Empirical Results

Model Specification

As Pokémon battles have only two outcomes, we may estimate the probability of winning using a standard probit model. There are minor differences between using a logit and probit models, so the choice of probit is simply a personal choice. Additionally, each battle is utilized as two separate observations, one observation for each player. As for the models, let Y denote the outcome of any battle for a given player, where Y takes the value of 0 if the player loses the battle and 1 if the player wins.To identify whether specific moves and Pokémon choices differentially impact the probability of winning a game, we define the dependent variable of the models as $f^{-1}(P(Y=1))$, where f is the probit function.

Surprisingly, there were no draws in the dataset, perhaps alluding to a small liklihood for a draw to occur. Nonetheless, to address the question of whether any entry hazards positively impact a player's liklihood of winning, we develop a number of different probit models.

Beginning with whether a specific move was used by a player in a battle, let the set of all entry hazards be denoted S_1. We define the set of moves as: S ={Stealth Rock, Spikes, Toxic Spikes, Sticky Web, Dragon Tail, Roar, Circle Throw, Whirlwind}.
Let S_1 denote the set of entry hazards. That is, S_1={Stealth Rock, Spikes, Toxic Spikes, Sticky Web}. Similarly let S_2 denote the set of all complementary moves to entry hazards, or S/S_1. By definition, $S = S_1 \cup S_2$. This distinction is important for later model specifications. Additionally, for simplicity let the elements of the set S be defined by the acronym of each move, i.e. Stealth Rock is denoted SR.

Then, define a random count variable on the set S that takes the value of how many times a specified move is used in a battle. As an example, let M_{SR} be the random variable that counts the number of times Stealth Rock was used in a battle. The variable takes value 1 when Stealth Rock is used once in a battle and 0 if it was not used at all by a player in a battle. We define the variables M_S,M_{TS},M_{SW},M_{DT},M_R,M_{CT}, and M_W similarly. These variables will be an interacted term in later models, but they may provide strategic value beyond their interactions. For this reasons they will be included in the preliminary model. The preliminary model is given by:

$(1) : f^{-1}(P(Y=1)) = \alpha + \sum_{i \in S} \beta_i (M_i)$

This study focuses particularly on the interactions and repeated use of the specified moves. Interactions in particular focus on Stealth Rock, notably because it directly damages Pokémon that switch in and because it can only be used once, making interaction terms easier to interprete than interactions with moves that can be used multiple times. Nonetheless, the squared term for Stealth Rock is included in the second model to test whether reapplying the move is an effective battling strategy. That being said, the model for including the squared term of moves is given as follows:

$(2) : f^{-1}(P(Y=1)) = \alpha + \sum_{i \in S} \beta_i (M_i) + \sum_{i \in S} \iota_i (M_i)^2$

We then include interactions between different moves and their squared terms. The coresponding model (3) is given by:

$(3) : f^{-1}(P(Y=1)) = \alpha + \sum_{i \in S} \beta_i (M_i) + \sum_{i \in S} \iota_i (M_i)^2 + \sum_{j \in S/SR} \theta_j (M_{SR} \times M_j) + \sum_{j \in S/SR} \lambda_j (M_{SR} \times (M_j)^2)$

These models have not yet included the vast variety of species composing teams. Before defining these models, we must first define the set of all competitive Pokémon and mega-Pokémon. To begin with the former, let the set of all competitive Pokémon be denoted P, where $P = \{Abomasnow, ..., Zygarde\}$. The full list of Pokémon and their frequency of use in the dataset is included in the Appendix. There are 415 elements in the set P and 39 in the set G, where G is the set of all Mega-Pokémon allowed in the OU format. Let P_1 be the first element in the set of Pokémon P. Let the numerical index apply for all 415 Pokémon. Similarly define G_1 as the first mega-Pokémon in the set G. Then we index the set of 39 mega-Pokémon numerically.

Following the indexing of the set of Pokémon and mega-Pokémon, we construct a number of random variables that act as indicator variables for whether the Pokémon was used in a battle by a player. Hence, we define the random variable for using the first Pokémon on the competitive roster as PU_1, which takes the value 1 if the first Pokémon on the competitive roster is used and 0 otherwise. This is applied iteratively across all 415 competitive Pokémon. Furthermore, let GU_1 denote the first mega-Pokémon included in the mega-Pokémon roster, and similarly applying this methodology across as 39 mega-Pokémon available in the OU format.

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:

$(4) : f^{-1}(P(Y=1)) = \alpha + \sum_{i \in S} \beta_i(M_i) + \sum_{i \in S} \iota_i(M_i)^2 + \sum_{j \in S/SR} \theta_j(M_{SR} \times M_j) + \sum_{j \in S/SR} \lambda_j(M_{SR} \times (M_j)^2) + \sum_{l \in P} \gamma_l(PU_l)$

Thirty nine 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. The model is given by:

$(5) : f^{-1}(P(Y=1)) = \alpha + \sum_{i \in S} \beta_i(M_i) + \sum_{i \in S} \iota_i(M_i)^2 + \sum_{j \in S/SR} \theta_j(M_{SR} \times M_j) + \sum_{j \in S/SR} \lambda_j(M_{SR} \times (M_j)^2) + \sum_{l \in P} \gamma_l(PU_l) + \sum_{k \in G} \tau_k(GU_k)$

After these six model specifications, the combination of models (1) through (3) are given following the combination of models (4) and (5). These are included to compare the coefficients, or the marginal effects of move, Pokémon, and Mega-Pokémon choice on the liklihood of winning a Pokémon battle holding all other factors considered equal. By doing so, the coefficients track whether a player won or lost more often when utilizing a move their opponent didn't use, for example.

After the first five models, the moves will be categorized by whether entry hazards were used 'early' or 'late' in a battle. The distinction between when early and late is distinguished by a specific line in the battle log, as each battle log is composed of a number of lines of code corresponding to the moves and outcomes of each turn. Though the cutoff point is determined arbitrarily, the cutoff effectively corresponds to whether a move was used before or after the 5th turn of a battle. With this in mind, we simply create an indicator variable that acts on the set E, where $E = \{Early, Late\}$. Similar to the use of acronyms used previously, E_e denotes early and E_l denotes late. Compared to models (1) through (5), models (6) through (10) do not count the number of times a specified move was used in a battle, specifically entry hazards. Instead, models (6) through (10) use an indicator variable for whether an entry hazard was used.

Thus we define a random indicator variable on the set S to takes the value 1 if a specified move is used in a battle and 0 otherwise. As an example, let I_{SR} be the random variable that indicates whether Stealth Rock was used in a battle. The variable takes value 1 when Stealth Rock is used and 0 if it was not used by a player in a battle. We define the variables I_S,I_{TS}, and I_{SW} similarly, but we do not construct indicator variables for the complementary moves. Thus, for model (6), we have the simple model differentiating between whether an entry hazard was used before or after the 5th turn, given by:

$(6) : f^{-1}(P(Y=1)) = \alpha + \sum_{n \in E} \sum_{i \in S_1} \beta_{n,i}(E_n)(I_i) + \sum_{i \in S_2} \delta_i(M_i)$

Similar to model (2), we include the squared term for count variables. However, this only includes moves complementary to the use of entry hazards. Including the squared terms for complementary moves yields the following model specification:

$(7) : f^{-1}(P(Y=1)) = \alpha + \sum_{n \in E} \sum_{i \in S_1} \beta_{n,i}(E_n)(I_i) + \sum_{i \in S_2} \delta_i(M_i) + \sum_{i \in S_2} \iota_i(M_i)^2$

$(8) : f^{-1}(P(Y=1)) = \alpha + \sum_{n \in E} \sum_{i \in S_1} \beta_{n,i}(E_n)(I_i) + \sum_{i \in S_2} \delta_i(M_i) + \sum_{i \in S_2} \iota_i(M_i)^2 + \sum_{n \in E} \sum_{j \in S_2} \theta_{n,j}((E_n)I_{SR} \times M_j) + \sum_{m \in E} \sum_{n \in E} \sum_{j \in S_2} \lambda_{m,n,j}((E_m)I_{SR} \times (E_n)(M_j)^2) + \sum_{m \in E} \sum_{n \in E} \sum_{j \in S_1/SR} \eta_{m,n,j}((E_m)I_{SR} \times (E_n)(I_j)) + \mu((E_e)I_{SR} \times (E_l)I_{SR})$

Following this, we follow a similar construction of models (4) and (5) for models (9) and (10) respectively. Thus, the final two models are given as follows:

$(9) : f^{-1}(P(Y=1)) = \alpha + \sum_{n \in E} \sum_{i \in S_1} \beta_{n,i}(E_n)(I_i) + \sum_{i \in S_2} \delta_i(M_i) + \sum_{i \in S_2} \iota_i(M_i)^2 + \sum_{n \in E} \sum_{j \in S_2} \theta_{n,j}((E_n)I_{SR} \times M_j) + \sum_{m \in E} \sum_{n \in E} \sum_{j \in S_2} \lambda_{m,n,j}((E_m)I_{SR} \times (E_n)(M_j)^2) + \sum_{m \in E} \sum_{n \in E} \sum_{j \in S_1/SR} \eta_{m,n,j}((E_m)I_{SR} \times (E_n)(I_j)) + \mu((E_e)I_{SR} \times (E_l)I_{SR}) + \sum_{l \in P} \gamma_l(PU_l)$

$(10): f^{-1}(P(Y=1)) = \alpha + \sum_{n \in E} \sum_{i \in S_1} \beta_{n,i}(E_n)(I_i) + \sum_{i \in S_2} \delta_i(M_i) + \sum_{i \in S_2} \iota_i(M_i)^2 + \sum_{n \in E} \sum_{j \in S_2} \theta_{n,j}((E_n)I_{SR} \times M_j) + \sum_{m \in E} \sum_{n \in E} \sum_{j \in S_2} \lambda_{m,n,j}((E_m)I_{SR} \times (E_n)(M_j)^2) + \sum_{m \in E} \sum_{n \in E} \sum_{j \in S_1/SR} \eta_{m,n,j}((E_m)I_{SR} \times (E_n)(I_j)) + \mu((E_e)I_{SR} \times (E_l)I_{SR}) + \sum_{l \in P} \gamma_l(PU_l) + \sum_{k \in G} \tau_k(GU_k)$

Interpretation

The summary of the variables used in the models are a preliminary point of interest. While the count variables, game length, player rank, and a number of other variables are included in this section, Figure 2 is lacking any details on team composition. For the sake of brevity, these will be briefly touched upon. The full list of summary statistics for Pokémon and Mega-Pokémon is found in Appendix A and B respectively. That being said, the average game length is sixteen turns. However, the standard deviation is nearly 12 turns with a maximum value of 171 and a minimum value of 0. As games lasting zero turns do not provide any meaningful information about player's decisions they are excluded from all regressions used henceforth. 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. This is an interesting feature of the data, but all regressions used in this study are composed of the entire sample. It may be possible that there are differences between high and low rank battles, but this point is not explored in greater detail.

Table 1: Non-Pokémon Summary Table

Statistic	Mean	St. Dev.	Min	Max
Outcome	0.500	0.500	0	1
Rank	1,153.582	128.706	1,000.000	1,836.428
Battle_Length	16.433	12.018	0	289

Table 2: Non-Pokémon Summary Table

Statistic	Mean	St. Dev.
Circle_Throw	0.001	0.052
Stealth_Rock	0.389	0.642
Spikes	0.127	0.552
Toxic_Spikes	0.023	0.199
Sticky_Web	0.019	0.149
Dragon_Tail	0.055	0.349
Roar	0.027	0.255
Whirlwind	0.035	0.334
Early_Stealth_Rock	0.222	0.416
Late_Stealth_Rock	0.139	0.346
Early_Spikes	0.040	0.195
Late_Spikes	0.038	0.191
Early_Toxic_Spikes	0.011	0.104
Late_Toxic_Spikes	0.007	0.082
Early_Sticky_Web	0.015	0.121
Late_Sticky_Web	0.004	0.061

In regards to Pokémon and Mega-Pokémon statistics, nearly half of the most frequently used Pokémon, that of Alakazam, Banette, and Garchomp, have a Mega-evolution. Within this group of three Garchomp may be considered an 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. Though specifically in regards to the Mega-evolution usage statistics, the four most frequently used Mega-Pokémon are Mega-Venusaur, Mega-Scizor, along with both Mega-evolutions of Charizard. This is surprising, given that Alakazam, Banette, and Garchomp are not the most frequently used Mega-evolutions yet appear so frequently in the initial usage statistics. This may be evidence to the fact that players prefer to use these Pokémon's regular form in lieu of their Mega-evolutions.

Another interesting point shown in the summary statistics is that Mega-Pokémon are not always utilized by players. This is shown 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 an interesting extension to this study to test whether utilizing any Mega-Pokémon positively impacts the marginal probability of a player winning a battle. Nonetheless, an stand-out feature of the summary statistics is that player's did not utilize Pokémon that were banned in the following years any more than other Pokémon.

However, the models provide meaningful information about whether specific moves and/or Pokémon positively or negatively impact the marginal win probability of players. Table 3.2 provides the output of a generalized linear probit model of specifications (1) through (3). However, given that the count variables only take values of 0 or 1, model specification (2) does not improve the quality of the model. Though disheartening, this does provide more reason to take into account the interaction between different move variables.

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Due to the primary focus on the move Stealth Rock, the move is interacted with the six other specified moves in model (2). Furthermore, Table 3.2 indicates that the model is improved by the inclusion of move interactions. When just the move Dragon Tail is used by players, they tend to lose more than win. However, surprisingly the interaction between Stealth Rock and Dragon Tail is positive and statistically significant. This is an indication that supplementary moves can positively impact a player's win outcome. Taken literally, utilizing either Stealth Rock or Stealth Rock and Dragon Tail will increase the marginal probability of winning a battle anywhere from 26.5% to 19.7% and 13.5% to 16.4% respectively. However, this interpretation should be taken with some hesistance, as the magnitude of using just Stealth Rock is greater than the interaction between Dragon Tail and Stealth Rock. Not only this, the coefficeints report the marginal impact of using a move holding all other factors constant and in comparison to any players that did not utilize that move. Furthermore, the two other moves Whirlwind and Roar are negative and statistically insignificant. Thus, Table 3.2 indicates some preliminary evidence that entry hazards not only influence the marginal win probability of players, but that they do so to considerably different degrees.

Following the preliminary models of (1) through (3) in Table 3.2, let us consider models (4) through (6). Table 3.3 is the output from these models, but the coefficients of the Pokémon and Mega-Pokémon are not shown for the sake of space. Additionally, it is important to note that these variables only provide the marginal impact of choosing one Pokémon or Mega-Pokémon. These variables noticeably provide scant prescriptive use, as they do not include the 415 choose 6 different teams possible under the specifications explored. Furthermore, even the 415 choose 6 different Pokémon teams possible does not include the different Mega-Pokémon options. Needless to say, Table 3.3 provides evidence about the robustness of the move variables and quality of model specifications.

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Table 3: Models 1-3 Basic Move Set

	Dependent variable:		
	Outcome		
	(1)	(2)	(3)
Stealth_Rock	0.153***	0.192***	0.200***
	(0.003)	(0.004)	(0.004)
Spikes	0.034***	0.043***	0.063***
	(0.004)	(0.005)	(0.006)
Toxic_Spikes	−0.071***	−0.107***	−0.090***
	(0.011)	(0.021)	(0.028)
Dragon_Tail	−0.005	−0.014	−0.045***
	(0.006)	(0.009)	(0.014)
Roar	−0.019**	−0.037***	−0.031
	(0.008)	(0.012)	(0.020)
Whirlwind	0.010*	0.004	0.017
	(0.006)	(0.008)	(0.012)
Circle_Throw	0.004	0.007	−0.055
	(0.037)	(0.073)	(0.082)
Observations	424,894	424,894	424,894
Log Likelihood	−293,162.400	−292,921.600	−292,863.000
Akaike Inf. Crit.	586,342.900	585,877.300	585,787.900
Note:			*p<0.1; **p<0.05; ***p<0.01 Standard Errors shown in parenthesis.

Table 4: Models 1-3 Squared Move Set.

	Dependent variable:		
		Outcome	
	(1)	(2)	(3)
Circle_Throw2		-0.0004	0.006
		(0.011)	(0.012)
Stealth_Rock2		-0.009^{***}	-0.009^{***}
		(0.0005)	(0.001)
Spikes2		-0.002^{***}	-0.004^{***}
		(0.001)	(0.001)
Toxic_Spikes2		0.014^{*}	0.008
		(0.008)	(0.012)
Sticky_Web2		-0.011	-0.004
		(0.008)	(0.011)
Dragon_Tail2		0.001	0.006^{**}
		(0.002)	(0.003)
Roar2		0.003	0.005
		(0.002)	(0.004)
Whirlwind2		0.0004	0.001
		(0.001)	(0.001)
Observations	424,894	424,894	424,894
Log Likelihood	$-293,162.400$	$-292,921.600$	$-292,863.000$
Akaike Inf. Crit.	586,342.900	585,877.300	585,787.900
Note:			*p<0.1; **p<0.05; ***p<0.01
			Standard Errors shown in parenthesis.

Table 5: Models 1-3 Squared Move Set with Interactions

	Dependent variable:		
	Outcome		
	(1)	(2)	(3)
Stealth_Rock_Spikes2			0.001^{***}
			(0.0002)
Stealth_Rock_Sticky_Web2			0.007^{**}
			(0.003)
Stealth_Rock_Toxic_Spikes2			0.015
			(0.010)
Stealth_Rock_Whirlwind2			−0.00001
			(0.001)
Stealth_Rock_Dragon_Tail2			-0.005^{***}
			(0.002)
Stealth_Rock_Roar2			−0.001
			(0.002)
Stealth_Rock_Circle_Throw2			−0.041
			(0.037)
Observations	424,894	424,894	424,894
Log Likelihood	−293,162.400	−292,921.600	−292,863.000
Akaike Inf. Crit.	586,342.900	585,877.300	585,787.900
Note:			*p<0.1; **p<0.05; ***p<0.01
			Standard Errors shown in parenthesis.

Table 6: Models 1-3 Move Set Interactions

	Dependent variable:		
	Outcome		
	(1)	(2)	(3)
Stealth_Rock_Spikes			-0.023^{***}
			(0.004)
Stealth_Rock_Sticky_Web			-0.101^{***}
			(0.022)
Stealth_Rock_Toxic_Spikes			-0.051^{*}
			(0.028)
Stealth_Rock_Whirlwind			-0.011
			(0.007)
Stealth_Rock_Dragon_Tail			0.030^{***}
			(0.011)
Stealth_Rock_Roar			-0.009
			(0.014)
Stealth_Rock_Circle_Throw			0.290
			(0.186)
Observations	424,894	424,894	424,894
Log Likelihood	$-293,162.400$	$-292,921.600$	$-292,863.000$
Akaike Inf. Crit.	586,342.900	585,877.300	585,787.900
Note:			*p<0.1; **p<0.05; ***p<0.01
			Standard Errors shown in parenthesis.

Table 7: Models 6-8 Basic Move Set

	Dependent variable:		
	Outcome		
	(1)	(2)	(3)
Early_Stealth_Rock	0.247***	0.247***	0.250***
	(0.005)	(0.005)	(0.005)
Late_Stealth_Rock	0.184***	0.185***	0.190***
	(0.006)	(0.006)	(0.006)
Early_Spikes	0.051***	0.051***	0.070***
	(0.012)	(0.012)	(0.017)
Late_Spikes	0.087***	0.088***	0.122***
	(0.012)	(0.012)	(0.018)
Early_Toxic_Spikes	−0.094***	−0.094***	−0.075***
	(0.022)	(0.022)	(0.029)
Late_Toxic_Spikes	−0.160***	−0.160***	−0.183***
	(0.026)	(0.026)	(0.037)
Early_Sticky_Web	0.016	0.016	0.067***
	(0.016)	(0.016)	(0.020)
Late_Sticky_Web	−0.096***	−0.097***	−0.038
	(0.032)	(0.032)	(0.044)
Observations	424,894	424,894	424,894
Log Likelihood	−292,600.000	−292,597.000	−292,536.500
Akaike Inf. Crit.	585,225.900	585,228.000	585,163.000

Note: *p<0.1; **p<0.05; ***p<0.01
Standard Errors shown in parenthesis.

Table 8: Models 6-8 Entry Hazards

	Dependent variable:		
	Outcome		
	(1)	(2)	(3)
Early_Stealth_Rock2			
Early_Spikes2			
Early_Toxic_Spikes2			
Early_Sticky_Web2			
Late_Stealth_Rock2			
Late_Spikes2			
Late_Toxic_Spikes2			
Late_Sticky_Web2			
Observations	424,894	424,894	424,894
Log Likelihood	−292,600.000	−292,597.000	−292,536.500
Akaike Inf. Crit.	585,225.900	585,228.000	585,163.000
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 9: Models 6-8 Complementary Move Set and Early Entry Hazards

	Dependent variable:		
		Outcome	
	(1)	(2)	(3)
Circle_Throw2		−0.0003	0.005
		(0.011)	(0.012)
Dragon_Tail2		0.003	0.017***
		(0.002)	(0.004)
Roar2		0.003*	0.007
		(0.002)	(0.006)
Whirlwind2		0.001	−0.00002
		(0.001)	(0.002)
Early_Stealth_RockXEarly_Spikes2			
Early_Stealth_RockXEarly_Sticky_Web2			
Early_Stealth_RockXEarly_Toxic_Spikes2			
Observations	424,894	424,894	424,894
Log Likelihood	−292,600.000	−292,597.000	−292,536.500
Akaike Inf. Crit.	585,225.900	585,228.000	585,163.000
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 10: Models 6-8 Complementary Move Set and Early Entry Hazards

	Dependent variable:		
	Outcome		
	(1)	(2)	(3)
Early_Stealth_RockXLate_Spikes2			
Early_Stealth_RockXLate_Sticky_Web2			
Early_Stealth_RockXLate_Toxic_Spikes2			
Early_Stealth_RockXWhirlwind2			0.002
			(0.002)
Early_Stealth_RockXDragon_Tail2			-0.015^{***}
			(0.005)
Early_Stealth_RockXRoar2			-0.0003
			(0.006)
Early_Stealth_RockXCircle_Throw2			0.046
			(0.071)
Observations	424,894	424,894	424,894
Log Likelihood	$-292{,}600.000$	$-292{,}597.000$	$-292{,}536.500$
Akaike Inf. Crit.	585,225.900	585,228.000	585,163.000
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 11: Models 6-8 Early and Late Move Set Interactions

	Dependent variable:		
	Outcome		
	(1)	(2)	(3)
Late_Stealth_RockXLate_Spikes2			
Late_Stealth_RockXLate_Sticky_Web2			
Late_Stealth_RockXLate_Toxic_Spikes2			
Late_Stealth_RockXEarly_Spikes2			
Late_Stealth_RockXEarly_Sticky_Web2			
Late_Stealth_RockXEarly_Toxic_Spikes2			
Late_Stealth_RockXWhirlwind2			0.001
			(0.002)
Late_Stealth_RockXDragon_Tail2			-0.019^{***}
			(0.005)
Late_Stealth_RockXRoar2			-0.006
			(0.006)
Late_Stealth_RockXCircle_Throw2			-0.231^{**}
			(0.107)
Observations	424,894	424,894	424,894
Log Likelihood	$-292,600.000$	$-292,597.000$	$-292,536.500$
Akaike Inf. Crit.	585,225.900	585,228.000	585,163.000
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 12: Models 6-8 Early and Late Move Set Interactions Cont.

	Dependent variable:		
	Outcome		
	(1)	(2)	(3)
Early_Stealth_RockXEarly_Spikes			−0.029
			(0.025)
Early_Stealth_RockXLate_Spikes			−0.048*
			(0.025)
Early_Stealth_RockXEarly_Sticky_Web			−0.121***
			(0.035)
Early_Stealth_RockXLate_Sticky_Web			−0.219***
			(0.077)
Early_Stealth_RockXEarly_Toxic_Spikes			−0.093*
			(0.049)
Early_Stealth_RockXLate_Toxic_Spikes			0.010
			(0.059)
Early_Stealth_RockXWhirlwind			−0.037*
			(0.019)
Early_Stealth_RockXDragon_Tail			0.119***
			(0.021)
Observations	424,894	424,894	424,894
Log Likelihood	−292,600.000	−292,597.000	−292,536.500
Akaike Inf. Crit.	585,225.900	585,228.000	585,163.000
Note:			*p<0.1; **p<0.05; ***p<0.01 Standard Errors shown in parenthesis.

Table 13: Models 6-8 (Interactions and Basic Roster) Cont.

	Dependent variable:		
	Outcome		
	(1)	(2)	(3)
Early_Stealth_RockXRoar			0.021
			(0.029)
Early_Stealth_RockXCircle_Throw			−0.019
			(0.263)
Late_Stealth_RockXEarly_Spikes			−0.043
			(0.030)
Late_Stealth_RockXLate_Spikes			−0.047*
			(0.025)
Late_Stealth_RockXEarly_Sticky_Web			−0.133**
			(0.055)
Late_Stealth_RockXLate_Sticky_Web			−0.006
			(0.071)
Late_Stealth_RockXEarly_Toxic_Spikes			0.014
			(0.062)
Late_Stealth_RockXLate_Toxic_Spikes			0.052
			(0.060)
Observations	424,894	424,894	424,894
Log Likelihood	−292,600.000	−292,597.000	−292,536.500
Akaike Inf. Crit.	585,225.900	585,228.000	585,163.000
Note:			*p<0.1; **p<0.05; ***p<0.01
			Standard Errors shown in parenthesis.

Table 14: Models 6-8 Complementary Move Set and Late InteractionsCont.

	Dependent variable:		
	Outcome		
	(1)	(2)	(3)
Dragon_Tail	−0.015***	−0.024***	−0.115***
	(0.006)	(0.009)	(0.017)
Roar	−0.024***	−0.040***	−0.063**
	(0.008)	(0.012)	(0.026)
Whirlwind	0.010*	0.005	0.035**
	(0.006)	(0.008)	(0.016)
Circle_Throw	0.005	0.006	−0.040
	(0.037)	(0.073)	(0.082)
Late_Stealth_RockXWhirlwind			−0.033*
			(0.018)
Late_Stealth_RockXDragon_Tail			0.093***
			(0.022)
Late_Stealth_RockXRoar			0.024
			(0.029)
Late_Stealth_RockXCircle_Throw			0.998**
			(0.450)
Observations	424,894	424,894	424,894
Log Likelihood	−292,600.000	−292,597.000	−292,536.500
Akaike Inf. Crit.	585,225.900	585,228.000	585,163.000
Note:			*p<0.1; **p<0.05; ***p<0.01 Standard Errors shown in parenthesis.

Table 15: Models 3-5 Basic Move Set

	Dependent variable:		
	Outcome		
	(1)	(2)	(3)
Stealth_Rock	0.200***	0.140***	0.137***
	(0.004)	(0.004)	(0.004)
Spikes	0.063***	0.049***	0.048***
	(0.006)	(0.007)	(0.007)
Toxic_Spikes	−0.090***	0.007	0.010
	(0.028)	(0.028)	(0.028)
Dragon_Tail	−0.045***	−0.062***	−0.069***
	(0.014)	(0.014)	(0.014)
Roar	−0.031	−0.021	−0.022
	(0.020)	(0.020)	(0.020)
Whirlwind	0.017	−0.004	−0.005
	(0.012)	(0.013)	(0.013)
Circle_Throw	−0.055	0.017	0.017
	(0.082)	(0.083)	(0.083)
Observations	424,894	424,894	424,894
Log Likelihood	−292,863.000	−289,365.000	−289,071.800
Akaike Inf. Crit.	585,787.900	579,602.000	579,091.600
Note:			*p<0.1; **p<0.05; ***p<0.01
			Standard Errors shown in parenthesis.

Table 16: Models 3-5 Squared Move Sets.

	Dependent variable:		
	Outcome		
	(1)	(2)	(3)
Circle_Throw2	0.006	−0.003	−0.002
	(0.012)	(0.012)	(0.012)
Stealth_Rock2	−0.009***	−0.006***	−0.006***
	(0.001)	(0.001)	(0.001)
Spikes2	−0.004***	−0.003***	−0.003***
	(0.001)	(0.001)	(0.001)
Toxic_Spikes2	0.008	−0.013	−0.013
	(0.012)	(0.011)	(0.011)
Sticky_Web2	−0.004	−0.023*	−0.023*
	(0.011)	(0.013)	(0.013)
Dragon_Tail2	0.006**	0.008***	0.009***
	(0.003)	(0.003)	(0.003)
Roar2	0.005	0.005	0.004
	(0.004)	(0.004)	(0.004)
Whirlwind2	0.001	0.002	0.002
	(0.001)	(0.002)	(0.002)
Observations	424,894	424,894	424,894
Log Likelihood	−292,863.000	−289,365.000	−289,071.800
Akaike Inf. Crit.	585,787.900	579,602.000	579,091.600
Note:			*p<0.1; **p<0.05; ***p<0.01 Standard Errors shown in parenthesis.

Table 17: Models 3-5 Squared Move Sets with Interactions

	Dependent variable:		
	Outcome		
	(1)	(2)	(3)
Stealth_Rock_Spikes2	0.001***	0.001***	0.001***
	(0.0002)	(0.0002)	(0.0002)
Stealth_Rock_Sticky_Web2	0.007**	−0.001	−0.002
	(0.003)	(0.014)	(0.014)
Stealth_Rock_Toxic_Spikes2	0.015	0.015*	0.016*
	(0.010)	(0.009)	(0.009)
Stealth_Rock_Whirlwind2	−0.00001	−0.0005	−0.001
	(0.001)	(0.001)	(0.001)
Stealth_Rock_Dragon_Tail2	−0.005***	−0.005***	−0.005***
	(0.002)	(0.002)	(0.002)
Stealth_Rock_Roar2	−0.001	−0.001	−0.001
	(0.002)	(0.002)	(0.002)
Stealth_Rock_Circle_Throw2	−0.041	−0.035	−0.035
	(0.037)	(0.037)	(0.037)
Observations	424,894	424,894	424,894
Log Likelihood	−292,863.000	−289,365.000	−289,071.800
Akaike Inf. Crit.	585,787.900	579,602.000	579,091.600
Note:			*p<0.1; **p<0.05; ***p<0.01 Standard Errors shown in parenthesis.

Table 18: Models 3-5 Mve Set Interactions

	Dependent variable:		
	Outcome		
	(1)	(2)	(3)
Stealth_Rock_Spikes	-0.023^{***}	-0.014^{***}	-0.013^{***}
	(0.004)	(0.004)	(0.004)
Stealth_Rock_Sticky_Web	-0.101^{***}	-0.048	-0.041
	(0.022)	(0.034)	(0.034)
Stealth_Rock_Toxic_Spikes	-0.051^{*}	-0.041	-0.041
	(0.028)	(0.028)	(0.028)
Stealth_Rock_Whirlwind	-0.011	-0.003	-0.003
	(0.007)	(0.008)	(0.007)
Stealth_Rock_Dragon_Tail	0.030^{***}	0.032^{***}	0.030^{***}
	(0.011)	(0.011)	(0.011)
Stealth_Rock_Roar	-0.009	-0.004	-0.004
	(0.014)	(0.014)	(0.014)
Stealth_Rock_Circle_Throw	0.290	0.297	0.295
	(0.186)	(0.187)	(0.187)
Observations	424,894	424,894	424,894
Log Likelihood	$-292{,}863.000$	$-289{,}365.000$	$-289{,}071.800$
Akaike Inf. Crit.	585,787.900	579,602.000	579,091.600
Note:	*p<0.1; **p<0.05; ***p<0.01		
	Standard Errors shown in parenthesis.		

Table 19: Models 8-10 Basic Move Set

	Dependent variable:		
	Outcome		
	(1)	(2)	(3)
Early_Stealth_Rock	0.250***	0.193***	0.190***
	(0.005)	(0.005)	(0.005)
Late_Stealth_Rock	0.190***	0.112***	0.108***
	(0.006)	(0.006)	(0.006)
Early_Spikes	0.070***	0.049***	0.049***
	(0.017)	(0.017)	(0.017)
Late_Spikes	0.122***	0.069***	0.066***
	(0.018)	(0.019)	(0.019)
Early_Toxic_Spikes	−0.075***	0.012	0.016
	(0.029)	(0.030)	(0.030)
Late_Toxic_Spikes	−0.183***	−0.093**	−0.093**
	(0.037)	(0.038)	(0.038)
Early_Sticky_Web	0.067***	0.157***	0.153***
	(0.020)	(0.024)	(0.024)
Late_Sticky_Web	−0.038	0.059	0.060
	(0.044)	(0.045)	(0.045)
Observations	424,894	424,894	424,894
Log Likelihood	−292,536.500	−289,107.100	−288,817.300
Akaike Inf. Crit.	585,163.000	579,114.300	578,612.500
Note:			*p<0.1; **p<0.05; ***p<0.01 Standard Errors shown in parenthesis.

Table 20: Models 8-10 Entry Hazards

	Dependent variable:		
	Outcome		
	(1)	(2)	(3)
Early_Stealth_Rock2			
Early_Spikes2			
Early_Toxic_Spikes2			
Early_Sticky_Web2			
Late_Stealth_Rock2			
Late_Spikes2			
Late_Toxic_Spikes2			
Late_Sticky_Web2			
Observations	424,894	424,894	424,894
Log Likelihood	−292,536.500	−289,107.100	−288,817.300
Akaike Inf. Crit.	585,163.000	579,114.300	578,612.500
Note:			*p<0.1; **p<0.05; ***p<0.01

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Table 21: Models 8-10 Complementary Move Set and Early Entry Hazards

	Dependent variable:		
	Outcome		
	(1)	(2)	(3)
Circle_Throw2	0.005	−0.004	−0.004
	(0.012)	(0.012)	(0.012)
Dragon_Tail2	0.017***	0.018***	0.019***
	(0.004)	(0.004)	(0.004)
Roar2	0.007	0.008	0.008
	(0.006)	(0.006)	(0.006)
Whirlwind2	−0.00002	0.001	0.001
	(0.002)	(0.002)	(0.002)
Early_Stealth_RockXEarly_Spikes2			
Early_Stealth_RockXEarly_Sticky_Web2			
Early_Stealth_RockXEarly_Toxic_Spikes2			
Observations	424,894	424,894	424,894
Log Likelihood	−292,536.500	−289,107.100	−288,817.300
Akaike Inf. Crit.	585,163.000	579,114.300	578,612.500
Note:			*p<0.1; **p<0.05; ***p<0.01

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Specifically, Table 3.3 corroborates the statistical significance and signage of the Stealth Rock variable. However, the values of the Akaike Information Criterion (AIC) and log liklihood indicate that the model improves in quality when including Pokémon, and improves even more when both Pokémon and Mega-Pokémon are included into the mix. This is not surprising given the role that Pokémon play in a battle and the sheer number of parameters composing the roster of Pokémon and Mega-Pokémon. Table 3.3 also indicates a finding that is explored in greater detail in Table 3.3: the loss of statistical significance for other entry hazards. Though both sticky web and Stealth Rock remain statistically significant across specifications, Toxic Spikes and Toxic Spikes both are not. However, these two entry hazards are ones that can be used more than once. Given that the multiple use of these moves was not captured in the variables considered, the lack of statistical significance may be a byproduct of the data collection method. Nonetheless, an interesting feature of Table 3.3 is the continued statistical insignificance of using multiple types of entry hazards, i.e. using both stealth rock and Toxic Spikes.

Table 22: Models 8-10 Early Move Set Interactions

	Dependent variable:		
	Outcome		
	(1)	(2)	(3)
Early_Stealth_RockXLate_Spikes2			
Early_Stealth_RockXLate_Sticky_Web2			
Early_Stealth_RockXLate_Toxic_Spikes2			
Early_Stealth_RockXWhirlwind2	0.002	0.002	0.001
	(0.002)	(0.002)	(0.002)
Early_Stealth_RockXDragon_Tail2	-0.015^{***}	-0.012^{**}	-0.011^{**}
	(0.005)	(0.005)	(0.005)
Early_Stealth_RockXRoar2	-0.0003	-0.003	-0.003
	(0.006)	(0.006)	(0.006)
Early_Stealth_RockXCircle_Throw2	0.046	0.046	0.047
	(0.071)	(0.066)	(0.067)
Observations	424,894	424,894	424,894
Log Likelihood	$-292,536.500$	$-289,107.100$	$-288,817.300$
Akaike Inf. Crit.	585,163.000	579,114.300	578,612.500
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 23: Models 8-10 Late Move Set Interactions

	Dependent variable:		
	Outcome		
	(1)	(2)	(3)
Late_Stealth_RockXLate_Spikes2			
Late_Stealth_RockXLate_Sticky_Web2			
Late_Stealth_RockXLate_Toxic_Spikes2			
Late_Stealth_RockXEarly_Spikes2			
Late_Stealth_RockXEarly_Sticky_Web2			
Late_Stealth_RockXEarly_Toxic_Spikes2			
Late_Stealth_RockXWhirlwind2	0.001	−0.001	−0.001
	(0.002)	(0.002)	(0.002)
Late_Stealth_RockXDragon_Tail2	−0.019***	−0.019***	−0.019***
	(0.005)	(0.005)	(0.005)
Late_Stealth_RockXRoar2	−0.006	−0.007	−0.007
	(0.006)	(0.006)	(0.006)
Late_Stealth_RockXCircle_Throw2	−0.231**	−0.241**	−0.240**
	(0.107)	(0.116)	(0.116)
Observations	424,894	424,894	424,894
Log Likelihood	−292,536.500	−289,107.100	−288,817.300
Akaike Inf. Crit.	585,163.000	579,114.300	578,612.500
Note:	*p<0.1; **p<0.05; ***p<0.01		

Table 24: Models 8-10 Early and Late Interactions Cont.

	Dependent variable:		
	Outcome		
	(1)	(2)	(3)
Early_Stealth_RockXEarly_Spikes	−0.029	0.015	0.019
	(0.025)	(0.026)	(0.026)
Early_Stealth_RockXLate_Spikes	−0.048*	−0.022	−0.020
	(0.025)	(0.025)	(0.025)
Early_Stealth_RockXEarly_Sticky_Web	−0.121***	−0.014	−0.009
	(0.035)	(0.038)	(0.038)
Early_Stealth_RockXLate_Sticky_Web	−0.219***	−0.216***	−0.218***
	(0.077)	(0.077)	(0.077)
Early_Stealth_RockXEarly_Toxic_Spikes	−0.093*	−0.057	−0.057
	(0.049)	(0.049)	(0.050)
Early_Stealth_RockXLate_Toxic_Spikes	0.010	0.017	0.018
	(0.059)	(0.059)	(0.059)
Early_Stealth_RockXWhirlwind	−0.037*	−0.021	−0.020
	(0.019)	(0.020)	(0.020)
Early_Stealth_RockXDragon_Tail	0.119***	0.107***	0.101***
	(0.021)	(0.021)	(0.021)
Observations	424,894	424,894	424,894
Log Likelihood	−292,536.500	−289,107.100	−288,817.300
Akaike Inf. Crit.	585,163.000	579,114.300	578,612.500

Note: *p<0.1; **p<0.05; ***p<0.01
Standard Errors shown in parenthesis.

Table 25: Models 8-10 Early and Late Interactions Cont.

	Dependent variable:		
	Outcome		
	(1)	(2)	(3)
Early_Stealth_RockXRoar	0.021	0.028	0.031
	(0.029)	(0.029)	(0.029)
Early_Stealth_RockXCircle_Throw	−0.019	−0.015	−0.022
	(0.263)	(0.259)	(0.260)
Late_Stealth_RockXEarly_Spikes	−0.043	−0.035	−0.035
	(0.030)	(0.030)	(0.030)
Late_Stealth_RockXLate_Spikes	−0.047*	0.006	0.009
	(0.025)	(0.025)	(0.025)
Late_Stealth_RockXEarly_Sticky_Web	−0.133**	−0.103*	−0.094*
	(0.055)	(0.055)	(0.055)
Late_Stealth_RockXLate_Sticky_Web	−0.006	0.072	0.078
	(0.071)	(0.072)	(0.072)
Late_Stealth_RockXEarly_Toxic_Spikes	0.014	0.006	0.006
	(0.062)	(0.062)	(0.062)
Late_Stealth_RockXLate_Toxic_Spikes	0.052	0.050	0.050
	(0.060)	(0.060)	(0.060)
Observations	424,894	424,894	424,894
Log Likelihood	−292,536.500	−289,107.100	−288,817.300
Akaike Inf. Crit.	585,163.000	579,114.300	578,612.500
Note:			*p<0.1; **p<0.05; ***p<0.01 Standard Errors shown in parenthesis.

Table 26: Models 8-10 Complementary Move Set and Late Interactions

	Dependent variable:		
	Outcome		
	(1)	(2)	(3)
Dragon_Tail	-0.115^{***}	-0.123^{***}	-0.128^{***}
	(0.017)	(0.018)	(0.018)
Roar	-0.063^{**}	-0.051^{**}	-0.053^{**}
	(0.026)	(0.026)	(0.026)
Whirlwind	0.035^{**}	0.009	0.008
	(0.016)	(0.017)	(0.017)
Circle_Throw	−0.040	0.031	0.031
	(0.082)	(0.083)	(0.083)
Late_Stealth_RockXWhirlwind	-0.033^{*}	−0.013	−0.011
	(0.018)	(0.019)	(0.019)
Late_Stealth_RockXDragon_Tail	0.093^{***}	0.093^{***}	0.090^{***}
	(0.022)	(0.022)	(0.021)
Late_Stealth_RockXRoar	0.024	0.026	0.026
	(0.029)	(0.029)	(0.029)
Late_Stealth_RockXCircle_Throw	0.998^{**}	1.069^{**}	1.069^{**}
	(0.450)	(0.468)	(0.469)
Observations	424,894	424,894	424,894
Log Likelihood	−292,536.500	−289,107.100	−288,817.300
Akaike Inf. Crit.	585,163.000	579,114.300	578,612.500
Note:			*p<0.1; **p<0.05; ***p<0.01
			Standard Errors shown in parenthesis.

Included in Table 3.3 are the results of models (1) through (3). Surprisingly, the second to last model (2) is better than the inclusion of all Pokémon that could use Stealth Rock (3). Via a comparison of log liklihood values and AIC values, model (2) is the best model of all those shown. Simply put, Table 3.3 indicates that breaking up the Stealth Rock count variable into component parts by the Pokémon that can use them does not improve the model more than by just including the interaction between moves and the full roster of Pokémon and Mega-Pokémon, which may provide reason to either expand the dataset or take caution interpreting the marginal effects of the parameters considered. This may also be explained by the characteristics of the model used, as battles where both players used the move Stealth Rock cancel each other out in the model. Nonetheless, it is important to note that nearly all of the move variables are statistically significant across specifications, save for Toxic Spikes and Toxic Toxic Spikes. Though, this being said, the interaction between Stealth Rock and Dragon Tail is the only statistically significant interaction variable across specifications. This contributes to some semblence of generalizability though, as Stealth Rock is the only entry hazard that significantly increases the marginal probability of winning across specifications. Furthermore, the interaction between Stealth Rock and Dragon Tail is robust across specifications, indicating that moves can work in synergy to produce positive, though also negative, effects on win outcome.

The statistical significance of the entry hazards is also verified in further model specifications. While the use of Toxic 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 Toxic Spikes as a statistically significant move choice, the magnitude of using the move appears to diminish when including other factors such as Pokémon choice. This makes interpretations similar to that used for the Stealth Rock variable less than appropriate. If anything, Table 3.3 specifically shows that further analysis is needed to formulate a more definite conclusion on the impact of a specific move on a player's win outcome.

Furthermore, though not explicitly shown, the interactions between the Stealth Rock variable and all Pokémon that can learn (and use) Stealth Rock in (6) vary from positive to negative and statistically significant to not. This provides some indication that there is a nonuniform effect on win outcome depending on which Pokémon used the move in question. 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. However, saying that the interaction between a Pokémon being present on a team and the player using Stealth Rock sometime during the battle is simplistic. The statistics created by this variable do not differentiate between the Pokémon that could have learned or used Stealth Rock during a battle and those that actually used it. Included within these variables is the situation where a Pokémon could have used Stealth Rock, but another Pokémon on a player's team used it instead. This is one of many reasons why the coefficients assigned to each interaction variable are not explicitly detailed or highlighted for further analysis.

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 in Figures 4 and 5. This improvement in model quality is also found in comparison to all previous models with (5). While residual deviance is not reported for each model, the AIC lends credence to the comparative view that model (5) is the model of best fit for those considered across specifications. Though, this being said, (6) provides better AIC and log liklihood values in comparison to all specifications except those reported in (5).