FOREGONE PAYOFFS

COSTAS LAMBROS*

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Abstract

This paper introduces a model that rationalizes a commonly observed behavior: under-utilization of information. By integrating an evolving switching-cost into the agent's utility function, the model diverges from traditional explanations such as fixed information cost (*FIC)* and rational inattention (*RI*) models. Whereas those models require information to be costly in order to explain inattentive behaviors, the model in this paper predicts inattentive behaviors without any information cost. Instead, the predictions of inattention found in this paper are stemming from an agent's regret of missed opportunity. Therefore, the model presented here is able to reach predictions consistent with behaviors that have been observed in experimental and empirical research, even in situations where the *FIC* and *RI* models would not be able to achieve such predictions.

1 Introduction

It has been well-documented that decision makers do not always collect and use all the information available to them. In fact, people sometimes seem to act downright bizarre when we look at their behavior through the lens of a utility-maximizing economist. Some examples that have been observed and documented are people seeking bias-confirming news, ignoring information entirely after receiving bad news (the ostrich effect), and displaying a bias toward the status-quo[1]. The question then is why, when more information should lead to a better informed decision, would a decision-maker opt to stay less-informed and become inattentive to their surroundings?

This is not a new question, and there are various models that have been developed over the past few decades which offer a rationale as to why a decision-maker may be inattentive. The common theme amongst these models is to impose a cost on the information collection process. This cost can be independent of a decision maker such as the price of a news-subscription, or an internal cost incurred by the agent such as the mental exertion of processing information. Either way, by imposing a cost on information acquisition, these models are able to reach a reasoning as to why agents actively ignore

*Department of Economics, Indiana University. E-mail: cglambro@iu.edu

[1] Beattie and Baron (1988); Karlsson et al. (2009); Samuelson and Zeckhauser (1988)

certain information.

This paper deviates from these models and instead offers a different rationale: people become increasingly stuck in their ways due to an evolving switching-cost. To make this clearer, let's consider an example. Suppose that a Bitcoin investor believes that Bitcoin is the future of currency and has been routinely investing in the cryptocurrency for the past two years. They have been strongly advocating for the currency, have told their friends and family to invest, and are an active member of r/Cryptocurrency (a Reddit community). Now, suppose that this investor starts to learn new information that sows doubt in their belief that Bitcoin is the future of currency. While some people in this investor's shoes may decide that it is time to un-wind their cryptocurrency holdings and exit the market, others may instead decide to ignore the new information, cling to hope that the new information is wrong and remain an active investor and proponent of Bitcoin. While it may first appear that the behavior of the latter type of investor is wrong and goes against conventional wisdom, it is behavior found time and again.[2] Some reasons why the investor might decide to act in this way are fear of embarrassment about being wrong, regret about their past actions and investments, guilt for pushing their friends and family toward the cryptocurrency, or angst about losing the relationships they have fostered in the crypto community. Regardless of the underlying reasons, the result is the same: the investor is not using the information at hand, and may even choose to actively ignore the information in the future.

This paper develops and presents a model that provides a rationale for the behavior displayed by the Bitcoin investor described above. The model, which I will call the switching-cost (*SC*) model from now on, achieves this goal by endowing a decision maker with a cost that is incurred only when they switch their chosen action over time. Returning to the Bitcoin investor example, the switching cost here would be incurred when the investor changes their chosen action from being a proponent of, and investing in, Bitcoin to cashing out and leaving the community. As stated previously, this cost could be coming from embarrassment, pride, guilt or perhaps some other mechanism, but these all manifest themselves into a form of regret about one's past actions. Furthermore, this switching-cost grows over time, and grows proportionally with how many times the decision-maker has previously chosen an action. Once again, return to the Bitcoin example. The model presented in this paper posits that a person who does in fact experience regret were they to stop investing in and/or advocating for Bitcoin, would experience *more* of this regret the longer that they have been investing in Bitcoin.

The model presented here does not contradict other models which aim to rationalize seemingly irrational behaviors that people have toward information. Instead, this model aims to expand on this growing literature by providing an explanation for these behaviors in a wide range of situations where other models may fail to reach predictions of inattention. Other models that explore the inattentive nature of rational agents mostly do so by endowing agents with a cost of information acquisition from the onset of their decision-making process. While this is a reasonable assumption in many setting, the changing landscape of information accessibility lowers the burdens to look for, find, and even process information. As will be shown in the subsequent sections, this model can rationalize inattentive

[2] Samuelson and Zeckhauser (1988);Andersen et al. (2015); Handel (2013)

behaviors without the need to impose a cost on said information. Moreover, the model presented in this paper uses an *evolving* cost to use the collected information, a feature which other models in this literature do not incorporate. To illustrate this contribution, consider another example. Suppose there is a registered Republican deciding who to vote for in the upcoming election. Consider the same *exact* agent, but suppose that in one scenario they are casting their first vote in an election while in the second scenario they are casting their twelfth vote. Current models which impose a cost from the onset would suggest that this agent, regardless of which of the two scenarios they are in, would be incurring the *same* cost to acquire information. In contrast, the model in this paper would suggest that the agent who has voted twelve times previously would be more averse to switching their vote and voting for the Democratic candidate than the agent who has never voted previously. This naturally leads to the conclusion that it would take stronger and more persuasive evidence against the Republican candidate and for the Democratic candidate to induce the seasoned voter to cast a ballot for the Democrat than it would take to induce the novice voter to do the same. The result of incorporating this growing, action-dependent cost into an agent's utility function is that agents can reach a form of action inertia regardless of the information structure that is being considered. This result is formalized in Proposition 1, where it is shown that, under the right parameters, an agent could always become 'stuck' in their action choice over time. This result emphasizes the versatility of the *SC* model and the wide range of scenarios that it could be applied to.

The rest of the paper proceeds as follows: Section 2 reviews the relevant literature and expands on the contributions of this model; Section 3 presents a simple version of the model; Section 4 presents stylized facts which can be explained by the model from Section 3; Section 5 discusses ways to extend the model and the implications of these extensions; Section 6 concludes.

2 Literature Review

There has been much theoretical, empirical and experimental work exploring why and when decision makers under-utilize available information. Below, I discuss several strands of theoretical literature which are similar to the model presented in this paper, and then discuss empirical and experimental results that fall within the scope of the model at hand.

One strand of literature that explores the inattentive behavior of decision-makers are theoretical models that impose a cost to acquire information. These information costs come in two main forms: fixed, external costs or internal, cognitive costs. The exogenous fixed-cost method for information costs is most commonly a monetary or time-based cost[3]. Some examples of what these types of information costs might look like are the price of a news-paper subscription or the time it takes to read an article. The result is that agents become averse to collecting information beyond a certain point, which can lead to inattentive agents and un-informed decision making. The other method for imposing information costs is the one found in rational inattention models, which endow agents with a cognitive

[3] Duffie and Sun (1990)

limitation on their information processing capabilities[4]. In these models, more information is more costly to agents due to the mentally taxing process of digesting the information, which leads to agents acquiring a limited amount of the information available to them. Both of these types of models differ from the model presented in this paper in a few key ways. Most importantly, there is no explicit cost of information acquisition in this model. In fact, we can assume that information is free while still deriving the result that agents can be inattentive. Moreover, the model presented in this paper will explore the *dynamics* of inattentiveness and how the level of an agent's inattentiveness is dependent on the actions they have previously made in addition to what information they have received.

It should be mentioned that, as discussed in Steiner et al. (2017), a dynamic decision problem for a rationally inattentive agent can lead to a predisposition toward the past actions of the agent. This result is similar to what will be shown in the following sections. However, as with any rational inattention model, that result is derived under the assumption that the information is costly to collect and to compute, while the result in this paper is not. Also, the reason that an agent would have a predisposition in their dynamic model stems from a very different cause than the one discussed in this paper. In the dynamic rational inattention framework, predisposition towards past actions (which is essentially "stickiness" in actions over time) comes from an agent using their past actions as a source of information in lieu of acquiring new, costly information. In contrast, the "stickiness" in this paper's model comes from the regret of changing actions and *not* because of any advantages/savings compared to collecting new information.

While the theory discussed above imposes a cost on information, there has been other work that aims to explore inattention without imposing *any* cost on information. One such paper is Andries and Haddad (2020). This paper incorporates disappointment aversion into a recursive utility model for agents, resulting in agents being averse to collecting information by making the "cost" of information come from the risk of disappointment that information brings. While this information aversion model provides an explanation for inattention without levying a cost on information itself, it also differs from the model presented in this paper. First, the information aversion model does not say anything about how inattention depends on an agent's past actions. Instead, that model posits that inattention is dependent solely on the risk of disappointment and therefore is a function of market conditions. Moreover, the information aversion model endows an agent with a level of disappointment aversion which remains constant over the course of the agent's decision making time frame. This feature misses the evolving inattentiveness and growing costs of attention that are captured in this paper.

There is also a large literature about how an agents actions become reinforced when they make repeated, identical choices over time. Some models that contain this reinforcement feature include habit formation models, reference-dependence models, and status-quo bias models[5]. Habit formation is the notion that agents consuming a certain level of a good over time become accustomed to that level of consumption, and their utility becomes partly dependent on retaining that level of consumption. This

[4] Sims (2003)

[5] Ryder Jr and Heal (1973); Constantinides (1990); Tversky and Kahneman (1991); Samuelson and Zeckhauser (1988)

idea is also similar to the reference-dependence model, which makes an agent's utility from consumption dependent on the level of consumption relative to a benchmark. Status-quo bias models fall into a similar category and assume that agents have a predisposition for inaction/no change. This results in a default option (the status-quo) that is over-chosen relative to the other alternatives. A neat feature of habit formation models is the history dependence aspect, which is also captured in this paper. While habit formation arises because past actions are acting as a reference point on which current actions are assessed against, the "habitual" element that will be seen in the *SC* model is not coming from the development and strengthening of a reference point, but rather a growing cost of switching. The same distinction can be made between the model in this paper and reference-dependence models. The distinction between this paper and status-quo bias models is that those models impose a default option which results in over-selection of that option from the onset, but this paper discusses a model where their is no default option at the start but one may develop over time with repeated, identical action choices.

Beyond the theoretical literature described above, there have been many empirical and experimental papers which have documented peoples' inattentive behaviors. The first strand of literature that relates to this paper is the evidence in support of inertia. Alós-Ferrer et al. (2016) present experimental evidence supporting the existence of decision inertia. This is a very similar concept to status-quo bias, and is the notion that agents disproportionately choose an action that they have already chosen. In the paper, the researchers find that participants over-select their previous choice in a repeated-choice setting. There have also been experiments testing the existence of inaction inertia. This form of inertia suggests that people who miss out on or forgo an attractive opportunity are more resistant to choosing the action later if given the chance. Zeelenberg et al. (2006) find that, in a controlled experiment, participants are less likely to sell a stock if they forewent the opportunity to sell at a higher price earlier, compared to participants who weren't given the same opportunity to sell early or participants who experienced a smaller loss compared to the earlier window. Both of these forms of inertia are related to the model in this paper because, as will be shown in the next section, the model predicts that agents can reach a point of inertia which makes them fully inattentive. Similar to the work above regarding inertia, there have also been many tests for the existence of status-quo bias in agents' decision making. For example, controlled experiments in Samuelson and Zeckhauser (1988) find that University faculty members exhibit status-quo bias when choosing their health and retirement plans. This field of experimental evidence suggests that agents have a propensity for "stickiness" in their decision-making, a feature that is captured in our model.

Another related strand of literature is about social-image concerns. As previously mentioned, one of the mechanisms under-pinning the agent's regret in the *SC* model could be social-image concerns. The has been both empirical and experimental work providing support for the idea that people care about their social-image. This work implies that people receive a dis-utility from harming their social-image, and are willing to pay a cost or receive dis-utility in order to avoid this social-image damage. Bursztyn and Jensen (2017) provides a somewhat recent review of work supporting the existence of social image concerns. This literature lends credence to the idea that people receive utility from their social-image and would therefore also receive a dis-utility from negatively altering their social-image.

3 Model

A single *myopic* agent, i, is tasked with repeatedly choosing among a set of J alternatives in each period $t \in \{1, \dots, T\}, T < \infty$. Let this set of J alternatives be constant over time, and we will denote the set as $A_t = A$, where $||A|| = J$. The choice of the agent in period t will be denoted as $a_t \in A$. The goal of the agent is to choose the alternative that matches the true, unobserved state $\theta_t \in A$. This state is a constant, true state realized in $t = 1$ and remains the same such that $\theta_t = \theta_1 = \theta^*$, $\forall t \in \{1, \dots, T\}$. In each period, the agent can choose to receive a costless signal, $x_t \in A$, which reveals truthful information about what θ^* is with probability $\lambda > 1/J$. The agent receives a higher payoff if they choose an action today which matches the underlying true state, but these payoffs are not realized until period T. Therefore, the utility of the agent choosing a_t in period t can be written as:

$$u_{it}(a_t) = \gamma_t \cdot 1\{a_t = \theta^*\} - \sigma_i \sum_{k=1}^{t-1} \delta^{t-k} 1\{a_k \neq a_t\}$$

where γ_t is the return to the agent received if they choose the action which matches the true state ($a_t = \theta^*$), $\delta \in (0, 1)$ is the discount rate between periods and σ_i is agent i's dis-utility scaling parameter. For now, assume $\gamma_t = \gamma \forall t$ and, without loss of generality, we can normalize $\gamma = 1$. This gives us the following re-formulation of agent i's utility in time t:

$$u_{it}(a_t) = 1\{a_t = \theta^*\} - \alpha_i \sum_{k=1}^{t-1} \delta^{t-k} 1\{a_k \neq a_t\} \tag{1}$$

where α_i is the re-scaled version of σ_i necessary following the normalization of γ_t.

The summation term in equation (1) is the switching cost mentioned previously in this paper. This component of the utility function is essentially a penalty assessed on the agent for switching their action in period t. It grows with the number of previous decisions which do not match the current action choice, a_t. Notice that if $\alpha_i = 0$, the above model simply returns to a standard model where a_t will be chosen by selecting the alternative with the highest probability of being the true state in any given period i.e. $a_t = \max_{a_t}\{\mathbb{P}(a_t = \theta^*)\}$. The same is true if $\delta = 0$, meaning the agent does not remember and/or care about the past at all. However, a positive α_i and δ indicates that the agent is receiving a dis-utility from deviating from past actions and this cost of deviating is growing when the agent repeatedly chooses the same alternative. This α_i parameter can be interpreted as capturing the regret of agent i in period t that comes from deviating from their past actions. As mentioned before, the regret incurred from switching could be stemming from the agent's displeasure in having chosen wrong in the past and a hesitancy to admit their past mistake(s). Alternatively, it could be coming from guilt or shame if they have tied some form of their self-worth or social image to their past decisions, which would crumble were they to deviate from this action. Or it could be some combination of these mechanisms, or another plausible mechanism entirely. The exact underlying mechanism causing this regret aspect to enter the agent's utility function is not essential to the model, and could vary across individuals. For example, α_i could represent the regret of being wrong and missing out on higher payoffs in the past for one agent while it represents the reputations concerns of deviating actions for another agent. The flexibility for interpretation of this term allows it to be applied to various situations and types of agents.

4 Applications

The last section presented a simple formulation of the *SC* model. Now, with just this simple model formulation in hand, we will turn to real-world behaviors and evaluate how well the model explains them.

4.1 Status-Quo Bias

Status-quo bias, when applied to a dynamic decision-making problem, is a preference for selecting the same alternative over time. Another name for this phenomenon in the literature is action inertia wherein agents have a tendency to repeat their action choice from period-to-period. The model described in Section 3 predicts, under the right parameters, that an agent will reach a point of action inertia and, as a result, they may become inattentive. At the start of an agent's decision making process ($t = 1$), there is no downside of collecting the available information (since it is assumed to be costless), so they should do so to make the best decision possible. However, if the agent makes repetitive decisions over time then the cost of switching to another alternative grows. Therefore, if they have chosen the same alternative enough times, they can become entirely "stuck" in the sense that information has been rendered essentially useless to the agent. This concept is formalized in the following proposition.

Proposition 1 *If agent i were to select alternative a^* for n consecutive periods starting from period t_0, where n satisfies*

$$f(\delta, n) \geq \frac{1}{\alpha_i}$$

then agent i will continue to choose alternative a^* for all periods $t > t_0 + n$, regardless of what information they receive in these time periods.[6]

The proof of Proposition 1 can be found in Appendix A. Intuitively, Proposition 1 states that an agent becomes fully "stuck" in their action choice if they make the same decision too many times. This happens because the regret that the agent would incur if they switch also grows over time. It is important to point out that the above condition for complete stickiness is a *sufficient* condition, but the

[6] $f(\delta, n) = \delta\left[\frac{1-\delta^n}{(1-\delta)(1+\delta^n)}\right]$

point of stickiness can happen prior to this condition being met. Regardless, we can see that if $\alpha_i = 0$ then this sticking point may never occur no matter what the agent's δ is, whereas if $\alpha_i \to \infty$ then the sticking point will approach an immediate occurrence. This result intuitively makes sense, since the more regret the agent incurs from switching decisions then the more resistant they are of doing so. Figure 1 below illustrates how long it will take to reach different points of complete information irrelevance depending on an agent's time-discounting rate (δ). For example, if $\frac{1}{\alpha_i} = 8$, then it would take an agent with $\delta = 0.9$ 27 identical, consecutive decisions to reach a point of complete "stickiness", an agent with δ of 0.95 would take up to 18 consecutive decisions, an agent with $\delta = 0.99$ up to 17 consecutive decisions and the other two types of agents shown may never reach that point.

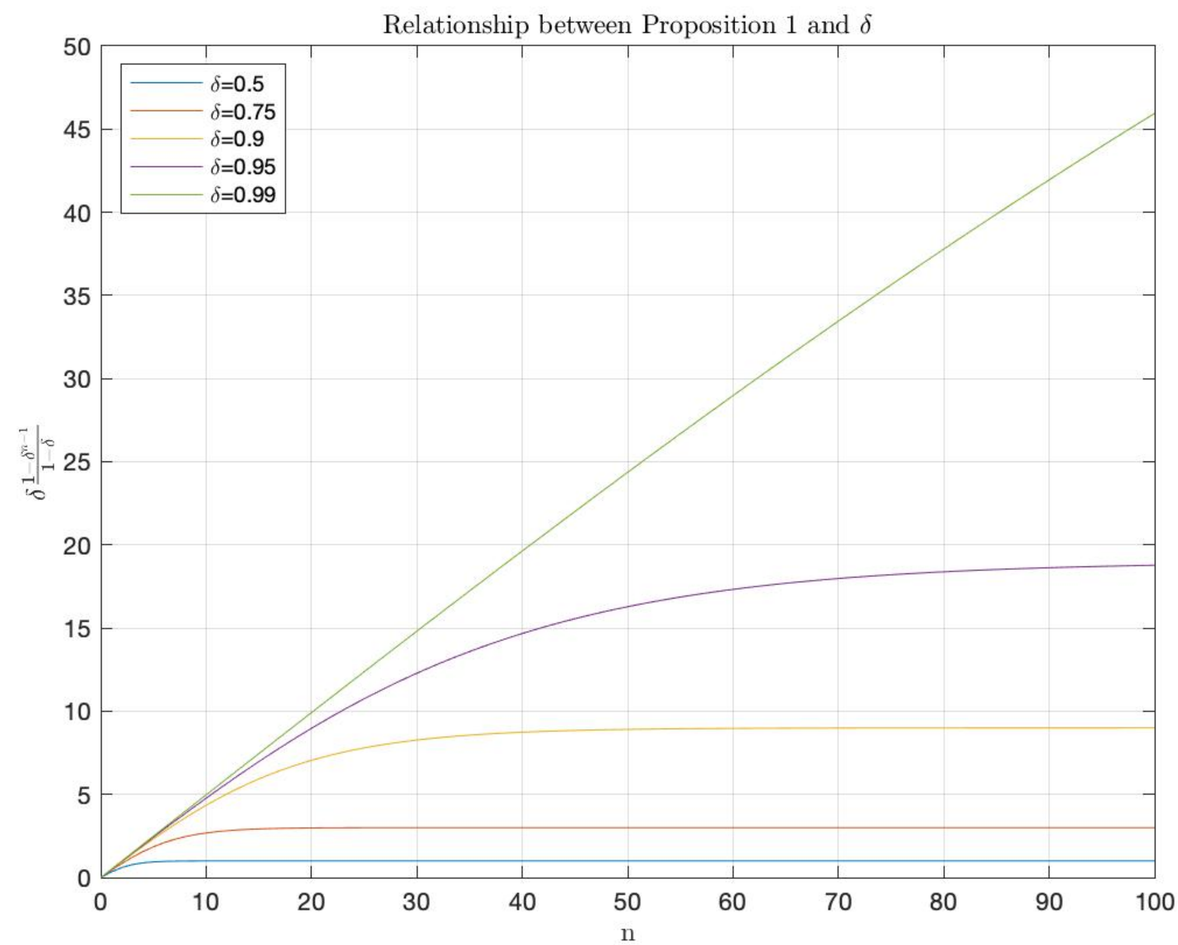

Figure 1

It should be mentioned that the result derived above is not unique to the *SC* model. As shown in Steiner et al. (2017), a status-quo bias can emerge in a dynamic *RI* problem because agent's use information gathered previously to inform their decisions in future periods. However, this bias only emerges in the dynamic *RI* model if all information is costly. Therefore, if some or all information is costless then their results may no longer hold.

4.2 Ostrich Effect and Confirmation-Bias

Next, we will show that the *SC* model can be used to explain both the ostrich effect and confirmation-seeking behaviors. First, the ostrich effect is the idea that, when confronted with negative news, an agent will bury their head into the sand and ignore all information from then on. To see how this phenomenon can be explained through the *SC* model, we will again use the basic formulation of the *SC* model as presented at the beginning of Section 3. We will use this model to analyze how an agent might respond to adverse news.

Let $A = \{0, 1\}$. Suppose that an agent has been receiving costless signals that are informative about the true state-of-nature, θ^*(ie. $\lambda \in (1/2, 1]$). Suppose that agent i has received a flow of costless signals such that they have selected $a_t = 0$ for all periods up until, but not including, $\hat{t} < T$. In this scenario, the utility that the agent receives in $\hat{t}$ from choosing $a_{\hat{t}} = 0$ and $a_{\hat{t}} = 1$ are

$$u_{i,\hat{t}}(a_{\hat{t}} = 0) = 1 \cdot \{\theta^* = 0\}$$
$$u_{i,\hat{t}}(a_{\hat{t}} = 1) = 1 \cdot \{\theta^* = 1\} - \alpha_i \sum_{j=1}^{\hat{t}-1} \delta^{\hat{t}-j}$$

respectively, where δ is the agent's time-discounting rate.

Now, suppose that the agent receives a strong, adverse signal in period $\hat{t}$ which indicates that $\theta^* = 1$ instead of 0 such that the agent updates their beliefs so that $\mathbb{P}(\theta^* = 1) > 1/2$. Should the agent respond by switching their action choice? Or should they instead bury their head in the sand and continue on their current path? To evaluate this question, we can turn to the expected utilities of switching from $a_t = 0$ to $a_t = 1$ in $t = \hat{t}$:

$$\mathbb{E}[u_{i,\hat{t}}(a_{\hat{t}} = 0)] = \mathbb{P}\{\theta^* = 0\}$$
$$\mathbb{E}[u_{i,\hat{t}}(a_{\hat{t}} = 1)] = \mathbb{P}\{\theta^* = 1\} - \alpha_i \sum_{j=1}^{\hat{t}-1} \delta^{\hat{t}-j}$$

Similarly to what was shown in Proposition 1, if $\hat{t}$ and α_i are significantly large then it may be too costly for the agent to alter their decision path at time $\hat{t}$. As a result, the only effect that this new, adverse news has had on the agent is to lower their expected payoffs today without having any benefit of being able to react and use the information. Moreover, the agent will bury their head into the sand because they now expect to receive further bad news if they were to look. To reach this conclusion, one simply must notice that:

$$\begin{aligned}\mathbb{P}[\text{Receiving } x_{\hat{t}+k} = 1|\mathbb{P}(\theta^* = 1)] &= \lambda\mathbb{P}(\theta^* = 1) + (1-\lambda)\mathbb{P}(\theta^* = 0) \\ &= (2\lambda - 1)\cdot\mathbb{P}(\theta^* = 1) + (1-\lambda)\end{aligned}$$

which is $> 1/2$ if $\mathbb{P}(\theta^* = 1) > 1/2$.

Therefore, while Proposition 1 showed that information may become irrelevant after a certain period of time, this example adds a subtlety that may not be as obvious. This exposition shows that an agent may continue to receive information even if it may not be relevant, since it is improving their expected utility today. However, if the agent receives a large, adverse flow of information then this may forever turn them off from receiving more news due to the negative impact that they now anticipate from further information. This result is known as the ostrich effect and there are several experimental and empirical papers that show people behave in this manner in various environments.

A natural implication following from the ostrich effect result discussed above is confirmation-seeking behavior. This is where an agent actively seeks out news that is known to be biased but affirms their beliefs. If we extend the model to include information that can be partially collected/ignored instead of an all-or-nothing signal, then the model would predict that agents seek out biased news sources. The reasoning is very similar to the reasoning used to illustrate the ostrich effect. If an agent has reached a point of action inertia wherein they can no longer use the information received, then the only benefit/cost of this information is its effect on the agents expected utility today. Therefore, if we assume that the agent can select what type of information they look at, they could increase their expected utility today by only looking at news which affirms their current action choice.

5 Extensions

In this section, we will present and discuss extensions to the model presented in Section 3.

5.1 Forward-Looking Agent

The model presented in Section 3 assumed that the agent is myopic. This assumption was made to simplify the model and to focus on the intuition and results of an action-dependent switching-cost. However, we will now consider the model with a forward-looking agent and see how their behavior might differ from a myopic agent. The model assumptions are the same as those in Section 3, except that the agent is now assumed to be forward-looking. To achieve this forward-looking aspect of the agent, we will use the following recursive formulation of the agent's utility function:

$$V(a^{t-1}, x^{t-1}) = \max_{a_t, x_t}\left[\mathbb{E}[u_{it}(a_t)|x_t] + \psi V((a^{t-1}, a_t), (x^{t-1}, x_t))\right]$$

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6 Conclusion

The *SC* model developed in this paper offers a rationale for the behaviors that people have displayed toward information in empirical and experimental research. This model relaxes the costly information assumption that has been typically used in the inattention literature and instead allows the cost of switching actions (and therefore collecting information) to depend on an agent's actions over time. As a result, the *SC* model can accommodate a wider range of information structures and can also be incorporated into existing models. While the *SC* model has the advantage of being flexible with regards to cost-of-information, it has been developed under the assumption that the state-of-nature is constant across time. This is a strict assumption but is applicable to many scenarios. For example, the constant state-of-nature framework that the *SC* model works within can be likened to long-term investments such as real-estate or crypto-currency investments wherein the returns to such an investment are not realized until the investor sells the home or crypto-currency is determined to be a long-term phenomena or a fad. Another situation which the *SC* model applies are decisions where an agent is trying to match their decision to an internal, complex attribute. Returning to the voting example discussed in the introduction, the agent is trying to vote for the candidate and party which best aligns with their internal belief system. However, the characteristics of the parties and their candidates is multi-faceted and is difficult to discern. Therefore, even if the agent can receive a costless signal indicating which party better matches their internal beliefs, mistakes can be made and the regret of switching parties grows over time.

Relaxing the constant state-of-nature assumption used in this paper is possible, but not without a change in interpretation of what the switching-cost represents. The state-of-nature being constant allows the switching-cost term to be interpreted as regret of foregone past payoffs or having built one's social-image or social-circle around a mistaken belief. Allowing the state-of-nature to evolve eliminates the ability to interpret the switching-cost as regret since it is possible to believe action **X** is optimal now while also maintaining that action **Y** was optimal in the past. However, the social-image concerns is still a possible interpretation of the switching-cost when the state-of-nature evolves. For example, if an agent has been selecting action **Y** in the past and they have built their social-image and social-circle around this decision, then switching to decision **Y** may not be optimal even if they believed it is the new, true state-of-nature. While I believe this is an important point to make, this alternative state-structure and the implications that the *SC* model would have in such a scenario is left for future work.

References

Alós-Ferrer, Carlos, Sabine Hügelschäfer, and Jiahui Li, "Inertia and decision making," *Frontiers in psychology*, 2016, *7*, 169809.

Andersen, Steffen, John Y Campbell, Kasper Meisner Nielsen, and Tarun Ramadorai, "Inattention and inertia in household finance: Evidence from the Danish mortgage market," 2015.

Andries, Marianne and Valentin Haddad, "Information aversion," *Journal of Political Economy*, 2020, *128* (5), 1901–1939.

Beattie, Jane and Jonathan Baron, "Confirmation and matching biases in hypothesis testing," *The Quarterly Journal of Experimental Psychology*, 1988, *40* (2), 269–297.

Bursztyn, Leonardo and Robert Jensen, "Social image and economic behavior in the field: Identifying, understanding, and shaping social pressure," *Annual Review of Economics*, 2017, *9*, 131–153.

Constantinides, George M, "Habit formation: A resolution of the equity premium puzzle," *Journal of political Economy*, 1990, *98* (3), 519–543.

Duffie, Darrell and Tong sheng Sun, "Transactions costs and portfolio choice in a discrete-continuous-time setting," *Journal of Economic dynamics and control*, 1990, *14* (1), 35–51.

Handel, Benjamin R, "Adverse selection and inertia in health insurance markets: When nudging hurts," *American Economic Review*, 2013, *103* (7), 2643–2682.

Jr, Harl E Ryder and Geoffrey M Heal, "Optimal growth with intertemporally dependent preferences," *The Review of Economic Studies*, 1973, *40* (1), 1–31.

Karlsson, Niklas, George Loewenstein, and Duane Seppi, "The ostrich effect: Selective attention to information," *Journal of Risk and uncertainty*, 2009, *38*, 95–115.

Samuelson, William and Richard Zeckhauser, "Status quo bias in decision making," *Journal of risk and uncertainty*, 1988, *1*, 7–59.

Sims, Christopher A, "Implications of rational inattention," *Journal of monetary Economics*, 2003, *50* (3), 665–690.

Steiner, Jakub, Colin Stewart, and Filip Matějka, "Rational inattention dynamics: Inertia and delay in decision-making," *Econometrica*, 2017, *85* (2), 521–553.

Tversky, Amos and Daniel Kahneman, "Loss aversion in riskless choice: A reference-dependent model," *The quarterly journal of economics*, 1991, *106* (4), 1039–1061.

Zeelenberg, Marcel, Bernard A Nijstad, Marijke van Putten, and Eric Van Dijk, "Inaction inertia, regret, and valuation: A closer look," *Organizational behavior and human decision processes*, 2006, *101* (1), 89–104.

A Appendix

Proof of Proposition 1

Proof.

In t_0, agent i can choose $a_{t_0} = a^*$ iff:

$$u_{it_0}(a^*) \geq u_{it_0}(a')$$

$$\gamma Pr(\theta_{t_0} = a^*|x^{t_0}) - \alpha_i \sum_{j=1}^{t_0-1} \delta^{t-j} \cdot 1\{a_j \neq a^*\} \geq \gamma Pr(\theta_{t_0} = a'|x^{t_0}) - \alpha_i \sum_{j=1}^{t_0-1} \delta^{t-j} \cdot 1\{a_j \neq a'\}$$

for all $a' \in A \setminus a^*$.

Suppose that the agent has then continued to select a^* for n consecutive periods.

For the proposition to hold, it must then be true that:

$$\gamma Pr(\theta_k = a^*|x^k) - \alpha_i \sum_{j=1}^{k-1} \delta^{k-j} \cdot 1\{a_j \neq a^*\} \geq \gamma Pr(\theta_k = a'|x^k) - \alpha_i \sum_{j=1}^{k-1} \delta^{k-j} \cdot 1\{a_j \neq a'\}$$

for all $a' \in A \setminus a^*$ and $k \geq t_0 + n$.

The above inequality is hardest to be met when $Pr(\theta_k = a^*|x^k) = 0$ and $Pr(\theta_k = a'|x^k) = 1$ for a' which has the lowest switching penalty.

Therefore, the following is sufficient to ensure that Proposition 1 holds:

$$\begin{aligned} -\alpha_i \sum_{j=1}^{k-1} \delta^{k-j} \cdot 1\{a_j \neq a^*\} &\geq \gamma - \alpha_i \sum_{j=1}^{k-1} \delta^{k-j} \cdot 1\{a_j \neq a'\} \\ &= \gamma - \alpha_i \Big[\delta^{k-t_0} \sum_{j=1}^{t_0-1} \delta^{t_0-j} \cdot 1\{a_j \neq a'\} + \sum_{l=t_0}^{k-1} \delta^{k-l}\Big] \end{aligned}$$

Note that the LHS is at least as great as:

$$\delta^{k-t_0}\Big[\gamma Pr(\theta_{t_0} = a'|x^{t_0}) - \alpha_i \sum_{j=1}^{t_0-1} \delta^{t-j} \cdot 1\{a_j \neq a'\} - \gamma Pr(\theta_{t_0} = a^*|x^{t_0})\Big]$$

We can re-write the above inequality as:

$$\begin{aligned} \delta^{k-t_0}\Big[\gamma Pr(\theta_{t_0} = a'|x^{t_0}) - \alpha_i \sum_{j=1}^{t_0-1} \delta^{t_0-j} \cdot 1\{a_j \neq a'\} - \gamma Pr(\theta_{t_0} = a^*|x^{t_0})\Big] &\geq \gamma - \alpha_i \delta^{k-t_0} \sum_{j=1}^{t_0-1} \delta^{t_0-j} \cdot 1\{a_j \neq a'\} \\ &\quad - \alpha_i \sum_{l=t_0}^{k-1} \delta^{k-l} \end{aligned}$$

which simplifies to:

$$\gamma\delta^{k-t_0}\Big[Pr(\theta_{t_0} = a'|x^{t_0}) - Pr(\theta_{t_0} = a^*|x^{t_0})\Big] \geq \gamma - \alpha_i \sum_{l=t_0}^{k-1} \delta^{k-l}$$

Again, this is hardest to meet if $Pr(\theta_{t_0} = a'|x^{t_0}) = 0$ and $Pr(\theta_{t_0} = a^*|x^{t_0}) = 1$, which yields:

$$-\gamma\delta^{k-t_0} \geq \gamma - \alpha_i \sum_{l=t_0}^{k-1} \delta^{k-l}$$

$$\alpha_i \sum_{l=t_0}^{k-1} \delta^{k-l} \geq \gamma(1 + \delta^{k-t_0})$$

$$\alpha_i\delta\Big[\frac{1-\delta^{k-t_0}}{1-\delta}\Big] \geq \gamma(1 + \delta^{k-t_0})$$

Finally, note that the LHS is increasing as k increases while the RHS is decreasing, meaning that it is most difficult to meet the above condition when $k = t_0 + n$. This gives us the sufficient condition from Proposition 1 of:

$$\alpha_i\delta\Big[\frac{1-\delta^{n}}{1-\delta}\Big] \geq \gamma(1 + \delta^{n})$$

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