



## SECONOMICS

The socio politics, public economics and operational research of security

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# The Scope of SECONOMICS:

SECONOMICS is an inter-disciplinary project with research excellence in comparative media analysis, the public economics of institutions and the quantitative operational research of organizations.

- ▶ In addition to the novel research group, we have very much embedded ourselves in our case studies.
- ▶ Our key objective is to provide guidance to policy-makers seeking to understand their policy options and potential outcomes of these policies.
- ▶ The project has three scientific work packages.
  1. Public choice and the saliency of the contemporary discourse in security: **Comparative Media Analysis of Security (CMA-S)**.
  2. The public economics of security and the decisions and interactions of citizens, firms and governments: **Public Policy and Economics of Security (PPE-S)**.
  3. The practical on-the-spot challenges of deriving optimal choices at the organizational level: **Operational Research on Adversarial Risk Analysis (OR-ARA)**.
- ▶ If we look at many prior approaches to the 'security policy' problem, the researchers have looked at one or two of these aspects in isolation, to my knowledge SECONOMICS is almost unique in combining all three.

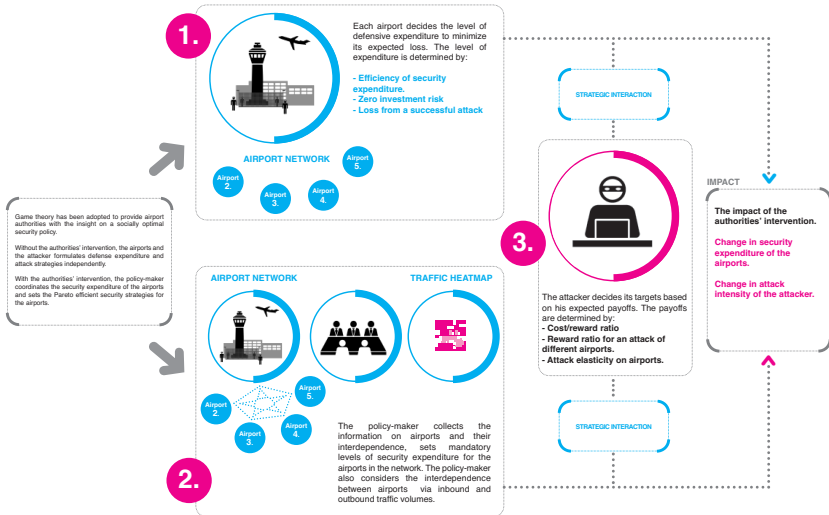
# A Quick Tour:



- ▶ We have *three* case study workpackages (WP), each matched to two or more scientific WPs.
- ▶ We have been very lucky in terms of the degree of access to our cases, which is almost unprecedented, for a research project that has such a public policy mandate.
- ▶ My intention here is to give a non-technical summary of the research interactions and results for each case study.
  1. Aviation Security.
  2. Critical National Infrastructure.
  3. Regional and Urban Transport.
- ▶ I will also provide a glimpse of the types of results we have generated and how we have integrated them into an interactive tool.

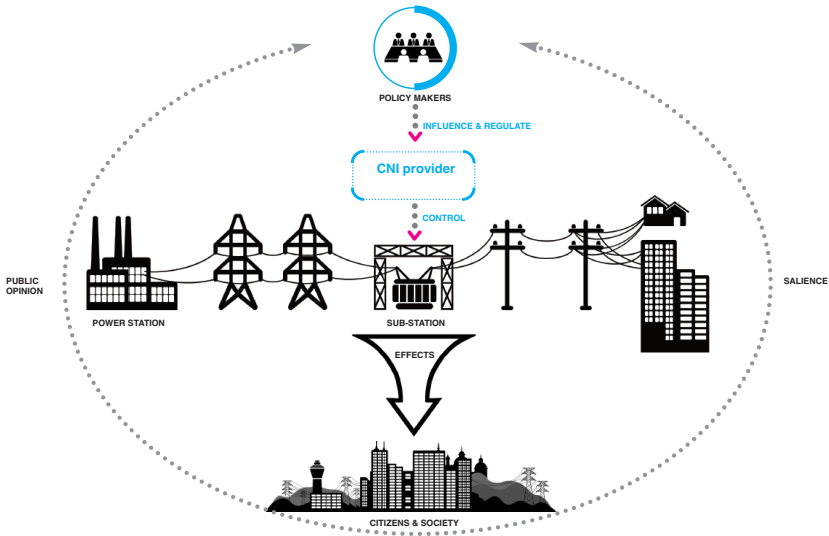


# Effective Security Policy Model





# National Grid Societal View of Security of CNI





**Background:** The safe and secure transportation of citizens is a core feature of our everyday economic and social activities. Regional transport is inevitably at the forefront of the security of society.

At the beginning of this project we made a controversial choice to focus on **societal aspects of security** such as public disorder and antisocial behaviour. Over the course of the project from the proposals inception in 2010 to the final stages of the project in 2015 this has proved highly prescient.

- ▶ **CMA-S:** What is the public perception of the use of CCTV and related security measures for regional and urban transport over the recent period of economic upheaval in Europe.
- ▶ **OR-ARA:** What is the optimal configuration of security measures to protect the transport infrastructure and reduce fare evasion without imposing measures that substantially impact the efficacy and enjoyment of the urban traveller?



# Metro. Fare evasion



We use Adversarial Risk Analysis to model and solve the problem. We take into account two intelligent adversaries, the Defender (metro authorities) and the Attacker (fare evaders), who have some common targets they will fight for. To model each adversary's preferences and utilities, we use utility functions, in which we aggregate all relevant information about costs, revenues, payoffs, etc. that influence their decisions. We assume that both adversaries are expected utility maximisers, i.e. they both will try to obtain the maximum profit from their actions, making the corresponding decision.

The computation proceeds through the following high-level steps:  
 1. Solve the Attacker's problem, i.e. obtain a probability distribution that gives us information about what actions will be most likely chosen by the Attacker, given the countermeasures eventually deployed by the Defender.  
 2. Solve the Defender's problem, i.e., find which portfolio of countermeasures will provide the best protection against the potential actions from the Attacker.

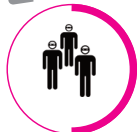
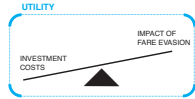
The final output of the model will be to provide advice to metro authorities for devising an optimal security plan with the portfolio of countermeasures that will maximise their expected utility, given all possible actions performed by the Attacker and the corresponding probabilities that the Attacker will choose such actions.



**METRO COUNTERMEASURES**

- Inspectors
- Bouncers
- Guards
- Automatic access doors
- Metro officers

COSTS	DETERRENCE	INSPECTION
€ 50k	Low	High
€ 25k	n.a.	n.a.
€ 30k	High	n.a.
€ 15k	Moderate	n.a.
€ 15k	Low	n.a.

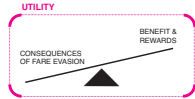


**EVADERS COSTS**

- Organised fraudsters
  - Preparation costs
  - Ticket fare if aborted
  - Fines
- Unorganised evaders not taken into account since they are regarded as unintentional fraudsters.

**COSTS**

Negligible for final users  
 € 2  
 € 100



**D. Impact of fare evasion**

- Investment costs
- Fraud
- Partly mitigated through fines
- Image costs

**A. Consequences of fare evasion**

- If aborted, cost of ticket
- If attempted and not caught, saving of ticket fare
- If attempted and caught, fined

# Why SECONOMICS is needed?



- ▶ A primary aim of SECONOMICS is to provide context to current evidence.
- ▶ Part of our job is not to find surprising results, but to carefully explain the mundane observations of reality models rich enough to capture the important effects, but tractable enough to make predictions.
- ▶ We address simple aspects of human behaviour, such as how we perceive risk and how our media communicates risk to us.
- ▶ We then make use of some of the most up-to-date approaches in game-theory, textual analysis and probabilistic modelling to solve our models from these simple beginnings.

This leads us to how we have built and are building policy recommendations for the future.

*There was a key challenge from the start to increase people's appetite in looking at how evidence is used and discussing how it can potentially provide more imaginative options when it comes to creating policy*

**Anne Glover, Professor of Molecular biology and Cell biology at the University of Aberdeen and Chief Scientific Adviser to the President of the European Commission.**

- ▶ There is a desire for evidence based approaches to policy development across the spectrum of societal and economic activities.
- ▶ The 'security' domain offers an almost unique set of problems to the public administrator, corporate officers and policy researchers.
  - ▶ There are very few natural experiments that can be used to determine the specific effects of policies.
  - ▶ Public preferences (risk preferences, value of privacy & freedom of expression) are diffuse and difficult to disentangle.
  - ▶ Direct experimentation is a) almost impossible and even if it is possible it is b) almost certainly unethical.

# What have we learned and where do we go from here?



*The field of security is the ultimate mix of public administration, economics, technology and social policy research.*

- ▶ The broadest message from SECONOMICS is that the institutional arrangements matter as much as the content and direction of policy.
- ▶ There is a 'public good' aspect to almost every facet of security that necessitates some type of public policy response to ensure that risks are fairly shared.
- ▶ There is also another more sinister aspect that economic and social theories predict that excessive security coordination can lead to rent seeking behaviour.
- ▶ These rents can be both financial and socio political (such as reductions in privacy and erosion of democratic legitimacy).
- ▶ These trade-offs are **inherent properties** and fundamentally the same for both cyber and physical security although the differing technological filtration results in different observed effects.