How long does it take for a policy to affect the market?

Analysing time lags in low-carbon technological change in Austria

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Impact of Research and Innovation Policy at the Crossroads of Policy Design, Implementation and Evaluation

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http://timelag.joanneum.at

Time is essential for decarbonisation strategies

National total GHG emissions without LULUCF

− 36% compared to 2005

− 80% to − 95% compared to 2005

Austria's Annual Greenhouse Gas Inventory 1990-2016
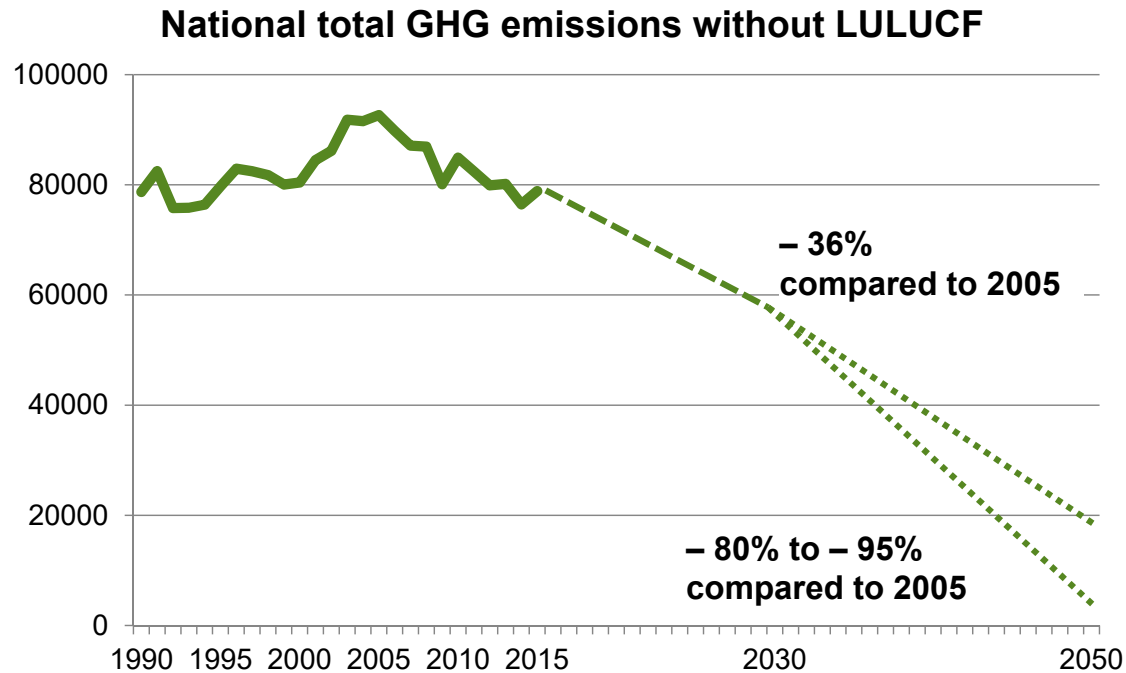
Effective policies for supporting low carbon technologies are well known

Each year of delay depletes the carbon budget

Understand time lags between policy actions and their actual impact on the market

Time is unspecified in current transformation research

Increasing structuration
of activities in local practices

Socio-technical landscape (exogenous context)

Landscape developments put pressure on existing regime, which opens up, creating windows of opportunity for novelties

New regime influences landscape

Socio-technical regime

Markets, user preferences
Industry
Science
Policy
Culture
Technology

Socio-technical regime is 'dynamically stable'.
On different dimensions there are ongoing processes.

New configuration breaks through, taking advantage of 'windows of opportunity'. Adjustments occur in socio-technical regime.

External influences on niches (via expectations and networks)

Elements become aligned, and stabilise in a dominant design. Internal momentum increases.

Niche-innovations

Small networks of actors support novelties on the basis of expectations and visions. Learning processes take place on multiple dimensions (co-construction). Efforts to link different elements in a seamless web.
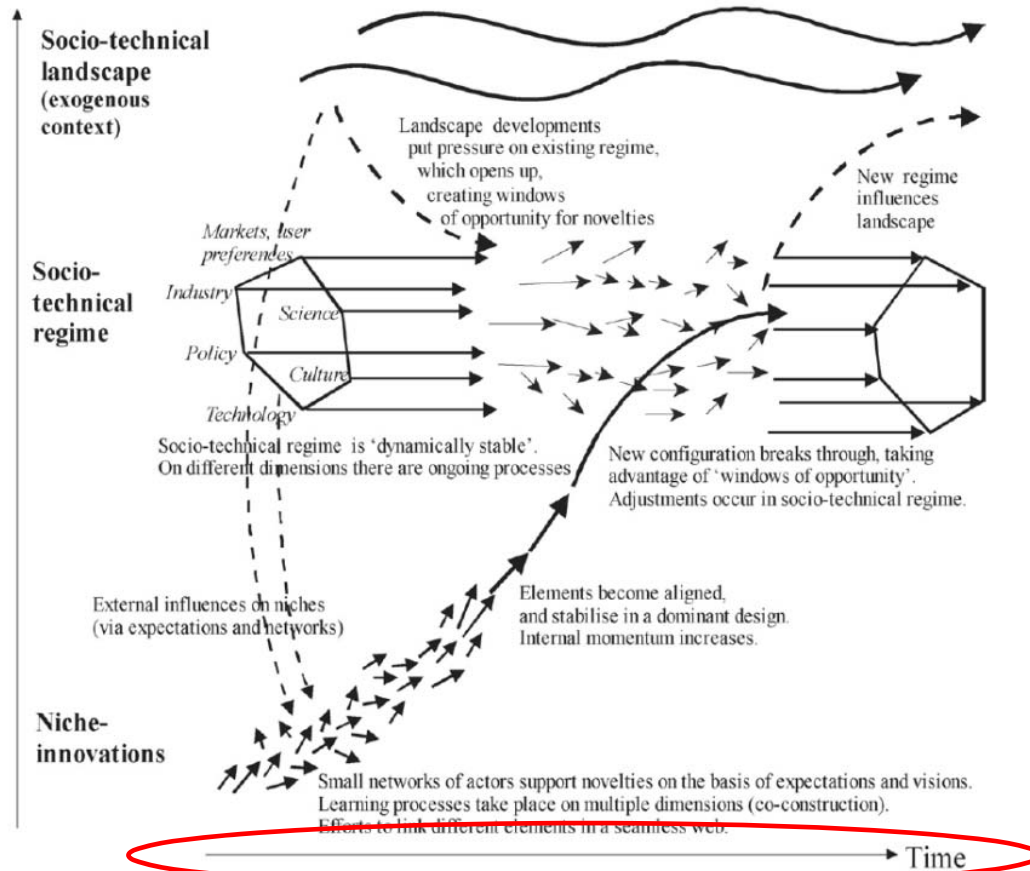
Time

No scaling of the time axis

Fig. 1. Multi-level perspective on transitions (adapted from Geels, 2002, p. 1263).

Incumbent regimes slow market entry

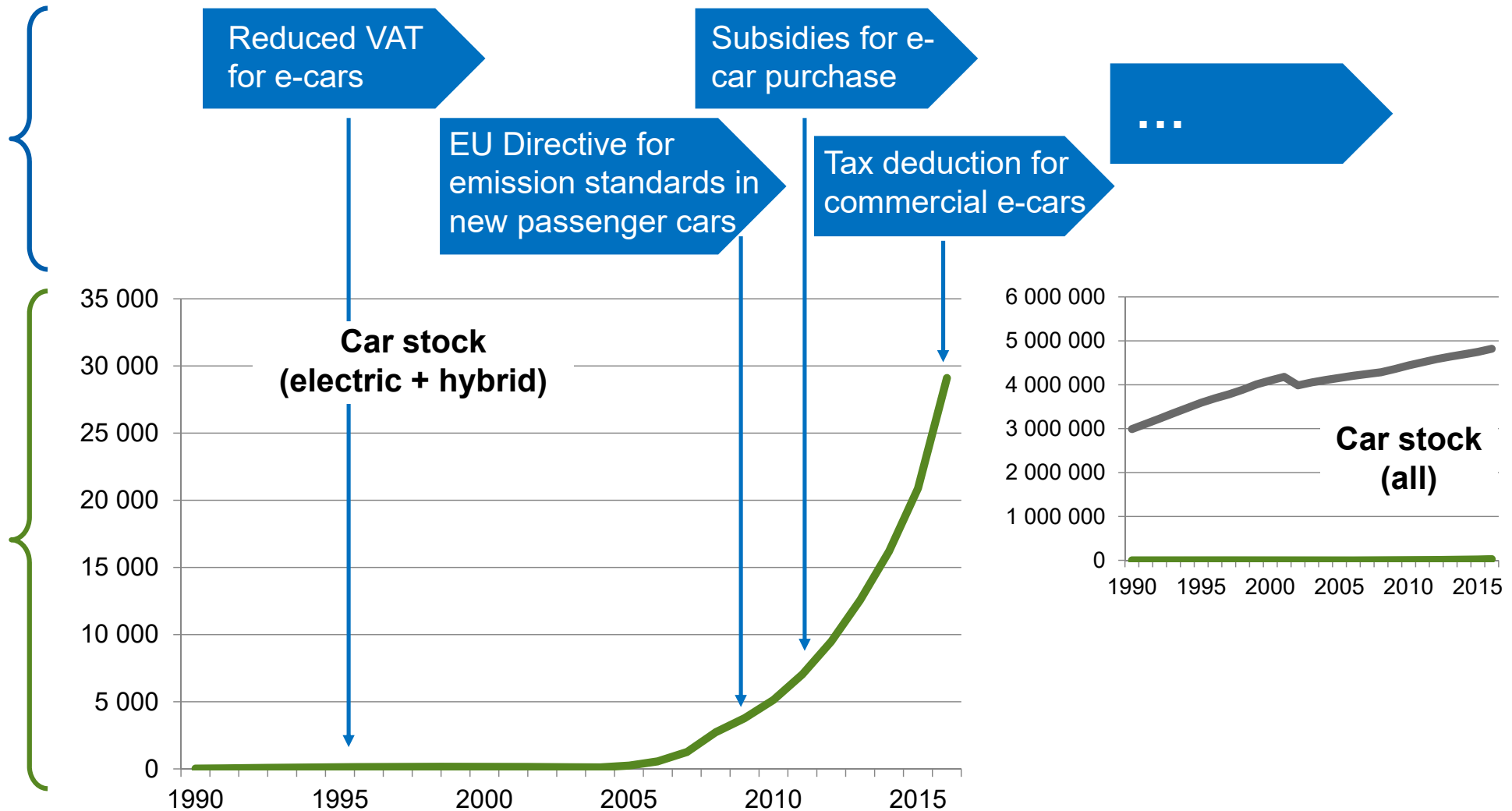Delay incurs substantial social and ecological costs

Delay limits the room for manoeuvre in the coming years

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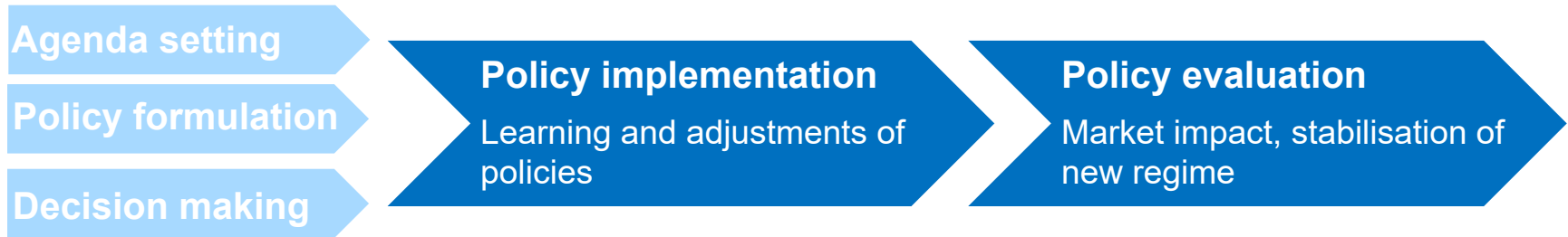# Market diffusion of electric and hybrid vehicles

Policy vector

Reduced VAT for e-cars

EU Directive for emission standards in new passenger cars

Subsidies for e-car purchase

Tax deduction for commercial e-cars

...

Technology diffusion vector

Car stock (electric + hybrid)

35 000
30 000
25 000
20 000
15 000
10 000
5 000
0

1990   1995   2000   2005   2010   2015

Car stock (all)

6 000 000
5 000 000
4 000 000
3 000 000
2 000 000
1 000 000
0

1990 1995 2000 2005 2010 2015

Statistics Austria Vehicle Stock 1990-2016

Impact lag

Policy vector

Agenda setting	Policy implementation	Policy evaluation
Policy formulation	Learning and adjustments of policies	Market impact, stabilisation of new regime
Decision making		

Technology diffusion vector

Pilot regions with one-off large-scale investments

Mandatory product standards, up to fossil phase-out

National energy strategy

Subsidies and tax benefits for a limited time

One-time effect

Market share

Trigger for growth

No immediate effect

Pull-forward effect

2010   2015   2020   2025   2030
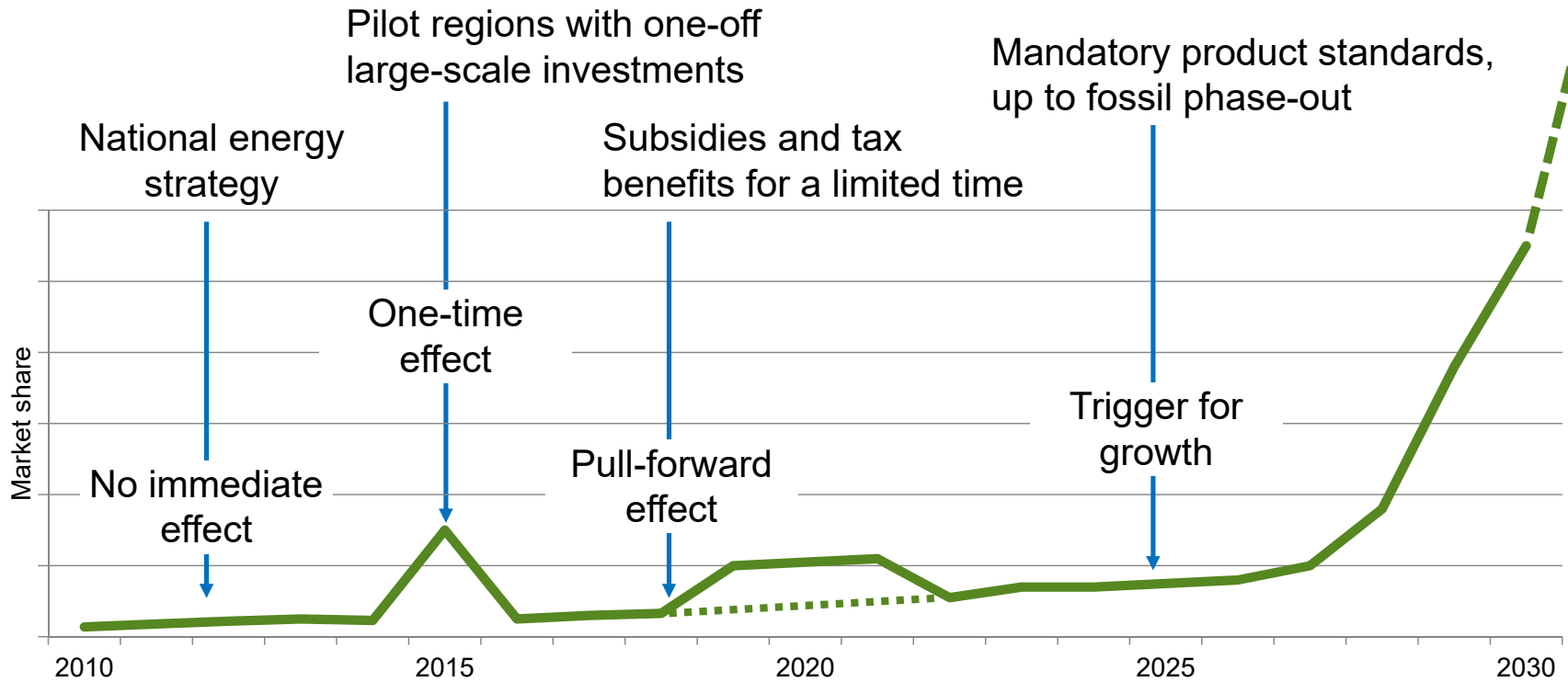
Connecting policy and market events

Policy vector: Document analysis, interviews with key informants
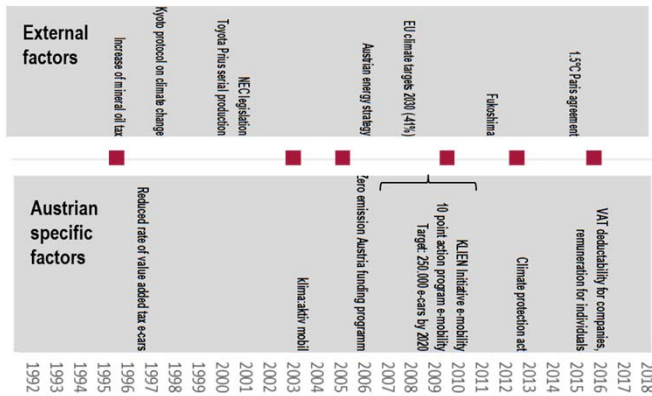
➡ Establishing a timeline of events

➡ Identifying critical junctures in the policy narrative

Technology diffusion vector: Fitting growth curves to market statistics
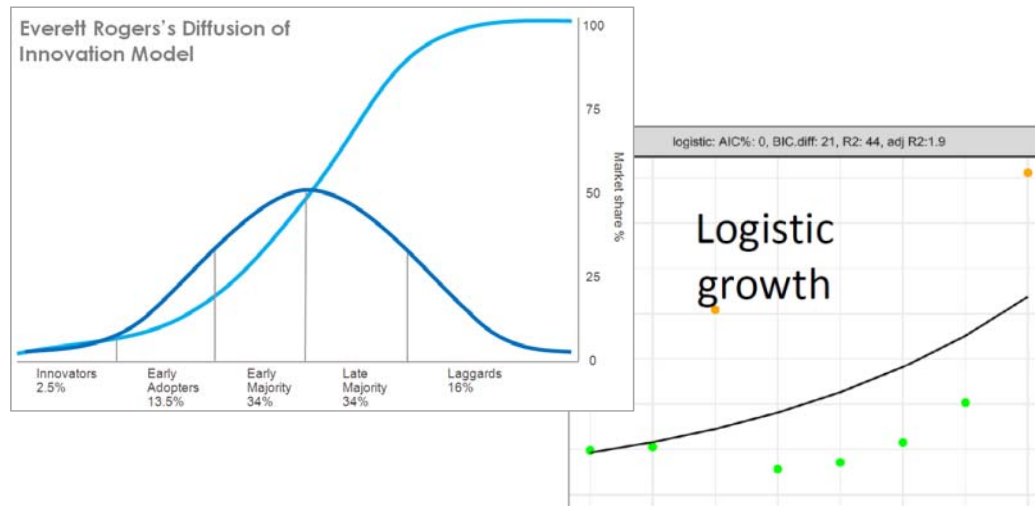
➡ Determining turning points:
1st order derivative exceeds general market growth

➡ Determining (sequences of) outliers:
Observations with low probability if curve is assumed correct

Niedertscheider et al. 2018, Rogers 2003

New registrated electric cars: observed market statistics

Statistics Austria, Vehicle stock.
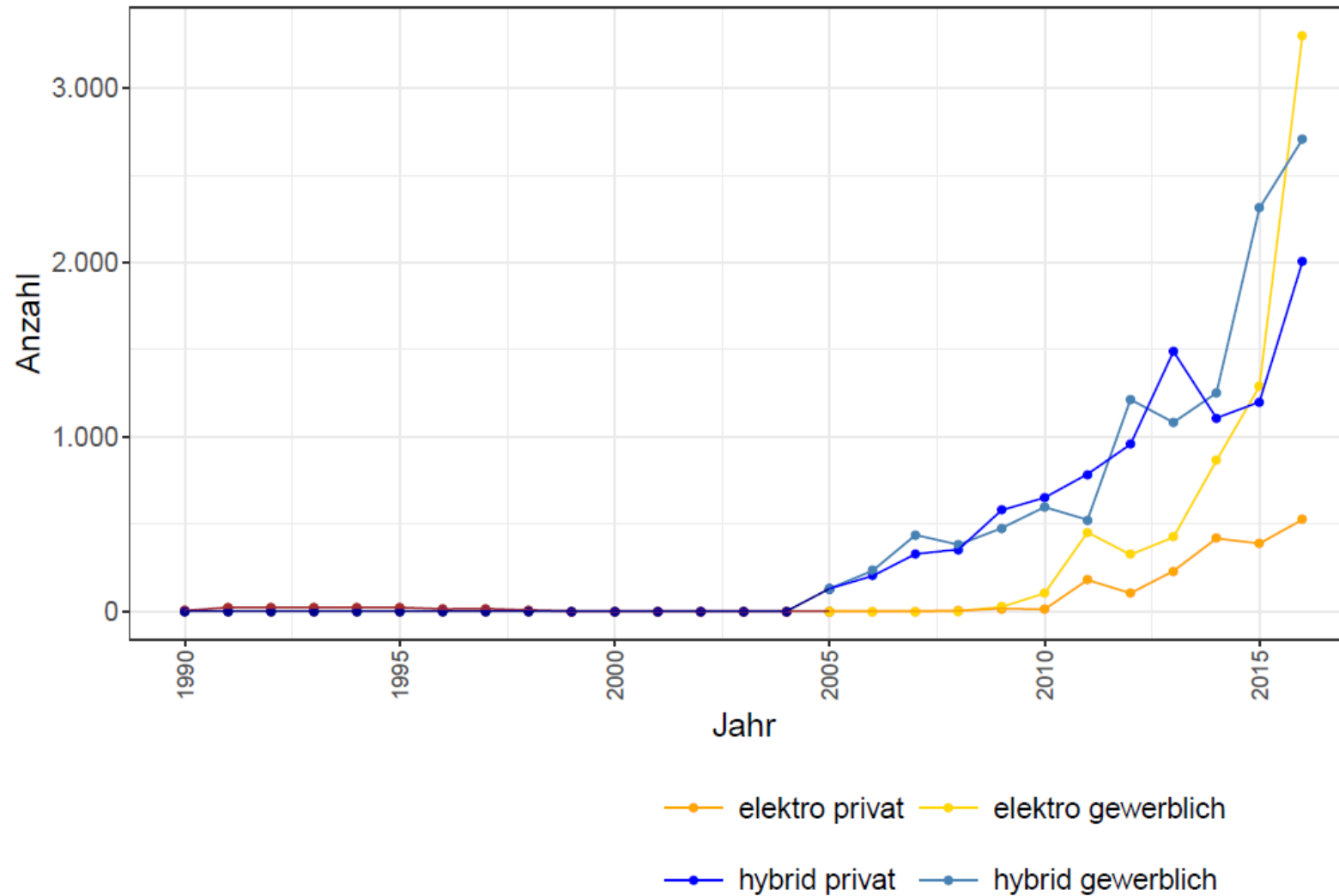
New registrated electric cars: growth curves

Austria

Styria

Vorarlberg

Private electric cars

Commercial electric cars
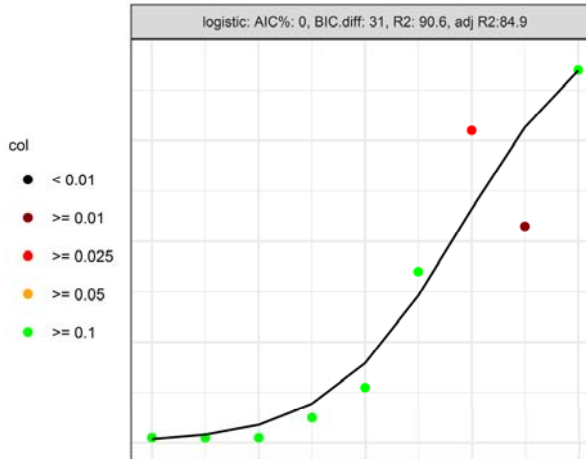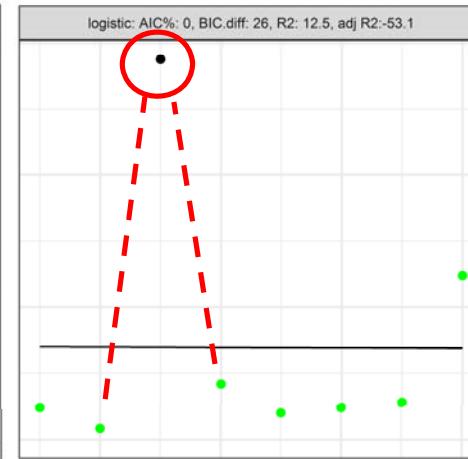
Pull-forward effect of Austria's first e-mobility model region VLOTTE
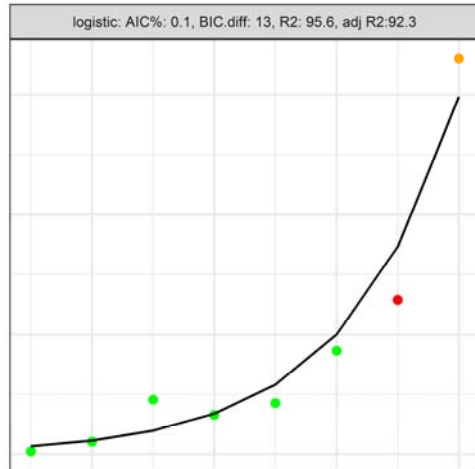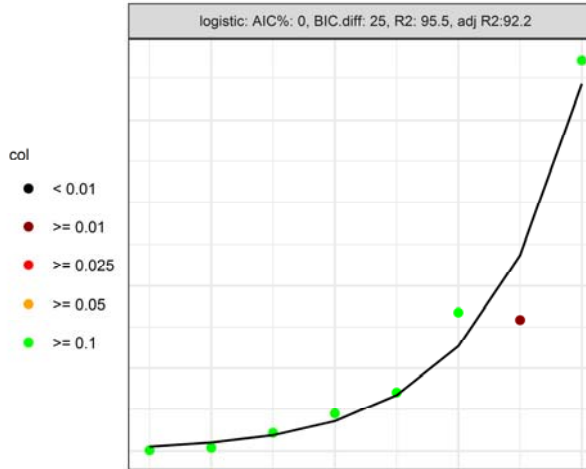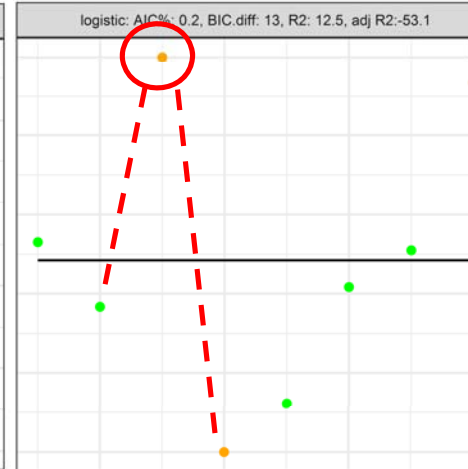
2008   2016   2008   2016   2008   2016

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PV installations: observed market statistics

E-Control Ökostrombericht 2003-2016
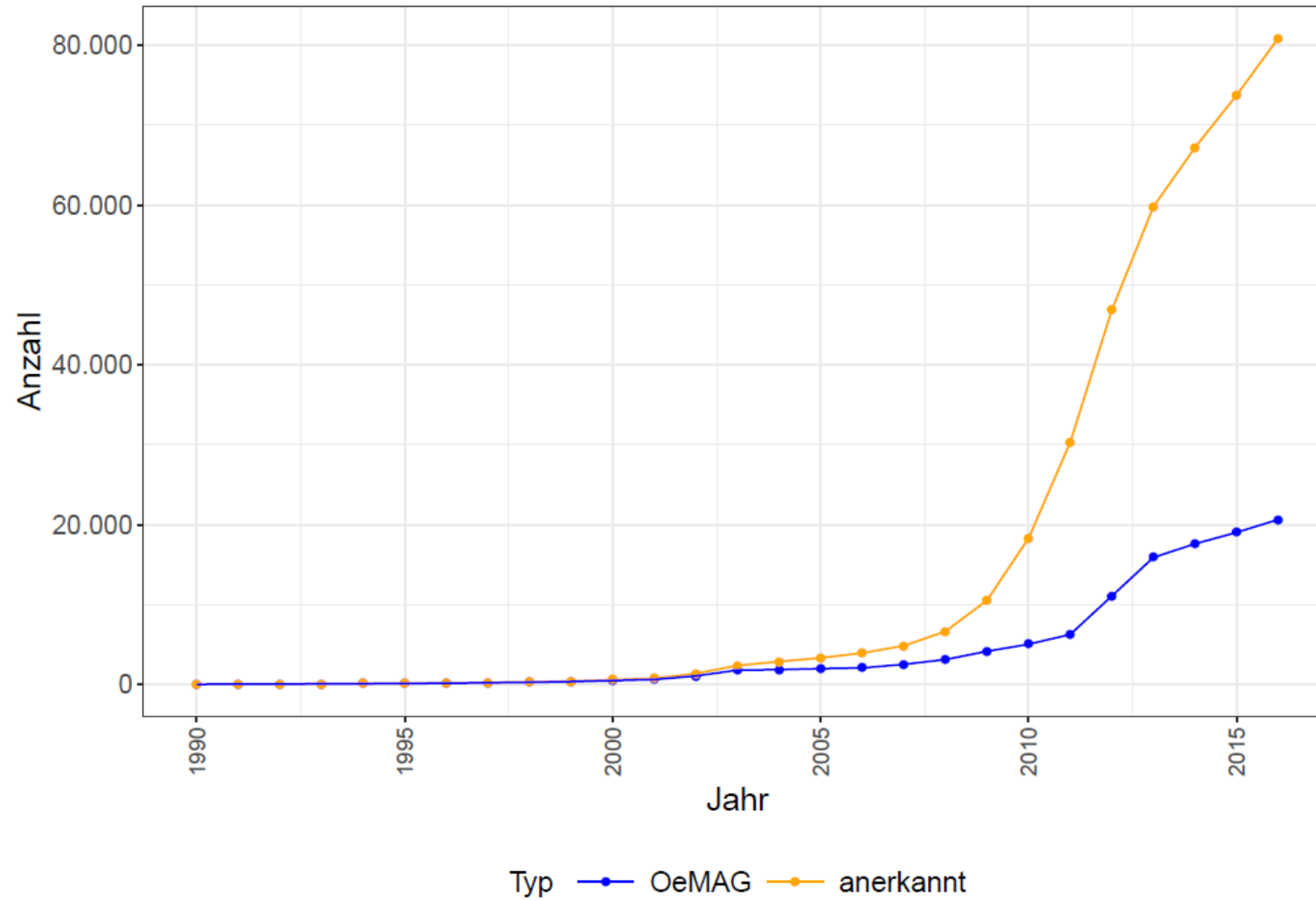
New PV OeMAG installations: growth curves
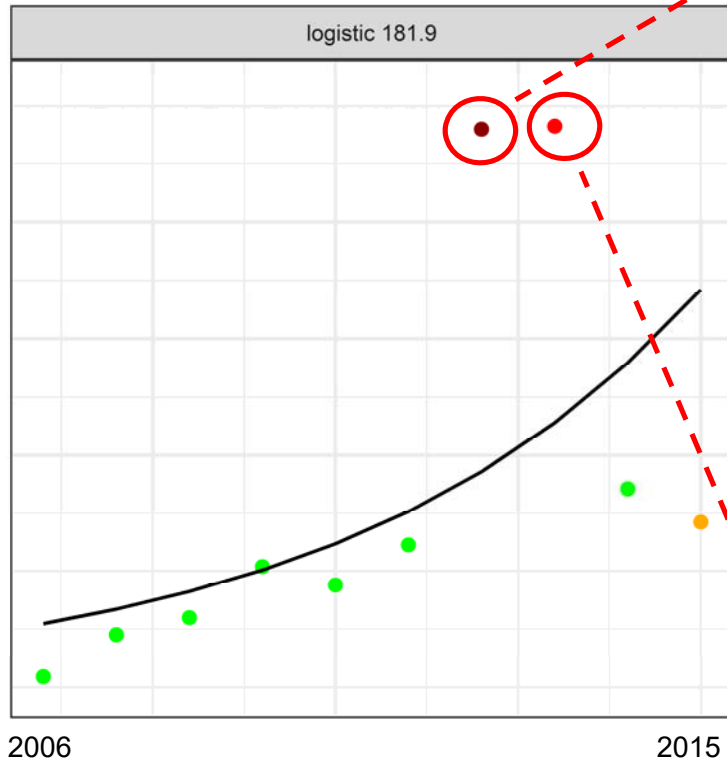
Installations submitted before feed-in tariff was discontinued

Level-off in system price decrease

PV installa-tions

logistic 181.9

col

● >= 0.01
● >= 0.025
● >= 0.05
● >= 0.1

2006   2015

Feed-in tariffs for newly built PV on buildings

—■— <5 kWp   —■— 5-10 kWp   —■— >10 kWp   —■— 5-200 kWp
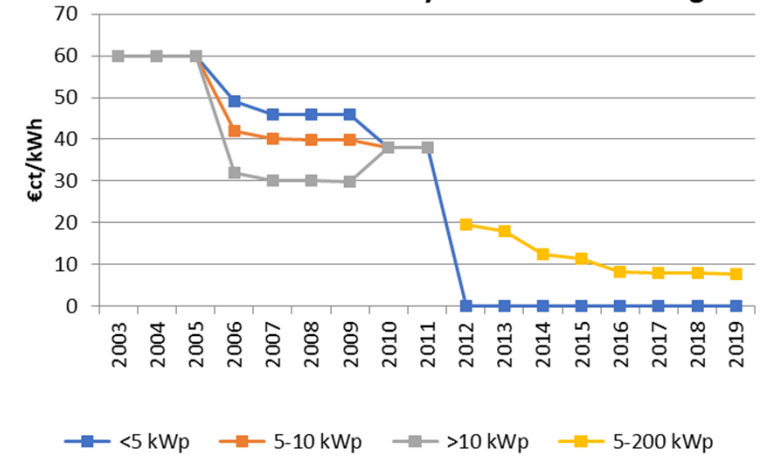
System price for newly built PV on buildings

1 kWp facility
5 kWp facility
10 kWp facility

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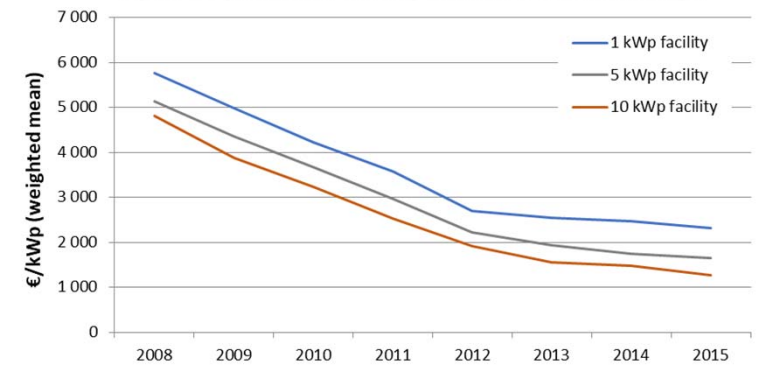
Application to policy design, implementation & evaluation

- **Reconstruct policy vectors**
  - Chain of policy events
  - Policy stringency vectors, e.g. tax rates

- **Determine significant deviations from the basic s-shape in market statistics**
  - Fitting growth curves
  - Pinpointing critical shifts with experts

- **Reference events between both vectors**
  - Identify the time of market acceleration
  - Identify pull-forward effects

Caveats and open questions

- Temporal sequence ≠ mono-causality

- Socio-economic trends obscure gradual policy impacts on technology diffusion vectors

- Short time series and sampling error in available market statistics