POLICE CORRUPTION

AN AGENT-BASED MODEL

by Isabel, Rick, Fatima, Karolina, Noah and Kostas

Police corruption in developing countries

When cops become criminals…

Introduction

Why is an ABM appropriate?

Realistic modelling of complex and hidden behaviour

What behavior is emerging?

Spread of corruption
Behaviour of citizens and cops

What local interactions are occurring?

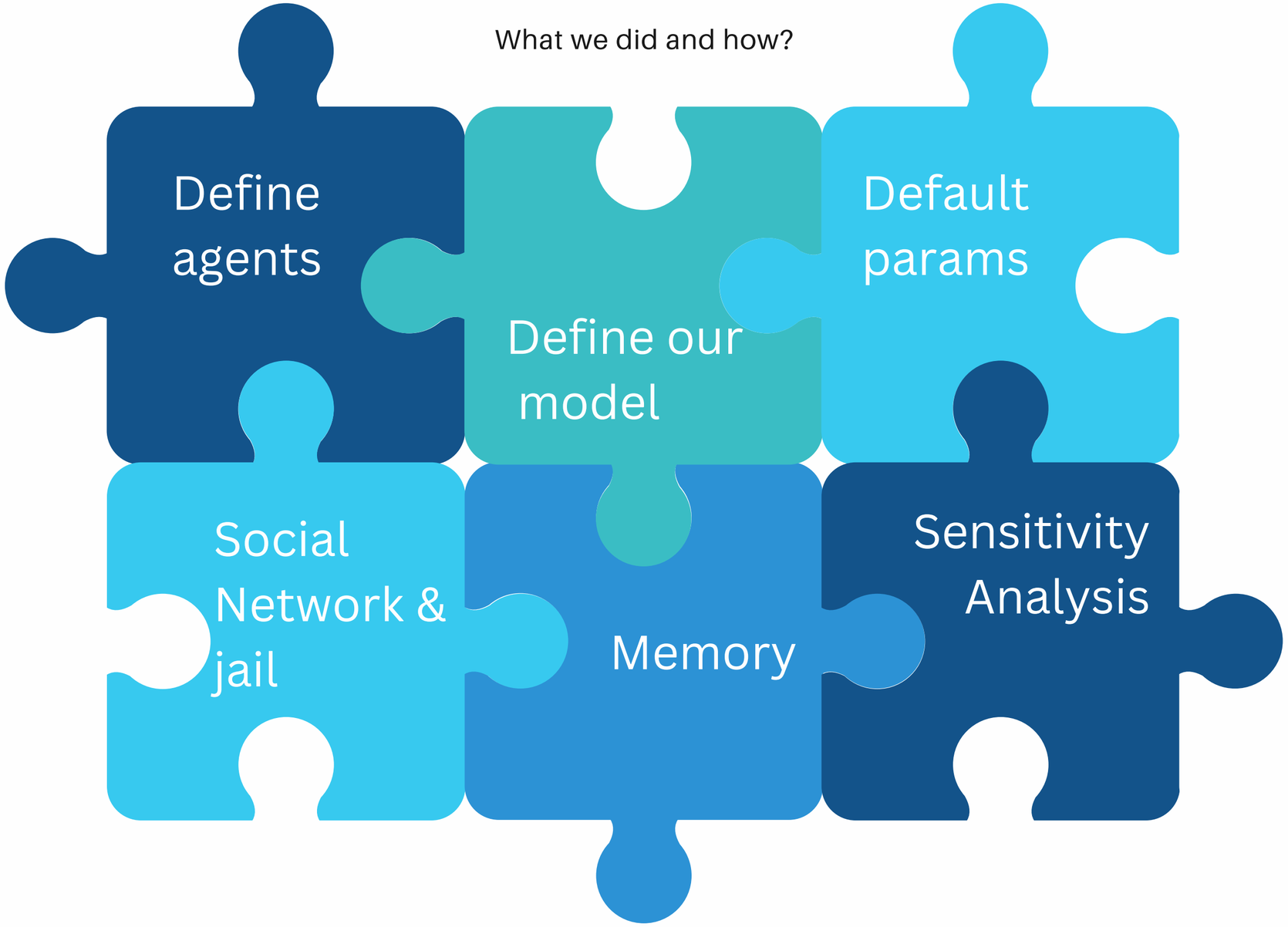
Bribing between cops and citizens

What heterogeneity is being presented?

Morality of agents
Likelihood to complain
Social network
Memory

EXPERIMENT PLAN

What we did and how?



Model

Description

MODEL PROCESS

Stage 1

Citizens are stopped by cops

Stage 2

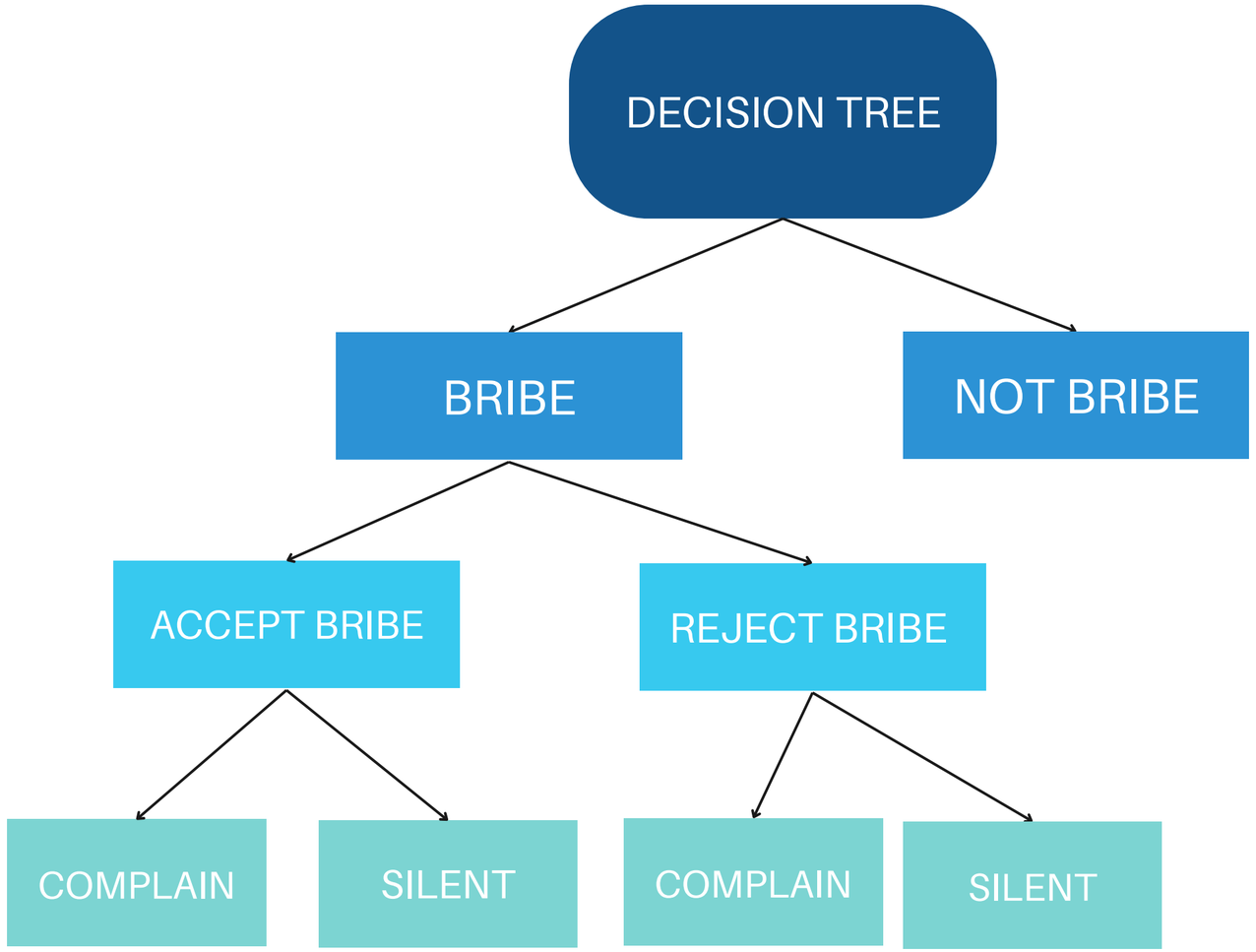
Cop decides whether or not to bribe citizen

Stage 3

Citizen decides to accept or reject bribe

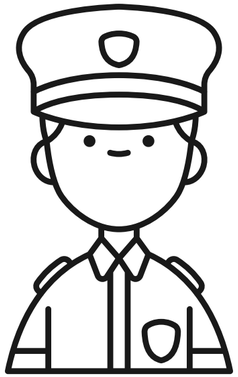
Stage4

Citizen decides to complain or keep silent



COP

AGENT



01 Bribe or not to bribe

Based on incomplete information, bounded rational decision

02 Initialisator

#Cops > #Citizens, cops stop a random citizen and initialize the interaction

03 P getting caught

Probability of being caught based on their network

04 P succesful bribe

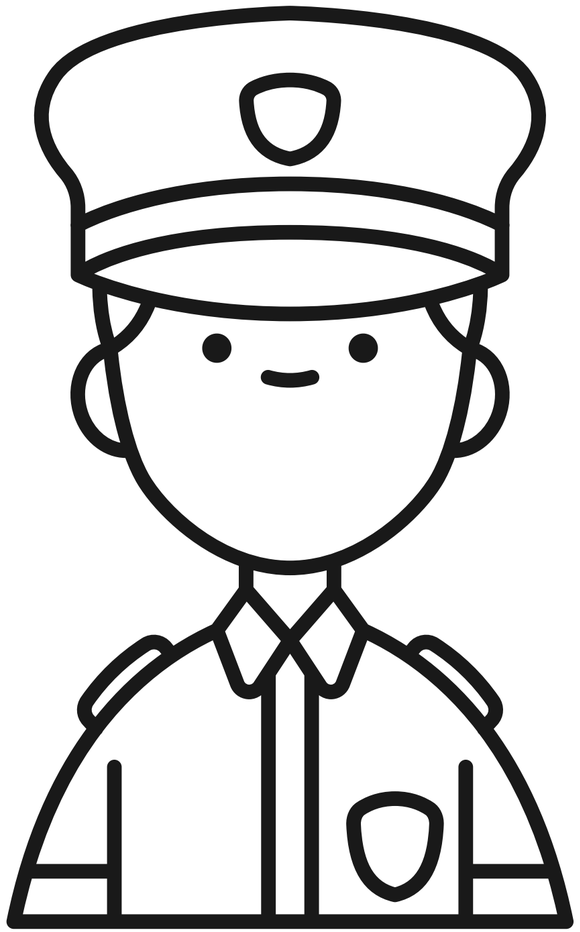
Probability of citizens accepting the bribe, based on previous interactions

05 Moral commitment

Heterogenous
Drawn from a normal distribution

06 Jail

Complains - cops sent to prison with GT probability of getting caught



P getting caught

p_caught = # teammates in jail / team size

P succesful bribe

memory = [0, 1, 0, 1, 1] { m_i = 1 if bribe was succesful
m_i = 0 if bribe was unsuccesful

p_accept = ($\sum$ memory) / memory size

Expected payoff

Expected pay off not caught — Expected pay off caught

utility_bribe = (1 - p_caught) * (p_accept * bribe_amount) - prob_caught * jail_cost

utility_not_bribe = moral commitment

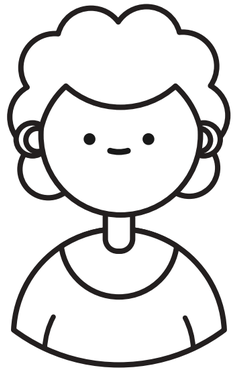
1. ***Sampled per cop***
2. ***Functions as threshold utility***

Decision

$$P_{ij} = \frac{\exp(\lambda EU_{ij}(P_{-i}))}{\sum_k \exp(\lambda EU_{ik}(P_{-i}))}$$

CITIZEN

AGENT



Penalty/reward accept

If complain was successful

06

Accept or reject

Accept: moral cost, bribe
Reject: pay fine amount

01

Moral commitment

Heterogeneous
cost of accepting the bribe and
cost of being silent

05

Complain or silent

Complain: resource cost ,
might get refunded
Silent: moral cost

02

P successful complain

Probability of the cop being
prosecuted, based on memory
(discount factor)

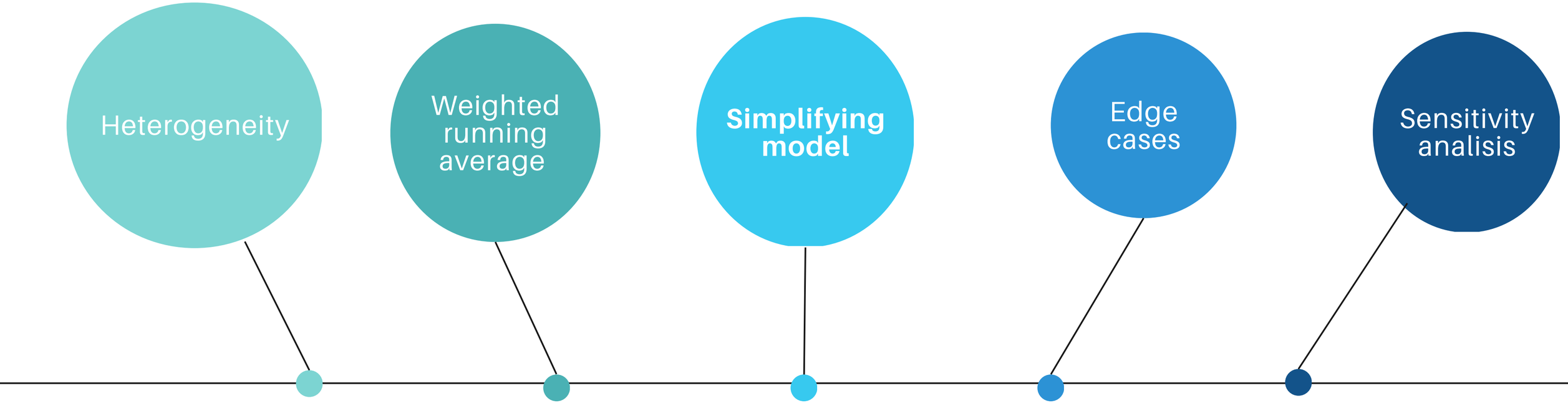
04

Cost of complain

Monetary/time/stress
investment

03

ISSUES ENCOUNTERED AND PARAMETER TUNING



Agents were too homogeneous

Memory of citizen: how to model in a realistic way

Which parameters are useful

What to do when all cops are in jail

What is the range of parameters we want tested

Sensitivity Analysis

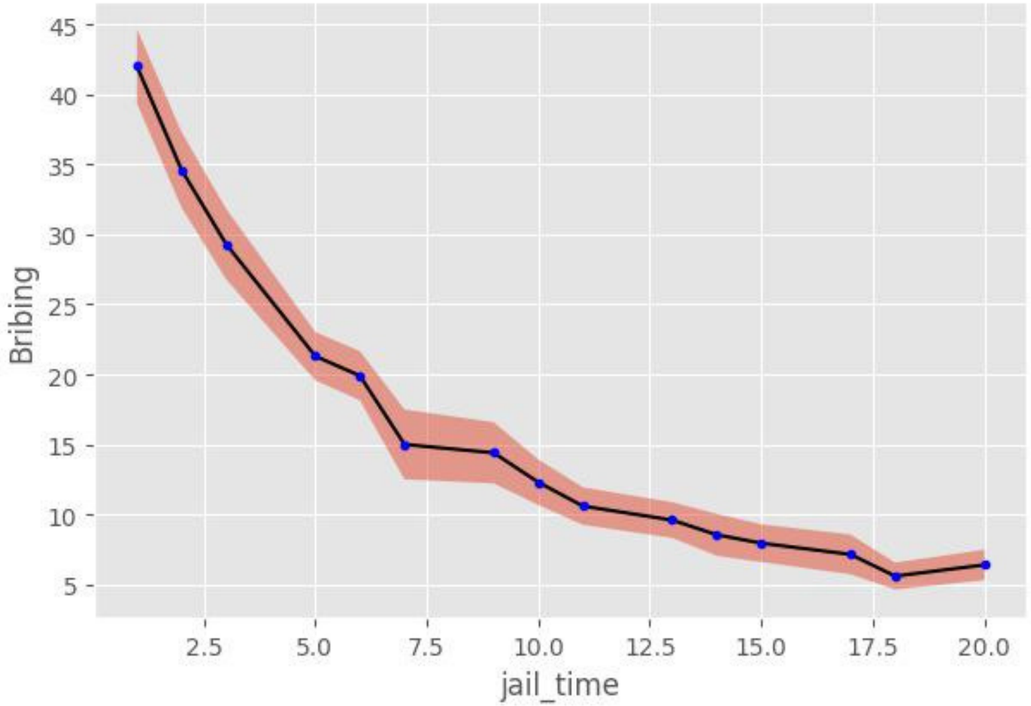
LOCAL	GLOBAL	PAWN*
• OFAT method, varying one parameter at a time. • We have 10 potentially interesting parameters • Which parameters when nudged will change the model output the most.	• Variance-based method for SA. • Computing and interpreting the First and Total-Order Sobol Indices for 10 parameters.	• Density-based method for SA. • Computationally cheaper than variance-based alternatives. • Measures the distance between the conditional and unconditional CDF of the output.

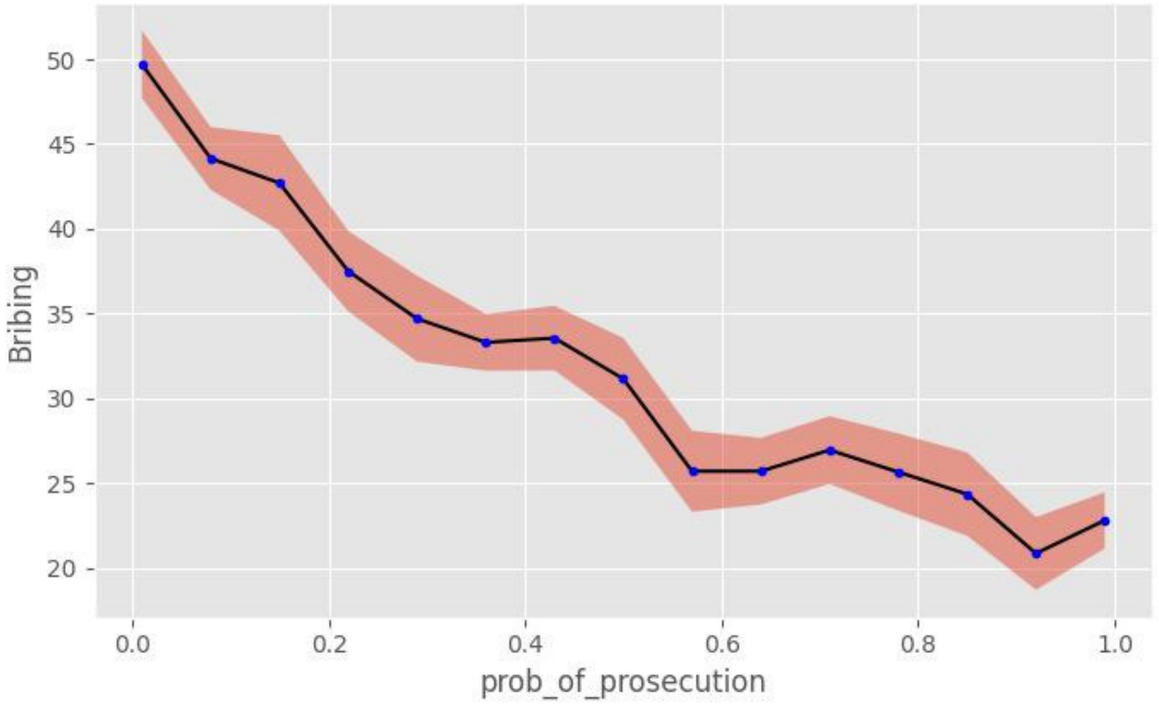
(*) Pianosi, F. and Wagener, T., 2015. A simple and efficient method for global sensitivity analysis based on cumulative distribution functions. Environmental Modelling & Software, 67, pp.1-11.

Key

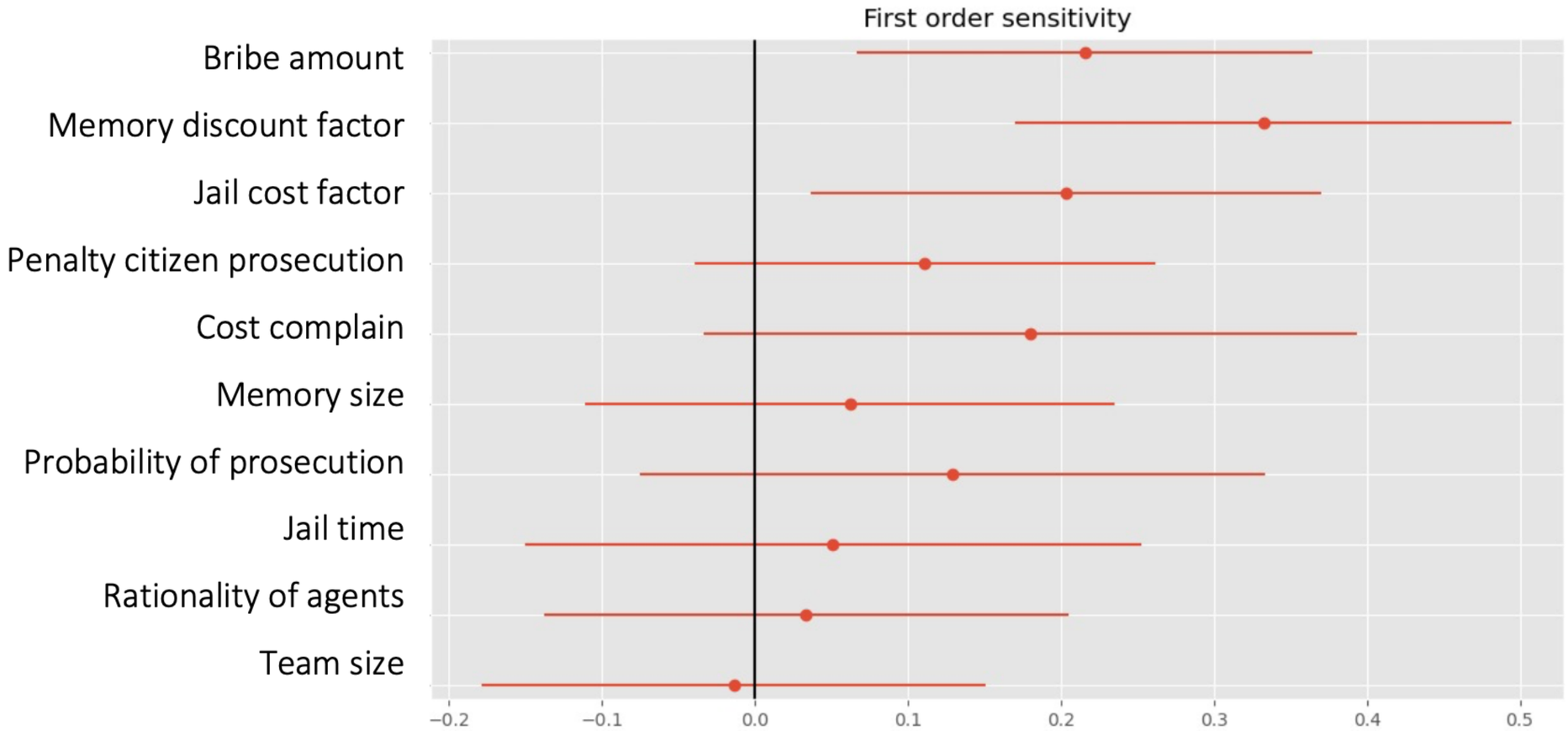
Findings

OFAT METHOD: EXAMPLE OF INTERESTING MODEL RELATIONS

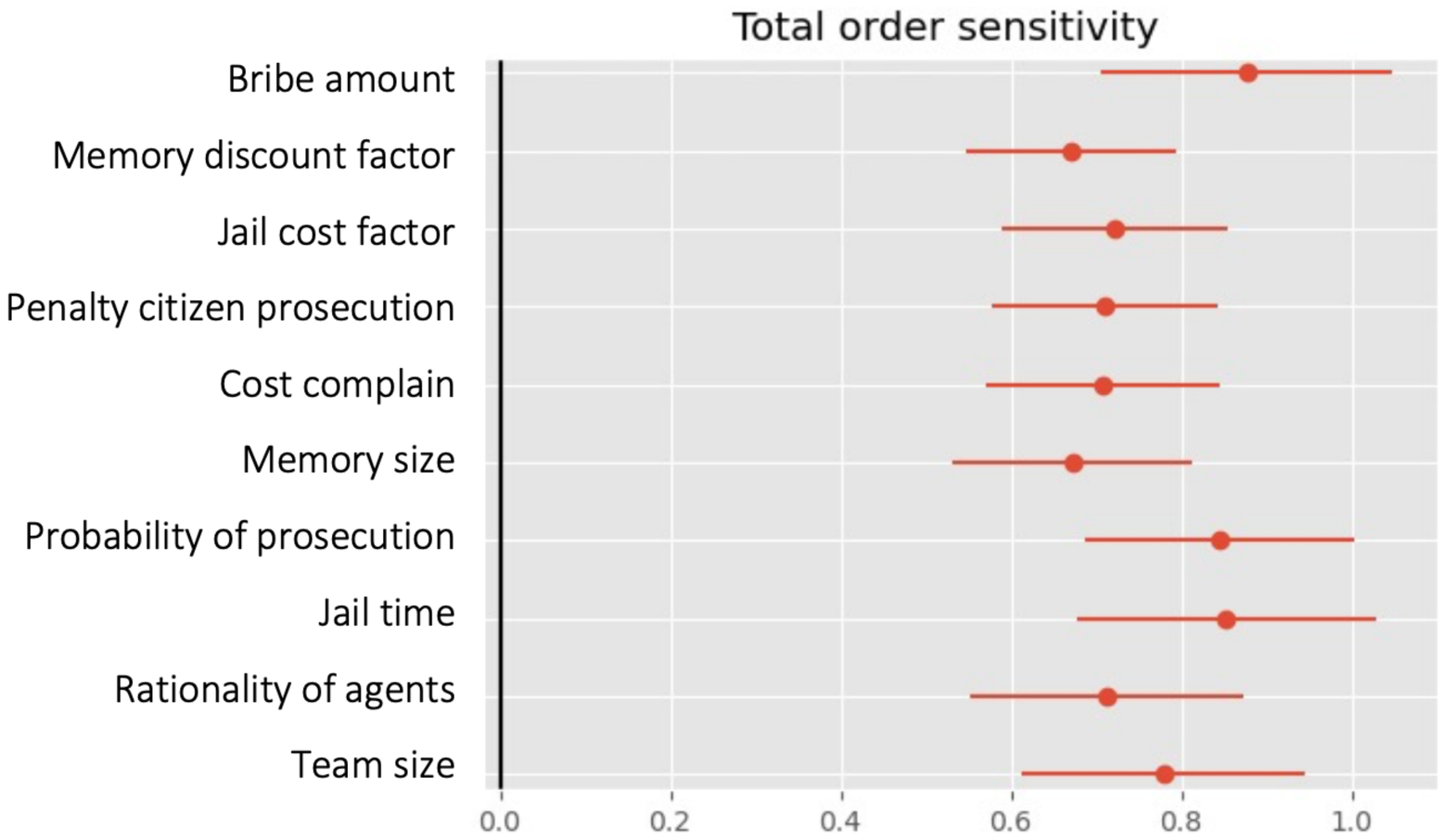




FIRST ORDER


First order sensitivity
Bribe amount
Memory discount factor
Jail cost factor
Penalty citizen prosecution
Cost complain
Memory size
Probability of prosecution
Jail time
Rationality of agents
Team size
−0.2
−0.1
0.0
0.1
0.2
0.3
0.4
0.5

TOTAL ORDER


Total order sensitivity
Bribe amount
Memory discount factor
Jail cost factor
Penalty citizen prosecution
Cost complain
Memory size
Probability of prosecution
Jail time
Rationality of agents
Team size
0.0
0.2
0.4
0.6
0.8
1.0

CURRENT AND FUTURE WORK

Defined, reasoned and checked model

A lot of factors with many dependencies

Which parameters have the biggest effect?

Translate this into policies and advice to combat corruption

Read our report for more...