APPLICATION OF INCENTIVES FOR DRIVERS TO ACHIEVE AN IMPROVEMENT IN THE QUALITY OF THE SERVICE

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THREDBO 16, SINGAPORE, 2019

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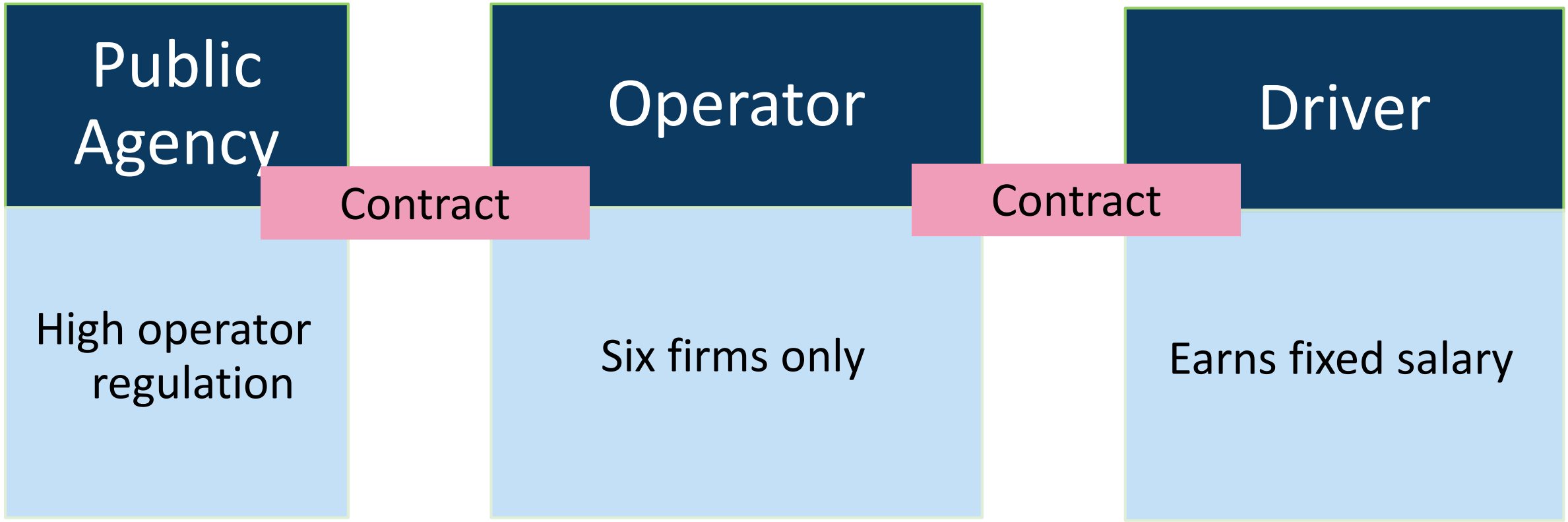
TRANSANTIAGO



EXISTING PUBLIC TRANSPORT MODEL

TRANSANTIAGO

Public Agency

Operator

Driver

Contract	≠	Contract
• Travelled km • Transported passengers • Regularity • Frequency • Bus size		• Fixed salary + overtime

DRIVERS TODAY IN TRANSANTIAGO

FIGURES

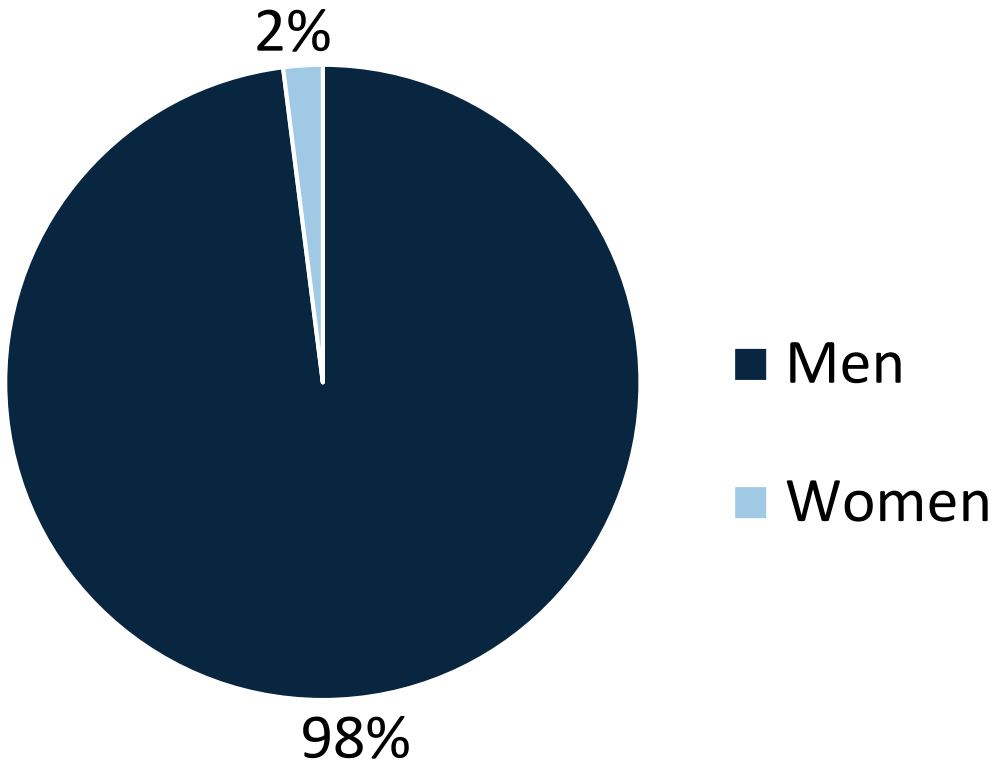
17.868 drivers

56 years average age

80% comes from old transport system

80%-90% belongs to a union

Monthly Salaries between $780 USD - $1,700 USD (considering working overtime).



(Sectra, 2016)

DRIVERS TODAY IN TRANSANTIAGO

MAIN ISSUES

1. There is a **driver deficit** in the system which causes:

   -working **overtime**

   -hard to **dismiss** workers with bad performance

   -generates additional **work stress** given the demand the operation implies

In 2016 driver deficit was of 7% Estimated defecit in 2026 will be from 16% to 20%

This limits **Public Transport Capacity** to deliver a better service.

DRIVERS TODAY IN TRANSANTIAGO

MAIN ISSUES

2. High rate of **medical licenses and absences**

21.700 days lost per year due to drivers' medical licenses (Mutual, 2012).

Reason	Firms' average
Holidays	4.9%
Medical licenses	12.3%
Injustified absenteeism	1.3%
Special days absenteeism	0.2%
Union jusrisdiction abseteeism	0.8%
Total not avaliable drivers per month	**19.4%**

17.868

Total drivers

3.467

Not available per month

DRIVERS TODAY IN TRANSANTIAGO

MAIN ISSUES

3. Driver's job may involve **Multitasking**

Drivers perform a job with multiple tasks

Bus operation depends directly from his behavior

Not having to charge tickets has less burden

With fixed salary incentives changed, so there is a new behavior

High depency of the system

RESEARCH OBJECTIVES

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Design, implement and evaluate **a monetary incentive scheme** for drivers in Transantiago.

We seek to **modify driver's behavior** and find empirical evidence of the **multitasking** aspect of their job

At the same time, study the **influence of the driver's work** on the KPI demandaded by the government.

METHODOLOGY

METHODOLOGY

Economic model between opeartor – driver

Define an **incentive** that takes into account the **operational KPIs** required to operator

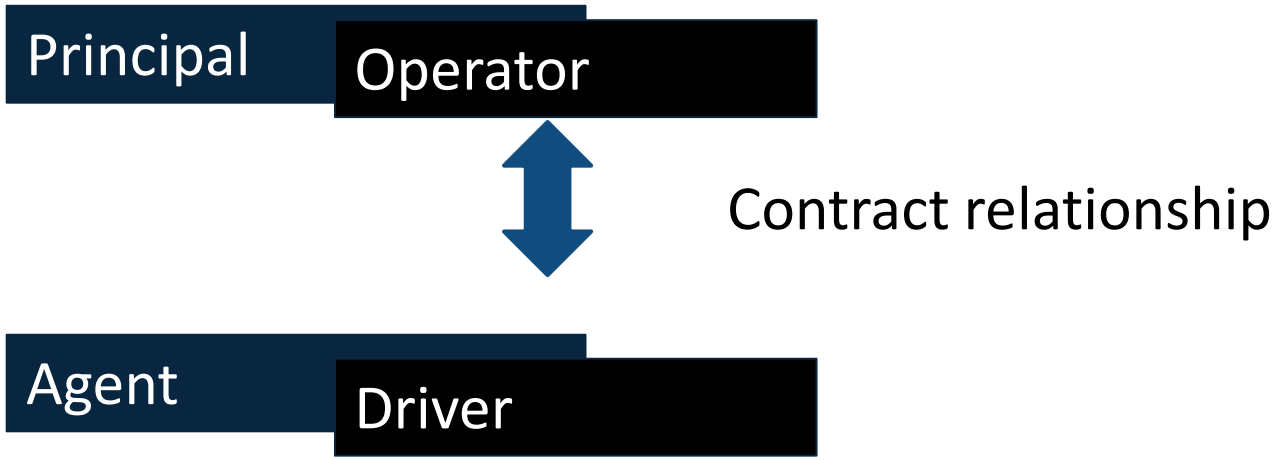
Apply incentive by an **randomized experiment**

Incentive evaluarion through **differences in differences**

Multitasking analysis

Methodology

Incentives through contract theory



Hidden information or adverse selection	Agent has proavte information about its (in)capacity which is hidden from principal
Hidden action or moral risk	Principal cannot see what agent does, if he works or not, or its efforts

Methodology

Incentives through contract theory

Case study conditions

Principal hires agent to perform certain tasks

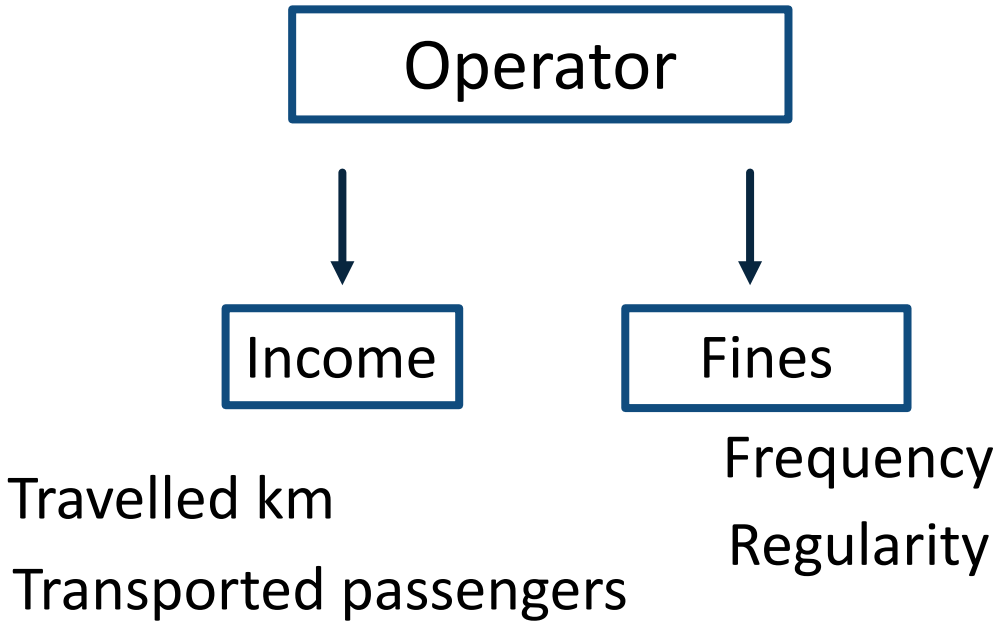
Agent chooses effort level which affects performance

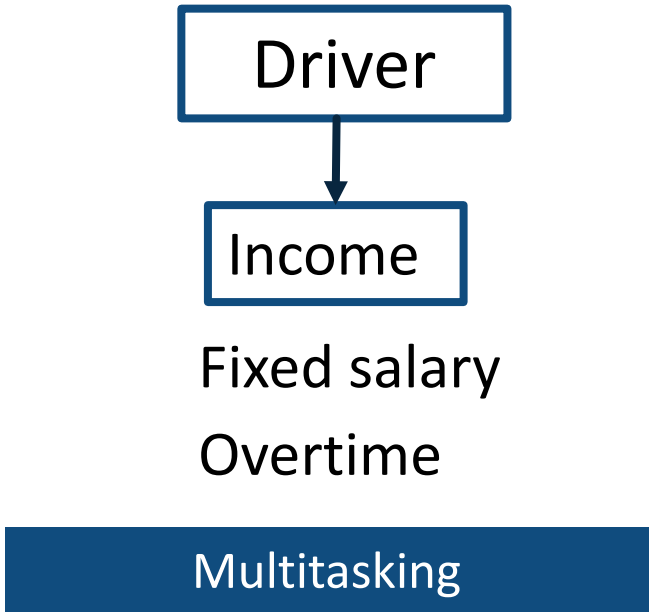
Principal only observes performance

Effort is not observable, so principal pays according to performance.

Methodology

Incentives through contract theory

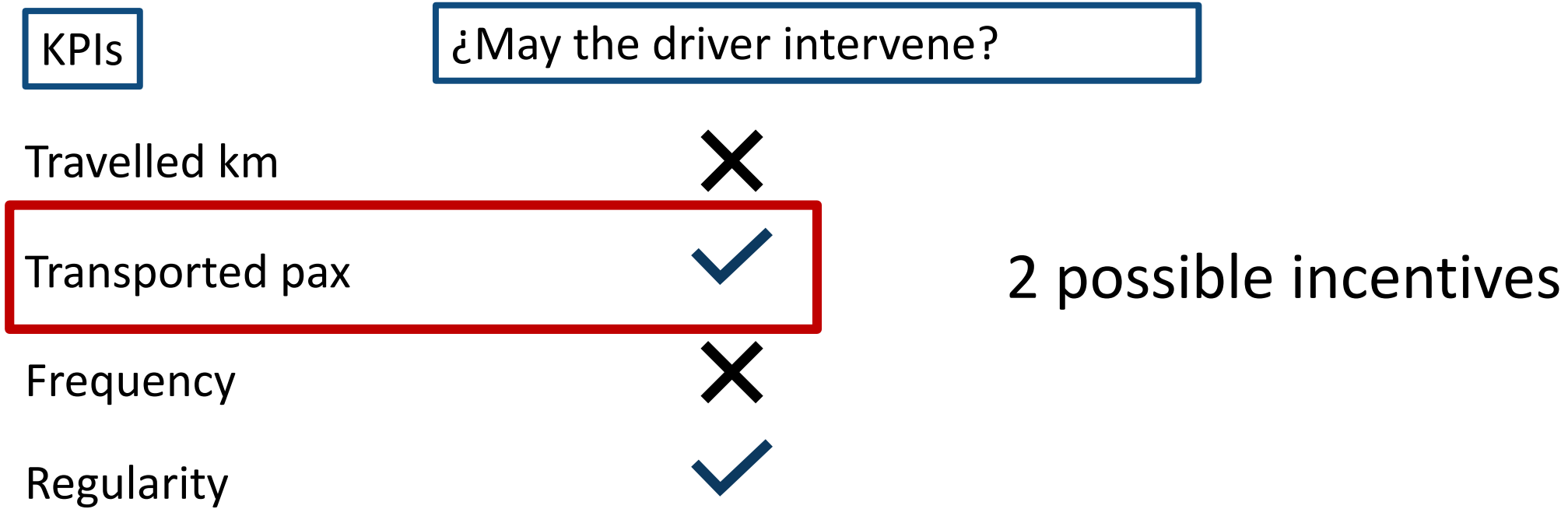




Methodology

Incentives through contract theory

Building of incentive scheme:



2 possible incentives

EXPERIMENT DESIGN

EXPERIMENT

Application of the incentive scheme to **a group of drivers** of an operating bus company

Stratification of the sample will be applied

Data will be analysed under **Differences in Differences** method

Multitasking will be analyzed

EXPERIMENT

OPERATOR DESCRIPTION

Two very different depots

237 drivers

Two types of shifts: morning or afternoon

Day shifts of 7.5 hours (1 free day a week) or 9 hours (2 free days a week)

Salaries starting at $859 USD

Commitment bonus (arriving on time at shift)

Service allocation bonus (reprimands)

	Drivers	Services	Buses
Depot 1	126	6	59
Depot 2	111	4	37

DIFFERENCES IN DIFFERENCES

DIFFERENCES IN DIFFERENCES

EXPERIMENT METHODOLOGY

¿What is needed?

Treatment group

Control group

Two time periods

DIFFERENCES IN DIFFERENCES

EXPERIMENT METHODOLOGY

Advantages:

Eliminates biases in comparisons between groups in the second period that could be the result of permanent differences between them.

Eliminates the biases of comparisons over time in the treatment group that could be the result of trends.

DIFFERENCES IN DIFFERENCES

EXPERIMENT METHODOLOGY

$$Y = \beta_0 + \beta_1 * dT + \beta_2 * d2 + \delta_1 * (d2 * dT)$$

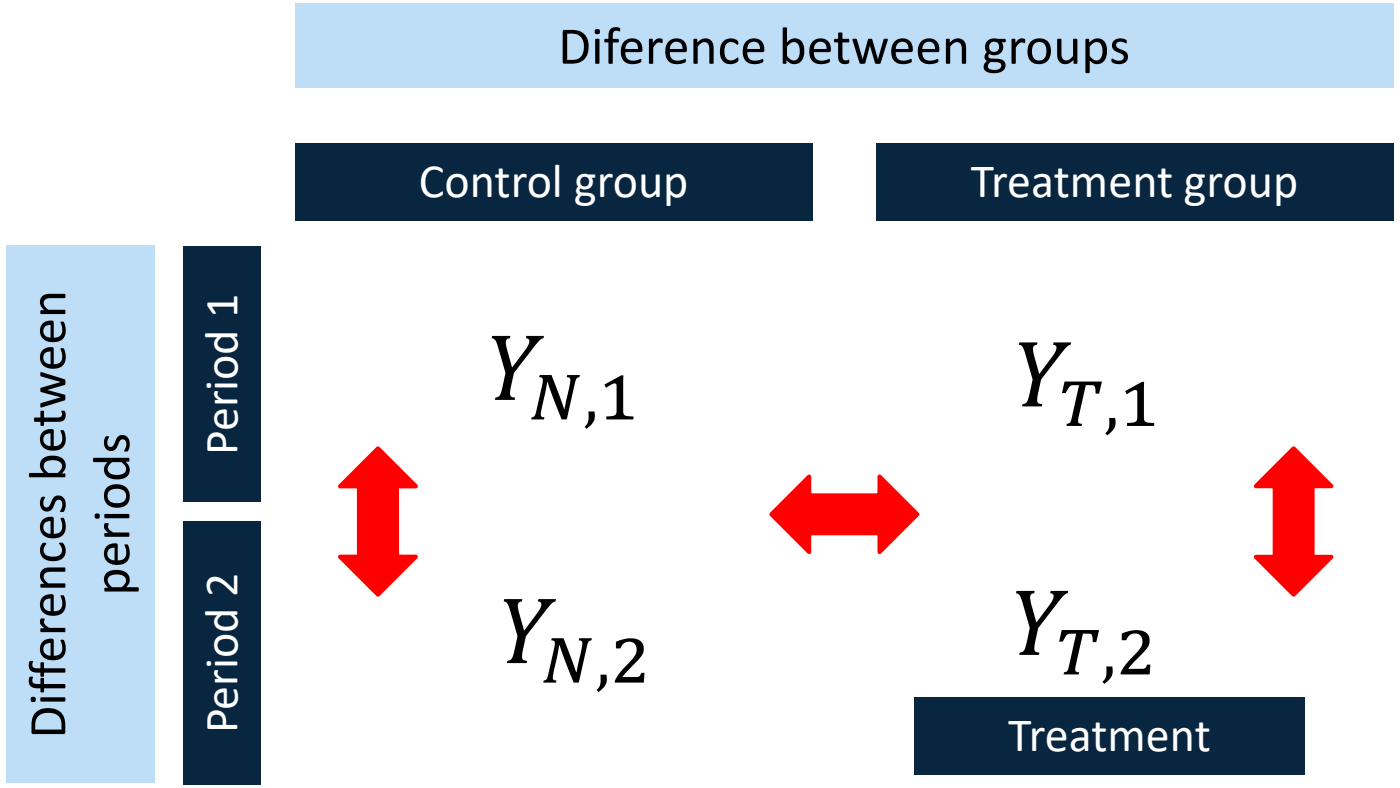
dT captures differences between gruops before experiment

d2 captures factors that may cause changes in the results even without treatment

We are interested **in coefficient $\boldsymbol{\delta_1}$** which multiplies interaction $d2 * dT$ (equivalent to a dummy variable equal to one when we observe an individual from the treatment group in the second period)

DIFFERENCES IN DIFFERENCES

EXPERIMENT METHODOLOGY



$$Estimator\ of\ interest = (y_{T,2} - y_{T,1}) - (y_{N,2} - y_{N,1})$$

MULTITASKING

Since we suspect there is **multitasking**, we will evaluate the variable for the incentive, but we will also keep an eye on others variables that may be affected due to multitasking:

Transported passengers

KPI for regularity

% of driven hours

Number of expeditions per shift

Absences

Delays

Maximum speeds

STRATIFICATION

STRATIFICATION

EXPERIMENT METHODOLOGY

¿What is needed?

Observable variables

Control group

Treatment group

STRATIFICATION

EXPERIMENT METHODOLOGY

Variables	Possible values
Gender	Female or male
Age	Year categories: 26-25, 36-45, 46-55, 56-65, 66-75.
Seniority	Year categories: 0-2, 3-5, 6-8, 9-11, 12-14, 15-17.
Type of Shift	AM, PM or AM-PM.
Nationality	Chilean or foreign.
Overtime arrangement	Signed or not signed.

EXPERIMENT

DIFFERENCES IN DIFFERENCES + STRATIFICATION

2 terminals

2 periods of measurement of 2 weeks each

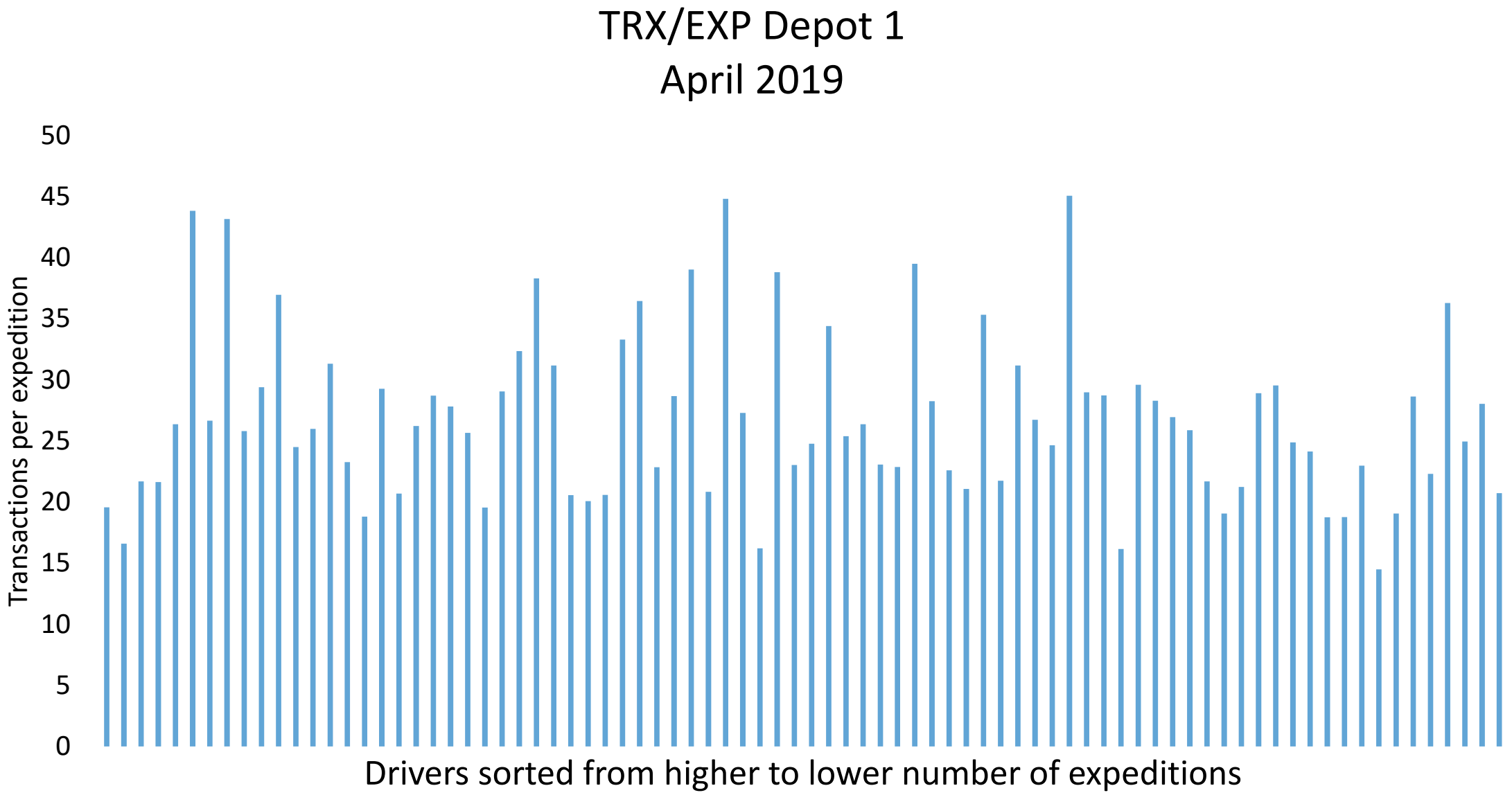
Treatment and control groups Grupos de tratamiento y control randomly determined by stratification

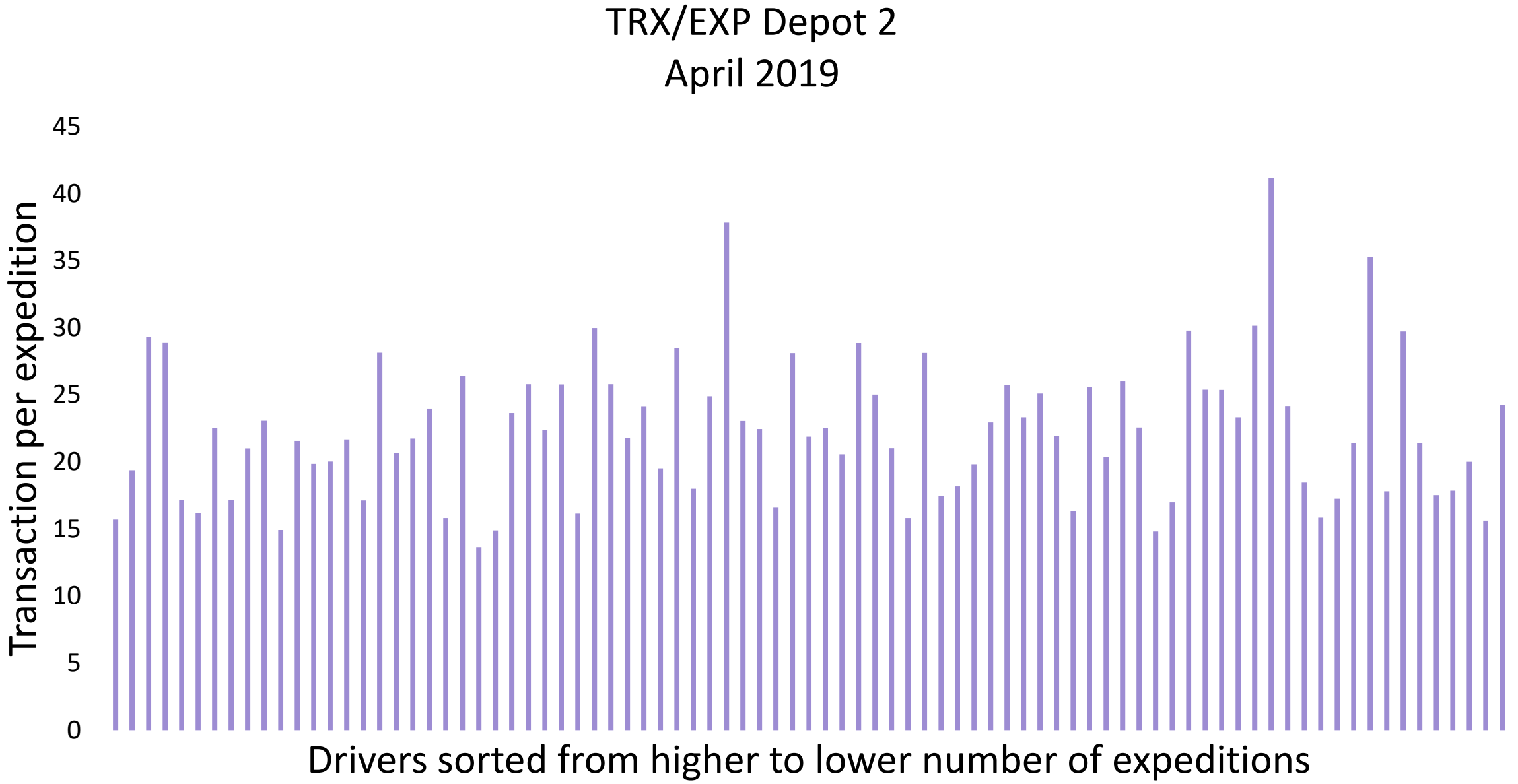
After a negociation with drivers' unions, groups will be inverted (everyone willing to participate in experiments will be control and treatment once)

Period 1: April 2019

Period 2: August 2019.

Incentive measure: transported passengers


TRX/EXP Depot 1
April 2019
Transactions per expedition
50
45
40
35
30
25
20
15
10
5
0
Drivers sorted from higher to lower number of expeditions


TRX/EXP Depot 2
April 2019
Transaction per expedition
45
40
35
30
25
20
15
10
5
0
Drivers sorted from higher to lower number of expeditions

INCENTIVE ACHIEVEMENT MEASURES

Transported passengers

- Incentive will be measured per driver during two weeks
- Must identify level of achievement that drivers currently have

Monetary incentive

Non-monetary incentive

- **BONUS payment per extra passenger above certain threshold: ($0.14 USD per passenger above 20% better)**
- Depends on period of time, direction (one way), bus size

OBJECTIVES EXAMPLES FOR DEPOT 2 FOR 20%

	B53		B53c		B54		B56	
LUNES A VIERNES	I	R	I	R	I	R	I	R
01 - Pre Nocturno	-	-	-	-	-	-	0	0
03 - Transición Nocturno	10	25	-	-	5	5	5	10
04 - Punta Mañana	55	90	45	110	50	45	40	35
05 - Transición Punta Mañana	55	80	35	80	40	35	30	35
06 - Fuera de Punta Mañana	40	60	-	-	25	30	20	30
07 - Punta Mediodía	45	60	-	-	30	30	25	30
08 - Fuera de Punta Tarde	75	65	-	-	40	35	45	30
09 - Punta Tarde	70	55	70	45	40	35	30	30
10 - Transición Punta Tarde	45	35	-	-	20	15	20	20
11 - Fuera de Punta Nocturno	30	25	-	-	15	15	15	15
12 - Pre Nocturno	5	5	-	-	-	-	5	5

EXPECTED RESULTS

RESULTS

EXPECTED

Increase in the number of transactions

Driver may stop longer at stops (achievement if he stops) → longer cycle times

May reduce average speed (to generate greater accumulation of passengers at stops) → effect on regularity (may cause bus bunching)

Difference between two consecutives drives (both may be or not on treatment), two treatment drivers on a row may compete for passengers

We expect less absences, more driving per shift, decrease in the delay of arrival time to the shift, may cause more overtime

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20% mejor

	B53		B53c		B54		B56		B61		B64		B65		B68		B70		B72	
	I	R	I	R	I	R	I	R	I	R	I		I	R	I	R	I	R	I	R
01 - Pre Nocturno	-	-	-	-	-	-	3	4	-	-	-	-	-	-	-	-	-	-	-	-
03 - Transición Nocturno	14	28	-	-	6	4	10	13	15	14	27	11	4	5	5	9	-	-	20	4
04 - Punta Mañana	57	93	54	112	54	48	42	37	73	31	100	30	71	28	12	45	90	0	33	23
05 - Transición Punta Mañana	55	82	38	89	43	36	32	38	67	22	85	30	72	21	11	43	91	0	35	23
06 - Fuera de Punta Mañana	43	65	-	-	27	31	24	34	44	20	21	31	48	18	20	22	50	0	34	18
07 - Punta Mediodía	50	62	-	-	30	32	27	30	31	23	19	48	29	28	24	23	31	0	32	31
08 - Fuera de Punta Tarde	78	66	-	-	46	36	49	31	32	42	20	82	31	52	21	42	51	0	27	52
09 - Punta Tarde	77	58	78	50	41	38	37	33	28	52	17	71	33	58	21	49	67	0	24	54
10 - Transición Punta Tarde	49	39	-	-	23	19	20	19	25	49	14	50	22	32	13	13	63	0	14	23
11 - Fuera de Punta Nocturno	35	27	-	-	18	17	22	16	18	20	10	44	15	18	10	11	35	0	8	18
12 - Pre Nocturno	7	6	-	-	-	-	5	7	6	2	7	12	-	-	1		9	0	-	-
13 - Pre Nocturno Sábado	-	-	-	-	-	-	6	8	2	1	-	-	-	-	-	-	-	-	-	-
15 - Transición Sábado Mañana	-	-	-	-	-	-	6	6	2	11	13	19	2	4	4	7	-	-	7	6
16 - Punta Mañana Sábado	33	57	-	-	19	19	20	28	29	10	21	38	28	10	21	16	28	0	29	13
17 - Mañana Sábado	39	46	-	-	25	20	24	20	24	16	18	54	26	19	17	13	30	0	16	21
18 - Punta Mediodía Sábado	46	40	-	-	23	21	27	23	25	23	14	72	23	21	14	16	36	0	13	26
19 - Tarde Sábado	41	32	-	-	24	21	28	18	21	32	14	67	18	21	12	11	50	0	11	24
20 - Transición Sábado Nocturno	35	28	-	-	26	15	30	23	21	47	11	36	14	27	12	9	49	0	10	13
21 - Pre Nocturno Sábado	6	10	-	-	-	-	15	11	6	3	10	9		4	3		10	0	2	
22 - Pre Nocturno Domingo	-	-	-	-	-	-	13	5	2	1	-	-	-	-	-	-	-	-	-	-
24 - Transición Domingo Mañana	23	30	-	-	11	13	11	13	20	9	20	37	21	10	11	9	23	0	19	14
25 - Mañana Domingo	23	37	-	-	12	14	18	19	24	7	15	29	23	7	11	7	25	0	9	8
26 - Mediodía Domingo	23	25	-	-	17	13	19	16	21	15	11	35	20	12	8	8	30	0	6	9
27 - Tarde Domingo	31	30	-	-	19	17	24	21	20	29	16	40	18	20	11	6	44	0	16	14
28 - Transición Domingo Nocturno	35	29	-	-	17	13	18	18	21	32	12	22	16	15	9	5	44	0	14	9
29 - Pre Nocturno Domingo	6	4	-	-	-	-	5	5	2	2	6	3		11	2		7	0	-	-