required the introduction of fixed effects to control for a respondent's origin (Quebec, Pennsylvania or Michigan).

e It should be noted that Figures 9 to 12 are based on regression results. They plot the marginal effects of the interactive terms while holding all other variables in the model (see Figures 8 and 9 for the list) constant.

f These results are similar to those obtained in the context of American research on other scientific issues. See: (Kahan et al. 2012).

Figure 9
Interaction between egalitarianism and level of information on support

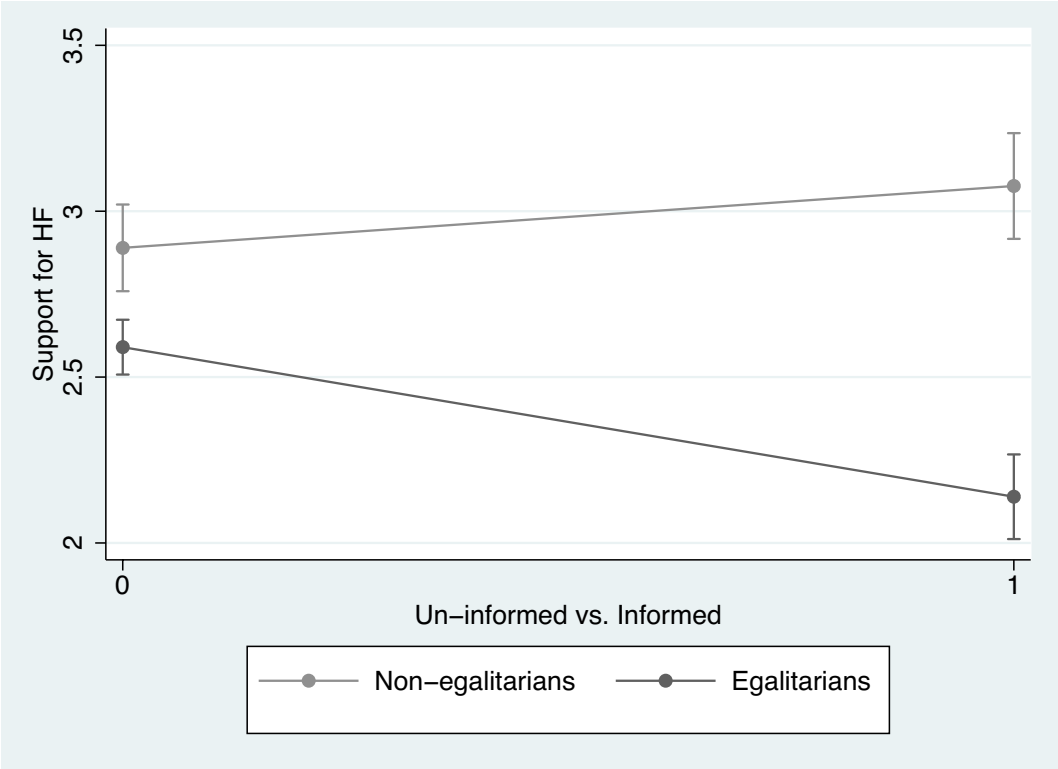


Figure 10
Interaction between egalitarianism and risk perceptions

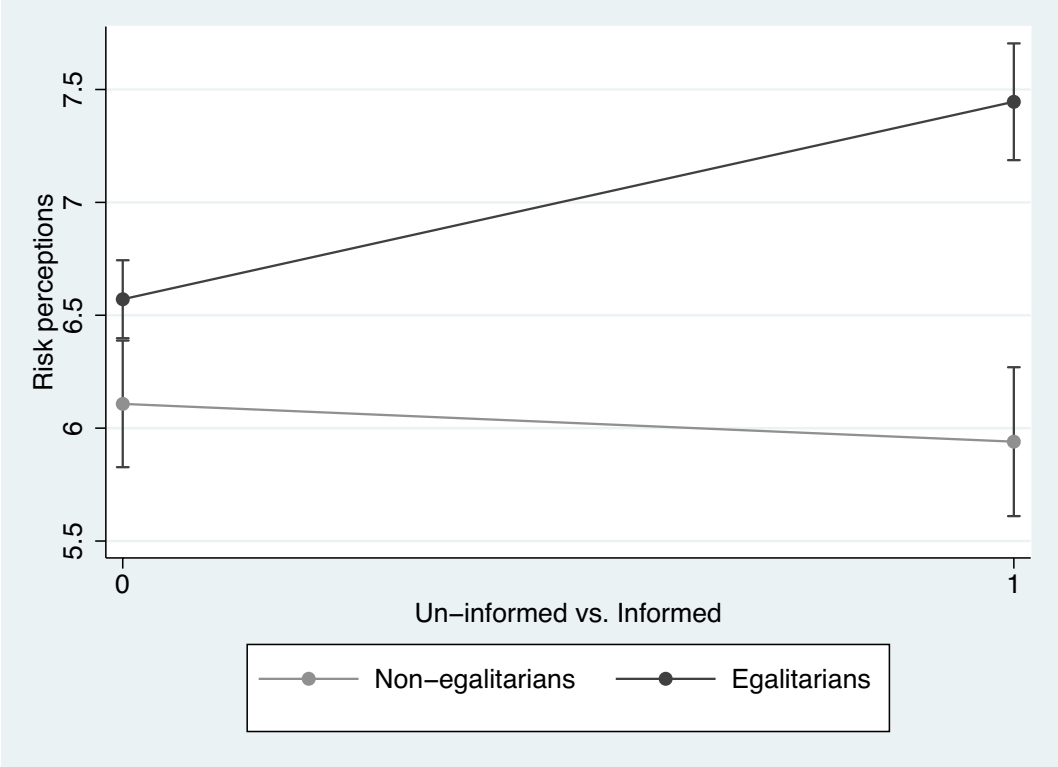


Figure 11
Interaction between level of attention and ENGO credibility on support

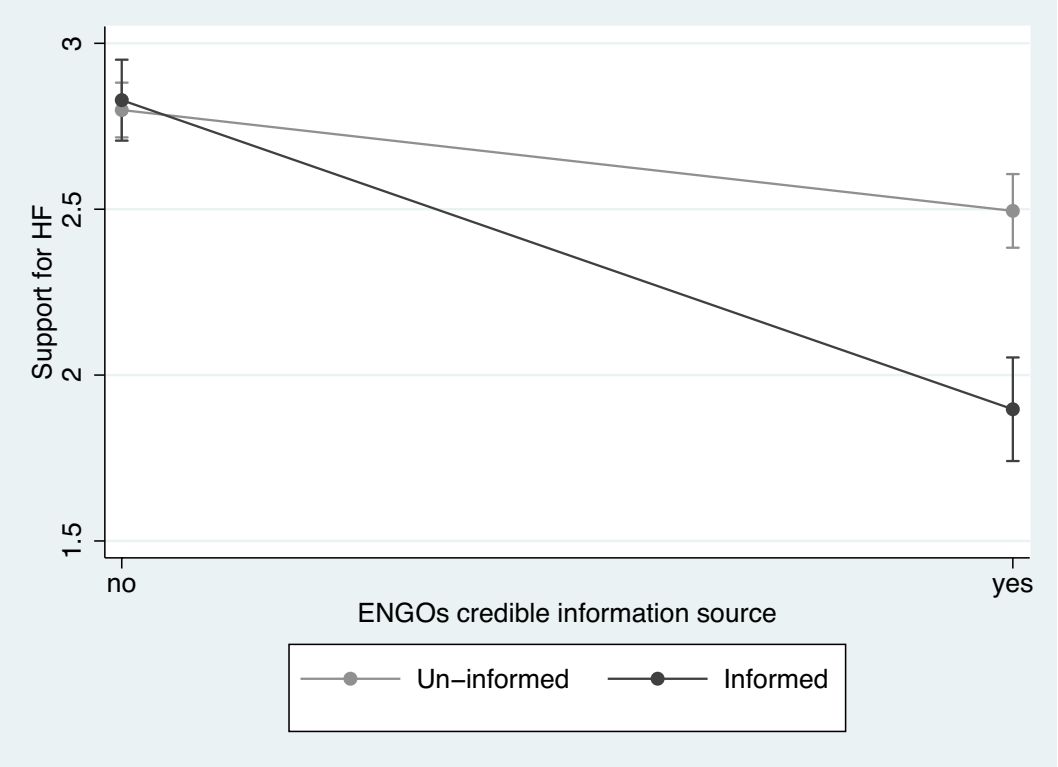
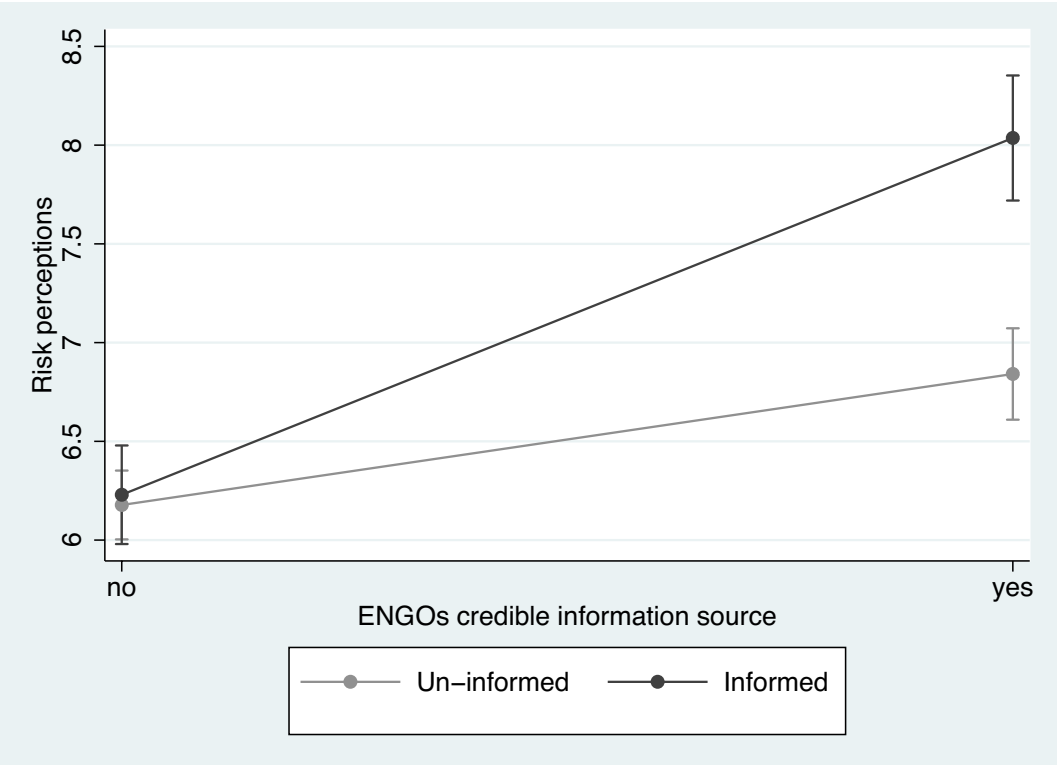


Figure 12
Interaction between level of attention and ENGO credibility on risk perceptions



Overall, these results provide evidence to suggest that the basis of Quebec's relative hostility toward the extraction of natural gas from shale is primarily cultural. Interpreted as such, the dominant cultural value orientation in Quebec, egalitarianism encourages the population to view the issue as one of fundamental inequality, with a sizeable portion of fellow citizens perceived as bearing the brunt of a fundamentally risky endeavor. Moreover, few in the province see shale gas as a good business opportunity that will benefit the provincial economy. Rather, Quebecers seem to say, "why should we pay collectively for the potential cost and risk of extraction, while the profits go into the pockets of big corporations that are largely from outside the province?" Egalitarianism also seems to heighten the predisposition of Quebec residents to favorably receive information emphasizing the risks posed by shale gas extraction. In fact, results from a content analysis of news paper coverage on the topic published in three Quebec newspapers[g] (results not shown here) during the summer of 2011 reveals that, out of 15 articles, 9 strongly insist on the risks, while none offer an optimistic analysis of the benefits of this energy source. Combined with the prevalence of egalitarian values, this dominant framing further contributes to explaining that in Quebec, the more a person is informed, the more he or she is resistant to the use of HF methods in the province. Among Americans, information does not have such an effect.

Quebec's hesitant approach to the further development of its shale industry appears to be anchored in cultural traits that are likely to be stable for some time. This raises the question, how deeply rooted is Quebec's rejection of fracking for gas? The answer may lie in the risks associated with HF methods, which are currently the subject of much scientific debate.[11] Unlike other cases of environmental risks, like climate change, there is no scientific consensus on the risks posed by HF for human health and the environment. Mirroring this state of relative uncertainty, the comparative survey work found that most Quebecers correctly believe that experts are divided on the question of the risk posed by this rapidly developing industry (*Figure 3*). Might new scientific information, approaching some form of scientific consensus regarding the risks associated with fracking help reassure Quebecers about the safety of shale gas extraction, and thus assuage concerns and help increase support?

The possibility of opinion change

The literature on public opinion has consistently demonstrated that faced with various issues, citizens may rely on elite cues to form their opinion. That is to say, individuals may rely on and adjust their opinion based on those held by respected elites. Existing research has relied on the use of survey experiments exposing different subsets of respondents to randomly assigned stimuli during the course of a survey. Using this method, for example, Bullock[12] has shown that Democratic and Republican partisans frequently adjust their opinion on precise public policies after being informed of the position held by legislators of the same political allegiance.

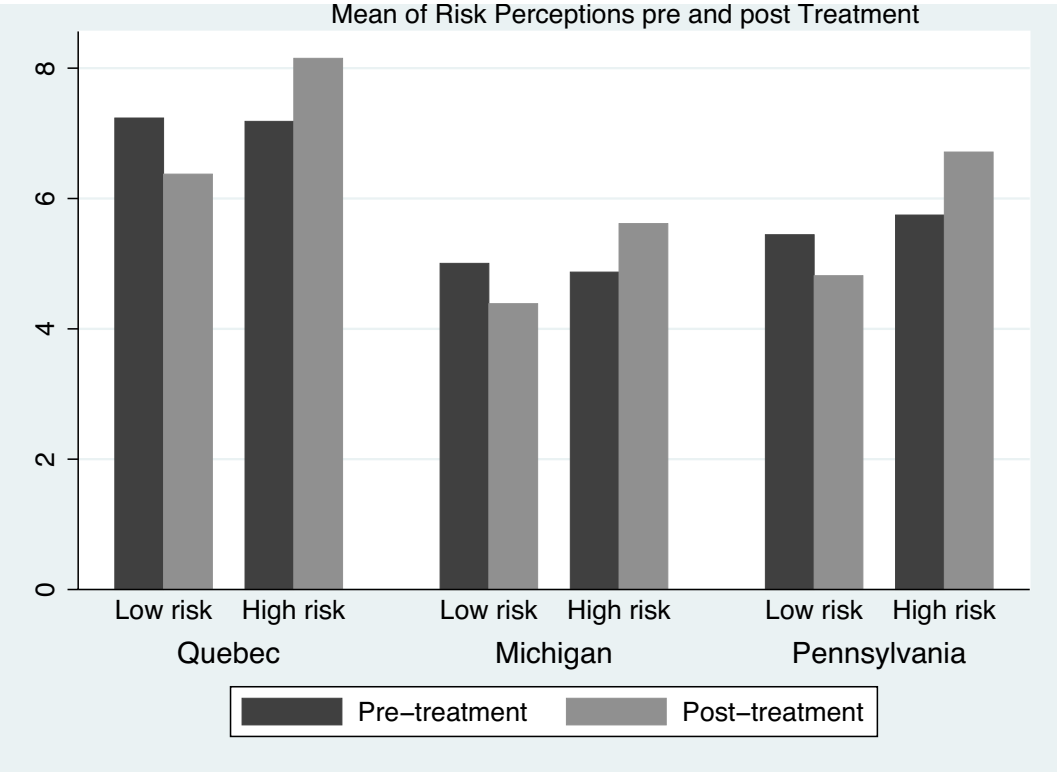
Building on this line of work, a similar type of survey experiment was included. After asking respondents to make their own risk assessment on the potential risks of fracking (*Figure 2*), respondents were randomly assigned to one of two versions of a follow up question. All respondents were first told that experts from their state's (or province's) lead environmental agency published a report. Half of the respondents were told that the report unequivocally showed that the risks of HF are very low. The other half of respondents were randomly assigned to the identical question, but were told the report strongly concluded that risks are very high. Respondents were then asked to reevaluate the risks of HF for human health and the environment on the same 0 to 10 scale. In Quebec, specific reference was made to the *Bureau d'Audience Publiques sur l'Environnement* (BAPE). As a check on whether respondents knew about this agency, questions were asked at the end of the survey. Results indicate that, among the 66% who reported having heard of the BAPE, 93% viewed it as a credible source for information.

Results from the experiment are presented in *Figure 13*. Consistent with previous research, the experiment resulted in a change in risk perceptions. For the high risk treatment group, an increase in average (mean) risk perceptions is observed between pre and post treatment scores in all three jurisdictions. Conversely, for the low risk treatment groups, a decrease in risk perceptions is observed pre and post treatment. This experimental design provides clear evidence that individuals adjust risk perceptions in accordance with expert cues.[h] What's more, the average risk assessment prior to treatment (dark bars) do not vary between the high and low risk treatment groups, further suggesting that the groups are equivalent in their untreated state.

g The three papers examined are: La Presse, Le Devoir and The Gazette.

h Balance tests confirm that the high and low risk treatment groups are equal in expectation (i.e. the groups are roughly equivalent for all other observed characteristics). This substantially increases confidence in the inference that the treatment exerts a causal effect.

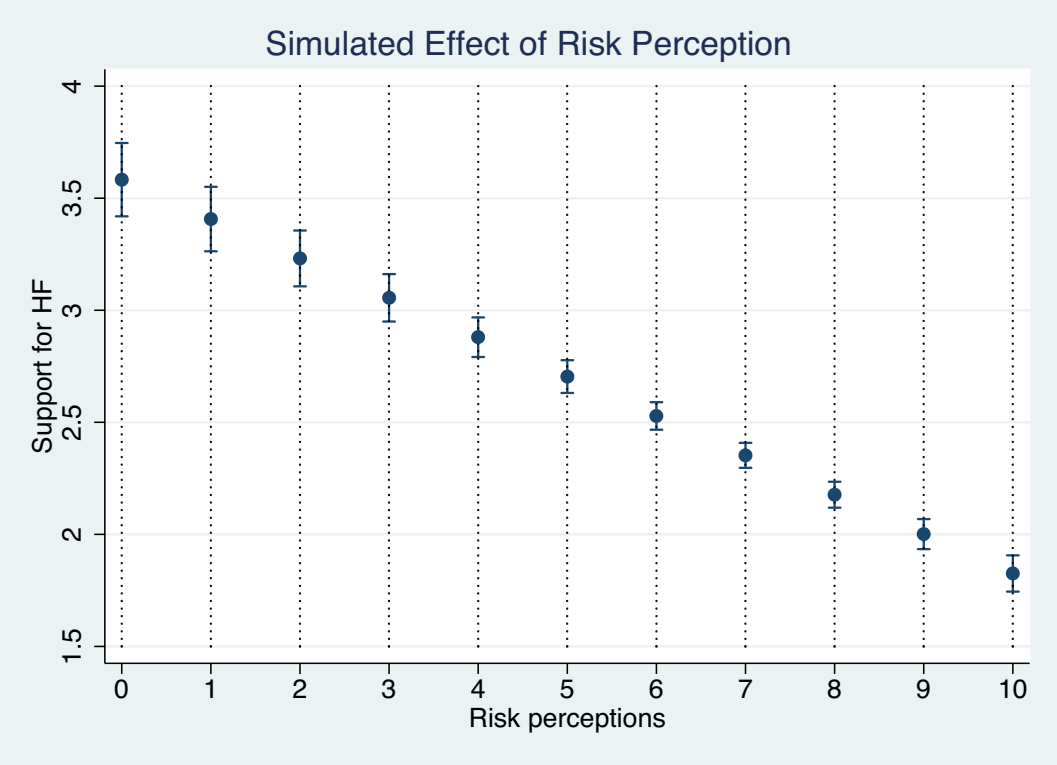
Figure 13
Experimental effect of expert cues on risk perceptions



As shown in *Figure 13*, post treatment risk perceptions are adjusted downward among respondents in the low risk treatment group. The effect is, however, modest. In Quebec, for instance, the adjustment is scarcely a point on the 0 to 10 scale. Given that the average pre-treatment risk assessment for residents in Quebec is already so high (i.e 7.2), a one-unit decrease on the risk perception scale brings average risk perceptions down to about a level of 6 (out of 10) post treatment. In other words, risk perceptions in Quebec respond to expert cues, but, in the event that experts agree risks are low, is this enough to bring attitudes in Quebec in line with more positive attitudes in Michigan and Pennsylvania?

To assess whether a change of this kind might swing support in favor of shale gas extraction in Quebec, a model was estimated regressing support on a host of variables (included in the earlier regressions) but this time including post-treatment risk perceptions as a predictor. As might be expected, risk perception is a strong predictor of support. The more a respondent perceives there are risks, the less he or she is inclined to support the extraction of natural gas from shale. In order to get a better sense of the relationship between risk perceptions and support, the effect of risk perceptions was simulated for each of the 10 levels of risk.

Figure 14
Simulated effect of risk perception on level of support in Quebec



The result of this simulation is presented in *Figure 14*. The dots indicate the predicted score on support given a particular value of risk perception, holding all other variables in the model at their means. So, for instance, the model estimates that, for a person holding a risk perception of 10, the level of support will be very low. Recall that support in Quebec is already very weak (*Figure 1*). The mean value on support was 2.32. A value of 5 indicates very strong and a value of 1 very weak support, with the middle category reserved for those without a strong view. The simulation accordingly allows to observe the estimated effect of reducing risk perceptions from 7.2 (the pre-treatment mean) and 6.2 (the post-treatment mean for the low risk treatment group). As shown in *Figure 14*, a one unit drop in perceived risk would move support up to just over mid-level support (at 2.5). This represents a very small shift in overall support. Given that the population in Quebec currently sees HF as a high risk, a considerable adjustment would be required in order to swing support to levels of support found in Michigan and Pennsylvania. As this experiment shows, even a strong signal from credible experts would barely change the level of resistence toward fracking observed in the province of Quebec.[i]

i It is also necessary to note that the research shows that experiments of this type have tended to overestimate the effects in relation to those observed in real situations. See (Barabas and Jerit 2010).

Conclusion

This study has shown that residents of Quebec are more opposed than residents of either Michigan or Pennsylvania to hydraulic fracturing on their respective territory. This reticence is particularly attributable to egalitarian values, which emphasize the negative effects of HF over potential benefits. More common in the province of Quebec, the egalitarian predisposition highlights potential environmental and social hazards from HF, thus limiting support for shale gas extraction in the province. Out of concern for equity, egalitarians are sensitive to the environmental risks posed by HF, and therefore have a limited appreciation of the potential benefits. They are likely to believe that the risks of exploiting shale gas deposits might unfairly affect their fellow citizens whereas the benefits would be concentrated in the hands of (mostly foreign) businesses. In contrast, individualist values emphasize more of the benefits over risks, and is more common in the United States.

Egalitarianism also predisposes Quebec citizens to pay attention and heed information on risks over benefits. Instead of moderating opposition, information only accentuates the reticence found in Quebec. In particular, informed egalitarians are more likely to oppose the extraction of natural gas from shale, and perceive risks from hydraulic fracturing. Moreover, among the more informed, those assigning credibility to environmental NGOs are more likely to oppose fracking in their province or state. Information providing a signal that risks are low can assuage such concerns regarding risk, however, even strong signals from experts is unlikely to change opinion in Quebec to levels of support observed in Michigan and Pennsylvania.

Overall, the comparative surveys find that Quebec has a particularly strong reticence regarding the extraction of natural gas from shale. Evident across the entire province, this reticence is not simply a manifestation of a "not in my backyard" syndrome. It is rather explained by political-cultural traits that distinguish Quebec respondents from American respondents. More egalitarian and less individualistic than their neighbors to the south, the people of Quebec are more likely to perceive risks from fracking, and more likely to believe that such risks outweigh any benefits. Consistent with a more egalitarian value orientation, this attitude reflects a preoccupation that foreign countries exploit this public resource for profit, while fellow citizens bear a disproportionate share of the costs. Instead of reducing egalitarian opposition to a perceived situation of exacerbated inequality, information only accentuates it. In fact, in the process of becoming informed egalitarians are predisposed to pay greater attention to risks, and to perceive critical sources – like environmental NGOs – as being most credible. Information in the United States, where the proportion of egalitarians is lower, does not have the same effect as in Quebec. While individuals adjust their attitudes to fit new scientific information in all three jurisdictions, opposition to drilling for natural gas in Quebec is unlikely to be reversed, even in a context where experts can demonstrate that risks are low. As a result, attitudes in Quebec are likely to remain opposed to the development of shale gas for the foreseeable future.

This being the case, the analysis here is not deterministic. The list of factors strongly influencing Quebec opinion, in one sense or another, is too long and complex to be considered in one study alone. It is quite possible that a change in the economic situation of the province, the emergence of new technologies, changes in supply and demand for energy and/or political leadership can change Quebec opinion on shale gas. By the same token, such changes might also work to reinforce, rather than reduce, public opposition.

Methodology

The Quebec portion of the survey was undertaken by Léger Marketing, which administered the questionnaire to 1505 Quebecers between October 29 and November 14, 2012. Of the 1505 respondents, 505 were drawn from the densely populated Lower St. Lawrence region, where exploration and commercial drilling projects had been undertaken or considered prior to the survey, and where the province's shale resource is found.[j] The oversample from the affected municipalities was included in order to explore the possibility that Quebec residents who live in proximity to shale gas drilling operations might have a different attitude than others in the province. Respondents in both the general population sample (n=974) and the Utica shale oversample (n=531) were recruited using a representative random digit dialing procedure, yielding a response rate of 26.2 per cent. Calculated at a 95 per cent level of confidence, results are accurate within a margin of error of 4.25 per cent (Utica oversample), 3.1 per cent (general population sample) and 2.5 per cent (when the samples are combined overall).

In the U.S., the Muhlenberg Institute of Public Opinion interviewed respondents from Michigan between October 21st and 25th, and Pennsylvania between October 24th and November 4th, 2012. In total, the American sample is composed of 839 respondents, drawn from the Michigan (n=415) and Pennsylvanian (n=424) populations. In both cases, these samples produce a margin of error of 5 per cent, at a confidence level of 95 per cent. As done in Quebec, adult respondents were recruited using representative random digit telephone dialing methods, garnering an AAPOR RR3 response rate of 14 per cent. Unlike the Quebec sample, however, the U.S. samples were recruited from both landlines and cell phones. All descriptive data summarized in this report (*Figures 1* to *6*) are weighted. Specifically, Canadian data are weighted to gender, age, language and region to reflect the latest population estimates from Statistics Canada. American results are weighted according to gender, race, income, educational attainment and age to reflect the most recent estimates a cording to the 2010 US census. Percentages are rounded upward at the .5 mark, and may thus not always equal 100 per cent.

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j This oversample is made up of residents randomly selected from the following municipalities: Bécancour, Champlain, Farnham, Fortierville, Gaspé, Joly, La Présentation, La Visitation-de-Yamaska, Leclercville, Saint-Antoine-sur-Richelieu, Saint-Augustin-de-Desmaures, Saint-Barnabé-Sud, Saint-David, Saint-Denis-sur-Richelieu, Saint-Édouard-de-Lotbinière, Saint-Flavien, Saint-Francois-du-Lac, Saint-Hyacinthe, Saint-Jean-sur-Richelieu, Saint-Louis, Val-Alain, Villeroy et Wotton.

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