



Universitat
de les Illes Balears

21746 - Data Mining

Final Project

Steam Successful Indie Games Study

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Contents

1	Introduction	1
1.1	Explanation of the Attributes	1
1.2	Objectives	1
2	Procesing de data	1
2.1	Handling of NA values	4
3	Requeriments for Successful Indie Games	6
3.1	Obtain Unique values for different columns	6
4	Can a single game have enough influence to make other games have its tag?	11
4.1	Game study: Slay the Spire (Roguelike Deckbuilder)	11
4.2	Game Study: The Binding Of Isaac + The Binding Of Isaac Rebirth (Roguelike)	15

1 Introduction

1.1 Explanation of the Attributes

The dataset we will be working with contains a total number of 94948 observations and 47 columns or variables. The columns that will be used are described below:

- **appid**: Unique identifier of the game on Steam. [num]
- **name**: Name of the game. [text]
- **'released_date'**: Represents the date where the game was released. [time]
- **'required_age'**: Corresponds to the minimum age required to play the game. [num]
- **price**: How much the game costs. If its 0 it means that the game is Free to Play. [num]
- **dlc_count**: Ammount of DLCs (Downloadable Contents) the game has. [num]
- **support_url**: URL to the support page of the game. [text]
- **windows**: Determines if the game runs in windows. [categorical]
- **mac**: Determines if the game runs in mac. [categorical]
- **linux**: Determines if the game runs in linux. [categorical]
- **metacritic_score**: Metacritic score based on critical reviews (reviews from professionalss). By performing an investigation we think that an score of 0 means that when the scraping of the data was done there where no reviews for that game yet. [num]
- **achievements**: Number of achievements the game has. [num]
- **'recommendations'**: Ammount of user recommendations. [num]
- **supported_languages**: List of languages that the game supports.[NO SÉ QUE CATEGORÍA DARLE]
- **packages**: Aavailable packages for the game. It contains the name and a description of the package and the names, descriptions and subprices of the subpackages. [LO MISMO QUE ARRIBA]
- **Developers**: List of developers associated with the game. [LO MISMO QUE ARRIBA]
- **publishers**: List of publishers associated with the game. [LO MISMO QUE ARRIBA]
- **categories**: List of categories that the game has. [LO MISMO QUE ARRIBA]
- **genres**: List of genres that the game belongs to. [LO MISMO QUE ARRIBA]
- **positive**: Ammount of positive votes the game has. [num]
- **negative**: Ammount of negative votes the game has. [num]
- **estimated_owners**: Estimated owners of the game. [text]
- **average_playtime_forever**: Average playtime since March 2009 measured in minutes. [num]
- **average_playtime_2weeks**: Average playtime in the last two weeks measured in minutes. [num]
- **median_playtime_forever**: Median playtime since March 2009 measured in minutes. [num]
- **median_playtime_2weeks**: Median playtime in the last two weeks measured in minutes.[num]
- **peak_ccu**: Number of current users playing the day before the data was scrapped. [num]
- **tags**: List of tags the game has with its name and its key. [NO SE QUE CATEGORIA DARLE]
- **pct_pos_total**: Percentage of all reviews that are positive. [num]
- **num_reviews_total**: Nummber of the total reviews the game has. [num]

1.2 Objectives

TODO: ADD OBJECTIVES OF STUDY

2 Procesing de data

General look of the dataset

```
summary(steam)
```

```
##      appid      name      release_date      required_age
## Min.   :    20  Length:94948  Length:94948  Min.   :-1.0000
## 1st Qu.: 887338  Class :character  Class :character  1st Qu.: 0.0000
## Median :1591145  Mode  :character  Mode  :character  Median : 0.0000
## Mean   :1707530                      Mean   : 0.1783
## 3rd Qu.:2491702                      3rd Qu.: 0.0000
## Max.   :3570420                      Max.   :21.0000
##
##      price      dlc_count      detailed_description about_the_game
## Min.   : 0.000  Min.   : 0.0000  Length:94948  Length:94948
## 1st Qu.: 0.990  1st Qu.: 0.0000  Class :character  Class :character
## Median : 3.990  Median : 0.0000  Mode  :character  Mode  :character
## Mean   : 6.911  Mean   : 0.5632
## 3rd Qu.: 9.990  3rd Qu.: 0.0000
## Max.   :999.980  Max.   :3427.0000
##
## short_description  reviews      header_image      website
## Length:94948      Length:94948  Length:94948  Length:94948
## Class :character  Class :character  Class :character  Class :character
## Mode  :character  Mode  :character  Mode  :character  Mode  :character
##
##
##
##
## support_url      support_email      windows      mac
## Length:94948      Length:94948  Length:94948  Length:94948
## Class :character  Class :character  Class :character  Class :character
## Mode  :character  Mode  :character  Mode  :character  Mode  :character
##
##
##
##
##      linux      metacritic_score metacritic_url      achievements
## Length:94948  Min.   : 0.000  Length:94948  Min.   : 0.00
## Class :character  1st Qu.: 0.000  Class :character  1st Qu.: 0.00
## Mode  :character  Median : 0.000  Mode  :character  Median : 2.00
##                      Mean   : 2.764  Mean   : 19.54
##                      3rd Qu.: 0.000  3rd Qu.: 19.00
##                      Max.   :97.000  Max.   :9821.00
##
## recommendations      notes      supported_languages full_audio_languages
## Min.   :    0  Length:94948  Length:94948  Length:94948
## 1st Qu.:    0  Class :character  Class :character  Class :character
## Median :    0  Mode  :character  Mode  :character  Mode  :character
## Mean   : 1022
## 3rd Qu.:    0
## Max.   :4401572
##
##      packages      developers      publishers      categories
## Length:94948  Length:94948  Length:94948  Length:94948
## Class :character  Class :character  Class :character  Class :character
```

```

## Mode :character Mode :character Mode :character Mode :character
##
##
##
##
## genres screenshots movies user_score
## Length:94948 Length:94948 Length:94948 Min. : 0.00000
## Class :character Class :character Class :character 1st Qu.: 0.00000
## Mode :character Mode :character Mode :character Median : 0.00000
## Mean : 0.03097
## 3rd Qu.: 0.00000
## Max. :100.00000
##
## score_rank positive negative estimated_owners
## Min. : 98.00 Min. : 0 Min. : 0.0 Length:94948
## 1st Qu.: 99.00 1st Qu.: 0 1st Qu.: 0.0 Class :character
## Median : 99.00 Median : 8 Median : 2.0 Mode :character
## Mean : 99.13 Mean : 1218 Mean : 202.1
## 3rd Qu.:100.00 3rd Qu.: 51 3rd Qu.: 15.0
## Max. :100.00 Max. :7480813 Max. :1135108.0
## NA's :94909
## average_playtime_forever average_playtime_2weeks median_playtime_forever
## Min. : 0.0 Min. : 0.000 Min. : 0.0
## 1st Qu.: 0.0 1st Qu.: 0.000 1st Qu.: 0.0
## Median : 0.0 Median : 0.000 Median : 0.0
## Mean : 108.6 Mean : 4.757 Mean : 108.4
## 3rd Qu.: 0.0 3rd Qu.: 0.000 3rd Qu.: 0.0
## Max. :1462997.0 Max. :18568.000 Max. :1462997.0
##
## median_playtime_2weeks discount peak_ccu
## Min. : 0.000 Min. : 0.000 Min. :0.000e+00
## 1st Qu.: 0.000 1st Qu.: 0.000 1st Qu.:0.000e+00
## Median : 0.000 Median : 0.000 Median :0.000e+00
## Mean : 5.018 Mean : 4.307 Mean :9.285e+01
## 3rd Qu.: 0.000 3rd Qu.: 0.000 3rd Qu.:0.000e+00
## Max. :18568.000 Max. :100.000 Max. :1.212e+06
##
## tags pct_pos_total num_reviews_total pct_pos_recent
## Length:94948 Min. : -1.00 Min. : -1 Min. : -1.000
## Class :character 1st Qu.: -1.00 1st Qu.: -1 1st Qu.: -1.000
## Mode :character Median : 58.00 Median : 15 Median : -1.000
## Mean : 44.63 Mean : 1448 Mean : 5.328
## 3rd Qu.: 84.00 3rd Qu.: 80 3rd Qu.: -1.000
## Max. :100.00 Max. :8632939 Max. :100.000
##
## num_reviews_recent
## Min. : -1.00
## 1st Qu.: -1.00
## Median : -1.00
## Mean : 16.88
## 3rd Qu.: -1.00
## Max. :96473.00
##

```

Explanation of first looks of it, bad formatting, NA's, negative values...

2.1 Handling of NA values

The attributes with missing values are:

```
na_counts <- steam %>% summarise_all(~ sum(is.na(.)))  
  
print(na_counts)
```

```
##  appid name release_date required_age price dlc_count detailed_description  
## 1      0      0          0          0      0          0  
##  about_the_game short_description reviews header_image website support_url  
## 1          0          0          0          0          0  
##  support_email windows mac linux metacritic_score metacritic_url achievements  
## 1          0      0      0      0          0          0  
##  recommendations notes supported_languages full_audio_languages packages  
## 1          0      0          0          0          0  
##  developers publishers categories genres screenshots movies user_score  
## 1          0          0          0          0          0  
##  score_rank positive negative estimated_owners average_playtime_forever  
## 1      94909          0          0          0          0  
##  average_playtime_2weeks median_playtime_forever median_playtime_2weeks  
## 1          0          0          0          0  
##  discount peak_ccu tags pct_pos_total num_reviews_total pct_pos_recent  
## 1          0      0      0          0          0  
##  num_reviews_recent  
## 1          0
```

The columns with missing values are as follows:

LOs juegos con número de reseñas = -1 creemos que son porque el scrapear ha fallado durante su ejecución. Si vamos a trabajar con las reseñas podríamos decir en la presentación que vamos a probar de volver a intentar scrapear la información

```
## tibble [88,982 x 30] (S3: tbl_df/tbl/data.frame)  
## $ appid : int [1:88982] 2556940 449940 1287250 866510 870990 439260 388390 224356  
## $ name : chr [1:88982] "¡ Shakabula *" "¡ That Bastard Is Trying To Steal Our Go  
## $ release_date : Date[1:88982], format: "2023-10-13" "2016-03-03" ...  
## $ required_age : int [1:88982] 0 0 0 0 0 0 0 0 0 ...  
## $ price : num [1:88982] 14.99 2.99 19.99 1.99 0.99 ...  
## $ dlc_count : int [1:88982] 0 0 0 39 0 0 0 1 3 0 ...  
## $ windows : chr [1:88982] "True" "True" "True" "True" ...  
## $ mac : chr [1:88982] "False" "False" "False" "False" ...  
## $ linux : chr [1:88982] "False" "True" "False" "False" ...  
## $ metacritic_score : int [1:88982] 0 0 0 0 0 0 0 0 0 ...  
## $ achievements : int [1:88982] 0 0 9 4997 2021 0 0 19 13 5 ...  
## $ recommendations : int [1:88982] 0 0 0 495 0 0 0 108 0 0 ...  
## $ supported_languages : chr [1:88982] "["English"]" "["English"]" "["English', 'Simplified Chin  
## $ packages : chr [1:88982] "["{'title': 'Buy ! Shakabula *', 'description': '', 'subs  
## $ developers : chr [1:88982] "["Skermunkel']" "["WTFOMGames']" "["Andreev Worlds']" "["  
## $ publishers : chr [1:88982] "["Skermunkel']" "["WTFOMGames']" "["Andreev Worlds']" "["  
## $ categories : chr [1:88982] "["Single-player', 'Full controller support', 'Steam Clou
```

```
## $ genres          : chr [1:88982] "[ 'Action', 'Indie', 'RPG', 'Early Access']" "[ 'Action',
## $ positive        : int [1:88982] 0 57 45 410 25 83 37 126 0 0 ...
## $ negative        : int [1:88982] 4 78 34 180 32 18 102 10 0 0 ...
## $ average_playtime_forever: int [1:88982] 0 312 0 360 0 0 244 0 0 0 ...
## $ average_playtime_2weeks : int [1:88982] 0 0 0 0 0 0 0 0 0 0 ...
## $ median_playtime_forever : int [1:88982] 0 391 0 378 0 0 244 0 0 0 ...
## $ median_playtime_2weeks  : int [1:88982] 0 0 0 0 0 0 0 0 0 0 ...
## $ peak_ccu        : int [1:88982] 0 0 0 6 0 0 0 0 0 0 ...
## $ tags            : chr [1:88982] "{ 'Early Access': 213, 'Action': 193, 'RPG': 187, 'JRPG':
## $ pct_pos_total    : int [1:88982] -1 55 61 71 55 82 55 91 95 66 ...
## $ num_reviews_total : int [1:88982] -1 68 62 495 18 101 20 108 281 12 ...
## $ estimated_owners_min : int [1:88982] 0 50000 0 100000 0 0 100000 20000 0 0 ...
## $ estimated_owners_max : int [1:88982] 20000 100000 20000 200000 20000 20000 200000 50000 0 0 ..
```

```
##      appid      name      release_date      required_age
## Min.      :    20  Length:88982      Min.   :1997-06-30  Min.     :-1.0000
## 1st Qu.: 852782  Class :character  1st Qu.:2018-12-05  1st Qu.: 0.0000
## Median :1522535  Mode  :character  Median :2021-10-29  Median : 0.0000
## Mean    :1655079                Mean    :2021-04-04  Mean    : 0.1826
## 3rd Qu.:2429338                3rd Qu.:2023-12-14  3rd Qu.: 0.0000
## Max.    :3542350                Max.    :2025-03-10  Max.    :21.0000
##      price      dlc_count      windows      mac
## Min.      : 0.000  Min.      : 0.0000  Length:88982  Length:88982
## 1st Qu.: 0.990  1st Qu.: 0.0000  Class :character  Class :character
## Median : 4.990  Median : 0.0000  Mode  :character  Mode  :character
## Mean    : 7.349  Mean     : 0.5957
## 3rd Qu.: 9.990  3rd Qu.: 0.0000
## Max.    :999.980  Max.     :3427.0000
##      linux      metacritic_score      achievements      recommendations
## Length:88982      Min.      : 0.00  Min.      : 0.00  Min.      : 0
## Class :character  1st Qu.: 0.00  1st Qu.: 0.00  1st Qu.: 0
## Mode  :character  Median : 0.00  Median : 5.00  Median : 0
##                      Mean    : 2.91  Mean    : 20.67  Mean    : 1013
##                      3rd Qu.: 0.00  3rd Qu.: 20.00  3rd Qu.: 0
##                      Max.    :97.00  Max.    :9821.00  Max.    :4401572
## supported_languages      packages      developers      publishers
## Length:88982      Length:88982      Length:88982      Length:88982
## Class :character  Class :character  Class :character  Class :character
## Mode  :character  Mode  :character  Mode  :character  Mode  :character
##
##
##
##      categories      genres      positive      negative
## Length:88982      Length:88982      Min.      : 0  Min.      : 0.0
## Class :character  Class :character  1st Qu.: 1  1st Qu.: 0.0
## Mode  :character  Mode  :character  Median : 10  Median : 2.0
##                      Mean    : 1267  Mean    : 208.3
##                      3rd Qu.: 59  3rd Qu.: 17.0
##                      Max.    :7480813  Max.    :1135108.0
## average_playtime_forever      average_playtime_2weeks      median_playtime_forever
## Min.      : 0.0  Min.      : 0.000  Min.      : 0.0
## 1st Qu.: 0.0  1st Qu.: 0.000  1st Qu.: 0.0
## Median : 0.0  Median : 0.000  Median : 0.0
## Mean    : 115.6  Mean    : 4.998  Mean    : 115.5
```

```
## 3rd Qu.:      0.0      3rd Qu.:      0.000      3rd Qu.:      0.0
## Max.      :1462997.0      Max.      :18568.000      Max.      :1462997.0
## median_playtime_2weeks      peak_ccu      tags      pct_pos_total
## Min.      :      0.000      Min.      :0.000e+00      Length:88982      Min.      : -1.00
## 1st Qu.:      0.000      1st Qu.:0.000e+00      Class :character      1st Qu.: -1.00
## Median :      0.000      Median :0.000e+00      Mode  :character      Median : 60.00
## Mean      :      5.277      Mean      :9.778e+01      Mean      : 45.39
## 3rd Qu.:      0.000      3rd Qu.:0.000e+00      3rd Qu.: 84.00
## Max.      :18568.000      Max.      :1.212e+06      Max.      :100.00
## num_reviews_total      estimated_owners_min      estimated_owners_max
## Min.      :      -1      Min.      :      0      Min.      :      0
## 1st Qu.:      -1      1st Qu.:      0      1st Qu.:     20000
## Median :      15      Median :      0      Median :     20000
## Mean      :     1320      Mean      :     59038      Mean      :    143056
## 3rd Qu.:      81      3rd Qu.:      0      3rd Qu.:     20000
## Max.      :8632939      Max.      :200000000      Max.      :500000000
```

3 Requeriments for Successful Indie Games

Create helper function for extracting unique elements from entries with a list of values. All lists follow the same pattern: ['e11', 'e12',...] being [] for empty lists.

Create helper function for extracting unique tags. These are formatted differently and follow dictionary-like pattern where each element is a key-value pair being [] for empty entries.

3.1 Obtain Unique values for different columns

```
## [1] "Captions available"      "Co-op"
## [3] "Commentary available"    "Cross-Platform Multiplayer"
## [5] "Family Sharing"          "Full controller support"
## [7] "HDR available"           "In-App Purchases"
## [9] "Includes level editor"   "Includes Source SDK"
## [11] "LAN Co-op"               "LAN PvP"
## [13] "MMO"                     "Multi-player"
## [15] "Online Co-op"            "Online PvP"
## [17] "Partial Controller Support" "PvP"
## [19] "Remote Play on Phone"    "Remote Play on Tablet"
## [21] "Remote Play on TV"       "Remote Play Together"
## [23] "Shared/Split Screen"     "Shared/Split Screen Co-op"
## [25] "Shared/Split Screen PvP" "Single-player"
## [27] "Stats"                   "Steam Achievements"
## [29] "Steam Cloud"             "Steam Leaderboards"
## [31] "Steam Timeline"          "Steam Trading Cards"
## [33] "Steam Turn Notifications" "Steam Workshop"
## [35] "SteamVR Collectibles"    "Tracked Controller Support"
## [37] "Valve Anti-Cheat enabled" "VR Only"
## [39] "VR Support"              "VR Supported"

## [1] "360 Video"      "Accounting"      "Action"
## [4] "Adventure"      "Animation & Modeling" "Audio Production"
## [7] "Casual"         "Design & Illustration" "Documentary"
## [10] "Early Access"   "Education"       "Episodic"
```


## [13]	"Free To Play"	"Game Development"	"Gore"
## [16]	"Indie"	"Massively Multiplayer"	"Movie"
## [19]	"Nudity"	"Photo Editing"	"Racing"
## [22]	"RPG"	"Sexual Content"	"Short"
## [25]	"Simulation"	"Software Training"	"Sports"
## [28]	"Strategy"	"Tutorial"	"Utilities"
## [31]	"Video Production"	"Violent"	"Web Publishing"

## [1]	"1980s"	"2.5D"
## [3]	"2D"	"2D Fighter"
## [5]	"2D Platformer"	"360 Video"
## [7]	"3D"	"3D Fighter"
## [9]	"3D Platformer"	"3D Vision"
## [11]	"4 Player Local"	"4X"
## [13]	"6DOF"	"8-bit Music"
## [15]	"Abstract"	"Action"
## [17]	"Action Roguelike"	"Action RPG"
## [19]	"Action RTS"	"Action-Adventure"
## [21]	"Addictive"	"Adventure"
## [23]	"Agriculture"	"Aliens"
## [25]	"Alternate History"	"Ambient"
## [27]	"America"	"Animation & Modeling"
## [29]	"Anime"	"Arcade"
## [31]	"Archery"	"Arena Shooter"
## [33]	"Artificial Intelligence"	"Assassin"
## [35]	"Asymmetric VR"	"Asynchronous Multiplayer"
## [37]	"Atmospheric"	"ATV"
## [39]	"Audio Production"	"Auto Battler"
## [41]	"Automation"	"Automobile Sim"
## [43]	"Base-Building"	"Baseball"
## [45]	"Based On A Novel"	"Basketball"
## [47]	"Battle Royale"	"Beautiful"
## [49]	"Benchmark"	"Bikes"
## [51]	"Birds"	"Blood"
## [53]	"BMX"	"Board Game"
## [55]	"Boomer Shooter"	"Boss Rush"
## [57]	"Bowling"	"Boxing"
## [59]	"Building"	"Bullet Hell"
## [61]	"Bullet Time"	"Capitalism"
## [63]	"Card Battler"	"Card Game"
## [65]	"Cartoon"	"Cartoony"
## [67]	"Casual"	"Cats"
## [69]	"Character Action Game"	"Character Customization"
## [71]	"Chess"	"Choices Matter"
## [73]	"Choose Your Own Adventure"	"Cinematic"
## [75]	"City Builder"	"Class-Based"
## [77]	"Classic"	"Clicker"
## [79]	"Co-op"	"Co-op Campaign"
## [81]	"Coding"	"Cold War"
## [83]	"Collectathon"	"Colony Sim"
## [85]	"Colorful"	"Combat"
## [87]	"Combat Racing"	"Comedy"
## [89]	"Comic Book"	"Competitive"
## [91]	"Conspiracy"	"Controller"

## [93]	"Conversation"	"Cooking"
## [95]	"Cozy"	"Crafting"
## [97]	"Creature Collector"	"Cricket"
## [99]	"Crime"	"Crowdfunded"
## [101]	"CRPG"	"Cult Classic"
## [103]	"Cute"	"Cyberpunk"
## [105]	"Cycling"	"Dark"
## [107]	"Dark Comedy"	"Dark Fantasy"
## [109]	"Dark Humor"	"Dating Sim"
## [111]	"Deckbuilding"	"Demons"
## [113]	"Design & Illustration"	"Destruction"
## [115]	"Detective"	"Dice"
## [117]	"Difficult"	"Dinosaurs"
## [119]	"Diplomacy"	"Documentary"
## [121]	"Dog"	"Dragons"
## [123]	"Drama"	"Driving"
## [125]	"Dungeon Crawler"	"Dungeons & Dragons"
## [127]	"Dwarf"	"Dynamic Narration"
## [129]	"Dystopian"	"e-sports"
## [131]	"Early Access"	"Economy"
## [133]	"Education"	"Electronic"
## [135]	"Electronic Music"	"Elf"
## [137]	"Emotional"	"Epic"
## [139]	"Episodic"	"Escape Room"
## [141]	"Experience"	"Experimental"
## [143]	"Exploration"	"Extraction Shooter"
## [145]	"Faith"	"Family Friendly"
## [147]	"Fantasy"	"Farming"
## [149]	"Farming Sim"	"Fast-Paced"
## [151]	"Feature Film"	"Female Protagonist"
## [153]	"Fighting"	"First-Person"
## [155]	"Fishing"	"Flight"
## [157]	"FMV"	"Football"
## [159]	"Football (American)"	"Football (Soccer)"
## [161]	"Foreign"	"Fox"
## [163]	"FPS"	"Free to Play"
## [165]	"Funny"	"Futuristic"
## [167]	"Gambling"	"Game Development"
## [169]	"GameMaker"	"Games Workshop"
## [171]	"Gaming"	"God Game"
## [173]	"Golf"	"Gore"
## [175]	"Gothic"	"Grand Strategy"
## [177]	"Great Soundtrack"	"Grid-Based Movement"
## [179]	"Gun Customization"	"Hack and Slash"
## [181]	"Hacking"	"Hand-drawn"
## [183]	"Hardware"	"Heist"
## [185]	"Hentai"	"Hero Shooter"
## [187]	"Hex Grid"	"Hidden Object"
## [189]	"Historical"	"Hobby Sim"
## [191]	"Hockey"	"Horror"
## [193]	"Horses"	"Hunting"
## [195]	"Idler"	"Illuminati"
## [197]	"Immersive"	"Immersive Sim"
## [199]	"Indie"	"Instrumental Music"

## [201]	"Intentionally Awkward Controls"	"Interactive Fiction"
## [203]	"Inventory Management"	"Investigation"
## [205]	"Isometric"	"Jet"
## [207]	"Job Simulator"	"JRPG"
## [209]	"Jump Scare"	"Kickstarter"
## [211]	"LEGO"	"Lemmings"
## [213]	"Level Editor"	"LGBTQ+"
## [215]	"Life Sim"	"Linear"
## [217]	"Local Co-Op"	"Local Multiplayer"
## [219]	"Logic"	"Loot"
## [221]	"Looter Shooter"	"Lore-Rich"
## [223]	"Lovecraftian"	"Magic"
## [225]	"Mahjong"	"Management"
## [227]	"Mars"	"Martial Arts"
## [229]	"Massively Multiplayer"	"Masterpiece"
## [231]	"Match 3"	"Mature"
## [233]	"Mechs"	"Medical Sim"
## [235]	"Medieval"	"Memes"
## [237]	"Metroidvania"	"Military"
## [239]	"Mini Golf"	"Minigames"
## [241]	"Minimalist"	"Mining"
## [243]	"MMORPG"	"MOBA"
## [245]	"Mod"	"Moddable"
## [247]	"Modern"	"Motocross"
## [249]	"Motorbike"	"Mouse only"
## [251]	"Movie"	"Multiplayer"
## [253]	"Multiple Endings"	"Music"
## [255]	"Music-Based Procedural Generation"	"Musou"
## [257]	"Mystery"	"Mystery Dungeon"
## [259]	"Mythology"	"Narration"
## [261]	"Narrative"	"Nature"
## [263]	"Naval"	"Naval Combat"
## [265]	"Ninja"	"Noir"
## [267]	"Nonlinear"	"Nostalgia"
## [269]	"NSFW"	"Nudity"
## [271]	"Offroad"	"Old School"
## [273]	"On-Rails Shooter"	"Online Co-Op"
## [275]	"Open World"	"Open World Survival Craft"
## [277]	"Otome"	"Outbreak Sim"
## [279]	"Parkour"	"Parody"
## [281]	"Party"	"Party Game"
## [283]	"Party-Based RPG"	"Perma Death"
## [285]	"Philosophical"	"Photo Editing"
## [287]	"Physics"	"Pinball"
## [289]	"Pirates"	"Pixel Graphics"
## [291]	"Platformer"	"Point & Click"
## [293]	"Political"	"Political Sim"
## [295]	"Politics"	"Pool"
## [297]	"Post-apocalyptic"	"Precision Platformer"
## [299]	"Procedural Generation"	"Programming"
## [301]	"Psychedelic"	"Psychological"
## [303]	"Psychological Horror"	"Puzzle"
## [305]	"Puzzle-Platformer"	"PvE"
## [307]	"PvP"	"Quick-Time Events"

## [309]	"Racing"	"Real Time Tactics"
## [311]	"Real-Time"	"Real-Time with Pause"
## [313]	"Realistic"	"Reboot"
## [315]	"Relaxing"	"Remake"
## [317]	"Replay Value"	"Resource Management"
## [319]	"Retro"	"Rhythm"
## [321]	"Robots"	"Rock Music"
## [323]	"Rogue-like"	"Rogue-lite"
## [325]	"Roguelike Deckbuilder"	"Roguevania"
## [327]	"Romance"	"Rome"
## [329]	"RPG"	"RPGMaker"
## [331]	"RTS"	"Rugby"
## [333]	"Runner"	"Sailing"
## [335]	"Sandbox"	"Satire"
## [337]	"Sci-fi"	"Science"
## [339]	"Score Attack"	"Sequel"
## [341]	"Sexual Content"	"Shooter"
## [343]	"Shop Keeper"	"Short"
## [345]	"Side Scroller"	"Silent Protagonist"
## [347]	"Simulation"	"Singleplayer"
## [349]	"Skateboarding"	"Skating"
## [351]	"Skiing"	"Sniper"
## [353]	"Snooker"	"Snow"
## [355]	"Snowboarding"	"Soccer"
## [357]	"Social Deduction"	"Software"
## [359]	"Software Training"	"Sokoban"
## [361]	"Solitaire"	"Souls-like"
## [363]	"Soundtrack"	"Space"
## [365]	"Space Sim"	"Spaceships"
## [367]	"Spectacle fighter"	"Spelling"
## [369]	"Split Screen"	"Sports"
## [371]	"Stealth"	"Steam Machine"
## [373]	"Steampunk"	"Story Rich"
## [375]	"Strategy"	"Strategy RPG"
## [377]	"Stylized"	"Submarine"
## [379]	"Superhero"	"Supernatural"
## [381]	"Surreal"	"Survival"
## [383]	"Survival Horror"	"Swordplay"
## [385]	"Tabletop"	"Tactical"
## [387]	"Tactical RPG"	"Tanks"
## [389]	"Team-Based"	"Tennis"
## [391]	"Text-Based"	"Third Person"
## [393]	"Third-Person Shooter"	"Thriller"
## [395]	"Tile-Matching"	"Time Attack"
## [397]	"Time Management"	"Time Manipulation"
## [399]	"Time Travel"	"Top-Down"
## [401]	"Top-Down Shooter"	"Touch-Friendly"
## [403]	"Tower Defense"	"TrackIR"
## [405]	"Trading"	"Trading Card Game"
## [407]	"Traditional Roguelike"	"Trains"
## [409]	"Transhumanism"	"Transportation"
## [411]	"Trivia"	"Turn-Based"
## [413]	"Turn-Based Combat"	"Turn-Based Strategy"
## [415]	"Turn-Based Tactics"	"Tutorial"

```
## [417] "Twin Stick Shooter"      "Typing"
## [419] "Underground"             "Underwater"
## [421] "Unforgiving"             "Utilities"
## [423] "Vampire"                 "Vehicular Combat"
## [425] "Video Production"        "Vikings"
## [427] "Villain Protagonist"     "Violent"
## [429] "Visual Novel"            "Voice Control"
## [431] "Volleyball"              "Voxel"
## [433] "VR"                      "VR Only"
## [435] "Walking Simulator"       "War"
## [437] "Wargame"                 "Warhammer 40K"
## [439] "Web Publishing"          "Well-Written"
## [441] "Werewolves"              "Western"
## [443] "Wholesome"               "Word Game"
## [445] "World War I"             "World War II"
## [447] "Wrestling"               "Zombies"
```

From steam's Categories, Genres and Tags, 3 subsets have been created with samples interesting for this study. Given steam's laxity at classifying these values, the 3 subsets have been created with our own interpretation. Additionally, tags that refer to non-game software have been ignored.

Thankfully the task of filtering indie games is already provided by steam with the Tags and Genres Indie, Crowfunded and Kickstarter. From the original dataset, only Indie games are obtained.

Prepare data for determining successful games

Cluster the data:

```
## [1] "appid"                "name"
## [3] "price"                "dlc_count"
## [5] "windows"              "mac"
## [7] "linux"                "achievements"
## [9] "recommendations"     "supported_languages"
## [11] "positive"             "negative"
## [13] "average_playtime_forever" "median_playtime_forever"
## [15] "peak_ccu"             "pct_pos_total"
## [17] "num_reviews_total"    "estimated_owners_min"
## [19] "estimated_owners_max" "estimated_revenue"
## [21] "success_cluster"
```

4 Can a single game have enough influence to make other games have its tag?

4.1 Game study: Slay the Spire (Roguelike Deckbuilder)

```
## [1] "Slay the Spire"
```

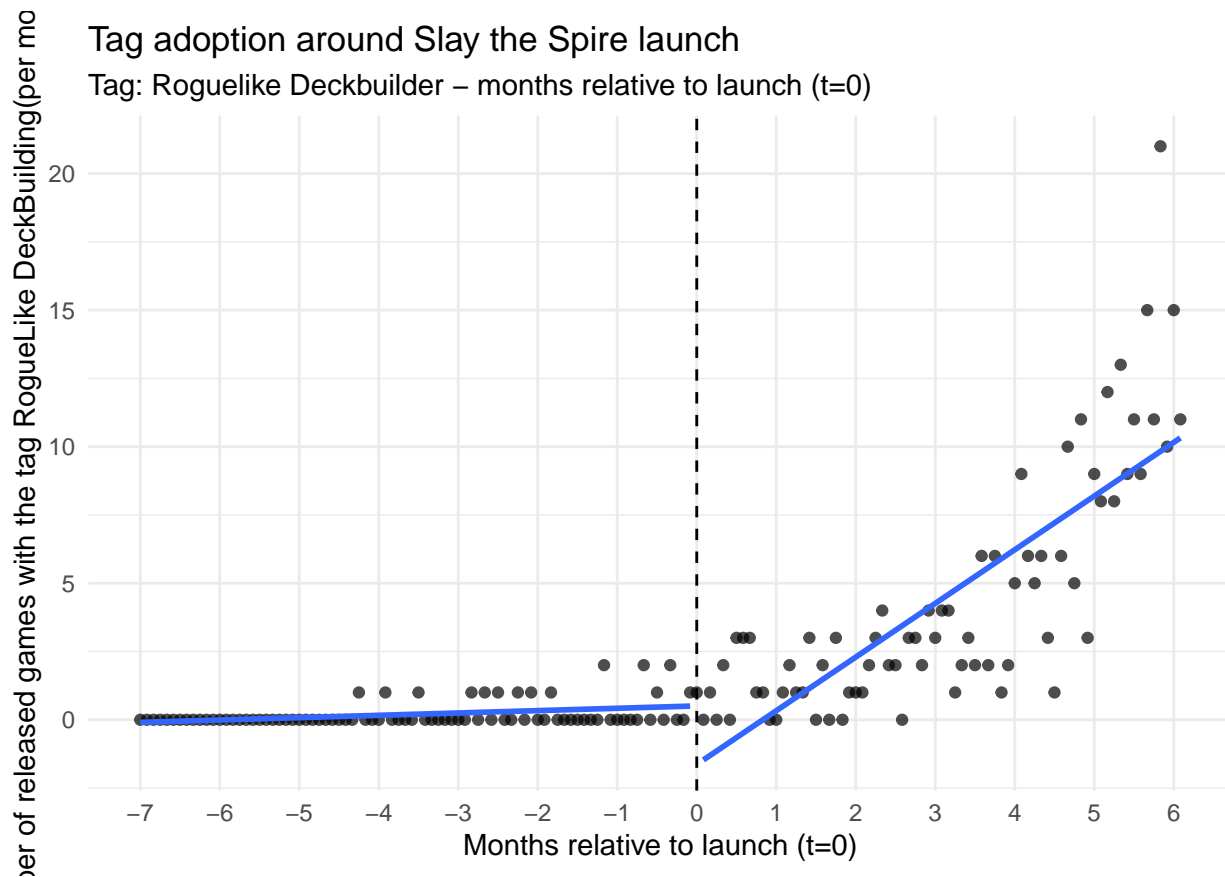
```
## [1] "2019-01-23"
```

```
##
```

```
## Call:
```

```
## lm(formula = freq ~ t + post + t:post, data = ts_slayTheSpire)
```

```
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -6.2087 -0.4368 -0.1021  0.5213 11.1710
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.529412   0.403337   1.313 0.191278
## t            0.007563   0.008292   0.912 0.363151
## post        -2.164115   0.599569  -3.609 0.000414 ***
## t:post       0.156203   0.013316  11.731 < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.876 on 154 degrees of freedom
## Multiple R-squared:  0.7433, Adjusted R-squared:  0.7383
## F-statistic: 148.7 on 3 and 154 DF,  p-value: < 2.2e-16
```



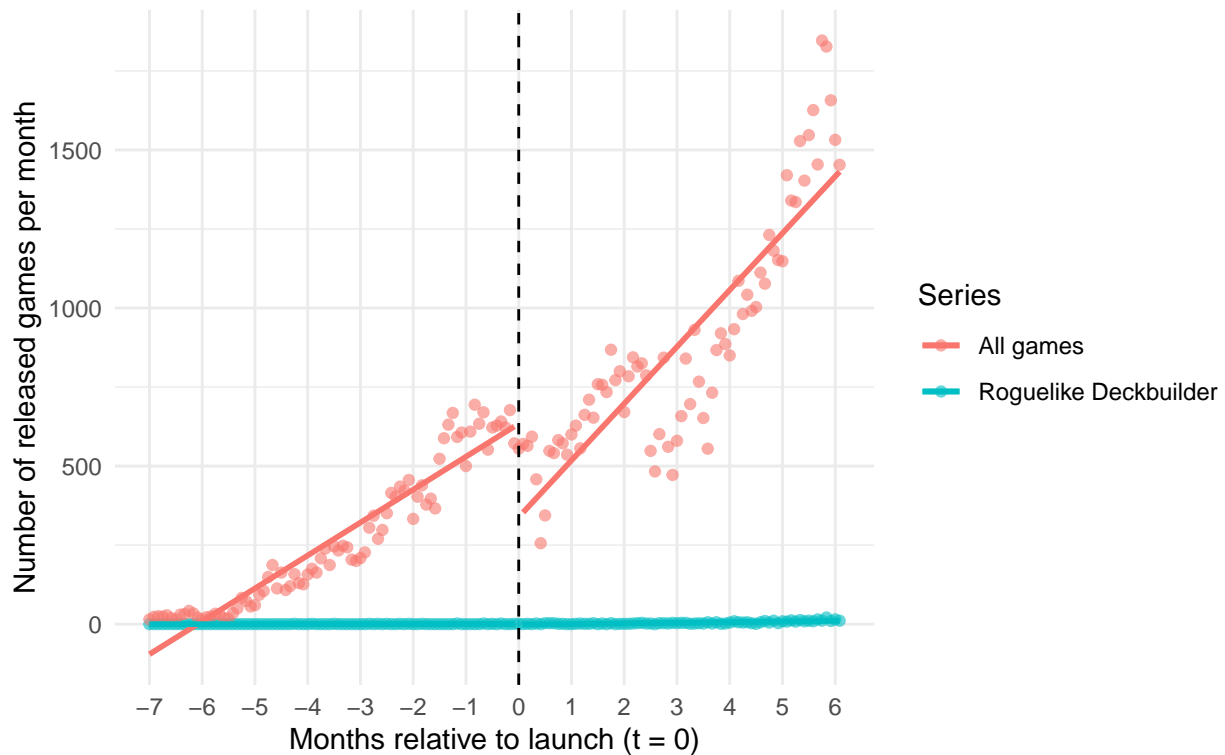
```
##
## Call:
## lm(formula = freq ~ t + post + t:post, data = ts_slayTheSpire)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -6.2087 -0.4368 -0.1021  0.5213 11.1710
```

```
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.529412   0.403337   1.313 0.191278
## t           0.007563   0.008292   0.912 0.363151
## post        -2.164115   0.599569  -3.609 0.000414 ***
## t:post       0.156203   0.013316  11.731 < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.876 on 154 degrees of freedom
## Multiple R-squared:  0.7433, Adjusted R-squared:  0.7383
## F-statistic: 148.7 on 3 and 154 DF, p-value: < 2.2e-16

##
## Call:
## lm(formula = freq ~ t + post + t:post, data = ts_global)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -427.10  -66.85   -1.87    81.84   474.64
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  630.1863    28.6368  22.006 < 2e-16 ***
## t             8.6137     0.5887  14.631 < 2e-16 ***
## post        -291.8553    42.5691  -6.856 1.61e-10 ***
## t:post        6.3578     0.9454   6.725 3.24e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 133.2 on 154 degrees of freedom
## Multiple R-squared:  0.9061, Adjusted R-squared:  0.9042
## F-statistic: 495.2 on 3 and 154 DF, p-value: < 2.2e-16
```

Slope comparison around Slay the Spire launch

Target tag vs overall Steam release trend (monthly bins)



```
##
## Call:
## lm(formula = freq ~ t * post * series, data = combined)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -427.10  -4.05   -0.12    4.33   474.64
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    630.1863    20.2513   31.118 < 2e-16 ***
## t               8.6137     0.4163   20.689 < 2e-16 ***
## post          -291.8553    30.1039  -9.695 < 2e-16 ***
## seriestag     -629.6569    28.6396 -21.986 < 2e-16 ***
## t:post         6.3578     0.6686    9.509 < 2e-16 ***
## t:seriestag    -8.6061     0.5888 -14.617 < 2e-16 ***
## post:seriestag  289.6912    42.5733   6.805 5.29e-11 ***
## t:post:seriestag -6.2015     0.9455  -6.559 2.29e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 94.18 on 308 degrees of freedom
## Multiple R-squared:  0.9488, Adjusted R-squared:  0.9476
## F-statistic: 815.6 on 7 and 308 DF, p-value: < 2.2e-16
```

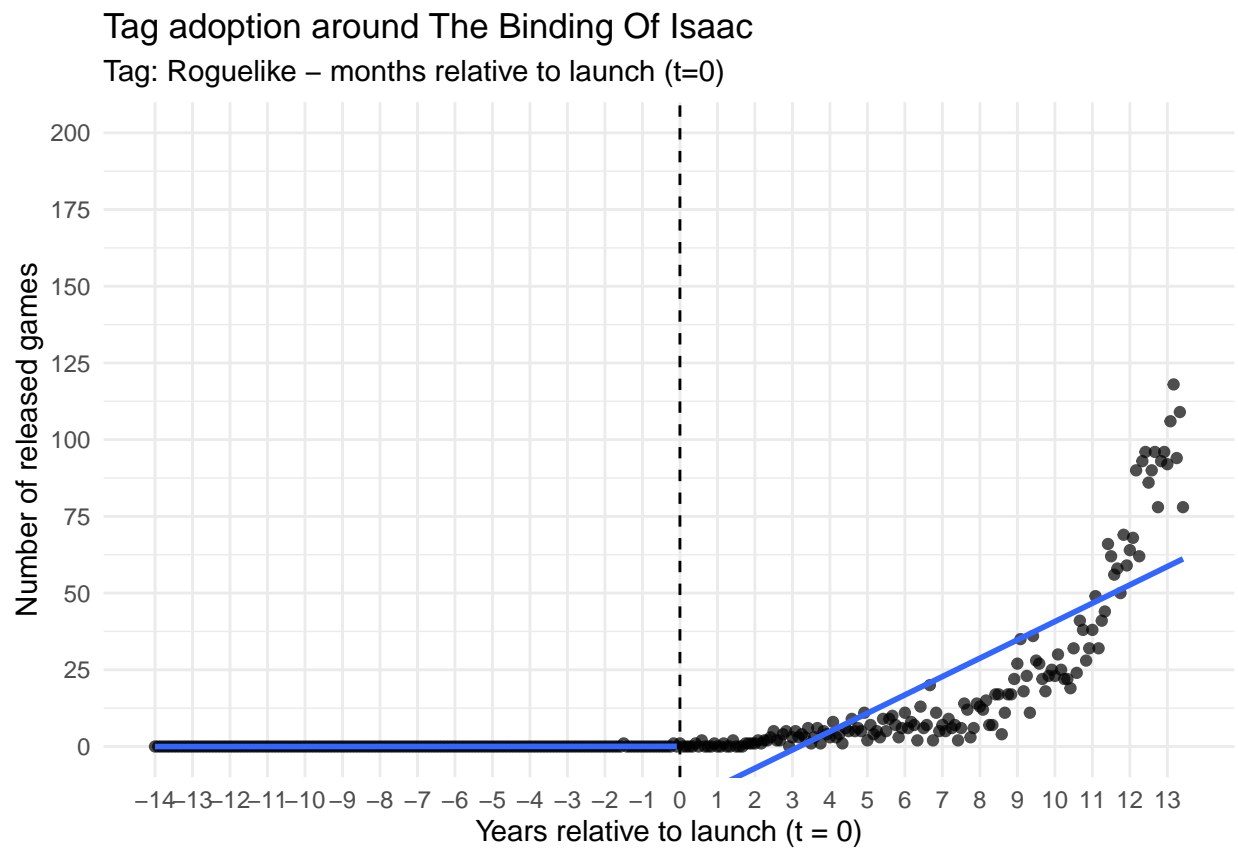

4.2 Game Study: The Binding Of Isaac + The Binding Of Isaac Rebirth (Roguelike)

[1] "The Binding of Isaac"

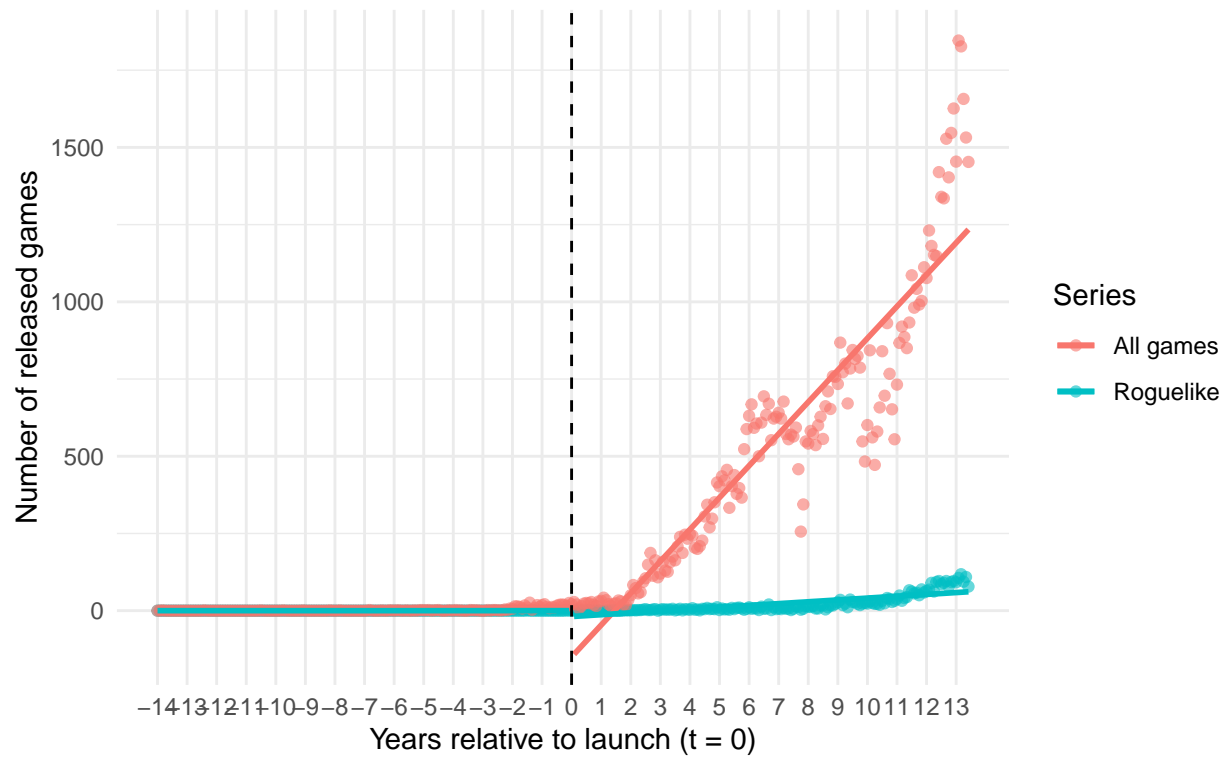
[1] "2011-09-28"

[1] "The Binding of Isaac: Rebirth"

[1] "2014-11-04"

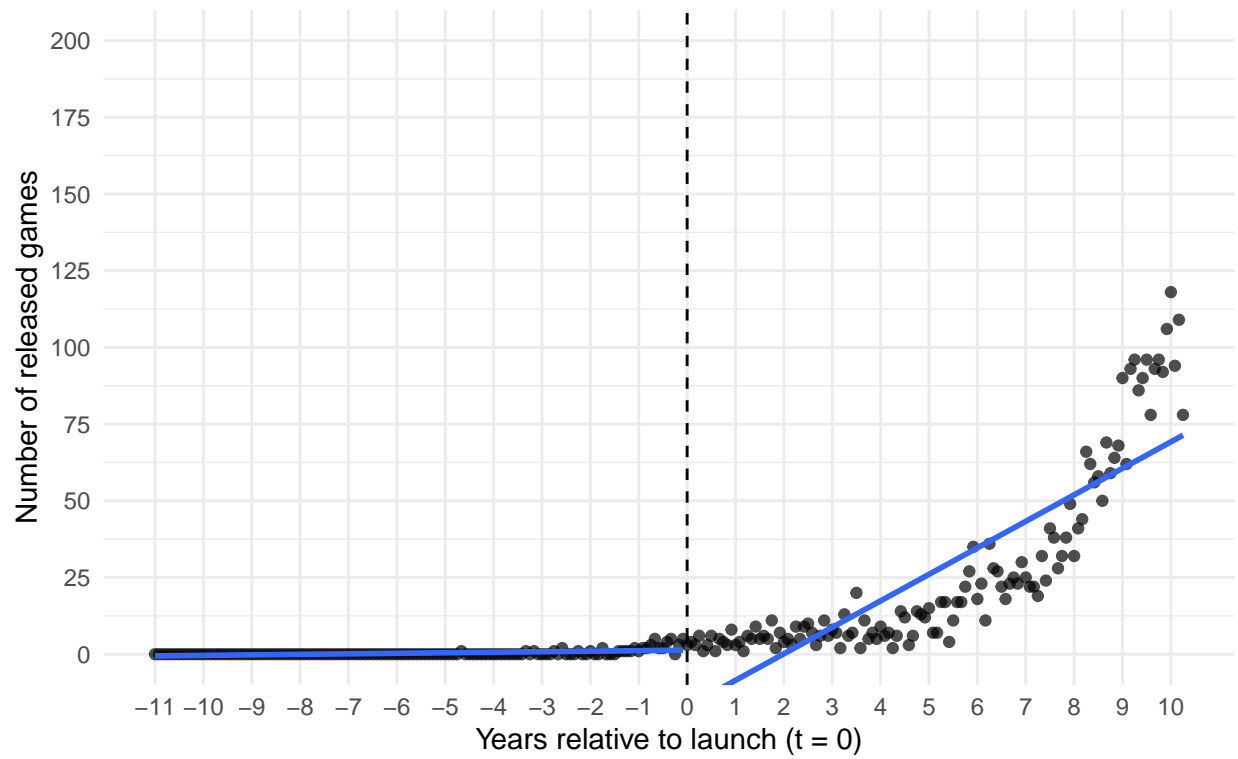


Slope comparison around The Binding of Isaac launch
Target tag vs overall Steam release trend (monthly bins)



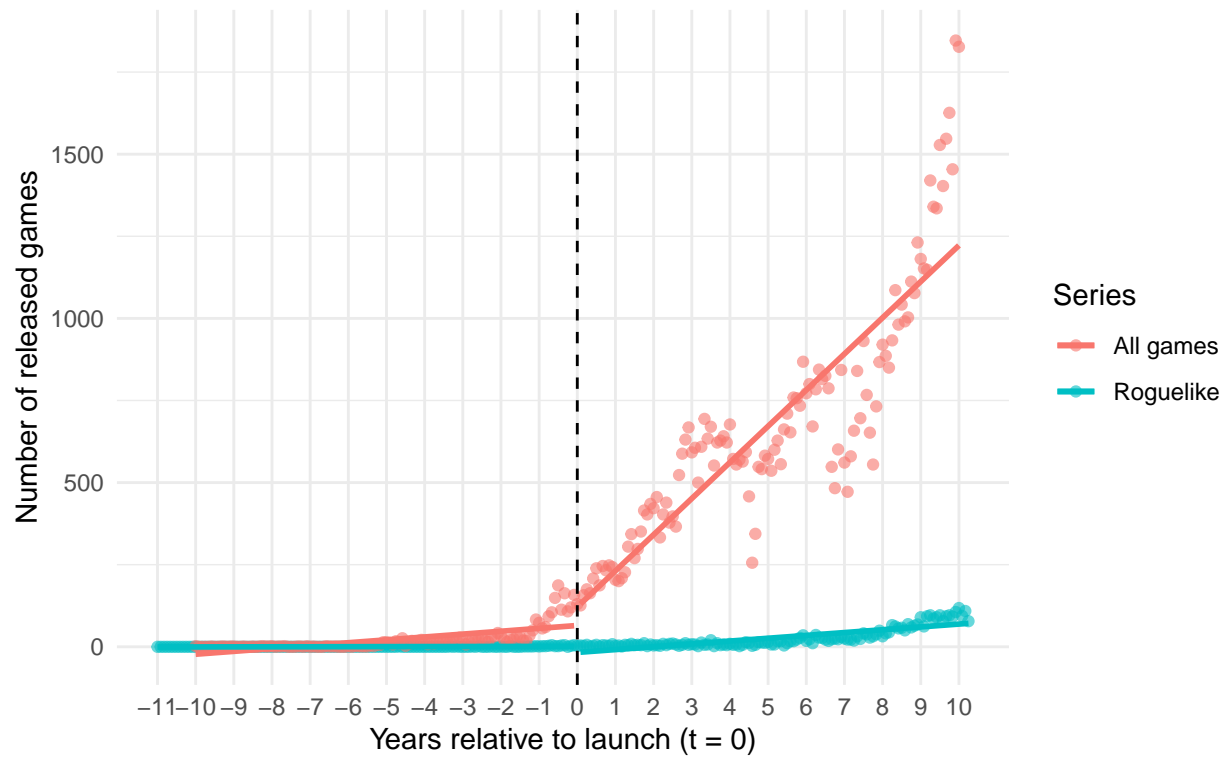
Tag adoption around The Binding Of Isaac REBIRTH

Tag: Roguelike – months relative to launch (t=0)



Slope comparison around The Binding of Isaac Rebirth launch

Roguelike tag vs overall Steam releases



```
## [1] "Terraria"
```

```
## [1] "2011-05-16"
```

Tag adoption around Terraria

Tag: Open World Survival Craft – months relative to launch ($t=0$)

