A Big Data Analysis of Pokémon Battling

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I wanted to thank everyone working for Pokémon Showdown for the opportunity to work with a rich dataset that continues to pose challenges well beyond the realm of Pokémon battling.

Preface

Overall, the this study highlights the gains to model quality when including parameters of team composition rather than battle decisions. Specifically in regards to Pokémon battling, the effectiveness of utilizing entry hazards is considered. Some evidence is provided that supports the statistical significance of using entry hazards, but the variability between entry hazards is highlighted in greater detail.The study lends support to the use of entry hazards as an effective Pokémon battling strategy, while at the same time highlighting the limitations of using the results prescriptively in a Pokémon battle.

Table of Contents

List of Tables

List of Figures

Abstract

The study lends support to the use of entry hazards as an effective Pokémon battling strategy, while at the same time highlighting the limitations of using the results prescriptively in a Pokémon battle.

Dedication

This work is dedicated to all past, current and future members of The Rocking Chair.

Chapter 1

Pokémon, Game Theory, and Behavioral Economics: A Brief Overview

1.1 Introduction

The world of Pokémon began in 1995 with the pair of games Pokémon Red and Green. For Western audiences, the latter game would become known as Pokémon Blue. These two games introduced a unique system of turn-based that continues to define the franchise of Pokémon games. Numerous other games have attempted to copy the Pokémon battling format, but none have been able to equal its widespread appeal and dedicated player base. With each successive iteration, new items, Pokémon types, and of course new species of Pokémon are added to the Pokémon lexicon. As a result the world of Pokémon has continued to grow and evolve into one of the largest video games franchises to date. The most recent iteration of Pokémon games, Pokémon Sun and Moon, have continued Pokémon's commercial and historical trend of turning profits while adding layers to an already complex system of battling.

Since 2011 the program Pokémon Showdown has offered a simplified version of Pokémon games. This simplified version allows players to exclusively battle one another, replicating the most recent iteration of the Pokémon games in the process. This has allowed players to hone and test their Pokémon battling skills through the years. With well-over 20,000 daily registered users and counting, this program has become the go-to program to test and practice Pokémon battling strategies in the ultimate pursuit of becoming the very best that no one ever was.

However, before any formal analysis of Pokémon battling is discussed the battling system must be rigorously detailed for laymen and theorists alike.

First and foremost, each Pokémon battle occurs exclusively between two players. Each of the two players has a team composed of six Pokémon. For the purposes of analysis teams with duplicate Pokémon will not be considered, namely because such teams are not allowed in ranked battles. As such, teams are composed of six distinct Pokémon. Depending on the battle format, the team of six Pokémon is either

randomly assigned or dictated by the player. The two formats being considered in this study, random battles and overused, provide an example of each respectively. As a point of note, only battles in the 'Anything Goes' category allow any Pokémon to be used, including duplicate species within a player's team.

Regardless of the battle format, each turn each player simultaneously make a decision for the Pokémon they have on the field. The decisions are then executed. The order of play is decided by comparison of the selected moves. Priority is given first to priority moves and then, if neither player selected a priority move for the turn, by a comparative assessment of the two Pokémons' speeds.

The potential moves Pokémon are able to execute have a wide variety of effects. This will be detailed later however. Regardless of the damage or effects of the executed moves, once a player's Pokémon loses all of its health, an event referred to as fainting, the player must switch into another Pokémon. If a player has no other Pokémon to switch into, the battle ends. As would be expected, the player whose Pokémon have all fainted loses the battle. Consequently the player who eliminates all of their opponent's Pokémon wins.

Furthermore, each Pokémon has at most four possible moves to chose from during any turn of a battle. Whenever a player has at least two Pokémon that have not fainted, they have additional choice to switch into another Pokémon. Doing so counts as the player's action for the turn. As a result, players almost always have five different choices to make each turn.

There are still a number of other details that are relevant to consider beyond those already mentioned. Namely, while some information is fixed during the battle -such as the opposing players team composition- some variables of interest are case-specific. These include what moves an opposing Pokémon has already used, and consequently revealed, along with a given Pokémon's held item, its ability, and a slew of other variables. However, similar to the different type of moves a Pokémon can chose from, these points will be detailed in the methodology section.

That being said, to formally analyze Pokémon battling the game itself must be formally denoted in game theoretic terms. This will aid in both describing the game and in highlighting its complexity. With this in mind, it bears noting that there are only two outcomes to any battle: One player wins and the other loses. Because of this, Pokémon battling is by definition a zero-sum game. However, it is important to note that there some distinctions between how a player wins or loses a game. Though the game ends when all of the Pokémon on one team have fainted, any player has the choice to forfeit the game any time before this occurs. Thus, the two ways to win or lose a battle are either by forfeiture or by having all of their Pokémon faint; this latter outcome is referred to as a "normal" game. Additionally, there is the potential for a game to result in a draw. However, draws result in a neutral payoff as neither player raises or lowers their ranking after a draw.

Within the scope of game theoretic terms, it is vital to note that each player is able to see all past decisions made over the course of a battle, and that battles typically last a number of turns. Speaking to the former point, players are able to recall not only their past decisions but also those of their opponent, including how much damage was done by a specific move during a previous turn. As this information is available at

any time during the battle, Pokémon battling is a perfect recall game. Furthermore as each game is composed of a sequence of turns, Pokémon battling is also a sequential game.

The points noted on information allude to a unique trait of Pokémon battling that further details the type of game Pokémon battling is: An incomplete information game. Though the extent of incompleteness is format specific, each player is given limited information about the opposing player's team at the beginning of the battle. After each turn, players learn not only the different moves each opposing Pokémon has, but also their abilities, held items, and sometimes what other Pokémon compose the opposing team. Generally speaking, there is almost always new information revealed each turn.

However, the extent to which player strategies are revealed from revealed information is an open topic of discussion, both in this study and in current game theory literature. Naturally, the analysis of such a topic relies upon at least one apriori assumption, namely that player strategies are revealed by their past decisions. However, whether player strategies are rational and consistent is another matter entirely; nonetheless, it is important to note that incorporating such information into players own decision-making complicates analysis and is a central topic in analyzing Pokémon battling.

Taken together, Pokémon battling is a special case of a sequential, zero-sum two-player game with incomplete information and perfect recall. As Pokémon battling lends itself to a discussion of imperfect information, it is all the more vital to consider the role of decision making within the context of sequential games. However, it is vital to note that this study will not do so using expansive game trees or comparison of payoffs. Namely this is done due to computational limitations.

Game theoretics aside, there are also important computational notes to detail. In this regard, initial computations and analysis focus on the distributions of turn length, i.e. the length of games played when one player forfeited or had all of their Pokémon faint and the corresponding distribution of game lengths. After these distributional computations, I categorize moves by their type, specifically whether a specific move is damaging or what is referred to as a "setup" move. After this categorization I gauge the effectiveness of using specific moves on the empirical probability that using such move corresponded to a winning outcome.

Overall I explore the decision-making process involved in Pokémon battling. By incorporating tenants of behavioral economics and game theory, I hope to highlight not only the empirical probabilities of winning associated with specific move sets, but also analyze how and why such events occur. More specifically I will continue the recent trend of 'Big Data' analysis to explore macro trends in player's decision making processes In doing so I hope to answer two main questions: What factors influence the liklihood of winning a Pokémon battle, and are these findings generalizable across specifications? In the context of Pokémon battling, is a player marginally better of by deciding to use one type of entry hazard over another?

1.2 Literature Review

Scant rigorous or academic research has been conducted within the scope of Pokémon-related topics. The most frequent publications have focused either on Pokémon as a cultural phenomena or have been official strategy guides for the various Pokémon games published by Nintendo affiliates. Importantly, these strategy guides do not detail Pokémon battling strategies, although they do detail the numerous Pokémon species, items, and moves available in each game. It comes as no surprise then that the Pokémon strategy guides do not formally detail Pokémon battling strategies or use of game theoretic terminology. That isn't to say that there aren't publications focusing on Pokémon battling strategies.

Academic papers that focus Pokémon battling have developed and analyzed algorithms to simulate Pokémon battling and engage in Pokémon battling against human players in the program Pokémon Showdown. The first paper of this kind gives a rudimentary background on Pokémon battling and focuses explicitly on 1v1 battle simulations (Gildardo 2013). However, in a detailed analysis of one particular one-on-one scenario the author is singularly-minded, insomuch as literally focusing only on one-on-one Pokémon battles. Furthermore, Gildardo (2013) does not consider other potential variants on Pokémon abilities or item pairings. In this regard, Gildardo's article does not go into great detail on the many variants of Pokémon battling, as highlighted by the exclusion of teams of Pokémon.

This point notwithstanding, since Gildardo (2013) there has been one other notable publication that focuses on Pokémon battling. This publication focuses on the creation and analysis of algorithms within the context of Pokémon battling; the article additionally goes into greater detail on battling strategies while incorporating comparative analysis of the different algorithms used to play against human opponents (Ho et al. 2016). Though Ho et al. 2016 focused on what is currently a previous iteration of Pokémon Showdown, the iteration of Pokémon Showdown is fundamentally the same as that of the data used in this study. Nonetheless, the paper did have its own shortcomings as well. Namely, the algorithms used would never select a move whose type would be not very effective against the opponents fielded Pokémon. This point will be detailed later, but needless to say such a decision is not always the preferred one.

Furthermore, on the subject of different versions of Pokémon Showdown, relevant documentation of the past iterations of Pokémon Showdown are available at the program's website. The website for Pokémon Showdown provides a hub for information ranging from Pokémon battling basics to specific battle format descriptions. Similar to all information mentioned thus far, replays and ladder ranking are available publically. Furthermore the site provides Pokémon usage statistics and a damage calculator for aspiring Pokémon battlers.

As noted previously, game theory vernacular has not entered into discussions on Pokémon battling strategies, at least in any formal setting. Applying such concepts to the context of Pokémon battling offers a formal foundation to discuss strategies and test hypotheses. In this regard, there are three main areas of game theory that intersect in the analysis of Pokémon battling. These three areas of interest include

the interpretation of Pokémon battling as a zero sum game, the role of incomplete information, and the implications of Pokémon battling as a non-cooperative game. These three topics actively influence the decision-making process associated with Pokémon battling.

A central factor involved in the decision making process as it relates to game theory is the role of information, specifically how players incorporate information revealed each turn into their strategies. As information is revealed each turn, including the four moves an opposing Pokémon has, its ability, held item, along with what other Pokémon are on the opposing team, it is vital for players to determine if the information they just received is relevant. Furthermore, players need to decide if the information provides any insight into their opponent's strategy. Overall, this speaks to Pokémon not being a perfect information game. As such, it is not possible to apply Zermelo's theorem, though its negation provides insight as to the possible existence of a winning strategy (Schwalbe et al. 2001).

An especially interesting addition to the analysis of incomplete information in Pokémon battling is the topic and implications of asymmetrical information. In this regard, the concepts of sunk costs and signaling may enter into the equation. Especially for the Random battle format, each player is given minimal information at the onset of the game. And while each turn, players both gain information, they may receive new information at different rates. The implications of this point may provide insight into specific strategies, and is a point of future analysis.

This being said, concepts from game theory are not the only relevant ideas for analyzing Pokémon battling. In the context of exploring the frequency of players switching Pokémon will necessarily invoke concepts from from behavioral economics as well as game theory. Relevant to the field of behavioral economics, the concept of "keeping doors open" applies as well as post-op payoff analysis. The concept of "keeping doors" open is explored in Chapter 6 of Ariely's work Predictably Irrational, giving a semblence of what the expected results may be. In the context of Pokémon battling, players may decide to preemptively switch Pokémon in the hopes of having that Pokémon later in the battle. Via application of Ariely's empirical results players may prefer to keep options -availability of certain Pokémon- open, even if doing so incurs costs and/or reduces their chances of winning. Whether this adversely influences the players' outcomes is another point of inquiry.

Chapter 2

Methodology

The data used is a compilation of battle logs taken from the Pokémon Showdown servers. Each battle log is stored as a .json file. The data spans the entirety of December 25th, 2015. No battle logs are incomplete, i.e. none of the daily data entries are empty, though some are excluded for reasons covered later. Overall, there were no dramatic overhauls done to Pokémon battling formats or the overall system for the data used in this study. However, some adjustments have been made since the time covered in this study and will be highlighted in the analysis portion of the study.

Furthermore only ranked games are included in the dataset. Ranked battles are battles that count towards a players global ranking in Pokémon Showdown. For each battle, players stand to gain or lose ranking points depending on whether they win or lose the battle. A number of links redirect users to the host site of this game: Smogon University. This website offers a wide variety of resources, similar to those found at the Pokémon Showdown website. Most importantly the Smogon forums are a prominent site for discussion of Pokémon battling strategies.

2.1 Pokémon Battling Basics

The Pokémon battle starts with Pokémon being sent out. For the purposes of the data used, one Pokémon is sent out for each opponent, totalling two Pokémon being out at any given time. Following this, each Pokémon has 4 moves to choose from, along with the option to switch to a different Pokémon (when applicable). After both players make a decision, the moves are weighted for priority and speed to determine the order of play. If both players decide not to switch one Pokémon will attack the other, after which the next Pokémon will do the same if it has not fainted. After each move has been executed the turn ends and the process is repeated. When one of the Pokémon faints, the player whose Pokémon fainted will be prompted to select another Pokémon from the bench. The first player to lose all of their Pokémon loses the battle.

However, before the nitty gritty details are explained it is important to make a concession. The entirety of the Pokémon battling system- even that used in the data -is not included in this analysis. The number of cases that deviate from the rules detailed below are either not included in the competitive format, or are generally

inconsequential to the scenarios and strategies considered in this study.

2.1.1 Battle Formats

The data used for this study includes only one battling format. The two most frequently used formats are known as Over Used and Random Battles, abbreviated as OU and Randbats respectively. Both formats have teams of six Pokémon and only allow one Pokémon to be out at any given time. While both battle formats are subsets of what are known as single battles, only OU will be highlighted in greater detail.

The OU format includes team composition. By including team composition, players are able to decide what Pokémon to include on their team, the moves of each Pokémon, and other factors such as held items and abilities. However, there are still some restrictions placed on players. Specific species of Pokémon are barred from use, notably Pokémon classified as "Ubers" that include a large portion of legendary and mega-Pokémon. Additionally certain "hidden" abilities are restricted, limiting the possible Pokémon abilities a specific species may use for a given format.

2.1.2 Pokémon Types

Typeage is a unique characteristic to Pokémon battling. Currently there are 18 distinct types. These include normal, fire, water, electric, grass, ice, fighting, poison, ground, flying, psychic, bug, rock, ghost, dragon, dark, steel, and fairy. Both moves and Pokémon are given a type attribute, though moves are only one type. And While a move may only be one of the 18 types, a Pokémon can be at most two different types at once.

However, some of these combinations are not found in Pokémon. From the initially possible 171 Pokémon type combinations, 18 choose 2 plus 18 monotypes, there are actually only 133 types that a players may encounter or chose from (as 38 type combinations had not yet been used during 2015). It is also worth noting that some Pokémon are able to change type during a battle, but for the purposes of analysis these Pokémon will be considered after-the-fact.

The typeage of each Pokémon influence not only the potential weaknesses of each Pokémon, but also the amount of damage that type-specific moves are able to do. Each Pokémon has at least one and at most two types. If a Pokémon uses a damaging move whose type corresponds to type of the Pokémon that used it, that Pokémon gets a same type attack bonus, abbreviated as a "stab" bonus. This causes the move to do 50% more damage, potentially 100% if the Pokémon also has the ability Adaptability.

2.1.3 Pokémon Attributes

Generally, there are a number of factors that are specific to each Pokémon. Some of these factors are considered static, meaning that they do not and cannot change over the course of the battle. These types of factors are defined as "Fixed" attributes. However some factors -such as the stats of a Pokémon- that are fixed at the beginning of the battle *can* change over the course of a battle. There are also a number of

factors that are able to generally change over the course of a battle. Such factors, by constrast, are defined as "Variable" attributes. The terminology is largely taken from Ho et al. for ease of translation and applicability. The attributes are detailed in the order given.

2.1.4 Pokémon Fixed Attributes

Fixed attributes include the typeage of a Pokémon, the four moves each specie Pokémon has, the item the Pokémon holds, the Pokémon's ability, the level of the Pokémon, and the Pokémon's baseline stats. However, there are exceptions to the rules for each of these attributes except for the level of the Pokémon. Every fixed attribute and its respective exception(s) will be considered in order.

First and foremost is the typeage of a Pokémon, detailed previously. However, one possible method for a Pokémon to change its type is specific to a Pokémon's ability. Both Protean and Color Change are abilities that are able to change a friendly Pokémon's typeage. The former ability changes the Pokémon Kecleon's type to that of the move that affected it, whereas the latter ability turns its type into the typeage of the move that just was just used by the Pokémon Greninja. These two abilities are specific to Kecleon and Greninja specifically. Furthermore, there are moves that able to make the opponents Pokémon into a water, grass, or ghost Pokémon -on top of their previous typeage- if they use the moves soak, forest's curse, and treat-or-treat respectively.

Each Pokémon's set moves are also fixed during a battle. The exception to this occurs when a Pokémon runs out of power points -denoted as PP- for all of its four moves, at which point it is only able to use the move struggle. Every move has a set limit to the number of times it can be used, though the number of times a move can be used varies across the set of moves. The struggle is real.

Pokémon are able to hold one item at the beginning of the match. Pokémon may also lose their held item either by being hit by the move Knock-off, which knocks the opponent's Pokémon's item off, or by using their held item. Held items are able to be consumed for a one-time effect. This scenario often includes the consumption of berries, which offer a variety of different effects to the Pokémon holding it. For example, if a Pokémon is given a status condition -a condition detailed in the following section- from an opposing Pokémon while holding a Lum berry, the berry will be consumed and the Pokémon's status condition will be cured. This example highlights an important characteristic of some held-items: Some items may only be used once and are discarded after their initial use.

One of the most important items that a Pokémon can hold is an item that allows the Pokémon to Mega-Evolve, increasing its stats, changing its ability, and even changing the typeage of the Pokémon. This special case of item holding is a focus of this study. Additionally, only one Mega-Pokémon is allowed on a team at once, making variables that account for the different Mega-Pokémon independent by nature.

Similar to items, a Pokémon can only have one ability at a time. However, by contrast to a Pokémon's held item a Pokémon always has an ability. Nonetheless, Pokémon may have their ability swapped with another Pokémon's. This scenario only

occurs a Pokémon makes physical contact with Yamask or Cofagrigus, at which point its ability is swapped with Mummy. Mummy will only change a physically-attacking Pokémon's ability; it has no other effect.

The level of a Pokémon varies between one and one-hundred. The higher the level, the better the baseline stats for a given Pokémon, specifically in comparison to lower levels of that given Pokémon. Baseline stats are divided into six categories. These categories include (baseline) health, attack, special attack, defense, special defense, and speed. There is further nuance with the inclusion of Pokémon natures and Individual Values, or IVs. These factors influence the base stats of each Pokémon. However due to the sheer number of trivial combinations of IV spreads and nature choices, these two factors will not be a pivotal aspect to the framework and analysis of Pokémon battling. Nonetheless, the votatility of these baseline stats will be considered as a variable attribute.

2.1.5 Pokémon Variable Attributes

Variable Attributes include boosts or reductions to a Pokémon's baseline stats, the status condition of the Pokémon, the volatile status of the Pokémon, the current health of the Pokémon, and whether the Pokémon is currently active.

The former-most attribute directly influences how effective an active Pokémon is able to be in battle. Pokémon are able to learn and use moves that can boost their own status or ones that reduce their opponents. However, these moves are only able to influence a Pokémon's attack, special attack, defense, special defense, or speed. For example, the move Swords Dance raises its users attack status so long as the Pokémon remains active. The move may be used multiple times, but is only effective until it boosts or lowers its target's baseline stat by 3 or 1/3 respectively.

Status conditions are composed of a variety of statuses. Pokémon that suffer a status condition are either burned, frozen, paralyzed, poisoned, badly poisoned, or have fallen asleep. A Pokémon can only suffer from one status condition at a time, although a Pokémon can suffer from multiple status conditions if it overcomes the first condition. Each of these statuses is distinct, though there are similarities between being poisoned or badly poisoned. A Pokémon that is just poisoned will take damage equal to 1/8th of its maximum HP at the end of each turn. By comparison a Pokémon that is badly poisoned takes n/16th of its maximum HP at the end of the nth turn the Pokémon has been badly poisoned. A Pokémon that is poison-type or steel-type is unable to be poisoned in any form, and if a Pokémon has the ability Poison Heal it is healed 1/8th of its maximum HP at the end of each turn.

Is a Pokémon is burned it takes 1/8th of its maximum HP in damage at the end of the turn. This has recently been changed to 1/16th of its maximum HP per turn, but this is just a passing point of note. Regardless of the amount of damage done to the burned Pokémon, the burned Pokémon's physical attacks do half damage. The exception to this rule is if the affected Pokémon has the ability Guts. A fire-type Pokémon cannot be burned.

In a similar vein to being burned, a paralyzed Pokémon has its speed reduced to 1/4th of its baseline speed. Furthermore, a Pokémon that is paralyzed has a 1/4

chance of not being able to move during its move. This event is referred to as being "fully paralyzed". Furthermore, electric-type Pokémon are unable to be paralyzed, and if a Pokémon has the ability Lightning Rod it's special attack is boosted by 1.5 its base level. Additionally, ground-type Pokémon cannot be paralyzed, just as they are not affected by electric-type moves.

A Pokémon that has fallen asleep is unable to use its moves except for the moves Snore and Sleep Talk. A Pokémon falls asleep for one to five turns. However, if a Pokémon purposely puts itself to sleep using the move rest, it is asleep for exactly two turns. If a Pokémon has either of the abilities Vital Spirit or Insomnia it cannot be put to sleep.

Lastly, there is the status condition of being frozen. Similar to previous typed statuses, ice type Pokémon are immune to becoming frozen, as are Pokémon with the ability Magma Armor. There is no set number of turns that a Pokémon can be frozen, but if a frozen Pokémon is hit by fire-type moves or the move scald is thaws out and is no longer frozen.

Volative statuses are similar to status conditions, except that the volatile status will be negated by switching out the affected Pokémon, if applicable. Similar to status conditions, a Pokémon can only be affected by one volatile status at a time. Another important point to consider is that a Pokémon can suffer from both a volatile status *and* a status condition. That being said, the most common form of volatile status is confusion. A Pokémon is confused for one to four turns, during which time the confused Pokémon has a 50% chance to hurt itself instead of executing its move for the turn. A Pokémon may also be encored, meaning that it has to use the same move it just moved for 3 turns. Additionally a Pokémon may flinch if hit before executing its move for the turn.

Only currently active Pokémon are able to execute moves. Likewise, only active Pokémon may be damaged. Beyond this there is not anything else to detail in regards to the current health and activity of a Pokémon that is exclusive to variable attributes.

2.1.6 Environmental Variables

There are one class category to detail that is relevant to the analysis of Pokémon battling This category is the role of the environment in battling and is a central focus of the analysis of Pokémon battling. Though related to the different types of moves and abilities a Pokémon has, including both fixed and variable attributes, the environment is not specific to any one move, ability, or specie of Pokémon and as such must be highlighted separately from the previous attributions.

The most prominent environmental variables to consider are what are referred to as "set-up" moves. These moves include Stealth Rock, Spikes, Toxic Spikes, Sticky Web, Light Screen, and Reflect. The latter two are different from the rest of the set-up moves in that they only last five turns, eight is the user was holding Light Clay when the move was used. When these moves are employed, the active Pokémon's special defense and defense are raised by one stage -or is increased by 1.5- respectively between Light Screen and Reflect.

The former four set-up moves are a focal point of analysis and are in a category of

moves known as entry hazard moves. These moves are of particular note because they can last for the entirety of a given battle. Once these moves are used, only certain moves or switches are able to eliminate them. Generally, using the move rapid spin or defog will eliminate the entry hazards, along with causing other effects. However, if a Pokémon uses defog both their and their opponents entry hazards will be eliminated, whereas rapid spin only eliminates entry hazards affecting the users team.

Both Stealth Rock and Sticky Web can only be active once during a battle -unless previous uses of either are eliminated by methods previously noted. However, each have dramatically different effects. Specific to the latter, Pokémon that enter the field after Sticky Web is employed have their speed lowered by one stage -or 2/3rd their baseline level. This only applied to grounded Pokémon however, or non-flying type Pokémon. By contrast, Stealth Rock will damage any Pokémon that enters the field after it is used. The amount of damage done to the Pokémon depends on the type effectiveness of rock-type moves, as Stealth Rock is a rock-type move. In ascending order, Stealth Rock will do 3.125%, 6.25%, 12.5%, 25%, and 50% of the affected Pokémon's maximum health for type effectivenesses of 0.25x, 0.5x, 1x, 2x, and 4x respectively.

Similar to Sticky Web, spikes only affect non-flying type Pokémon. However, spikes will inflict damage to Pokémon that switch in instead of afflicting them with a volatile or status condition. The amount of damage is dependent upon the number of layers of spikes active on the field. Spikes may be applied a maximum of three times. One layer of spikes will damage the opposing Pokémon by 1/8th of its maximum HP, while two layers will deal 1/6th, and three layers will do 1/4th of the opposing Pokémon's maximum health.

Lastly is toxic spikes that, just like spikes and sticky web, only affect grounded Pokémon. However, toxic spikes are able to be applied two times. The first layer of toxic spikes will poison opposing Pokémon that switch in, while two layers of toxic spikes will badly poison Pokémon that switch in (that is if the Pokémon that switches in is able to be poisoned). Just like most other entry hazards, toxic spikes only affects grounded Pokémon.

2.2 Model Specification

As Pokémon battles have only two outcomes, we may estimate the probability of winning using a standard probit model. Let Y denote the outcome of any battle for a given player. Y takes the value of 0 if the player loses the battle and 1 if the player wins. To address the question of whether any entry hazards positively impact a player's liklihood of winning, we develop a number of different binomial probit models. Beginning with whether a specific move was used by a player in a battle, let the ith move be denoted M_i. For models with entry hazards only, we have $i = 1, ..4$. But over all models tested $i = 1, ..., 9$ to include moves that are able to supplement or supplant entry hazards. Similarly, we denote the jth Pokémon as P_j, where $j = 1, ..., 415$. Furthermore, there are 39 different Mega-Pokémon that are usable in the OU format, so we denote the usage of the kth Mega-Pokémon as Mp_k. In

later model specifications, specific moves will be interacted with Pokémon selections. As an example, the specification of the model for the move stealth rock would include the full roster of moves and Pokémon, or $\sum_{i=1}^{9} M_i + \sum_{j=1}^{415} P_j$ along with an interaction of each Pokémon that can potentially learn that move with the count of stealth rocks for that battle. The lth Pokémon that can learn Stealth Rock is denoted stP_l. Similar notation is used for other move-specific Pokémon subsets.

Letting ϵ denote the error term, we begin with the simplified model. This model only includes whether a specific move was used. We have:

$$(1) : Y = \alpha + \sum_{i=1}^{9} M_i + \epsilon$$

However, the repeated use of a move can lead to additional benefits. It is possible that the repeated use of a move has a lower marginal impact on a player's win liklihood. To test this hypothesis, we expand the initial model to include squared terms for each move. Thus we have:

$$(2) : Y = \alpha + \sum_{i=1}^{9} M_i + \sum_{i=1}^{9} M_i^2 + \epsilon$$

These models have not yet included the vast variety of species composing teams. However, before examining the interactions between a team's composition of Pokémon and specific moves, there needs to be a formal model of just the marginal impact of a single Pokémon on a team. Respective to the indexing outlined previously, we have:

$$(3) : Y = \alpha + \sum_{j=1}^{415} P_j + \epsilon$$

Thirty eight different Pokémon can turn into Mega-Pokémon however. To test whether a Pokémon negatively or positively impacts the marginal probability of winning, the next model specification includes Mega-Pokémon within the roster of competitive Pokémon.

$$(4) : Y = \alpha + \sum_{j=1}^{415} P_j + \sum_{k=1}^{39} Mp_k + \epsilon$$

The next specification is the combination of models (1) and (4). Then, the last specification includes the interaction of having a specific Pokémon with the use of the move stealth rock. Respectively, the models are given by:

$$(5) : Y = \alpha + \sum_{i=1}^{9} M_i + \sum_{j=1}^{415} P_j + \sum_{k=1}^{39} Mp_k + \epsilon$$

$$(6) : Y = \alpha + \sum_{i=1}^{9} M_i + \sum_{j=1}^{415} P_j + \sum_{l=1}^{93} (M_1) * (stP_l) + \sum_{k=1}^{39} Mp_k + \epsilon (6)$$

After these six model specifications, the combination of all six models will be given to cross-check results and check for potential robustness for move and Pokémon combinations. The inclusion of interactions may be particularly key in identifying outlying results.

Chapter 3

Data

Due to the vast number of parameters included in the numerous models outlined previously, summary statistics and an output of five of the six models is contained in the Appendix section. Comments on each are provided with some brief context of their interpretation.

Going in the order of the Appendices, the summary of the variables used in the analysis are a good starting point. The average game length is sixteen turns. However, the average is biased from games that lasted zero turns. As these games did not provide any meaningful information, they are excluded from all regressions used. Furthermore, in regards to ranking, most observations are within the range of 1000 to 1280 elo, as the mean rank is 1154 with a standard deviation of nearly 130 elo points. Given that the highest rank observed in the data is 1815, there is a noticeable divide between the highest ranking games and those within the range of standard deviations to the mean rank.

Nonetheless, the real meat of the summary statistics is with the large range of different Pokémon species and Mega-Pokémon that players used. In this regard, nearly half of the most frequently used Pokémon, that of Alakazam, Banette, and Garchomp, have a Mega-evolution. Though specifically in regards to the Mega-evolution usage statistics, the four most frequently used Mega-Pokémon are Mega-Venusaur, Mega-Scizor, and both Mega-evolutions of Charizard, though Alakazam, Banette, and Garchomp are not the most infrequently used Mega-evolutions.

It is important to bear in mind that Mega-Pokémon are not always utilized however, given by the fact that the cumulative sum of the mean of all Mega-Pokémon variables does not add up to one. Given this discrepancy, it would be fruitful to test whether utilizing a Mega-Pokémon marginally impacts whether a player wins a battle. Within this group of three Garchomp is the outlier, as both Mega-Alakazam and Mega-Banette were banned from the OU format following the year of the data used. Besides this standout feature of the summary statistics, the remaining frequently used Pokémon are considered staples of the OU format: Clefable, Talonflame, and Heatran. Of the total six most frequently used Pokémon, half have the ability to use the move Stealth Rock. This is important to bear in mind when considering the preliminary models.

Move-Specific Models

	Dependent variable:	
	Outcome	
	(1)	(2)
stealthrockcount	0.264*** (0.007)	0.264*** (0.007)
st2		
spikescount	0.069*** (0.015)	0.069*** (0.015)
sp2		
toxspikecount	-0.161*** (0.030)	-0.161*** (0.030)
toxsp2		
stickywebcount	-0.002 (0.027)	-0.002 (0.027)
stw2		
defogcount	-0.034** (0.016)	-0.034** (0.016)
fog2		
rapidspincount	-0.055*** (0.017)	-0.055*** (0.017)
rapid2		
dragontailcount	-0.080*** (0.019)	-0.080*** (0.019)
dt2		-0.016 (0.025)
roarcount		
roar2		
whirlwindcount	-0.016 (0.025)	
whirl2		
Constant	-0.085*** (0.004)	-0.085*** (0.004)
Observations	141,154	141,154
Log Likelihood	-97,132.680	-97,132.680
Akaike Inf. Crit.	194,283.400	194,283.400
Note:	*p<0.1; **p<0.05; ***p<0.01	

Included above is the results of the first two model specifications. Sadly, the two models are alike in their log liklihood values and in their Akaike information criterion (AIC) values. Simply put, adding squared terms for the nine specified moves did not add anything meaningful to the initial model. This may be just a byproduct of the data however, as the only move variable with values greater than one was for the move Dragon Tail. Nonetheless, it is important to note that nearly all of the entry hazard moves are statistically significant. Though, this being said, only Stealth Rock and Spikes contribute positively to the marginal likliehood of winning a battle. This contributes to some semblence of generalizability though, as both Stealth Rock and Spikes are the only entry hazards that directly damage opposing Pokémon when they enter the battlefield.

The statistical significance of the entry hazards is also verified in further model specifications. While the use of Toxic Spikes becomes less statistically significant with the inclusion of both single Pokémon choice and Mega-Pokémon choice, the sign of the variable remains negative. Furthermore, while later specifications continue to report Spikes as a statistically significant move choice, the magnitude of using the move appears to diminish when including other factors such as Pokémon choice.

Overall, the use of Pokémon roster and Mega-Pokémon roster appear to be more meaningful variables than the use of simple move counts, as is evidence from comparison of log liklihood and AIC values. This improvement in model quality is also found in comparison to all previous models with the final model (6). While residual deviance is not reported for each model, the AIC lends credence to the comparative view of

model (6) as the model of best fit for those specified. Though, this being said, the final model is particularly difficult to digest due to the number of parameters specified.

The final model is adds meaningful insight to the simple move counting variables. Interacting the move count variable for Stealth Rock and all Pokémon that can potentially learn (and use) Stealth Rock, the model indicates that there is a nonuniform effect on win outcome depending on which Pokémon used it. This view may be appear counterintuitive, but it does offer a useful illustration to the complexity of Pokémon. Take for example two hypothetical instances where Stealth Rock is used by two different Pokémon on the same enemy Pokémon. While each may successfully execute the move on that turn, the opposing Pokémon gets to execute a move as well. If, in this instance, the move is the same, then damage is calculated according to the type matchup of the opposing move with the Pokémon; this may knock out one Pokémon while leave another with enough health to execute one more move.

Chapter 4

Conclusion

Overall, the models improved in quality when more parameters were added. Additionally, including the interaction between using a specified move, Stealth Rock, and the inclusion of a specific Pokémon provided a more meaningful estimation of a player's liklihood to win a Pokémon battle. Overall, only one of the four entry hazards was not statistically significant across any model specifications. There is some evidence to support variability between different entry hazards, and the use of the moves Stealth Rock and Spikes contributed a positive marginal effect on a player's game outcome.

Nonetheless, there are a number of other points to bear in mind. For starters, interactions were only considered between a move and a Pokémon, not one move and another move. This means that only the marginal effect of using Stealth Rock or Spikes was considered, not the joint use of Stealth Rock and Spikes. Furthermore, while ranking was briefly touched upon, no comparisons were made between different groups on the basis of rank. It would be meaningful to see if the usefulness of entry hazards was extended to groups that are considered high ranking, though this would significantly reduce the number of observations drawn upon.

In regards to the missed opportunities associated with different interactions, there is one other elephant in the room: the Pokémon variables. While the models indicate whether one Pokémon has more wins or loses associated with its use, this is only a marginal effect being captured. Just as moves may interact or compound with the use of another move, so too can Pokémon. While including all combinations of six Pokémon would exhaust the degrees of freedom for the sample used, reducing the model to all combinations found in the sample would lend the data for more prescriptive use.

Additionally, only one Pokémon battling format is considered during the study. Just as it would be intriging to see differences across rank, differences across battle format would lend greater external validity to the results found.

Appendix A

Appendix A: Summary Statistics

Summary Statistics

Statistic	N	Mean	St. Dev.	Min	Max
battleid	141,154	35,289.000	20,373.900	1	70,577
outcome	141,154	0.500	0.500	0	1
player	141,154	1.500	0.500	1	2
rank	141,154	1,153.971	128.737	1,000.000	1,810.277
bl	141,154	16.529	11.980	0	171
switches	133,920	6.696	4.457	1	99
M1	141,154	0.339	0.473	0	1
M2	141,154	0.069	0.254	0	1
M3	141,154	0.017	0.128	0	1
M4	141,154	0.016	0.126	0	1
M5	141,154	0.044	0.205	0	1
M6	141,154	0.040	0.196	0	1
M7	141,154	0.034	0.180	0	1
M8	141,154	0.000	0.000	0	0
M9	141,154	0.019	0.137	0	1
P1	141,154	0.008	0.087	0	1
P2	141,154	0.012	0.107	0	1
P3	141,154	0.003	0.051	0	1
P4	141,154	0.013	0.114	0	1
P5	141,154	0.014	0.118	0	1
P6	141,154	0.067	0.249	0	1
P7	141,154	0.006	0.076	0	1
P8	141,154	0.034	0.182	0	1
P9	141,154	0.009	0.092	0	1
P10	141,154	0.016	0.125	0	1
P11	141,154	0.010	0.099	0	1
P12	141,154	0.001	0.032	0	1
P13	141,154	0.025	0.155	0	1
P14	141,154	0.003	0.054	0	1
P15	141,154	0.001	0.033	0	1
P16	141,154	0.002	0.046	0	1
P17	141,154	0.001	0.026	0	1
P18	141,154	0.002	0.046	0	1
P19	141,154	0.002	0.049	0	1
P20	141,154	0.002	0.046	0	1
P21	141,154	0.003	0.053	0	1
P22	141,154	0.011	0.103	0	1
P23	141,154	0.105	0.307	0	1
P24	141,154	0.006	0.076	0	1
P25	141,154	0.002	0.046	0	1
P26	141,154	0.0001	0.010	0	1
P27	141,154	0.001	0.036	0	1
P28	141,154	0.001	0.028	0	1
P29	141,154	0.0004	0.019	0	1
P30	141,154	0.015	0.121	0	1
P31	141,154	0.001	0.029	0	1
P32	141,154	0.0004	0.020	0	1

P33	141,154	0.0005	0.022	0	1
P34	141,154	0.082	0.274	0	1
P35	141,154	0.022	0.148	0	1
P36	141,154	0.018	0.135	0	1
P37	141,154	0.002	0.039	0	1
P38	141,154	0.002	0.045	0	1
P39	141,154	0.074	0.262	0	1
P40	141,154	0.005	0.069	0	1
P41	141,154	0.002	0.040	0	1
P42	141,154	0.002	0.046	0	1
P43	141,154	0.003	0.052	0	1
P44	141,154	0.001	0.027	0	1
P45	141,154	0.0002	0.013	0	1
P46	141,154	0.002	0.044	0	1
P47	141,154	0.0005	0.022	0	1
P48	141,154	0.031	0.174	0	1
P49	141,154	0.020	0.140	0	1
P50	141,154	0.059	0.236	0	1
P51	141,154	0.139	0.346	0	1
P52	141,154	0.002	0.048	0	1
P53	141,154	0.0005	0.022	0	1
P54	141,154	0.010	0.101	0	1
P55	141,154	0.0001	0.012	0	1
P56	141,154	0.005	0.067	0	1
P57	141,154	0.002	0.044	0	1
P58	141,154	0.002	0.041	0	1
P59	141,154	0.102	0.303	0	1
P60	141,154	0.0004	0.019	0	1
P61	141,154	0.020	0.140	0	1
P62	141,154	0.005	0.067	0	1
P63	141,154	0.007	0.084	0	1
P64	141,154	0.001	0.032	0	1
P65	141,154	0.068	0.252	0	1
P66	141,154	0.0004	0.020	0	1
P67	141,154	0.005	0.072	0	1
P68	141,154	0.013	0.113	0	1
P69	141,154	0.008	0.091	0	1
P70	141,154	0.017	0.128	0	1
P71	141,154	0.001	0.036	0	1
P72	141,154	0.001	0.035	0	1
P73	141,154	0.018	0.133	0	1
P74	141,154	0.003	0.052	0	1
P75	141,154	0.0003	0.018	0	1
P76	141,154	0.001	0.037	0	1
P77	141,154	0.006	0.077	0	1
P78	141,154	0.0003	0.017	0	1
P79	141,154	0.042	0.200	0	1
P80	141,154	0.012	0.110	0	1
P81	141,154	0.008	0.089	0	1
P82	141,154	0.001	0.025	0	1
P83	141,154	0.015	0.120	0	1
P84	141,154	0.008	0.090	0	1

P85	141,154	0.007	0.084	0	1
P86	141,154	0.0002	0.014	0	1
P87	141,154	0.088	0.283	0	1
P88	141,154	0.007	0.085	0	1
P89	141,154	0.002	0.045	0	1
P90	141,154	0.002	0.039	0	1
P91	141,154	0.008	0.092	0	1
P92	141,154	0.001	0.025	0	1
P93	141,154	0.00002	0.005	0	1
P94	141,154	0.003	0.053	0	1
P95	141,154	0.005	0.072	0	1
P96	141,154	0.003	0.058	0	1
P97	141,154	0.0001	0.011	0	1
P98	141,154	0.006	0.080	0	1
P99	141,154	0.012	0.111	0	1
P100	141,154	0.001	0.026	0	1
P101	141,154	0.004	0.061	0	1
P102	141,154	0.002	0.049	0	1
P103	141,154	0.013	0.115	0	1
P104	141,154	0.012	0.107	0	1
P105	141,154	0.003	0.056	0	1
P106	141,154	0.026	0.159	0	1
P107	141,154	0.101	0.302	0	1
P108	141,154	0.002	0.046	0	1
P109	141,154	0.003	0.053	0	1
P110	141,154	0.0002	0.016	0	1
P111	141,154	0.0003	0.016	0	1
P112	141,154	0.015	0.121	0	1
P113	141,154	0.0004	0.021	0	1
P114	141,154	0.134	0.340	0	1
P115	141,154	0.003	0.056	0	1
P116	141,154	0.0001	0.011	0	1
P117	141,154	0.002	0.044	0	1
P118	141,154	0.010	0.101	0	1
P119	141,154	0.005	0.072	0	1
P120	141,154	0.017	0.129	0	1
P121	141,154	0.0001	0.008	0	1
P122	141,154	0.006	0.078	0	1
P123	141,154	0.001	0.031	0	1
P124	141,154	0.001	0.024	0	1
P125	141,154	0.0003	0.018	0	1
P126	141,154	0.028	0.165	0	1
P127	141,154	0.017	0.130	0	1
P128	141,154	0.001	0.031	0	1
P129	141,154	0.164	0.370	0	1
P130	141,154	0.057	0.232	0	1
P131	141,154	0.010	0.100	0	1
P132	141,154	0.119	0.324	0	1
P133	141,154	0.001	0.033	0	1
P134	141,154	0.0002	0.014	0	1
P135	141,154	0.003	0.056	0	1
P136	141,154	0.002	0.047	0	1

P137	141,154	0.001	0.030	0	1
P138	141,154	0.091	0.287	0	1
P139	141,154	0.001	0.034	0	1
P140	141,154	0.001	0.035	0	1
P141	141,154	0.001	0.030	0	1
P142	141,154	0.005	0.068	0	1
P143	141,154	0.002	0.047	0	1
P144	141,154	0.026	0.160	0	1
P145	141,154	0.001	0.025	0	1
P146	141,154	0.001	0.028	0	1
P147	141,154	0.0002	0.013	0	1
P148	141,154	0.001	0.037	0	1
P149	141,154	0.0003	0.017	0	1
P150	141,154	0.0002	0.013	0	1
P151	141,154	0.052	0.222	0	1
P152	141,154	0.002	0.041	0	1
P153	141,154	0.001	0.026	0	1
P154	141,154	0.016	0.125	0	1
P155	141,154	0.013	0.115	0	1
P156	141,154	0.0001	0.011	0	1
P157	141,154	0.134	0.341	0	1
P158	141,154	0.008	0.088	0	1
P159	141,154	0.025	0.155	0	1
P160	141,154	0.044	0.204	0	1
P161	141,154	0.003	0.054	0	1
P162	141,154	0.004	0.065	0	1
P163	141,154	0.003	0.056	0	1
P164	141,154	0.006	0.079	0	1
P165	141,154	0.002	0.039	0	1
P166	141,154	0.000	0.000	0	0
P167	141,154	0.008	0.089	0	1
P168	141,154	0.0002	0.014	0	1
P169	141,154	0.017	0.131	0	1
P170	141,154	0.001	0.026	0	1
P171	141,154	0.0001	0.010	0	1
P172	141,154	0.029	0.169	0	1
P173	141,154	0.007	0.086	0	1
P174	141,154	0.051	0.220	0	1
P175	141,154	0.023	0.150	0	1
P176	141,154	0.001	0.032	0	1
P177	141,154	0.001	0.038	0	1
P178	141,154	0.006	0.077	0	1
P179	141,154	0.0001	0.011	0	1
P180	141,154	0.001	0.030	0	1
P181	141,154	0.003	0.054	0	1
P182	141,154	0.054	0.227	0	1
P183	141,154	0.016	0.126	0	1
P184	141,154	0.002	0.047	0	1
P185	141,154	0.0001	0.008	0	1
P186	141,154	0.043	0.204	0	1
P187	141,154	0.002	0.041	0	1
P188	141,154	0.0003	0.018	0	1

P189	141,154	0.0001	0.012	0	1
P190	141,154	0.012	0.111	0	1
P191	141,154	0.002	0.046	0	1
P192	141,154	0.000	0.000	0	0
P193	141,154	0.000	0.000	0	0
P194	141,154	0.004	0.064	0	1
P195	141,154	0.008	0.089	0	1
P196	141,154	0.063	0.244	0	1
P197	141,154	0.091	0.287	0	1
P198	141,154	0.003	0.055	0	1
P199	141,154	0.001	0.034	0	1
P200	141,154	0.0003	0.018	0	1
P201	141,154	0.001	0.038	0	1
P202	141,154	0.002	0.049	0	1
P203	141,154	0.002	0.046	0	1
P204	141,154	0.002	0.047	0	1
P205	141,154	0.053	0.224	0	1
P206	141,154	0.021	0.145	0	1
P207	141,154	0.007	0.086	0	1
P208	141,154	0.0002	0.013	0	1
P209	141,154	0.001	0.028	0	1
P210	141,154	0.00005	0.007	0	1
P211	141,154	0.004	0.066	0	1
P212	141,154	0.012	0.109	0	1
P213	141,154	0.001	0.023	0	1
P214	141,154	0.001	0.025	0	1
P215	141,154	0.004	0.062	0	1
P216	141,154	0.003	0.050	0	1
P217	141,154	0.049	0.215	0	1
P218	141,154	0.006	0.075	0	1
P219	141,154	0.017	0.131	0	1
P220	141,154	0.049	0.217	0	1
P221	141,154	0.016	0.125	0	1
P222	141,154	0.044	0.204	0	1
P223	141,154	0.001	0.035	0	1
P224	141,154	0.0003	0.017	0	1
P225	141,154	0.002	0.041	0	1
P226	141,154	0.001	0.028	0	1
P227	141,154	0.001	0.033	0	1
P228	141,154	0.033	0.178	0	1
P229	141,154	0.002	0.042	0	1
P230	141,154	0.004	0.061	0	1
P231	141,154	0.004	0.061	0	1
P232	141,154	0.0004	0.021	0	1
P233	141,154	0.065	0.247	0	1
P234	141,154	0.0001	0.011	0	1
P235	141,154	0.041	0.199	0	1
P236	141,154	0.007	0.081	0	1
P237	141,154	0.0004	0.021	0	1
P238	141,154	0.025	0.155	0	1
P239	141,154	0.003	0.050	0	1
P240	141,154	0.0001	0.011	0	1

P241	141,154	0.0002	0.016	0	1
P242	141,154	0.004	0.063	0	1
P243	141,154	0.001	0.035	0	1
P244	141,154	0.00005	0.007	0	1
P245	141,154	0.0001	0.011	0	1
P246	141,154	0.001	0.029	0	1
P247	141,154	0.002	0.049	0	1
P248	141,154	0.001	0.032	0	1
P249	141,154	0.001	0.027	0	1
P250	141,154	0.017	0.128	0	1
P251	141,154	0.003	0.054	0	1
P252	141,154	0.014	0.116	0	1
P253	141,154	0.004	0.060	0	1
P254	141,154	0.001	0.029	0	1
P255	141,154	0.009	0.092	0	1
P256	141,154	0.001	0.029	0	1
P257	141,154	0.004	0.060	0	1
P258	141,154	0.0004	0.020	0	1
P259	141,154	0.003	0.056	0	1
P260	141,154	0.0003	0.017	0	1
P261	141,154	0.0002	0.014	0	1
P262	141,154	0.001	0.027	0	1
P263	141,154	0.002	0.039	0	1
P264	141,154	0.0001	0.010	0	1
P265	141,154	0.015	0.120	0	1
P266	141,154	0.001	0.035	0	1
P267	141,154	0.032	0.176	0	1
P268	141,154	0.00004	0.007	0	1
P269	141,154	0.023	0.149	0	1
P270	141,154	0.002	0.042	0	1
P271	141,154	0.008	0.089	0	1
P272	141,154	0.009	0.095	0	1
P273	141,154	0.001	0.035	0	1
P274	141,154	0.0001	0.009	0	1
P275	141,154	0.001	0.038	0	1
P276	141,154	0.0004	0.021	0	1
P277	141,154	0.002	0.043	0	1
P278	141,154	0.014	0.116	0	1
P279	141,154	0.000	0.000	0	0
P280	141,154	0.001	0.025	0	1
P281	141,154	0.005	0.071	0	1
P282	141,154	0.052	0.221	0	1
P283	141,154	0.001	0.038	0	1
P284	141,154	0.001	0.039	0	1
P285	141,154	0.001	0.032	0	1
P286	141,154	0.001	0.034	0	1
P287	141,154	0.001	0.028	0	1
P288	141,154	0.001	0.028	0	1
P289	141,154	0.001	0.037	0	1
P290	141,154	0.0002	0.013	0	1
P291	141,154	0.008	0.086	0	1
P292	141,154	0.001	0.032	0	1

P293	141,154	0.008	0.091	0	1
P294	141,154	0.00004	0.007	0	1
P295	141,154	0.012	0.107	0	1
P296	141,154	0.0005	0.021	0	1
P297	141,154	0.000	0.000	0	0
P298	141,154	0.000	0.000	0	0
P299	141,154	0.000	0.000	0	0
P300	141,154	0.000	0.000	0	0
P301	141,154	0.000	0.000	0	0
P302	141,154	0.066	0.248	0	1
P303	141,154	0.018	0.132	0	1
P304	141,154	0.003	0.054	0	1
P305	141,154	0.002	0.039	0	1
P306	141,154	0.002	0.042	0	1
P307	141,154	0.002	0.044	0	1
P308	141,154	0.025	0.157	0	1
P309	141,154	0.127	0.333	0	1
P310	141,154	0.015	0.120	0	1
P311	141,154	0.009	0.096	0	1
P312	141,154	0.001	0.030	0	1
P313	141,154	0.001	0.026	0	1
P314	141,154	0.007	0.084	0	1
P315	141,154	0.075	0.263	0	1
P316	141,154	0.0001	0.009	0	1
P317	141,154	0.001	0.030	0	1
P318	141,154	0.009	0.094	0	1
P319	141,154	0.002	0.047	0	1
P320	141,154	0.005	0.074	0	1
P321	141,154	0.002	0.046	0	1
P322	141,154	0.013	0.111	0	1
P323	141,154	0.007	0.083	0	1
P324	141,154	0.0001	0.010	0	1
P325	141,154	0.0003	0.017	0	1
P326	141,154	0.0002	0.012	0	1
P327	141,154	0.076	0.265	0	1
P328	141,154	0.001	0.029	0	1
P329	141,154	0.003	0.055	0	1
P330	141,154	0.060	0.237	0	1
P331	141,154	0.007	0.084	0	1
P332	141,154	0.006	0.076	0	1
P333	141,154	0.007	0.082	0	1
P334	141,154	0.0001	0.011	0	1
P335	141,154	0.019	0.138	0	1
P336	141,154	0.001	0.024	0	1
P337	141,154	0.001	0.024	0	1
P338	141,154	0.003	0.057	0	1
P339	141,154	0.001	0.027	0	1
P340	141,154	0.020	0.142	0	1
P341	141,154	0.079	0.270	0	1
P342	141,154	0.007	0.081	0	1
P343	141,154	0.002	0.041	0	1
P344	141,154	0.0004	0.020	0	1

P345	141,154	0.001	0.024	0	1
P346	141,154	0.011	0.105	0	1
P347	141,154	0.0002	0.012	0	1
P348	141,154	0.0004	0.019	0	1
P349	141,154	0.034	0.180	0	1
P350	141,154	0.001	0.024	0	1
P351	141,154	0.003	0.055	0	1
P352	141,154	0.001	0.035	0	1
P353	141,154	0.069	0.253	0	1
P354	141,154	0.126	0.332	0	1
P355	141,154	0.001	0.025	0	1
P356	141,154	0.004	0.063	0	1
P357	141,154	0.002	0.039	0	1
P358	141,154	0.020	0.140	0	1
P359	141,154	0.013	0.112	0	1
P360	141,154	0.001	0.033	0	1
P361	141,154	0.053	0.225	0	1
P362	141,154	0.000	0.000	0	0
P363	141,154	0.037	0.190	0	1
P364	141,154	0.001	0.035	0	1
P365	141,154	0.003	0.053	0	1
P366	141,154	0.001	0.031	0	1
P367	141,154	0.000	0.000	0	0
P368	141,154	0.005	0.071	0	1
P369	141,154	0.009	0.095	0	1
P370	141,154	0.008	0.091	0	1
P371	141,154	0.001	0.036	0	1
P372	141,154	0.007	0.082	0	1
P373	141,154	0.091	0.287	0	1
P374	141,154	0.006	0.078	0	1
P375	141,154	0.027	0.161	0	1
P376	141,154	0.001	0.023	0	1
P377	141,154	0.0002	0.014	0	1
P378	141,154	0.002	0.042	0	1
P379	141,154	0.001	0.036	0	1
P380	141,154	0.001	0.028	0	1
P381	141,154	0.016	0.126	0	1
P382	141,154	0.002	0.040	0	1
P383	141,154	0.072	0.258	0	1
P384	141,154	0.001	0.028	0	1
P385	141,154	0.00001	0.003	0	1
P386	141,154	0.022	0.148	0	1
P387	141,154	0.001	0.038	0	1
P388	141,154	0.001	0.026	0	1
P389	141,154	0.002	0.044	0	1
P390	141,154	0.002	0.040	0	1
P391	141,154	0.003	0.057	0	1
P392	141,154	0.001	0.031	0	1
P393	141,154	0.039	0.194	0	1
P394	141,154	0.0001	0.010	0	1
P395	141,154	0.0004	0.021	0	1
P396	141,154	0.002	0.042	0	1

P397	141,154	0.0002	0.015	0	1
P398	141,154	0.0002	0.013	0	1
P399	141,154	0.076	0.265	0	1
P400	141,154	0.006	0.077	0	1
P401	141,154	0.012	0.111	0	1
P402	141,154	0.0004	0.019	0	1
P403	141,154	0.001	0.027	0	1
P404	141,154	0.001	0.037	0	1
P405	141,154	0.00001	0.003	0	1
P406	141,154	0.0001	0.008	0	1
P407	141,154	0.00003	0.005	0	1
P408	141,154	0.003	0.054	0	1
P409	141,154	0.003	0.054	0	1
P410	141,154	0.003	0.052	0	1
P411	141,154	0.021	0.142	0	1
P412	141,154	0.001	0.035	0	1
P413	141,154	0.010	0.098	0	1
P414	141,154	0.00001	0.004	0	1
P415	141,154	0.006	0.077	0	1
M1	141,154	0.006	0.075	0	1
M2	141,154	0.011	0.103	0	1
M3	141,154	0.009	0.096	0	1
M4	141,154	0.008	0.090	0	1
M5	141,154	0.036	0.187	0	1
M6	141,154	0.034	0.182	0	1
M7	141,154	0.008	0.087	0	1
M8	141,154	0.002	0.042	0	1
M9	141,154	0.006	0.074	0	1
M10	141,154	0.015	0.121	0	1
M11	141,154	0.014	0.116	0	1
M12	141,154	0.002	0.049	0	1
M13	141,154	0.075	0.263	0	1
M14	141,154	0.060	0.238	0	1
M15	141,154	0.039	0.193	0	1
M16	141,154	0.026	0.159	0	1
M17	141,154	0.019	0.136	0	1
M18	141,154	0.047	0.212	0	1
M19	141,154	0.002	0.045	0	1
M20	141,154	0.027	0.162	0	1
M21	141,154	0.018	0.133	0	1
M22	141,154	0.006	0.078	0	1
M23	141,154	0.006	0.080	0	1
M24	141,154	0.008	0.087	0	1
M25	141,154	0.053	0.225	0	1
M26	141,154	0.041	0.199	0	1
M27	141,154	0.031	0.174	0	1
M28	141,154	0.054	0.226	0	1
M29	141,154	0.014	0.119	0	1
M30	141,154	0.032	0.176	0	1
M31	141,154	0.048	0.215	0	1
M32	141,154	0.021	0.143	0	1
M33	141,154	0.060	0.238	0	1

M34	141,154	0.006	0.078	0	1
M35	141,154	0.015	0.123	0	1
M36	141,154	0.004	0.065	0	1
M37	141,154	0.022	0.146	0	1
M38	141,154	0.019	0.136	0	1
M39	141,154	0.058	0.234	0	1

Appendix B

Appendix B: Model Summary

Models 2-6					
	Dependent variable:				
	Outcome				
	(2)	(3)	(4)	(5)	(6)
stealthrockcount	0.264*** (0.007)			0.202*** (0.008)	
st2					
spikescount	0.069*** (0.015)			0.034** (0.017)	0.038** (0.017)
sp2					
toxspikecount	-0.161*** (0.030)			-0.057* (0.033)	-0.051 (0.033)
toxsp2					
stickywebcount	-0.002 (0.027)			0.110*** (0.034)	0.137*** (0.035)
stw2					
defogcount	-0.034** (0.016)			-0.099*** (0.017)	-0.092*** (0.017)
fog2					
rapidspincoun	-0.055*** (0.017)			-0.088*** (0.018)	-0.078*** (0.018)
rapid2					
dragontailcount	-0.080*** (0.019)			-0.110*** (0.020)	-0.108*** (0.021)
dt2	-0.016 (0.025)			-0.045* (0.027)	-0.036 (0.027)
roarcount					
roar2					
whirlwindcount					
whirl2					
stAerodactyl					0.168*** (0.063)
stAggron					-0.017 (0.062)
stArcheops					0.174 (0.178)
stArmaldo					-0.160 (0.190)
stAurorus					0.220 (0.205)
stAzelf					0.196*** (0.069)
stBarbaracle					0.136 (0.194)
stBastiodon					0.011 (0.204)
stBibarel					-0.819* (0.496)
stBisharp					0.074*** (0.025)
stBlissey					-0.002 (0.055)
stBronzong					-0.148 (0.101)
stCamerupt					0.042 (0.156)
stCarbink					0.710*** (0.273)

stCarracosta			0.034 (0.200)
stCelebi			0.172*** (0.040)
stChansey			0.098*** (0.030)
stClaydol			0.206 (0.182)
stClefable			0.065*** (0.023)
stClefairy			-3.990 (18.120)
stCobalion			0.199* (0.111)
stCorsola			-3.540 (19.017)
stCradily			0.071 (0.111)
stCrustle			-0.046 (0.216)
stDiancie			0.062* (0.035)
stDonphan			0.182*** (0.058)
stDruddigon			0.032 (0.182)
stDugtrio			0.151* (0.079)
stDunsparce			0.546* (0.300)
stEmpoleon			0.064 (0.062)
stExcadrill			0.095*** (0.023)
stFerroseed			-0.414 (0.356)
stFerrothorn			0.096*** (0.020)
stForretress			0.064 (0.053)
stGabite			0.383 (0.436)
stGarchomp			0.125*** (0.019)
stGigalith			-0.288 (0.240)
stGligar			0.465* (0.244)
stGliscor			0.040 (0.025)
stGolem			0.046 (0.107)
stGolurk			-0.107 (0.180)
stHeatran			0.092*** (0.019)
stHippowdon			0.032 (0.034)
stInfernape			0.020 (0.043)
stJirachi			0.071** (0.031)
stKabutops			0.118 (0.098)
stKecleon			0.044 (0.175)
stKrokorok			
stKrookodile			0.119* (0.067)
stLunatone			0.334 (0.357)
stMagcargo			0.310 (0.297)
stMamoswine			-0.009 (0.052)
stMarowak			0.118 (0.193)
stMawile			0.676*** (0.262)
stMesprit			-0.345 (0.540)
stMetagross			0.064** (0.029)
stMetang			-3.909 (16.922)
stMew			0.052 (0.036)
stMiltank			-0.305* (0.163)
stMonferno			
stNidoking			0.047 (0.062)
stNidoqueen			0.140 (0.132)
stOmastar			0.036 (0.123)
stPawniard			-0.123 (0.539)
stPiloswine			-0.173 (0.206)
stPinsir			0.068* (0.040)
stPrinplup			-4.110 (36.576)
stProbopass			-0.127 (0.189)
stRampardos			-0.309 (0.235)
stRegirock			0.131 (0.246)
stRegisteel			-0.240 (0.186)
stRelicanth			-0.852 (0.744)
stRhydon			0.471** (0.235)
stRhyperior			0.137 (0.089)
stSandslash			0.223 (0.204)
stSeismitoad			0.308*** (0.084)
stShuckle			-0.001 (0.065)
stSkarmory			0.034 (0.026)
stSolrock			-0.154 (0.288)
stSteelix			0.186** (0.090)
stStunfisk			-0.238 (0.346)
stSudowoodo			-0.281 (0.394)
stSwampert			0.136*** (0.043)
stTerrakion			0.124** (0.061)
stTorkoal			0.147 (0.136)
stTorterra			0.183 (0.128)
stTyranitar			0.025 (0.025)
stTyrantrum			0.018 (0.111)
stUxie			0.145 (0.197)
stWigglytuff			0.228 (0.383)
stWormadamSandy			-0.119 (0.967)
stWormadamTrash			0.007 (36.561)
stWormadam			
Abomasnow	-0.173*** (0.043)	-0.139** (0.069)	-0.138** (0.070)
Absol	-0.097*** (0.032)	0.078 (0.075)	0.077 (0.075)
Accelgor	-0.186*** (0.069)	-0.178** (0.069)	-0.181*** (0.069)

Aerodactyl	-0.043 (0.030)	-0.024 (0.052)	-0.075 (0.059)
Aggron	-0.117*** (0.030)	-0.085* (0.043)	-0.072 (0.047)
Alakazam	-0.060*** (0.014)	-0.002 (0.019)	0.0002 (0.019)
Alomomola	-0.027 (0.045)	-0.027 (0.045)	-0.023 (0.045)
Altaria	-0.064*** (0.019)	-0.250*** (0.096)	-0.237** (0.095)
Ambipom	0.018 (0.038)	0.035 (0.038)	0.029 (0.038)
Amoonguss	0.072*** (0.028)	0.075*** (0.028)	0.082*** (0.028)
Ampharos	-0.165*** (0.035)	-0.345*** (0.069)	-0.343*** (0.069)
Arbok	-0.273** (0.119)	-0.220* (0.119)	-0.244** (0.120)
Arcanine	-0.047** (0.023)	-0.036 (0.023)	-0.043* (0.023)
Archeops	-0.258*** (0.072)	-0.254*** (0.072)	-0.305*** (0.082)
Ariados	-0.131 (0.109)	-0.150 (0.110)	-0.184* (0.110)
Armaldo	-0.021 (0.078)	-0.009 (0.078)	0.025 (0.088)
Aromatisse	-0.047 (0.129)	-0.022 (0.130)	-0.023 (0.130)
Articuno	-0.169** (0.077)	-0.133* (0.077)	-0.144* (0.078)
Audino	-0.068 (0.072)	0.148 (0.114)	0.114 (0.114)
Aurorus	-0.127 (0.081)	-0.113 (0.081)	-0.164* (0.090)
Avalugg	0.018 (0.065)	0.046 (0.065)	0.028 (0.066)
Azelf	0.070** (0.033)	0.007 (0.033)	-0.081 (0.055)
Azumarill	0.034*** (0.012)	0.035*** (0.012)	0.038*** (0.012)
Banette	-0.188*** (0.047)	-0.336** (0.138)	-0.350** (0.138)
Barbaracle	-0.051 (0.076)	-0.036 (0.076)	-0.067 (0.085)
Basculin	-0.390 (0.358)	-0.416 (0.359)	-0.464 (0.365)
Bastiodon	-0.305*** (0.100)	-0.330*** (0.100)	-0.312** (0.126)
Beartic	-0.059 (0.123)	-0.041 (0.124)	-0.046 (0.124)
Beautifly	-0.465** (0.221)	-0.440** (0.223)	-0.416* (0.222)
Beedrill	-0.099*** (0.029)	-0.094*** (0.030)	-0.089*** (0.030)
Beheeyem	-0.045 (0.126)	-0.028 (0.126)	-0.040 (0.126)
Bellossom	0.200 (0.179)	0.238 (0.179)	0.247 (0.180)
Bibarel	0.016 (0.160)	0.038 (0.160)	0.153 (0.173)
Bisharp	0.059*** (0.013)	0.048*** (0.013)	0.026 (0.016)
Blastoise	-0.067*** (0.024)	-0.022 (0.037)	-0.025 (0.037)
Blissey	-0.124*** (0.026)	-0.117*** (0.026)	-0.116*** (0.031)
Bouffalant	-0.191** (0.091)	-0.147 (0.092)	-0.149 (0.092)
Braviary	-0.056 (0.078)	-0.049 (0.078)	-0.041 (0.078)
Breloom	-0.065*** (0.013)	-0.054*** (0.013)	-0.054*** (0.013)
Bronzong	-0.024 (0.051)	-0.070 (0.051)	0.020 (0.065)
Butterfree	-0.191** (0.093)	-0.161* (0.093)	-0.159* (0.094)
Cacturne	-0.280*** (0.080)	-0.240*** (0.080)	-0.239*** (0.080)
Camerupt	-0.055 (0.067)	0.088 (0.147)	0.067 (0.149)
Carbink	-0.181 (0.132)	-0.200 (0.132)	-0.438** (0.171)

Carnivine	0.354 (0.265)	0.399 (0.266)	0.364 (0.268)
Carracosta	-0.267*** (0.080)	-0.248*** (0.080)	-0.258*** (0.089)
Castform	-0.276 (0.178)	-0.283 (0.179)	-0.270 (0.179)
Celebi	-0.092*** (0.020)	-0.082*** (0.020)	-0.141*** (0.025)
Chandelure	-0.018 (0.025)	0.002 (0.025)	-0.004 (0.025)
Chansey	-0.037** (0.015)	-0.037** (0.015)	-0.067*** (0.019)
Charizard	-0.101*** (0.011)	-0.298*** (0.036)	-0.296*** (0.036)
Chatot	-0.045 (0.076)	-0.047 (0.076)	-0.061 (0.077)
Cherrim	-0.237 (0.166)	-0.202 (0.167)	-0.214 (0.167)
Chesnaught	-0.042 (0.034)	-0.045 (0.035)	-0.047 (0.035)
Chimecho	0.136 (0.294)	0.287 (0.294)	0.214 (0.296)
Cinccino	-0.075 (0.052)	-0.070 (0.052)	-0.072 (0.052)
Clawitzer	-0.178** (0.079)	-0.155* (0.080)	-0.166** (0.080)
Claydol	0.020 (0.086)	-0.002 (0.086)	-0.060 (0.105)
Clefable	0.028** (0.012)	0.024** (0.012)	0.007 (0.015)
Clefairy	-0.294 (0.181)	-0.244 (0.181)	-0.205 (0.189)
Cloyster	-0.023 (0.025)	-0.008 (0.025)	-0.014 (0.025)
Cobalion	-0.113** (0.051)	-0.115** (0.052)	-0.174*** (0.062)
Cofagrigus	0.013 (0.041)	0.006 (0.041)	0.018 (0.042)
Combusken	-0.079 (0.110)	-0.056 (0.110)	-0.059 (0.110)
Conkeldurr	-0.030** (0.014)	-0.020 (0.014)	-0.019 (0.014)
Corsola	-0.336 (0.231)	-0.310 (0.230)	-0.323 (0.241)
Cradily	-0.176*** (0.053)	-0.182*** (0.053)	-0.193*** (0.065)
Crawdaunt	-0.008 (0.030)	-0.004 (0.031)	-0.004 (0.031)
Cresselia	-0.103*** (0.038)	-0.091** (0.038)	-0.092** (0.038)
Crobat	-0.021 (0.027)	-0.007 (0.027)	-0.010 (0.027)
Crustle	0.042 (0.099)	0.015 (0.099)	0.041 (0.119)
Cryogonal	-0.159 (0.105)	-0.131 (0.105)	-0.128 (0.105)
Darmanitan	-0.047* (0.026)	-0.037 (0.026)	-0.038 (0.026)
Dedenne	-0.180*** (0.067)	-0.159** (0.067)	-0.160** (0.067)
Delcatty	-0.082 (0.257)	-0.070 (0.257)	-0.098 (0.258)
Delibird	-0.080 (0.126)	-0.016 (0.127)	-0.028 (0.128)
Delphox	-0.078* (0.046)	-0.065 (0.046)	-0.073 (0.046)
Dewgong	-0.268 (0.210)	-0.264 (0.211)	-0.266 (0.211)
Diancie	-0.009 (0.018)	-0.096* (0.055)	-0.103* (0.057)
Diggersby	0.068** (0.031)	0.072** (0.031)	0.072** (0.031)
Ditto	-0.010 (0.039)	-0.016 (0.039)	-0.013 (0.039)
Dodrio	0.120 (0.140)	0.140 (0.140)	0.142 (0.140)
Donphan	0.072** (0.029)	0.056* (0.030)	0.0004 (0.038)
Doublade	-0.001 (0.038)	0.010 (0.038)	0.004 (0.038)
Dragalge	0.027 (0.041)	0.029 (0.042)	0.032 (0.042)

Dragonair	-0.318 (0.261)	-0.320 (0.262)	-0.336 (0.262)
Dragonite	-0.030** (0.012)	-0.022* (0.012)	-0.024* (0.012)
Drapion	-0.106** (0.041)	-0.087** (0.042)	-0.095** (0.042)
Drifblim	-0.001 (0.079)	-0.00001 (0.079)	-0.006 (0.079)
Druddigon	0.010 (0.090)	-0.017 (0.090)	-0.010 (0.118)
Dugtrio	0.092** (0.040)	0.086** (0.040)	0.050 (0.049)
Dunsparce	-0.075 (0.144)	-0.148 (0.145)	-0.343* (0.193)
Duosion	0.022 (0.787)	0.046 (0.789)	-0.107 (0.793)
Durant	-0.037 (0.066)	-0.025 (0.067)	-0.029 (0.067)
Dusclops	-0.050 (0.048)	-0.051 (0.048)	-0.047 (0.048)
Dusknoir	-0.091 (0.062)	-0.063 (0.062)	-0.078 (0.062)
Dustox	-0.302 (0.364)	-0.327 (0.364)	-0.286 (0.365)
Eelektross	-0.186*** (0.043)	-0.172*** (0.043)	-0.176*** (0.043)
Electivire	-0.072** (0.032)	-0.047 (0.032)	-0.055* (0.032)
Electrode	-0.191 (0.137)	-0.168 (0.137)	-0.179 (0.138)
Emboar	-0.087 (0.056)	-0.086 (0.057)	-0.085 (0.057)
Emolga	-0.215*** (0.074)	-0.206*** (0.075)	-0.199*** (0.075)
Empoleon	-0.017 (0.030)	-0.032 (0.030)	-0.038 (0.037)
Entei	0.102*** (0.033)	0.110*** (0.033)	0.113*** (0.033)
Escavalier	-0.063 (0.062)	-0.039 (0.062)	-0.059 (0.062)
Espeon	-0.012 (0.022)	-0.013 (0.022)	-0.016 (0.022)
Excadrill	0.067*** (0.012)	0.056*** (0.013)	0.030* (0.016)
Exeggutor	0.076 (0.077)	-0.076 (0.077)	-0.086 (0.078)
Exploud	0.062 (0.066)	0.075 (0.066)	0.084 (0.067)
Farfetchd	-0.198 (0.238)	-0.130 (0.239)	-0.134 (0.240)
Fearow	-0.046 (0.228)	-0.074 (0.229)	-0.079 (0.229)
Feraligatr	-0.055* (0.029)	-0.047 (0.030)	-0.048 (0.030)
Ferroseed	-0.080 (0.176)	-0.170 (0.176)	0.114 (0.298)
Ferrothorn	0.040*** (0.011)	0.010 (0.011)	-0.011 (0.014)
Flareon	-0.027 (0.067)	-0.016 (0.067)	-0.037 (0.067)
Fletchinder	-0.480 (0.357)	-0.363 (0.357)	-0.510 (0.368)
Floatzel	-0.160* (0.082)	-0.149* (0.083)	-0.155* (0.084)
Florges	-0.057* (0.034)	-0.041 (0.034)	-0.041 (0.035)
Flygon	-0.087* (0.048)	-0.069 (0.049)	-0.073 (0.049)
Forretress	-0.008 (0.027)	-0.052* (0.028)	-0.046 (0.040)
Fraxure	0.006 (0.405)	0.064 (0.405)	0.047 (0.405)
Froslass	0.034 (0.045)	0.032 (0.045)	0.030 (0.046)
Furfrou	-0.260** (0.115)	-0.194* (0.115)	-0.204* (0.115)
Furret	-0.400*** (0.155)	-0.394** (0.156)	-0.412*** (0.156)
Gabite	-0.012 (0.258)	-0.117 (0.257)	-0.173 (0.343)
Gallade	-0.086*** (0.021)	-0.160*** (0.058)	-0.156*** (0.058)

Galvantula	-0.006 (0.026)	-0.035 (0.031)	-0.057* (0.032)
Garbodor	-0.167 (0.109)	-0.210* (0.111)	-0.200* (0.111)
Garchomp	0.023** (0.010)	0.033*** (0.011)	-0.004 (0.013)
Gardevoir	-0.054*** (0.015)	-0.061* (0.032)	-0.057* (0.032)
Gastrodon	0.027 (0.034)	0.036 (0.035)	0.037 (0.035)
Gengar	-0.041*** (0.011)	-0.032*** (0.011)	-0.032*** (0.011)
Gigalith	-0.118 (0.108)	-0.131 (0.108)	-0.033 (0.128)
Girafarig	-0.240 (0.275)	-0.233 (0.276)	-0.206 (0.277)
Glaceon	-0.276*** (0.065)	-0.247*** (0.066)	-0.251*** (0.066)
Glalie	-0.095 (0.074)	-0.073 (0.199)	-0.074 (0.199)
Gligar	0.021 (0.114)	0.001 (0.115)	-0.135 (0.141)
Gliscor	-0.046*** (0.012)	-0.043*** (0.012)	-0.054*** (0.015)
Gogoat	-0.364*** (0.108)	-0.359*** (0.109)	-0.365*** (0.109)
Golbat	0.086 (0.107)	0.085 (0.107)	0.094 (0.107)
Golduck	-0.216* (0.126)	-0.213* (0.126)	-0.226* (0.126)
Golem	-0.018 (0.051)	-0.047 (0.052)	-0.047 (0.063)
Golurk	-0.052 (0.073)	-0.037 (0.074)	-0.011 (0.083)
Goodra	0.020 (0.022)	0.030 (0.022)	0.031 (0.022)
Gorebyss	-0.048 (0.140)	-0.070 (0.141)	-0.092 (0.141)
Gothitelle	-0.036 (0.120)	-0.042 (0.121)	-0.051 (0.121)
Gourgeist	0.137 (0.269)	0.132 (0.270)	0.132 (0.271)
Granbull	-0.116 (0.092)	-0.096 (0.092)	-0.099 (0.093)
Grumpig	-0.044 (0.219)	0.024 (0.220)	0.030 (0.222)
Gurdurr	-0.077 (0.257)	-0.049 (0.257)	-0.095 (0.257)
Gyarados	-0.007 (0.016)	0.023 (0.022)	0.022 (0.022)
Hariyama	-0.181** (0.089)	-0.164* (0.089)	-0.184** (0.089)
Haunter	-0.103 (0.149)	-0.111 (0.149)	-0.101 (0.150)
Hawlucha	-0.063** (0.028)	-0.050* (0.028)	-0.054** (0.028)
Haxorus	-0.026 (0.030)	-0.019 (0.030)	-0.022 (0.030)
Heatmor	-0.504 (0.338)	-0.433 (0.338)	-0.401 (0.338)
Heatran	0.057*** (0.011)	0.039*** (0.011)	0.017 (0.014)
Heliolisk	-0.082** (0.039)	-0.072* (0.040)	-0.080** (0.040)
Heracross	0.005 (0.022)	0.046 (0.041)	0.049 (0.041)
Hippowdon	0.047*** (0.017)	0.024 (0.017)	0.027 (0.025)
Hitmonchan	-0.154** (0.066)	-0.161** (0.066)	-0.159** (0.066)
Hitmonlee	-0.078 (0.053)	-0.079 (0.054)	-0.076 (0.054)
Hitmontop	-0.007 (0.061)	0.011 (0.062)	-0.001 (0.062)
Honchkrow	-0.062 (0.044)	-0.049 (0.044)	-0.043 (0.044)
Hoopa	-0.164* (0.091)	-0.137 (0.091)	-0.153* (0.091)
HoopaU			
Houndoom	-0.118*** (0.039)	-0.130* (0.078)	-0.135* (0.078)

Huntail	-0.072 (0.244)	-0.109 (0.245)	-0.069 (0.246)
Hydreigon	0.012 (0.026)	0.010 (0.026)	0.015 (0.026)
Hypno	-0.061 (0.142)	-0.056 (0.142)	-0.067 (0.142)
Illumise	0.019 (0.331)	0.026 (0.332)	0.010 (0.332)
Infernape	-0.041** (0.021)	-0.049** (0.021)	-0.045* (0.025)
Jellicent	-0.088** (0.040)	-0.099** (0.040)	-0.092** (0.040)
Jirachi	0.059*** (0.016)	0.045*** (0.016)	0.030 (0.021)
Jolteon	-0.067*** (0.024)	-0.063*** (0.024)	-0.064*** (0.024)
Jumpluff	-0.002 (0.116)	-0.018 (0.116)	-0.011 (0.116)
Jynx	-0.172* (0.097)	-0.157 (0.097)	-0.157 (0.097)
Kabutops	0.057 (0.049)	0.058 (0.049)	0.021 (0.057)
Kadabra	-1.118*** (0.413)	-1.007** (0.416)	-1.013** (0.415)
Kangaskhan	-0.028 (0.125)	-0.007 (0.125)	-0.040 (0.128)
Kecleon	-0.096 (0.067)	-0.075 (0.067)	-0.092 (0.074)
Keldeo	0.058*** (0.016)	0.047*** (0.016)	0.052*** (0.016)
Kingdra	-0.042 (0.031)	-0.046 (0.031)	-0.042 (0.031)
Kingler	0.096 (0.079)	0.090 (0.079)	0.102 (0.079)
Klang	0.010 (0.481)	0.052 (0.484)	0.067 (0.485)
Klefki	0.042** (0.017)	0.040** (0.018)	0.042** (0.018)
Klinklang	0.035 (0.092)	0.025 (0.092)	0.014 (0.093)
Kricketune	-0.517** (0.202)	-0.509** (0.203)	-0.512** (0.204)
Krokorok	-0.338 (0.327)	-0.263 (0.325)	-0.254 (0.340)
Krookodile	-0.048 (0.032)	-0.050 (0.032)	-0.077** (0.038)
Kyurem	-0.080 (0.078)	-0.075 (0.078)	-0.071 (0.078)
KyuremB			
LandorusT			
Lanturn	-0.010 (0.054)	0.004 (0.054)	0.009 (0.054)
Lapras	-0.227*** (0.040)	-0.192*** (0.041)	-0.200*** (0.041)
Latias	0.034** (0.015)	0.041*** (0.016)	0.054*** (0.015)
Latios	0.036*** (0.013)	0.055*** (0.013)	0.066*** (0.013)
Leafeon	-0.147** (0.067)	-0.132** (0.067)	-0.149** (0.067)
Leavanny	0.054 (0.103)	0.020 (0.104)	0.004 (0.104)
Ledian	-0.418** (0.208)	-0.389* (0.210)	-0.379* (0.210)
Lickilicky	-0.125 (0.099)	-0.085 (0.099)	-0.079 (0.099)
Liepard	0.067 (0.073)	0.094 (0.074)	0.093 (0.074)
Lilligant	-0.212*** (0.076)	-0.203*** (0.076)	-0.210*** (0.076)
Linoone	-0.077 (0.075)	-0.042 (0.075)	-0.054 (0.075)
Lopunny	0.007 (0.016)	-0.284*** (0.079)	-0.277*** (0.079)
Lucario	-0.098*** (0.024)	-0.077*** (0.024)	-0.080*** (0.024)
Ludicolo	-0.063 (0.042)	-0.048 (0.042)	-0.047 (0.042)
Lumineon	-0.092 (0.311)	0.030 (0.312)	0.042 (0.312)

Lunatone	-0.270* (0.153)	-0.202 (0.154)	-0.292 (0.181)
Luvdisc	-0.245 (0.527)	-0.285 (0.527)	-0.293 (0.526)
Luxray	-0.281*** (0.055)	-0.254*** (0.055)	-0.252*** (0.056)
Machamp	0.001 (0.032)	0.009 (0.032)	0.005 (0.032)
Machoke	-0.139 (0.191)	-0.151 (0.192)	-0.139 (0.193)
Magcargo	-0.227 (0.159)	-0.251 (0.160)	-0.342* (0.198)
Magmortar	-0.067 (0.056)	-0.060 (0.056)	-0.060 (0.057)
Magneton	0.052 (0.070)	0.049 (0.070)	0.063 (0.070)
Magnezone	-0.008 (0.016)	-0.017 (0.016)	-0.010 (0.016)
Malamar	-0.075 (0.046)	-0.066 (0.046)	-0.072 (0.046)
Mamoswine	0.070*** (0.026)	0.048* (0.026)	0.074** (0.034)
Manaphy	0.068*** (0.016)	0.057*** (0.016)	0.059*** (0.016)
Mandibuzz	0.075*** (0.027)	0.097*** (0.028)	0.096*** (0.028)
Manectric	-0.007 (0.017)	-0.088 (0.061)	-0.088 (0.061)
Mantine	-0.179* (0.101)	-0.153 (0.101)	-0.161 (0.102)
Maractus	-0.071 (0.245)	-0.080 (0.246)	-0.097 (0.248)
Marowak	-0.176** (0.084)	-0.182** (0.084)	-0.200** (0.097)
Masquerain	-0.078 (0.146)	-0.114 (0.147)	-0.144 (0.147)
Mawile	-0.318*** (0.107)	-0.330*** (0.108)	-0.466*** (0.123)
Medicham	0.008 (0.020)	-0.107 (0.074)	-0.111 (0.074)
Meganium	-0.173** (0.086)	-0.177** (0.087)	-0.194** (0.087)
Meloetta	0.051 (0.056)	0.061 (0.056)	0.067 (0.056)
Meowstic	-0.069 (0.059)	-0.050 (0.059)	-0.071 (0.059)
Mesprit	-0.310* (0.168)	-0.275 (0.168)	-0.250 (0.178)
Metagross	-0.013 (0.014)	-0.031 (0.029)	-0.043 (0.031)
Metang	-0.419 (0.351)	-0.406 (0.350)	-0.150 (0.395)
Mew	-0.022 (0.017)	-0.012 (0.017)	-0.023 (0.021)
Mienshao	-0.097** (0.043)	-0.088** (0.043)	-0.091** (0.043)
Mightyena	-0.168 (0.178)	-0.157 (0.178)	-0.140 (0.179)
Milotic	-0.022 (0.023)	-0.012 (0.023)	-0.010 (0.023)
Miltank	-0.123* (0.069)	-0.131* (0.070)	-0.049 (0.079)
Minun	-0.990** (0.409)	-1.005** (0.412)	-1.053** (0.419)
Misdreavus	-0.298 (0.225)	-0.307 (0.225)	-0.298 (0.226)
Mismagius	-0.008 (0.055)	-0.019 (0.055)	-0.018 (0.055)
Moltres	-0.146 (0.099)	-0.120 (0.099)	-0.130 (0.099)
Monferno	0.031 (0.529)	-0.021 (0.529)	-0.033 (0.530)
Mothim	-0.474 (0.386)	-0.451 (0.386)	-0.500 (0.386)
MrMime	0.036 (0.118)	0.057 (0.119)	0.047 (0.119)
Muk	-0.198*** (0.073)	-0.189** (0.073)	-0.201*** (0.074)
Murkrow	-0.033 (0.105)	-0.029 (0.106)	-0.013 (0.106)
Musharna	0.131 (0.124)	0.160 (0.124)	0.163 (0.125)

Nidoking	0.010 (0.027)	0.018 (0.027)	0.003 (0.031)
Nidoqueen	0.002 (0.063)	-0.019 (0.063)	-0.052 (0.079)
Ninetales	-0.051* (0.031)	-0.023 (0.031)	-0.026 (0.031)
Ninjask	-0.232*** (0.057)	-0.195*** (0.057)	-0.203*** (0.058)
Noctowl	0.026 (0.127)	-0.013 (0.128)	0.017 (0.127)
Noivern	-0.053 (0.038)	-0.044 (0.038)	-0.049 (0.038)
Octillery	0.403*** (0.126)	0.423*** (0.127)	0.415*** (0.127)
Omastar	-0.010 (0.058)	-0.010 (0.058)	-0.012 (0.071)
Pachirisu	-0.085 (0.190)	-0.067 (0.190)	-0.096 (0.191)
Pangoro	-0.028 (0.062)	-0.022 (0.062)	-0.013 (0.063)
Parasect	-0.114 (0.207)	-0.088 (0.208)	-0.114 (0.208)
Pawniard	0.283 (0.261)	0.194 (0.261)	0.282 (0.326)
Pelipper	0.051 (0.137)	0.123 (0.137)	0.104 (0.138)
Persian	-0.099 (0.098)	-0.101 (0.099)	-0.093 (0.099)
Phione	-0.145 (0.348)	-0.154 (0.348)	-0.099 (0.357)
Pidgeot	-0.063** (0.029)	-0.151 (0.100)	-0.150 (0.101)
Piloswine	0.088 (0.102)	0.006 (0.103)	0.162 (0.162)
Pinsir	-0.004 (0.020)	-0.140 (0.103)	-0.164 (0.104)
Plusle	4.530 (14.898)	4.499 (14.802)	4.518 (14.196)
Politoed	0.057* (0.031)	0.071** (0.033)	0.063* (0.033)
Poliwrath	-0.371*** (0.085)	-0.347*** (0.085)	-0.355*** (0.085)
PorygonZ	-0.065* (0.039)	-0.061 (0.039)	-0.067* (0.039)
Porygon2	0.005 (0.036)	0.021 (0.036)	0.022 (0.036)
Primeape	-0.068 (0.103)	-0.035 (0.103)	-0.048 (0.104)
Prinplup	-0.217 (0.422)	-0.222 (0.424)	-0.090 (0.443)
Probopass	0.181* (0.097)	0.136 (0.097)	0.211* (0.127)
Purugly	-0.134 (0.236)	-0.144 (0.236)	-0.152 (0.237)
Pyroar	-0.028 (0.086)	-0.029 (0.086)	-0.037 (0.087)
Quagsire	0.013 (0.030)	0.024 (0.030)	0.021 (0.030)
Quilladin			
Qwilfish	-0.298** (0.145)	-0.275* (0.145)	-0.314** (0.146)
Raichu	-0.124** (0.050)	-0.075 (0.051)	-0.085* (0.051)
Raikou	0.021 (0.016)	0.018 (0.016)	0.027* (0.016)
Rampardos	-0.185* (0.100)	-0.161 (0.100)	-0.085 (0.113)
Rapidash	-0.141 (0.095)	-0.135 (0.095)	-0.141 (0.095)
Raticate	-0.095 (0.115)	-0.101 (0.115)	-0.103 (0.115)
Regice	0.179* (0.103)	0.199* (0.104)	0.204* (0.104)
Regigigas	-0.532*** (0.142)	-0.496*** (0.143)	-0.512*** (0.144)
Regirock	-0.079 (0.122)	-0.081 (0.122)	-0.130 (0.162)
Registeel	0.143 (0.093)	0.123 (0.093)	0.273** (0.129)
Relicanth	0.042 (0.256)	0.044 (0.257)	0.176 (0.281)

Reuniclus	0.031 (0.040)	0.027 (0.040)	0.029 (0.040)
Rhydon	-0.076 (0.106)	-0.074 (0.107)	-0.188 (0.127)
Rhyperior	-0.060 (0.039)	-0.052 (0.039)	-0.085* (0.045)
Roselia	-1.058* (0.623)	-1.090* (0.628)	-1.131* (0.630)
Roserade	-0.090*** (0.032)	-0.071** (0.033)	-0.081** (0.033)
Rotom	0.063 (0.167)	0.091 (0.167)	0.083 (0.168)
RotomC			
RotomF			
RotomH			
RotomS			
RotomW			
Sableye	-0.018 (0.015)	-0.013 (0.025)	-0.016 (0.025)
Salamence	-0.029 (0.026)	-0.016 (0.026)	-0.022 (0.026)
Samurott	-0.292*** (0.067)	-0.248*** (0.067)	-0.253*** (0.067)
Sandslash	-0.164* (0.090)	-0.158* (0.091)	-0.201* (0.106)
Sawk	-0.174** (0.085)	-0.139 (0.085)	-0.151* (0.086)
Sawsbuck	-0.207** (0.086)	-0.196** (0.086)	-0.224*** (0.086)
Sceptile	-0.182*** (0.023)	-0.152*** (0.048)	-0.157*** (0.048)
Scizor	0.054*** (0.011)	0.063*** (0.014)	0.069*** (0.014)
Scolipede	-0.038 (0.029)	-0.015 (0.029)	-0.022 (0.029)
Scrafty	-0.080** (0.036)	-0.070* (0.036)	-0.070* (0.036)
Scyther	-0.306*** (0.115)	-0.319*** (0.115)	-0.315*** (0.116)
Seaking	-0.004 (0.134)	-0.047 (0.135)	-0.011 (0.135)
Seismitoad	0.113*** (0.043)	0.076* (0.043)	-0.061 (0.061)
Serperior	-0.017 (0.013)	-0.011 (0.013)	-0.010 (0.013)
Servine	-0.910** (0.445)	-0.866* (0.443)	-0.890** (0.443)
Seviper	-0.137 (0.128)	-0.128 (0.128)	-0.107 (0.129)
Sharpedo	-0.077** (0.037)	-0.060 (0.064)	-0.067 (0.064)
Shaymin	0.020 (0.072)	0.012 (0.073)	0.020 (0.073)
Shedinja	-0.066 (0.050)	-0.047 (0.050)	-0.065 (0.051)
Shiftry	-0.282*** (0.077)	-0.281*** (0.077)	-0.279*** (0.078)
Shuckle	-0.043 (0.031)	-0.120*** (0.034)	-0.104** (0.041)
Sigilyph	-0.164*** (0.042)	-0.125*** (0.042)	-0.130*** (0.043)
Simipour	-0.804* (0.441)	-0.700 (0.451)	-0.699 (0.449)
Simisage	-0.104 (0.206)	-0.123 (0.207)	-0.106 (0.208)
Simisear	0.044 (0.320)	0.018 (0.323)	-0.003 (0.324)
Skarmory	0.056*** (0.013)	0.029** (0.015)	0.031* (0.019)
Skuntank	-0.132 (0.127)	-0.115 (0.127)	-0.109 (0.128)
Slaking	-0.189*** (0.063)	-0.180*** (0.064)	-0.181*** (0.064)
Slowbro	0.030** (0.015)	0.030* (0.017)	0.034** (0.017)
Slowking	0.040 (0.041)	0.047 (0.041)	0.050 (0.041)

Slurpuff	-0.085* (0.045)	-0.072 (0.045)	-0.073 (0.045)
Smeargle	-0.189*** (0.043)	-0.211*** (0.043)	-0.211*** (0.044)
Sneasel	0.708** (0.320)	0.625* (0.321)	0.718** (0.321)
Snorlax	-0.110*** (0.026)	-0.073*** (0.026)	-0.081*** (0.026)
Solrock	-0.010 (0.145)	-0.020 (0.146)	0.069 (0.183)
Spinda	-0.626*** (0.164)	-0.560*** (0.164)	-0.578*** (0.164)
Spiritomb	-0.003 (0.062)	0.018 (0.062)	0.017 (0.062)
Stantler	-0.041 (0.168)	-0.094 (0.169)	-0.109 (0.169)
Staraptor	-0.010 (0.024)	-0.002 (0.024)	-0.004 (0.024)
Starmie	0.042*** (0.013)	0.036*** (0.014)	0.046*** (0.014)
Steelix	-0.228*** (0.044)	-0.203*** (0.067)	-0.247*** (0.079)
Stoutland	-0.067 (0.087)	-0.053 (0.087)	-0.057 (0.087)
Stunfisk	-0.267 (0.173)	-0.292* (0.173)	-0.124 (0.244)
Sudowoodo	-0.536*** (0.158)	-0.544*** (0.159)	-0.486*** (0.178)
Suicune	-0.038 (0.032)	-0.018 (0.033)	-0.019 (0.033)
Sunflora	-0.157 (0.313)	-0.180 (0.315)	-0.195 (0.316)
Swalot	0.125 (0.183)	0.170 (0.183)	0.133 (0.183)
Swampert	-0.101*** (0.021)	-0.102*** (0.032)	-0.131*** (0.035)
Swanna	-0.402** (0.159)	-0.403** (0.159)	-0.424*** (0.160)
Swellow	-0.040 (0.064)	-0.032 (0.064)	-0.042 (0.064)
Swoobat	-0.298*** (0.101)	-0.287*** (0.101)	-0.277*** (0.101)
Sylveon	-0.052*** (0.014)	-0.047*** (0.014)	-0.042*** (0.014)
Talonflame	-0.013 (0.011)	-0.004 (0.011)	-0.003 (0.011)
Tangela	0.246* (0.146)	0.251* (0.147)	0.240 (0.147)
Tangrowth	-0.022 (0.054)	-0.024 (0.055)	-0.024 (0.055)
Tauros	-0.044 (0.089)	-0.065 (0.090)	-0.062 (0.090)
Tentacruel	0.021 (0.025)	0.032 (0.025)	0.038 (0.025)
Terrakion	0.001 (0.030)	-0.004 (0.031)	-0.042 (0.039)
Throh	-0.247** (0.116)	-0.230** (0.117)	-0.242** (0.117)
Thundurus	0.041*** (0.016)	0.038** (0.016)	0.041*** (0.016)
ThundurusT			
Togekiss	-0.045** (0.018)	-0.032* (0.018)	-0.032* (0.018)
Togetic	-0.050 (0.098)	-0.027 (0.098)	-0.023 (0.099)
Torkoal	0.025 (0.067)	-0.013 (0.067)	-0.035 (0.085)
Tornadus	0.091 (0.109)	0.121 (0.109)	0.109 (0.109)
TornadusT			
Torterra	-0.226*** (0.050)	-0.216*** (0.050)	-0.244*** (0.056)
Toxicroak	0.034 (0.037)	0.028 (0.037)	0.033 (0.037)
Trevenant	-0.115*** (0.039)	-0.110*** (0.039)	-0.111*** (0.039)
Tropius	-0.176* (0.099)	-0.135 (0.099)	-0.157 (0.100)
Typhlosion	-0.133*** (0.043)	-0.117*** (0.044)	-0.118*** (0.044)

Tyranitar	-0.052*** (0.013)	-0.024* (0.014)	-0.027 (0.017)
Tyrantrum	-0.091** (0.045)	-0.085* (0.045)	-0.092* (0.051)
Umbreon	-0.045** (0.022)	-0.035 (0.022)	-0.039* (0.022)
Unfezant	-0.296* (0.160)	-0.252 (0.160)	-0.243 (0.160)
Unown	-1.165*** (0.392)	-1.202*** (0.394)	-1.178*** (0.396)
Ursaring	-0.034 (0.081)	-0.017 (0.082)	-0.029 (0.082)
Uxie	-0.054 (0.095)	-0.063 (0.095)	-0.094 (0.118)
Vanilluxe	-0.107 (0.132)	-0.092 (0.132)	-0.108 (0.133)
Vaporeon	-0.099*** (0.028)	-0.089*** (0.0	-0.089*** (0.028)
Venomoth	-0.107 (0.100)	-0.099 (0.100)	-0.109 (0.101)
Venusaur	-0.047*** (0.014)	-0.119*** (0.030)	-0.124*** (0.030)
Vespiquen	-0.306** (0.134)	-0.328** (0.135)	-0.327** (0.135)
Vibrava	5.478 (36.577)	5.344 (36.577)	5.335 (36.577)
Victini	-0.045* (0.023)	-0.031 (0.023)	-0.031 (0.023)
Victreebel	-0.160* (0.095)	-0.180* (0.096)	-0.192** (0.096)
Vigoroth	-0.120 (0.138)	-0.093 (0.138)	-0.073 (0.141)
Vileplume	-0.194** (0.082)	-0.208** (0.082)	-0.197** (0.083)
Virizion	-0.139 (0.089)	-0.094 (0.089)	-0.103 (0.090)
Vivillon	-0.011 (0.066)	0.022 (0.067)	0.012 (0.067)
Volbeat	0.073 (0.109)	0.109 (0.110)	0.097 (0.110)
Volcarona	-0.016 (0.018)	-0.002 (0.018)	-0.002 (0.018)
Vullaby	-0.939** (0.450)	-0.905** (0.451)	-0.945** (0.451)
Wailord	-0.427** (0.176)	-0.396** (0.177)	-0.415** (0.177)
Walrein	-0.249*** (0.088)	-0.246*** (0.088)	-0.249*** (0.088)
Wartortle	-0.498** (0.241)	-0.501** (0.242)	-0.507** (0.243)
Watcho	-0.425 (0.292)	-0.402 (0.292)	-0.445 (0.293)
Weavile	0.004 (0.013)	0.007 (0.013)	0.007 (0.013)
Weezing	-0.017 (0.045)	0.0002 (0.045)	0.0002 (0.045)
Whimsicott	-0.066** (0.031)	-0.058* (0.031)	-0.060* (0.031)
Whiscash	0.032 (0.198)	0.079 (0.198)	0.060 (0.199)
Wigglytuff	-0.114 (0.132)	-0.088 (0.132)	-0.126 (0.142)
Wobbuffet	-0.213** (0.101)	-0.181* (0.101)	-0.201** (0.101)
Wormadam	-4.023 (36.574)	-4.063 (36.574)	-4.056 (36.574)
WormadamSandy	-0.655 (0.483)	-0.697 (0.485)	-0.587 (0.685)
WormadamTrash	-4.137 (18.258)	-4.093 (18.276)	-4.095 (25.862)
Xatu	0.102 (0.066)	0.111* (0.066)	0.115* (0.066)
Yanmega	0.063 (0.064)	0.068 (0.064)	0.059 (0.064)
Zangoose	-0.142** (0.069)	-0.136** (0.069)	-0.151** (0.069)
Zapdos	0.060** (0.024)	0.074*** (0.024)	0.078*** (0.024)
Zebstrika	-0.250** (0.111)	-0.229** (0.111)	-0.236** (0.112)
Zoroark	-0.032 (0.035)	-0.014 (0.035)	-0.022 (0.035)

Zweilous	5.112 (25.864)		5.018 (25.864)	4.952 (25.864)
Zygarde	-0.060 (0.045)		-0.029 (0.045)	-0.032 (0.045)
Abomasite		-0.063 (0.081)	-0.067 (0.081)	
Abite		-0.188*** (0.045)		
Aerotylite		-0.133*** (0.033)	-0.200** (0.079)	-0.199** (0.079)
Aggron		-0.061* (0.035)	-0.053 (0.062)	-0.059 (0.062)
Alakazit		-0.201*** (0.038)	-0.084 (0.056)	-0.066 (0.057)
Altarianit		-0.058*** (0.019)	-0.115*** (0.026)	-0.114*** (0.026)
Ampharosite		0.021 (0.019)	0.188* (0.096)	0.179* (0.096)
Audinite		-0.104*** (0.039)	0.256*** (0.078)	0.254*** (0.078)
Banettite		-0.292*** (0.080)	-0.279** (0.133)	-0.254* (0.133)
Beedrillite		-0.228*** (0.046)	0.155 (0.142)	0.170 (0.142)
Blastoisinite		-0.124*** (0.029)	-0.049 (0.046)	-0.046 (0.046)
Cameruptite		-0.205*** (0.070)	-0.179 (0.158)	-0.164 (0.159)
Charizarditex		-0.052*** (0.014)	0.196*** (0.038)	0.194*** (0.038)
Charizarditey		-0.048*** (0.015)	0.245*** (0.038)	0.242*** (0.038)
Diancite		0.107*** (0.018)	0.080 (0.058)	0.066 (0.058)
Galladite		-0.044** (0.022)	0.085 (0.061)	0.082 (0.061)
Garchompite		-0.161*** (0.025)	-0.177*** (0.027)	-0.177*** (0.027)
Gardevoirite		0.001 (0.017)	0.007 (0.035)	0.005 (0.035)
Glalitite		-0.159** (0.075)	-0.028 (0.208)	-0.024 (0.208)
Gyaradosite		0.014 (0.021)	-0.057* (0.030)	-0.055* (0.030)
Heracronite		0.068*** (0.026)	-0.059 (0.047)	-0.057 (0.047)
Houndoominite		-0.132*** (0.043)	0.035 (0.089)	0.035 (0.089)
Latiasite		0.035 (0.042)	-0.092** (0.045)	-0.101** (0.045)
Latiosite		-0.217*** (0.039)	-0.288*** (0.041)	-0.296*** (0.041)
Lopunnite		0.102*** (0.016)	0.273*** (0.080)	0.274*** (0.080)
Manectite		0.094*** (0.018)	0.066 (0.063)	0.072 (0.063)
Medichamite		0.097*** (0.020)	0.111 (0.076)	0.119 (0.076)
Metagrossite		0.058*** (0.016)	0.013 (0.033)	0.008 (0.033)
Pidgeotite		-0.072** (0.029)	0.090 (0.102)	0.087 (0.102)
Pinsirite		0.091*** (0.020)	0.124 (0.103)	0.126 (0.103)
Sablenite		0.079*** (0.017)	-0.005 (0.030)	-0.001 (0.030)
Sceptilite		-0.175*** (0.024)	-0.020 (0.053)	-0.021 (0.053)
Scizorite		0.126*** (0.015)	-0.030 (0.020)	-0.027 (0.020)
Sharpedonite		-0.040 (0.043)	-0.043 (0.077)	-0.033 (0.077)
Slowbronite		0.083*** (0.028)	-0.007 (0.032)	-0.007 (0.033)
Steelixite		-0.321*** (0.053)	-0.084 (0.084)	-0.082 (0.085)
Swampertite		-0.065*** (0.023)	-0.004 (0.042)	-0.005 (0.042)
Tyranitarite		-0.115*** (0.025)	-0.121*** (0.029)	-0.131*** (0.029)
Venusaurite		0.039** (0.015)	0.081** (0.033)	0.086** (0.033)

Constant	-0.085***(0.004)	0.083***(0.017)	0.005 (0.007)	0.027 (0.018)	0.068*** (0.018)
Observations	141,154	141,154	141,154	141,154	141,154
Log Likelihood	-97,132.680	-96,235.580	-97,454.260	-95,725.700	-95,763.950
Akaike Inf. Crit.	194,283.400	193,281.200	194,986.500	192,353.400	192,607.900
Note:					*p<0.1; **p<0.05; ***p<0.01

In the main Rmd file

```
# This chunk ensures that the thesisdown package is
# installed and loaded. This thesisdown package includes
# the template files for the thesis.
if(!require(devtools))
  install.packages("devtools", repos = "http://cran.rstudio.com")
if(!require(thesisdown))
  devtools::install_github("ismayc/thesisdown")
library(thesisdown)
```

In Chapter ??:

```
# This chunk ensures that the thesisdown package is
# installed and loaded. This thesisdown package includes
```

```
# the template files for the thesis and also two functions
# used for labeling and referencing
if(!require(devtools))
  install.packages("devtools", repos = "http://cran.rstudio.com")
if(!require(dplyr))
    install.packages("dplyr", repos = "http://cran.rstudio.com")
if(!require(ggplot2))
    install.packages("ggplot2", repos = "http://cran.rstudio.com")
if(!require(ggplot2))
    install.packages("bookdown", repos = "http://cran.rstudio.com")
if(!require(thesisdown)){
  library(devtools)
  devtools::install_github("ismayc/thesisdown")
  }
library(thesisdown)
load("data/d1.Rda")
```

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