462 Marketing Models

THE IMPACT OF ANIPANG ADOPTION ON KAKAO GAME USAGE

VIA MULTIPLE PSM MATCHED SAMPLES AND PANEL DID ANALYSES

Brianna Chen, Sheryl Xu, Yang Zhou

RESEARCH QUESTIONS

How does adopting Anipang change users' Kakao-platform game usage (time & number) and how do those changes differ between adopters and non-adopters?

CONCEPTUAL FRAMEWORK

IVs

DVs

tg → Anipang adoption

Kakao-platform game numbers

ii

Control Variables

week → Time

Kakao-platform game time

Brianna Chen
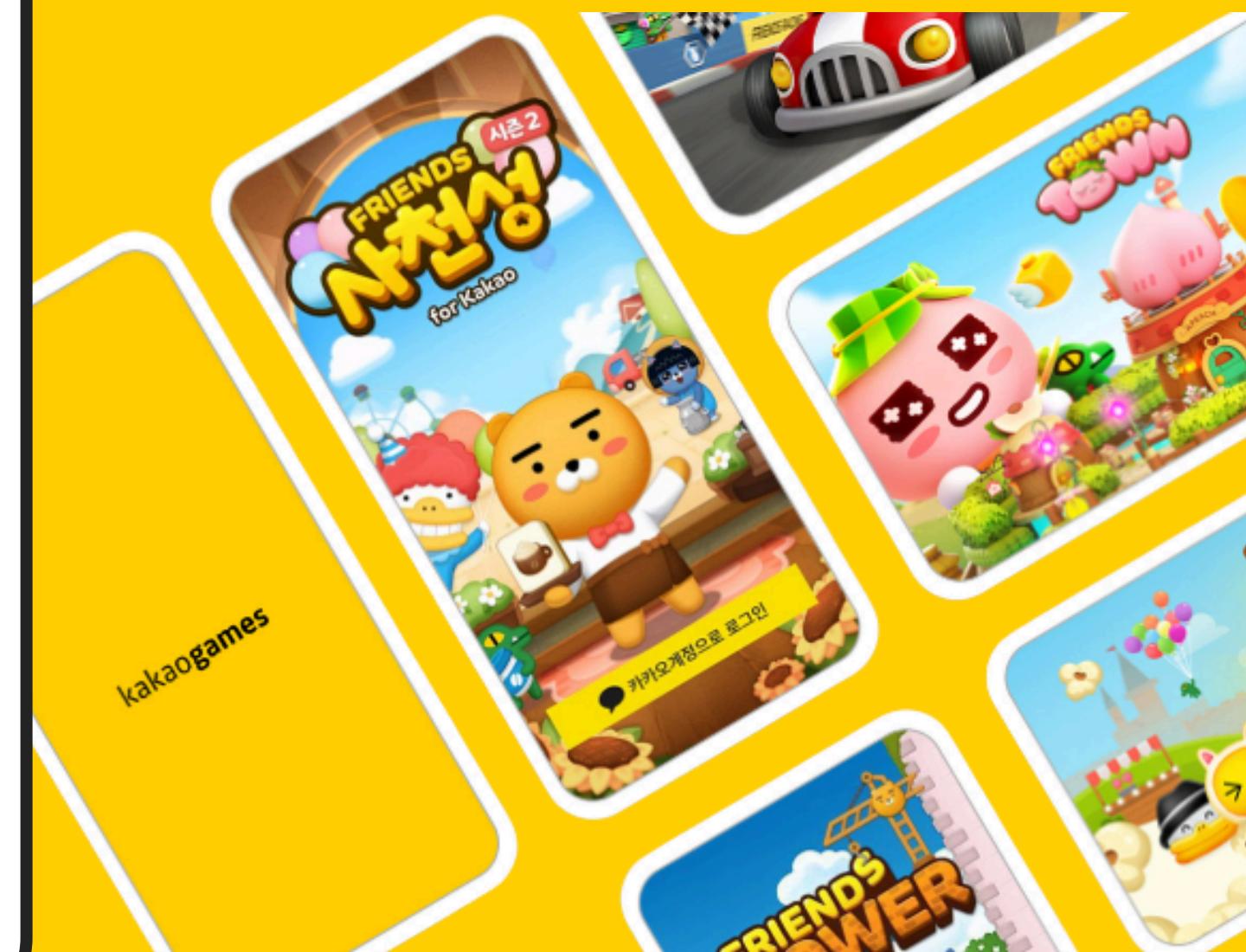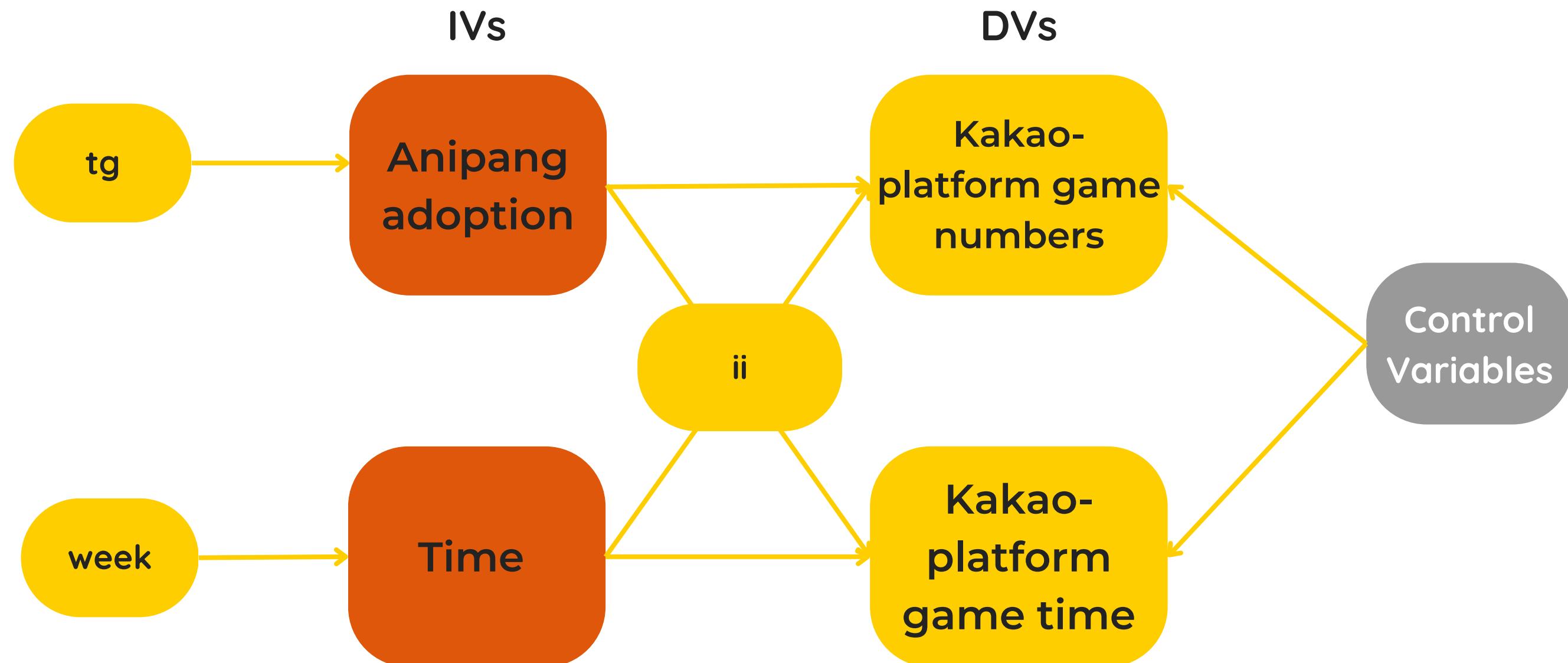
DATA

Individual-level weekly panel data of

(1) the number of apps used

(2) the app usage time spent on Android-based mobile devices

- 849 users (N = 849)
- 2 weeks from July 23 to August 05, 2012 (T = 2)
- Demographic profiles: age, gender, education, and monthly income

VARIABLES

What is the impact of adopting Anipang on users' Kakao-platform game usage, in terms of both time spent and number of games played?

- Dependent Variables:
  - Time spent on Kakao-platform games (t_kakao_game)
  - Number of Kakao-platform games played (n_kakao_game)
- Independent Variables:
  - Adoption of Anipang (ii)
  - Time dummy (week)
- Control Variables:
  - Demographics (age, income, education, gender)
  - Kakao-Platform Usage (t_kakao_talk, t_kakao_story)
  - Non_Kakao-Platform Usage (t_non_kakao_talk, t_non_kakao_story, t_non_kakao_game, t_non_kakao, n_non_kakao_talk, n_non_kakao_story, n_non_kakao_game, n_non_kakao)

DESCRIPTIVE STATISTICS

| Kakao Games				
week	Time - Control Group	Number - Control Group	Time-Treatment Group	Number - Treatment Group
1	0	0	0	0
2	**46.73**	**0.045**	**2026.82**	**0.75**
Non-Kakao Games				
week	Time - Control Group	Number - Control Group	Time-Treatment Group	Number - Treatment Group
1	5388.19	1.16	14195.8	2.18
2	6092.51	1.23	11225	1.61

DESCRIPTIVE STATISTICS

- The distributions of the demographic variables between the control and treatment groups are *very different*, which poses potential selection bias for comparison.


Age Distribution by Treatment Group
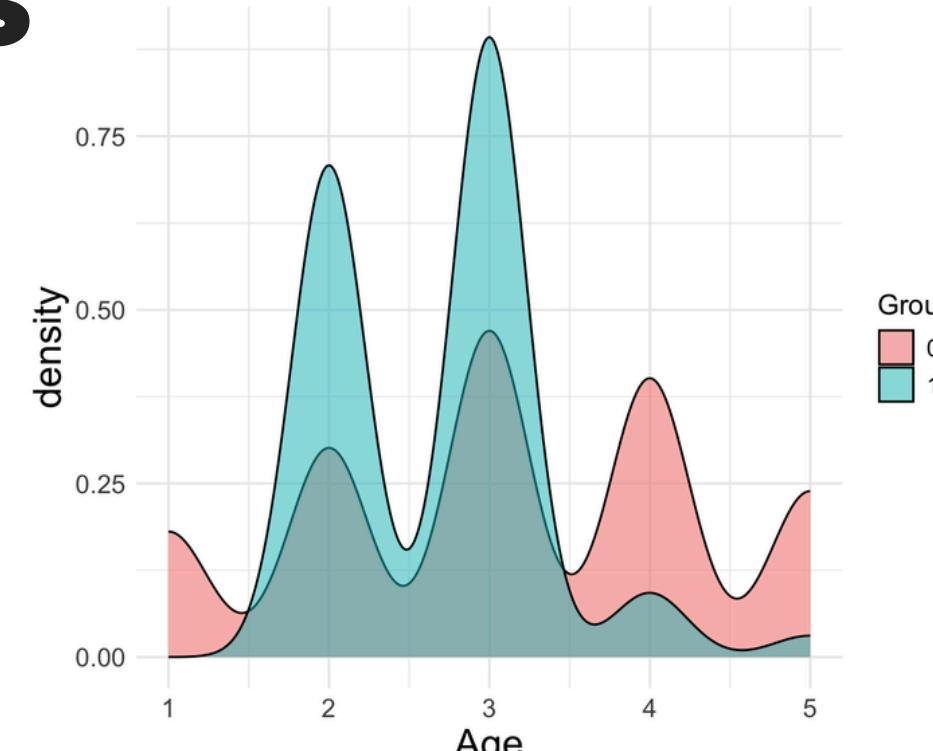
Education Distribution by Treatment Group

Income Distribution by Treatment Group
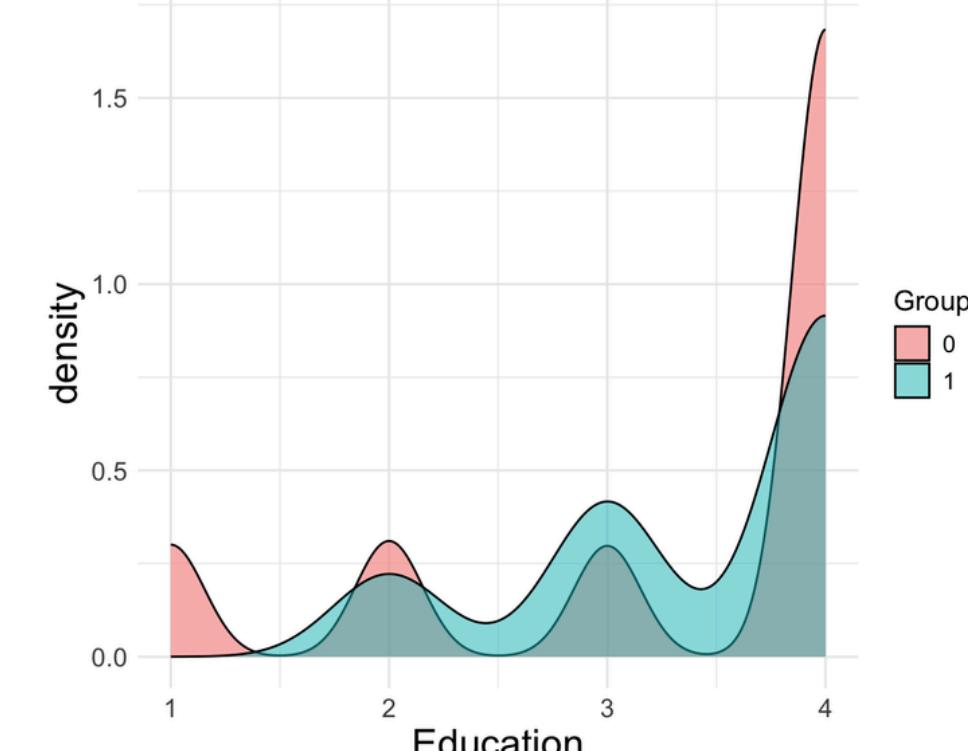
Gender Proportion by Group

Sheryl Xu
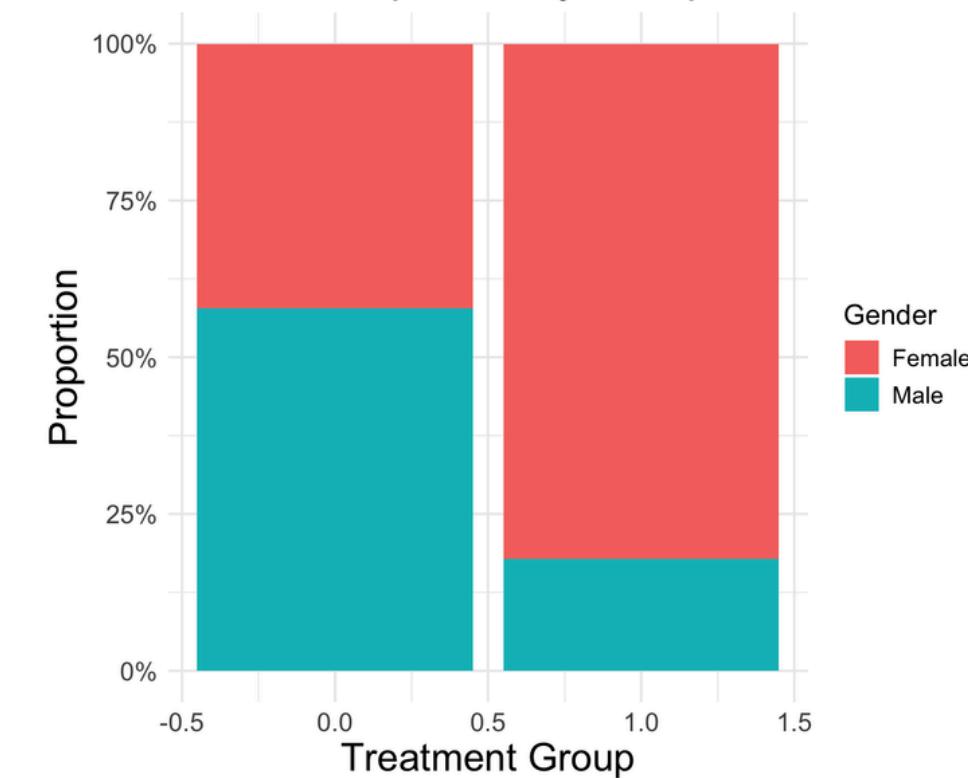
PSM

Matches are selected on a basis of minimum std. mean differences, except for M10, which is the default one-to-one matching with no replacement or caliper.

Variables used:
- **Demographics (age + income + education + gender)**
- **Use of Kakao Apps on week 1 (t_kakao_talk~n_kakao_game)**
- **Use of non-Kakao Apps on week 1 (t_non_kakao_talk ~ n_non_kakao)**

Name	ratio	replace	caliper
M1	3	TRUE	0.25
M2	3	FALSE	0.25
M3	2	TRUE	0.25
M4	1	FALSE	0.2
M5	3	TRUE	0.2
M6	1	FALSE	0.25
M7	2	FALSE	0.25
M8	2	TRUE	0.2
M9	1	FALSE	0.1
M10	1	FALSE	NA

Yang Zhou

MODELS

ANIPANG X NUMBER OF GAME USAGE (WITHIN) KAKAO PLATFORM

01

Dummy Regression:

```
lm(formula = n_kakao_game ~
   as.factor(ii) + as.factor(week) + as.factor(panel_id)
   + age + income + education + gender
   + t_kakao_talk + t_kakao_story + t_kakao_game
   + t_non_kakao_talk + t_non_kakao_story + t_non_kakao_game + t_non_kakao
   + n_non_kakao_talk + n_non_kakao_story + n_non_kakao_game + n_non_kakao,
   data    = matched_panel1)
```

MODELS

ANIPANG X NUMBER OF GAME USAGE (WITHIN) KAKAO PLATFORM

02
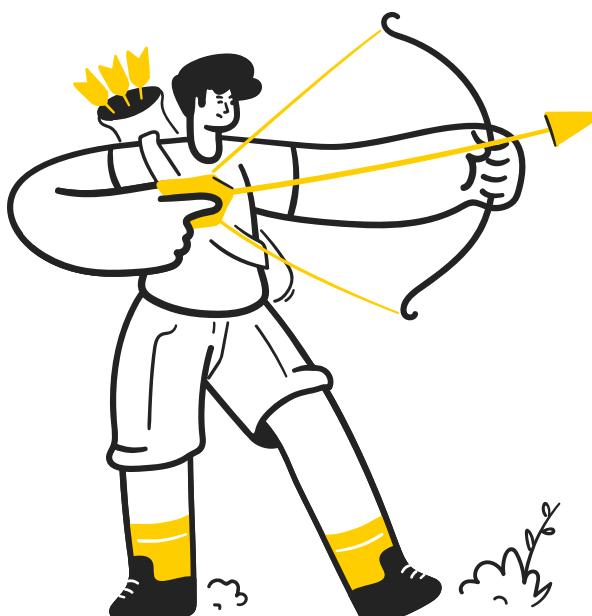
FE Estimation:
plm(formula = n_kakao_game ~
  as.factor(ii) + as.factor(week)
  + age + income + education + gender
  + t_kakao_talk + t_kakao_story + t_kakao_game
  + t_non_kakao_talk + t_non_kakao_story + t_non_kakao_game + t_non_kakao
  + n_non_kakao_talk + n_non_kakao_story + n_non_kakao_game + n_non_kakao,
  data = pdata1,
  model = "within")
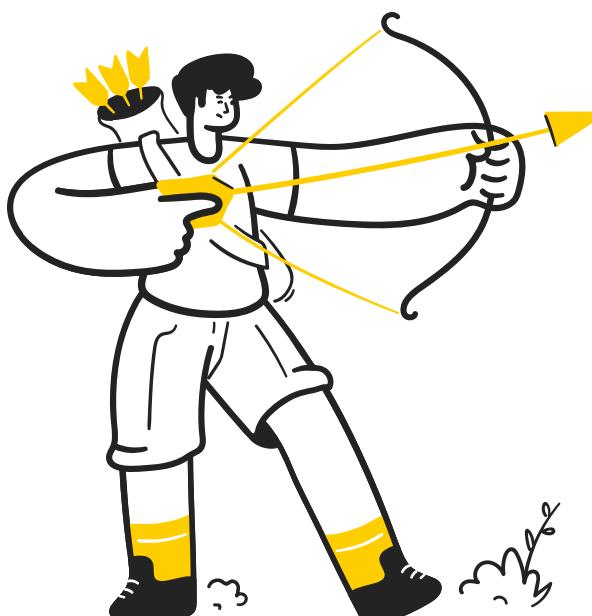
RESULTS

NUMBER OF GAME USAGE (WITHIN) KAKAO PLATFORM

01 **Dummy Regression:**
- Users who adopted Anipang (ii=1) have larger number of Kakao Game apps used (excluding Anipang).
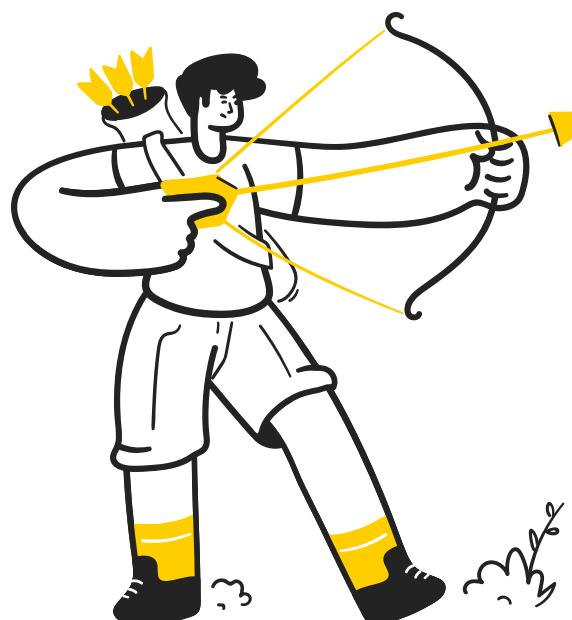
|	as.factor (ii)	t_kakao_game
M1	0.3979***	0.00009***
M2	0.4312***	0.000009***
M3	0.3821***	0.000094***
M4	0.4312***	0.000093***
M5	0.38335***	0.00009***
M6	0.4637***	0.00009***
M7	0.4368***	0.00009***
M8	0.3672***	0.00009***
M9	0.5264***	0.000086***
M10	0.3835***	0.000095***

RESULTS

NUMBER OF GAME USAGE (WITHIN) KAKAO PLATFORM

02

FE Estimation:
- The adoption of Anipang (ii=1) increase the number of Kakao Game apps used (excluding Anipang).
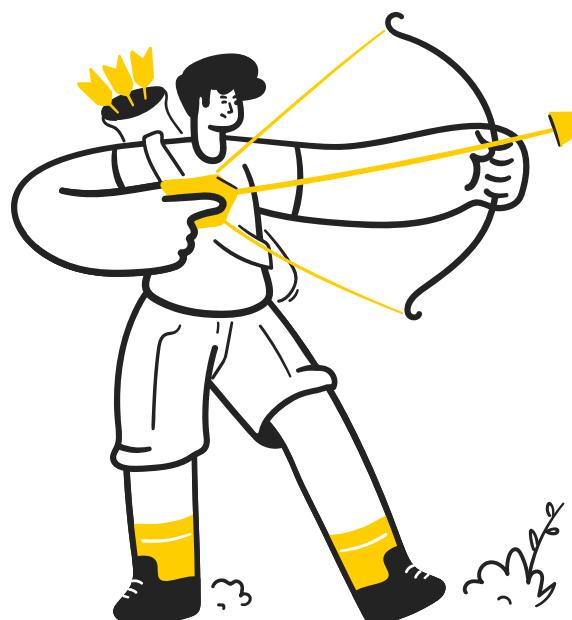
	as.factor (ii)	t_kakao_game
M1	0.3967***	0.00009***
M2	0.458***	0.00009***
M3	0.3893***	0.000097***
M4	0.458***	0.000095***
M5	0.3964***	0.000097***
M6	0.4594***	0.000096***
M7	0.4568***	0.000094***
M8	0.3893***	0.000097***
M9	0.5239***	0.00009***
M10	0.3864***	0.000097***

MODELS

ANIPANG X TIME OF GAME USAGE (WITHIN) KAKAO PLATFORM

01

Dummy Regression:
lm(formula = t_kakao_game ~
as.factor(ii) + as.factor(week) + as.factor(panel_id)
+ age + income + education + gender
+ t_kakao_talk + t_kakao_story + n_kakao_game
+ t_non_kakao_talk + t_non_kakao_story + t_non_kakao_game + t_non_kakao +
n_non_kakao_talk +n_non_kakao_story + n_non_kakao_game + n_non_kakao,
data = matched_panel)

MODELS

ANIPANG X TIME OF GAME USAGE (WITHIN) KAKAO PLATFORM

02
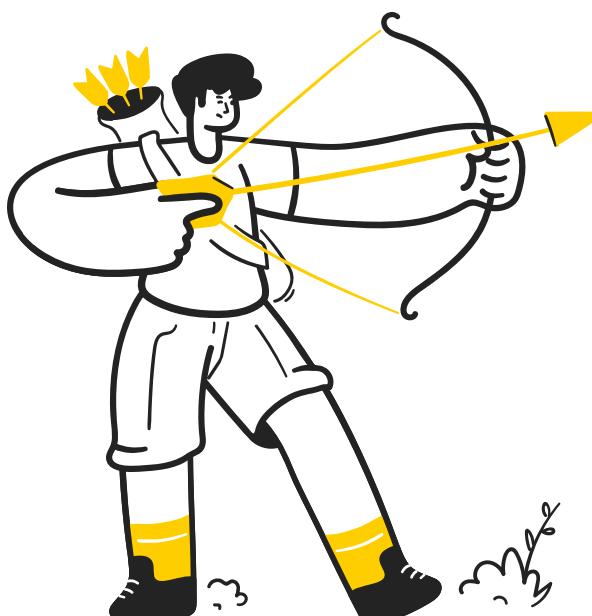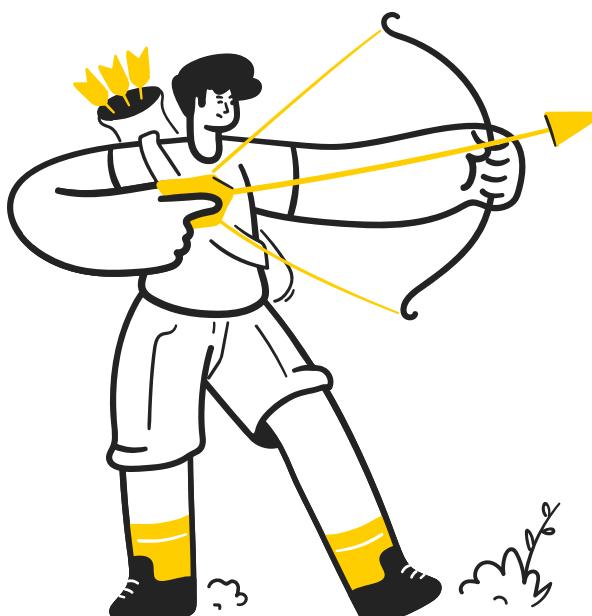
FE Estimation:
plm(formula= t_kakao_game ~
as.factor(ii) + as.factor(week)
+ age + income + education + gender
+ t_kakao_talk + t_kakao_story + n_kakao_game
+ t_non_kakao_talk + t_non_kakao_story + t_non_kakao_game + t_non_kakao
+n_non_kakao_talk + n_non_kakao_story + n_non_kakao_game + n_non_kakao,
data = pdata, model = "within")

RESULTS

TIME OF GAME USAGE (WITHIN) KAKAO PLATFORM

01 **Dummy Regression:**
- ii is not significant across all 10 models
- There's a strong positive usage correlation between time and number of kakao game apps played

|	as.factor (ii)	n_kakao_game
M1	145	2950***
M2	344	2642***
M3	138	3018***
M4	344	2642***
M5	188	2963***
M6	-173	3306***
M7	166	2899***
M8	181	3030***
M9	-176	3399***
M10	188	2963***

Brianna Chen

RESULTS

TIME OF GAME USAGE (WITHIN) KAKAO PLATFORM

02 **FE Estimation**
- ii is not significant across all 10 models

|	as.factor (ii)	n_kakao_game
M1	54	2956***
M2	95	2641***
M3	-177	2968***
M4	95	2641***
M5	-42	2956***
M6	-514	3304***
M7	-102	2851***
M8	-166	2966***
M9	-656	3388***
M10	-42	2956***

Brianna Chen
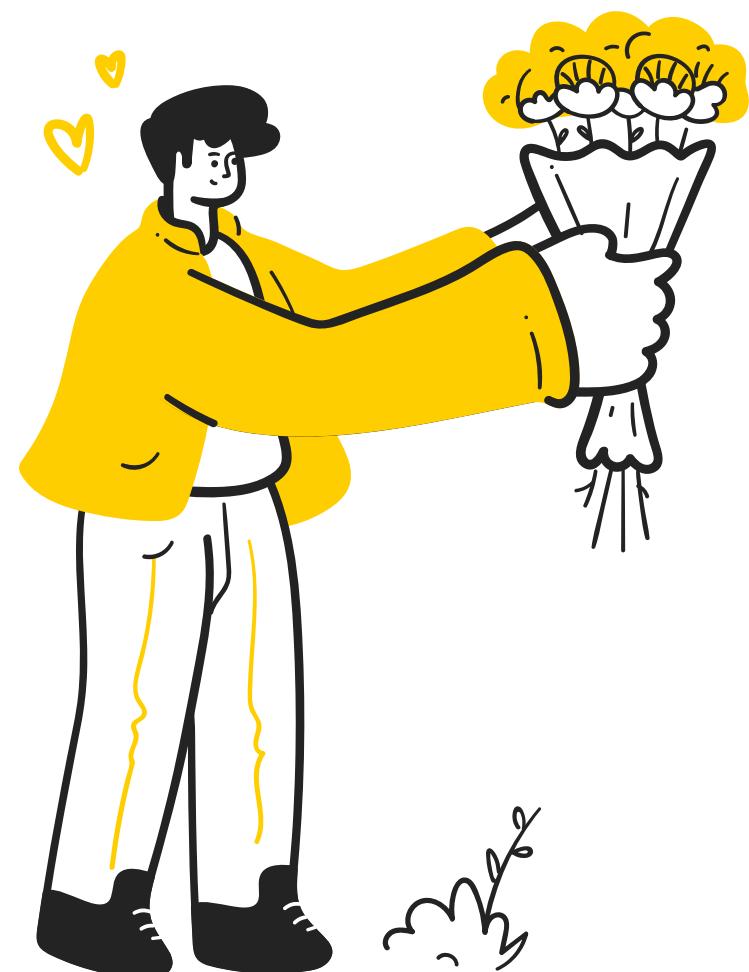
RESULTS - NUMBER

- Anipang adopters showed increase in number of other Kakao Game apps used, at a highly significant level.
- Effect was consistent across all 10 PSM matched samples.

Anipang adoption leads to increased number of Kakao Game apps used.

RESULTS - TIME
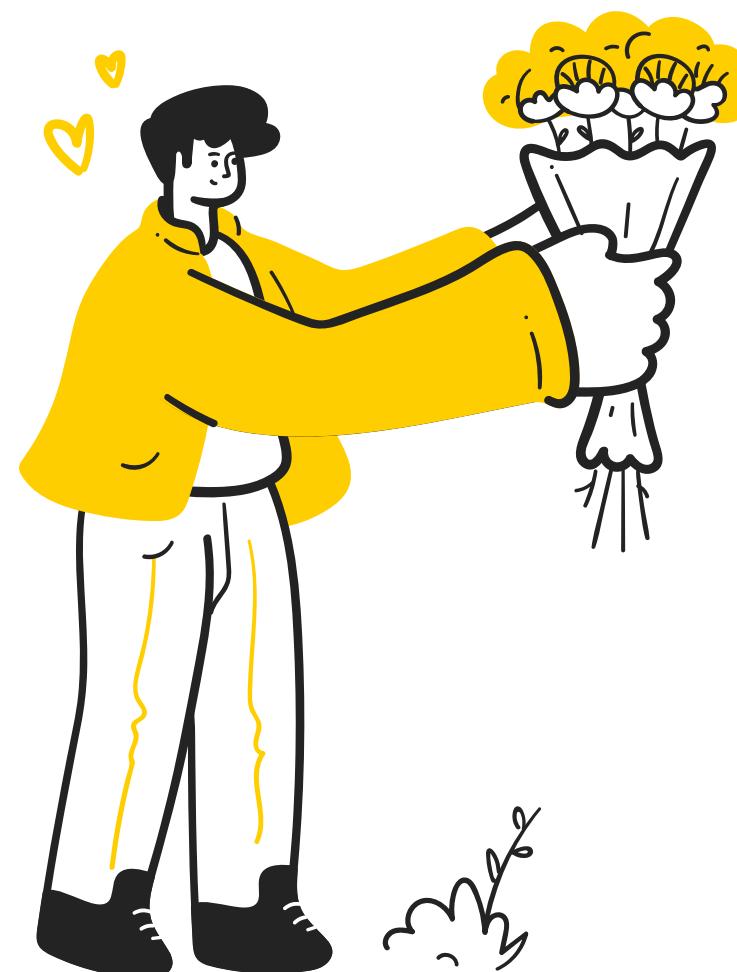
- Anipang adoption on gaming time was not statistically significant across models.
- There's no correlation between increased time usage in other Kakao games.

A diverse app portfolio doesn't correlate to increased total gaming time.

Brianna Chen

COMPARISON - NON-KAKAO GAMES

- Further regression analyses suggest that the Anipang adopters show **no significant difference** on the number of non-Kakao games played and time spent on them.

- This suggests that the effect of Anipang on game usage is exclusively significant **within the Kakao platform**.

Yang Zhou
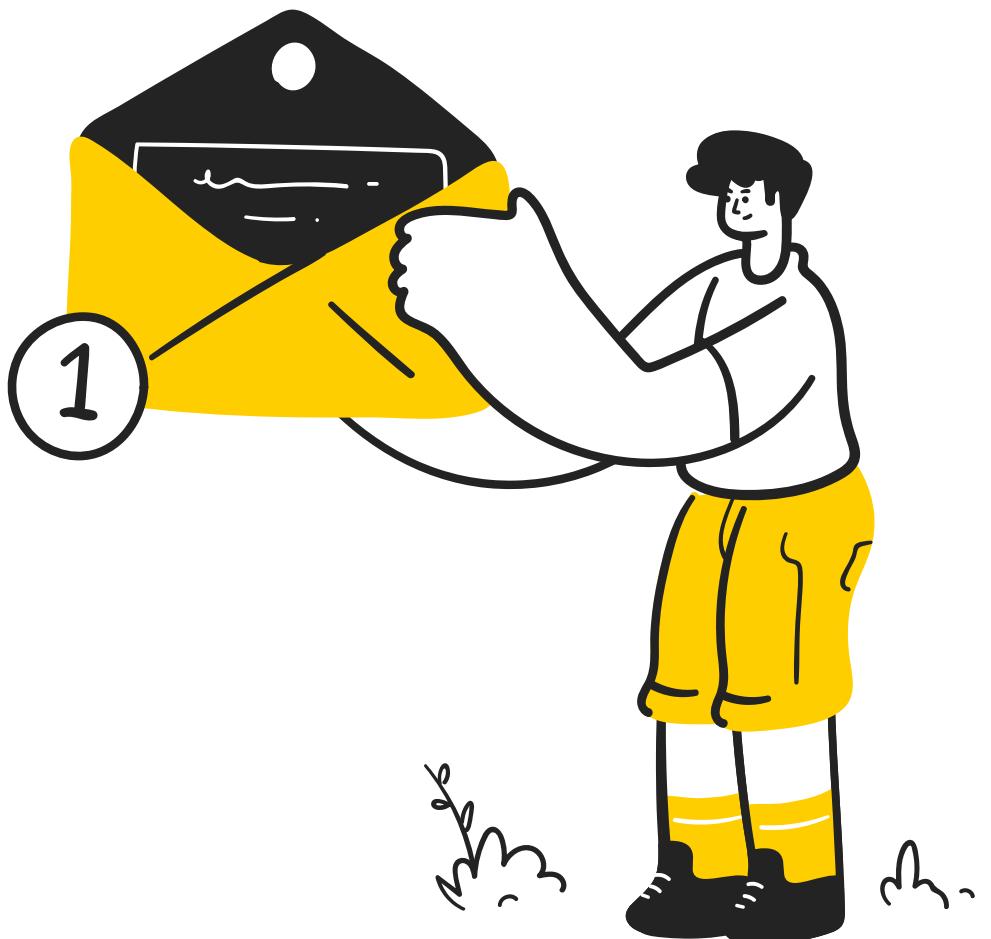
MARKETING IMPLICATIONS

01

Anipang proves that they are a stepping stone to get users to adapt to the broader Kakao ecosystem.

New games should leverage existing apps to promote cross-promotion.
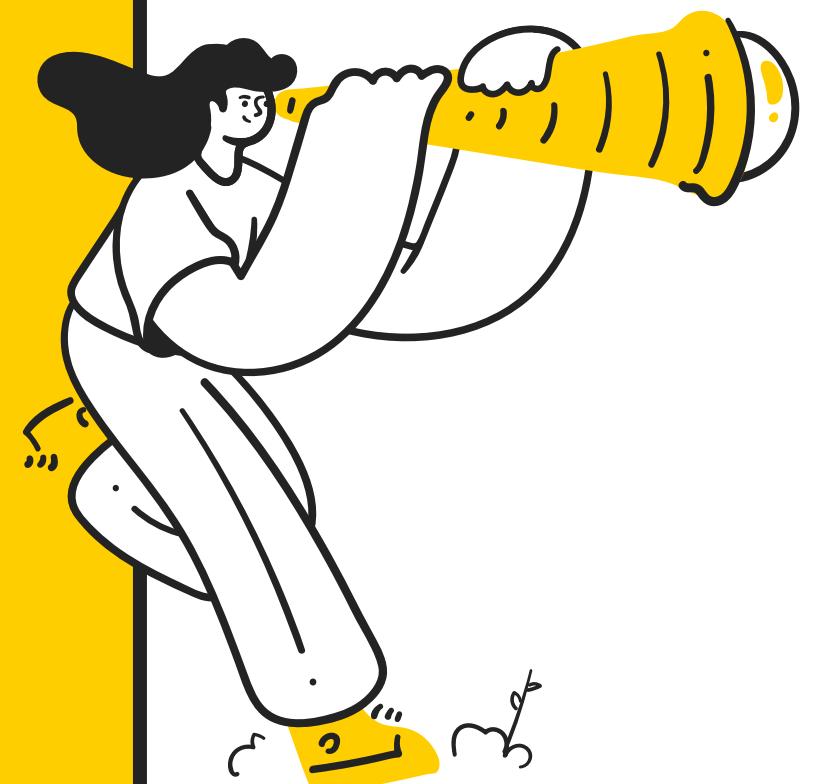
## 02

Leverage a tiered system so that free games will lead to users willingness to purchase paid items or games.

Brianna Chen

CONCLUSION

- Anipang adoption creates a complimentary effect with the Kakao gaming ecosystem. This drives exploration and adoption with other Kakao games while having no impact on non-Kakao gamers.
  - Anipang drives adoption of other Kakao games, which builds loyalty.
  - Users seek game variety rather than increased gaming time.
  - Popular games can be utilized as tools to acquire more customers through different platforms.

Sheryl Xu

LIMITATIONS & FUTURE RESEARCH

01

Data Constraints:

- Only 2 weeks of observations in the summer, which doesn't capture *long-term* adoption or patterns.
- Limitations through 849 users and Android users only. South Korean market doesn't apply to global gaming.

02

Other Limitations to Consider:

- PSM matching doesn't *eliminate* selection bias.
- Kakao ecosystem is a generalization that doesn't *transfer* to other gaming ecosystems or app stores.

03

Future Considerations:

- Longer studies to capture the adoption lifecycle and seasonal effects.
- Platform comparison studies (App Store, Google Play, iOS, etc).
- Revenue impact analysis of cross-game adoption.

Sheryl Xu

THANK YOU FOR LISTENING!

APPENDIX-I

NUMBER OF GAME USAGE (OUTSIDE) KAKAO PLATFORM

01 Dummy Regression:
- ii and week are not significant across all panels

	income	t_non_kakao_game	t_non_kakao_story	n_non_kakao
M1	-0.43**	0.00004***	-0.38*	0.078***
M2	-0.31*	0.00005***	-0.41**	0.086***
M3	-0.52**	0.00005***	-0.395*	0.085***
M4	-0.31*	0.00005***	-0.414**	0.086***
M5	-0.44**	0.00004***	-0.395*	0.077***
M6	-0.65***	0.000009***	-	0.084***
M7	-0.33*	0.00005***	-0.38*	0.08***
M8	-0.52**	0.000045***	-0.41*	0.084***
M9	-0.64***	0.00004***	-0.41.	0.09***
M10	-0.44**	0.00004***	-0.39*	0.077***

APPENDIX-II

NUMBER OF GAME USAGE (OUTSIDE) KAKAO PLATFORM

02 FE Estimation:
- ii and week are not significant across all panels

	t_non_kakao_game	t_non_kakao_story	n_non_kakao
M1	0.00004***	-0.76**	0.072***
M2	0.00004***	-0.72*	0.1***
M3	0.00005***	-0.76*	0.076**
M4	0.00004***	-0.72*	0.1***
M5	0.00004***	-0.76**	0.072**
M6	0.00005***	-0.72.	0.076**
M7	0.00004***	-0.66.	0.08***
M8	0.00005***	-0.77*	0.076**
M9	0.00005*	-0.799.	0.07*
M10	0.00004***	-0.76**	0.072**

APPENDIX-III

TIME OF GAME USAGE (OUTSIDE) KAKAO PLATFORM

01 **Dummy Regression:**
- There are no signficant spillover effects
- No time trend effects
- Non-Kakao gaming time unaffected by Anipang adoption
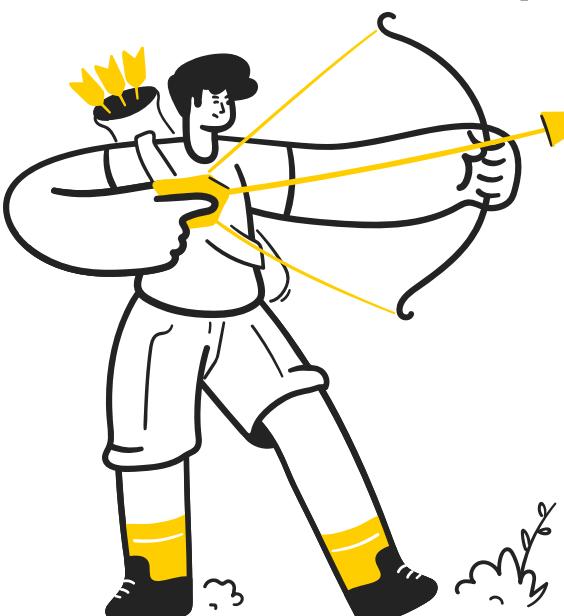
|	income	as.factor.ii.1	as.factor.week.2
M1	-0.4337**	-0.319	-0.0364
M2	-0.3123*	-0.4714	0.1254
M3	-0.5194**	-0.464	0.056
M4	-0.6655***	-0.3612	-0.0842
M5	-0.4368**	-0.3498	-0.03
M6	-0.6531***	-0.3743	-0.0837
M7	-0.3317*	-0.3187	-0.0484
M8	-0.5152**	-0.4943	0.0654
M9	-0.6429***	-0.5673	0.0516
M10	-0.6003***	-0.5456	-0.0187

APPENDIX-IV

TIME OF GAME USAGE (OUTSIDE) KAKAO PLATFORM

02 FE Estimation:
- No treatement effects detected
- Minimal usage correlation
- Fixed effects confirm adbsence of competitive displacement

	as.factor.ii.1	as.factor.week.2
M1	-0.1488	0.0401
M2	-0.3006	0.2154
M3	-0.1586	0.0679
M4	-0.1863	-0.0189
M5	-0.1586	0.0511
M6	-0.1652	-0.0289
M7	-0.1123	0.0454
M8	-0.1635	0.0747
M9	-0.2219	0.0804
M10	-0.268	0.162

APPENDIX-V
R CODE - PREPARATION

```r
install.packages("dplyr")
library(dplyr)
install.packages("MatchIt")
library(MatchIt)
install.packages("cobalt")
library(cobalt)
install.packages("plm")
library(plm)
install.packages("car")
library(car)
```

```r
# Filter for data of week 1
data = read.csv("kakao_all.csv")
data_before = data%>%filter(week ==1)

full_panel <- read.csv("kakao_all.csv") %>%
  filter(week %in% c(1, 2))
```

APPENDIX-V

R CODE - PSM

```
### PSM
# Nearest Neighbor Three-to-One PSM With Replacement and With 0.25 Caliper
M1 = matchit(tg ~ age + income + education + gender +
        t_kakao_talk + t_kakao_story + t_kakao_game + n_kakao_game+
        t_non_kakao_talk + t_non_kakao_story + t_non_kakao_game + t_non_kakao +
        n_non_kakao_talk + n_non_kakao_story + n_non_kakao_game + n_non_kakao,
      data = data_before, method = "nearest", replace = T, ratio = 3, caliper = 0.25)
summary(M1)
plot(M1, type = "hist")
m1_pre   <- match.data(M1)   # contains only week 1 for matched units
matched_ids1 <- m1_pre %>% select(panel_id, weights)
# Use the full two-week `data` (not data_before) and inner_join to keep only matched users
matched_panel1 <- data %>%
  filter(week %in% c(1, 2)) %>%   # keep both weeks
  inner_join(matched_ids1, by = "panel_id")
```

APPENDIX-V
R CODE - PANEL DID

```
### Panel DID Models
# Dummy-Variable Regression on the matched sample
did_dummy <- lm(
  formula = n_kakao_game ~
    + as.factor(ii) + as.factor(week) + age + income + education + gender
  + t_kakao_talk + t_kakao_story + t_kakao_game + t_non_kakao_talk + t_non_kakao_story + t_non_kakao_game + t_non_kakao
  + n_non_kakao_talk + n_non_kakao_story + n_non_kakao_game + n_non_kakao, data    = matched_panel1)
summary(did_dummy)

#One way Fixed Effects Estimation on the matched sample
# Convert to a pdata.frame so that plm knows how to interpret panel_id & week
pdata1 <- pdata.frame(matched_panel1, index = c("panel_id", "week"))

did_fe <- plm(
  formula = n_kakao_game ~ as.factor(ii) + as.factor(week)
  + age + income + education + gender
  + t_kakao_talk + t_kakao_story + t_kakao_game + t_non_kakao_talk + t_non_kakao_story + t_non_kakao_game + t_non_kakao
  + n_non_kakao_talk + n_non_kakao_story + n_non_kakao_game + n_non_kakao, data   = pdata1, model  = "within")
summary(did_fe)
```