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Receptiveness to advice, cognitive ability, and technology adoption☆

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ABSTRACT

We construct a model of technology adoption with agents differing on two dimensions: their cognitive ability and their receptiveness to advice. While cognitive ability unambiguously speeds adoption, receptiveness to advice may speed adoption for individuals with low cognitive ability, but slow adoption for individuals with high cognitive ability. We conduct economic experiments measuring US farmers' cognitive ability and receptiveness to advice and examine how these characteristics impact their speed of adoption of genetically modified (GM) corn seeds. The empirical analysis shows that early adopters are those who are both quite able cognitively and not receptive to advice.

1. Introduction

The diffusion of new technologies is a key contributor to economic growth, and differences in technology use account for much of cross-country inequality (Comin and Hobijn, 2010; Klenow and Rodríguez- Clare, 1997). Limited access to credible information has been shown to be a major deterrent to technology adoption (Jack, 2013). And yet, recent studies also find that increased advice and information sometimes have small impacts on technology adoption (Karlan et al., 2015; Ryan, 2015).

The potential under-performance of advice and information provision may, in part, arise because individuals are unable to process information effectively and/or they are not receptive to advice. How these two dimensions interact is not well understood. Previous studies focus on how adoption is shaped by the identity of the advice-giver (Banerjee et al., 2013;

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Beaman et al., 2015; Kim et al., 2015; Maertens, 2017) and how best to incentivize advice-givers (BenYishay and Mobarak, 2015).

While there is significant research looking at the ideal identity and incentives of advice-givers, there is much less research on differential receptiveness of advice-receivers. Coffman and Niehaus (2015) find that the literature's focus on the advice-givers (in their setting these are the sellers) may not be well-placed. They find that "buyer fixed effects explain more of the variation in our data than do seller fixed effects, product fixed effects, and order effects combined." Given this result, they argue that "it may be as important to understand what makes a person *persuadable* as to understand what makes them persuasive" and "the evidence for *persuadable* types is stronger than the evidence for *persuasive* types" (emphasis as in the original). Recent papers in the experimental literature have shown that individual-level receptiveness to advice is stable across settings (Ambuehl and Li, 2015; Buser et al., 2016; Coffman and Niehaus, 2015) but technology adoption studies have not explored this character trait.

This article addresses this gap by examining which individuals are most receptive to advice and how receptiveness interacts with cognitive ability to shape the patterns of adoption of a profitable technology. Specifically, we present a Bayesian technology adoption model in which individuals vary on two dimensions: cognitive ability and receptiveness to advice. Individuals with high cognitive ability are good at 'learning from doing,' which in the model means they interpret the signals they get from experimentation with higher precision. Individuals who are highly receptive to advice are good at 'learning from advice,' which in the model means they have a subjective belief that the advice signal they receive is more precise.

Advice influences technology adoption when individuals respond to advice. Thus, when analyzing advice taking, we distinguish between two related concepts: responsiveness, a measure of how much the individual changes his prior when presented with advice; and receptiveness, the focus of this paper, a measure of how precise an individual believes advice to be. Our model shows that responsiveness to advice depends on both cognitive ability and receptiveness, and so our paper focuses on those two traits as more fundamental determinants of technology adoption.

Consistent with previous empirical findings on schooling and cognitive ability (Aldana et al., 2011; Feder et al., 1985; Foster and Rosenzweig, 2010), the model predicts that high cognitive ability individuals will adopt before low cognitive ability individuals. The model also reveals that being receptive to advice can slow adoption for high cognitive ability individuals, because these individuals have greater incentives to wait for additional information from others.

As in Liu's (2013) research on GM cotton diffusion in China, we combine experimental evidence gathered from farmers with survey data on their technology adoption practices to test the model's predictions empirically. We designed a game that allows us to estimate both cognitive ability and receptiveness to advice. This incentivized game is a variant of a typical "advice-taking" experiment found in the industrial and organizational psychology literature. Bonaccio and Dalal (2006) offer a review of this class of games.

First, to measure the farmer's cognitive ability, we have him play multiple rounds of an individual learning game in which he learns about how a signal translates into an outcome. All else equal, individuals who have higher cognitive ability (i.e., those who are better at learning from doing and those who interpret their signals with more precision in the individual learning game) will have more accurate predictions by the end of the first game. Next, to measure responsiveness and receptiveness to advice, we have each participating farmer play multiple rounds of an advice-taking game in which he predicts the outcome, is given the prediction of a more experienced player, and is given the opportunity to change his prediction.

Many studies compare actual behavior with optimal behavior and show that individuals are not as receptive to advice as they ought to be (Stone and Zafar, 2014; Weizsäcker, 2010). Other studies measure receptiveness multiple times or in multiple ways and show that it is a stable character trait which varies across people. Ambuehl and Li (2015), Buser et al. (2016), and Peterson et al. (1965) find that individuals have heterogeneous levels of receptiveness to information that is consistent within individual across games.[1] In Buser et al. (2016) this trait predicts entry into a competitive task. Receptiveness to advice is correlated with personality traits such as agreeableness and dependency (Dalal and Bonaccio, 2010), expressivity (Feng and MacGeorge, 2006), and autonomy (Koestner et al., 1999). Consistent with our results, others find that women are more responsive to advice than men[2] (Dalal and Bonaccio, 2010; Feng and MacGeorge, 2006; Mesoudi et al., 2014), providing further evidence that receptiveness to advice has a substantive 'fixed' component.

We find that individuals with higher cognitive ability are less responsive to advice, as predicted by the theory; but they are more receptive to advice (a relationship about which there is no theoretical prediction). This result stresses the importance of distinguishing between responsiveness (how much the individual's beliefs change in response to advice) and receptiveness to advice (how precise the individual believes the advice to be).

The empirical results support the predictions of the model showing that, conditional on farmers' underlying cognitive ability, being receptive to advice does not necessarily speed adoption of a good technology. While it tends to speed adoption for low cognitive ability individuals, it also slows adoption for high cognitive ability individuals.

[1] Similarly Moore and Healy (2008) find that overprecision (excessive precision in one's beliefs) has high test–retest reliability. Cesarini et al. (2009) find that overconfidence (in this case the difference between actual rank on a cognitive ability test and the individual's estimate of his rank) is correlated within both monozygotic and dizygotic twin pairs suggesting overconfidence is due to both genetic and environmental factors (with more due to genetics).

[2] Relatedly Niederle and Vesterlund (2007) and references therein show women are less overconfident than men.