



SUSTAINABLE  
RESILIENT  
EU FARMING  
SYSTEMS

# Generational Renewal and European agriculture: a resilience analysis from agent based simulations

Christine Pitson  
Franziska Appel  
IAMO



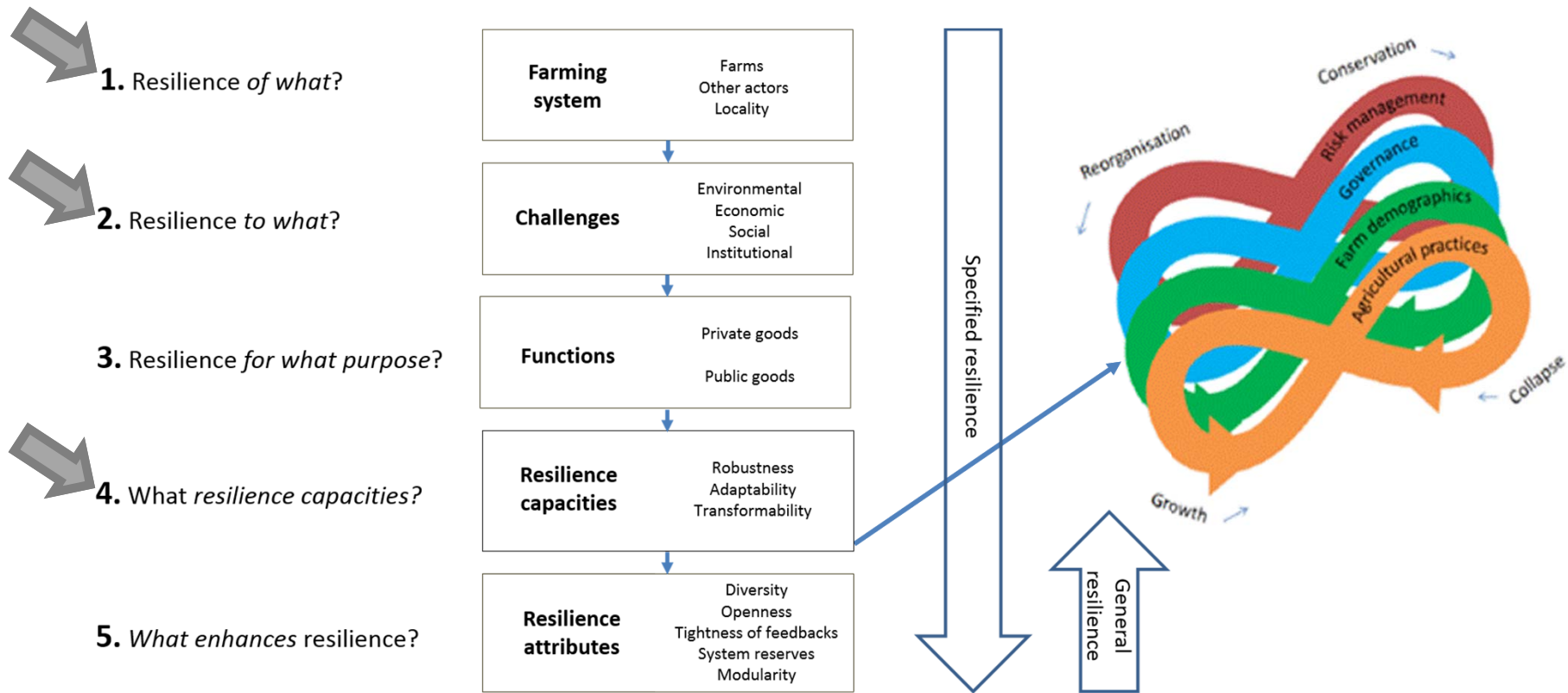
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EAAE Bucharest 2019

# Objective:

## Analyzing farm and regional resilience using agent-based simulations



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# Motivation

- Number of farms decreasing, size of farms increasing
- EU politicians concerned --> stimulate farm generational renewal
- Generational renewal (GR) is defined by the EU as the goal of not only reducing the “average age of farmers in the EU ... [but] empowering a new generation of farmers...”
- Since 2007 18.3 billion euros have been dedicated by EU countries (EU Court of Auditors, 2017)
- Lack of tools for Ex Ante GR Policy assessment
- Predominant focus on family farm model despite diverse agricultural sector



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# Relevant Literature

## Generational renewal of family farms

- Suess-Reyes & Feutsch (2016), Lobley and Baker (2012)

## “European” farms are family farms

- Cardwell (2004), Calus and Van Huylenbroeck (2010), Chiswell (2014)

## CAP excludes large farms

- Kostov et al. (2018), Gorton et al. (2009)

## CAP effects on hired labour

- Petrick & Zier (2011 & 2012), Mantino (2017)

## Family labour vs hired labour

- Kostov et al (2018), Allen & Lueck (1998)

## Gap: Generational renewal of European farming regions



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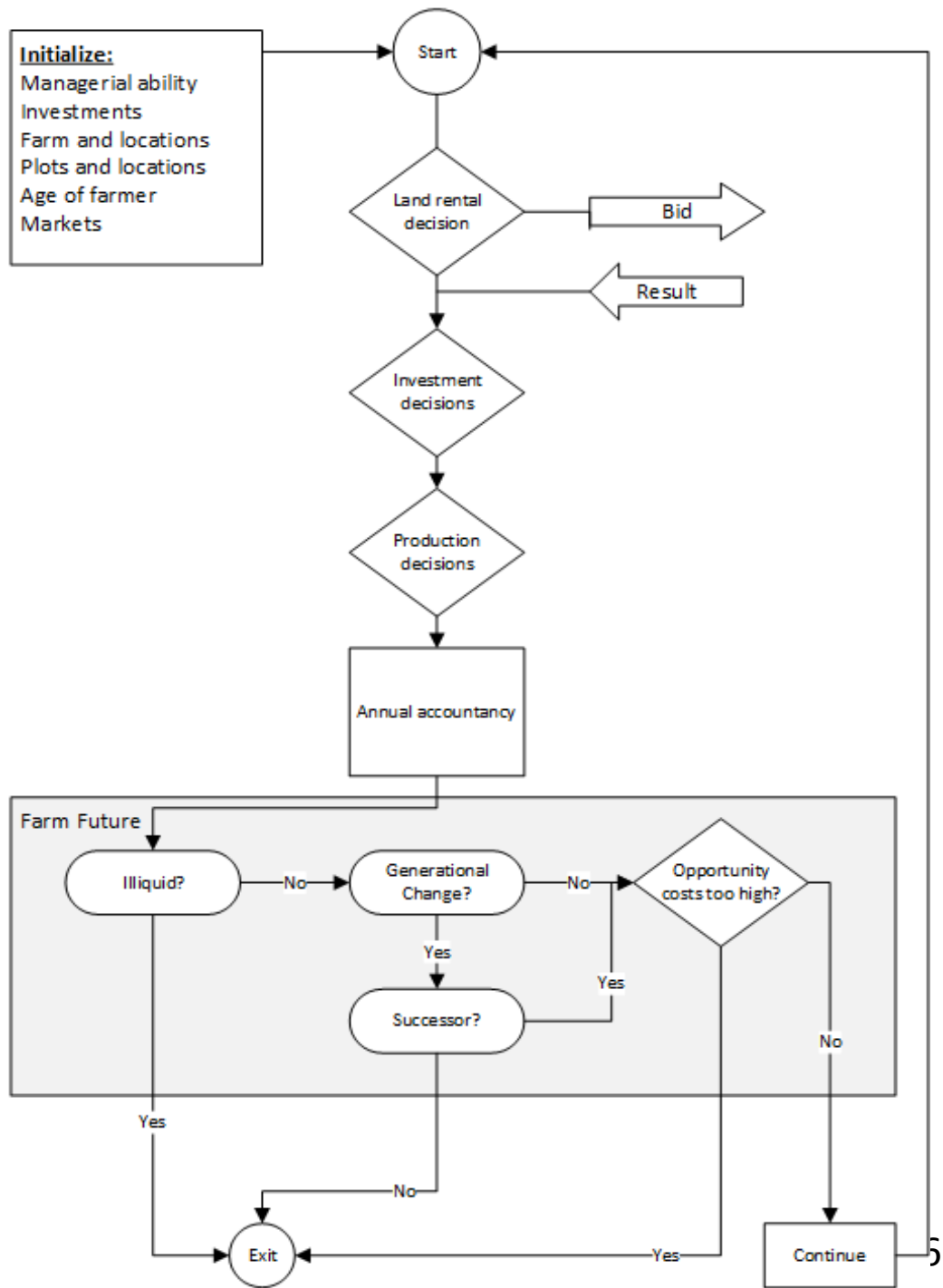
# Model Overview

- The Agricultural Policy Simulator (AgriPoliS) core version (Happe, 2004)
- Agent-based model used to observe and analyze the effects of policies and shocks on farm structural change over time
- Agents: heterogenous typical farms of a region and auctioneer
- Inputs: Farm structural data, market data, investment options, globals
- Decision making: profit- / income- maximization
- Environment: farms, factor and product markets, and space
- Interactions: markets
- Random variables: farmer age, farm and plot locations, age of investments, managerial ability



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## Case Study: The Altmark



- Agricultural region located in the former East Germany
- Heterogeneous farms
  - large corporate and small family
  - Arable, grassland, bovine, granivore
- Dependent on qualified hired labour
- Farm Demographic changes:
  - Farm sizes increasing as number of farms decrease
  - Technology complexity increasing
  - Regional exodus



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## Focus Group Results

- Held November 2018 in the Altmark
- Mixed breadth of participants: corporate farmer, young family farmer, retired family farmer, farm succession consultant
- Semi-structured format: four topics ~1 hour per topic
- Main results: difficulty attracting workers to the sector and region, low pay, increasing demand for skilled workers, outward migration affecting family farms and hired labour



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# Generational Renewal Extension

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## Initialization:

Family Farmer's age	minimum: 30 years	maximum: 70 years
Corporate Farmer's age	minimum: 30 years	maximum: 66 years
Family farmer age distribution	average: 51.5 years	standard deviation: 11.83856
Corporate farmer age distribution	average: 50.1 years	standard deviation: 11.14596

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## Generational Change:

Age of generational change	67 years	
New farmer's age	minimum: 30 years	maximum: 45 years
New farmer's age distribution	average: 35 years	standard deviation: 1.5

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## Probability of a Successor:

Family farms	75%
Corporate farms	100%

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## Farming without a Successor:

Maximum age of farmer with no successor	75 years
Productivity decrease past generational change age	1%

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# Simulation Scenarios

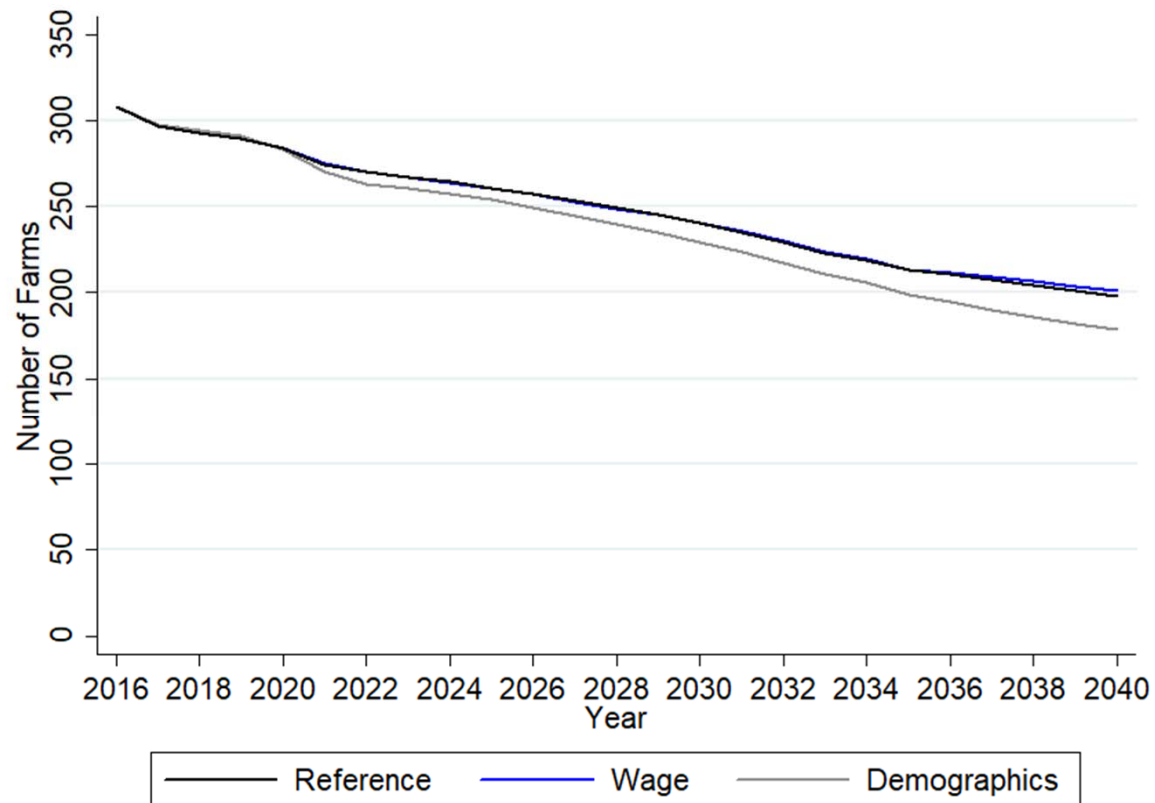
<u>Scenario Title:</u>	<u>Description:</u>
Reference	<ul style="list-style-type: none"><li>- Core version of model</li><li>- No differentiation between corporate and family farm managers age distribution</li><li>- Normal distribution of manager ages (35 – 60)</li><li>- 100% presence of successor</li><li>- Generational change at 25 years of operating</li><li>- Farm wages increase at 1.9% annually</li><li>- Off farm wages increase at 2.7% annually</li></ul>
Wage	<ul style="list-style-type: none"><li>- Same as “Reference” except farm wages increase at 2.7% annually as well</li></ul>
Demographics	<ul style="list-style-type: none"><li>- Extended version of the model with demographics input file</li><li>- Wages same as in “Reference”</li></ul>



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# Number of farms



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# Operational status

## Farms in 2026 per scenario in %

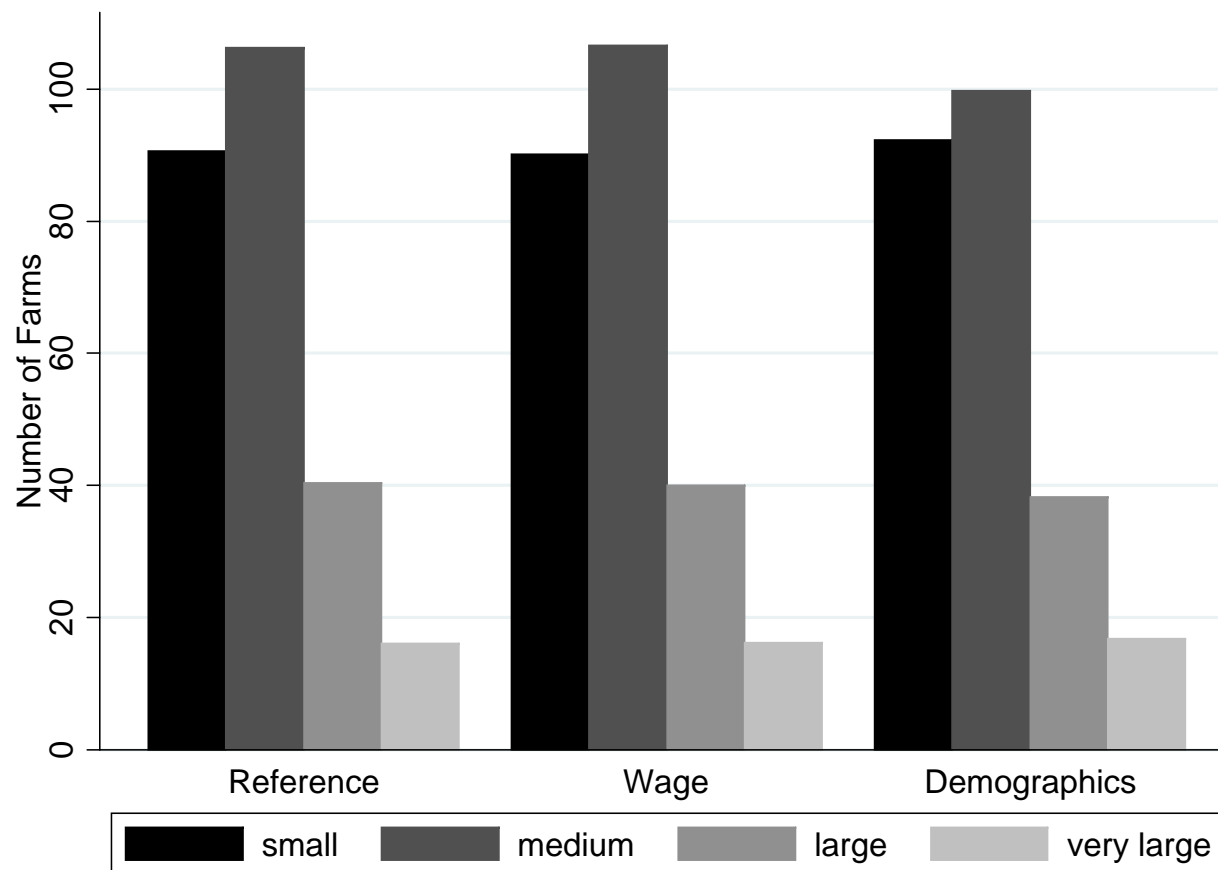
	Reference	Wage	Demographics
Operating	82.3	82.1	79.5
Closed due to opportunity costs	9.5	9.8	9.8
Closed due to opportunity costs at generational change	3.5	3.5	0.6
Closed due to illiquidity	4.7	4.6	5
Closed due to lack of successor	-	-	5.1



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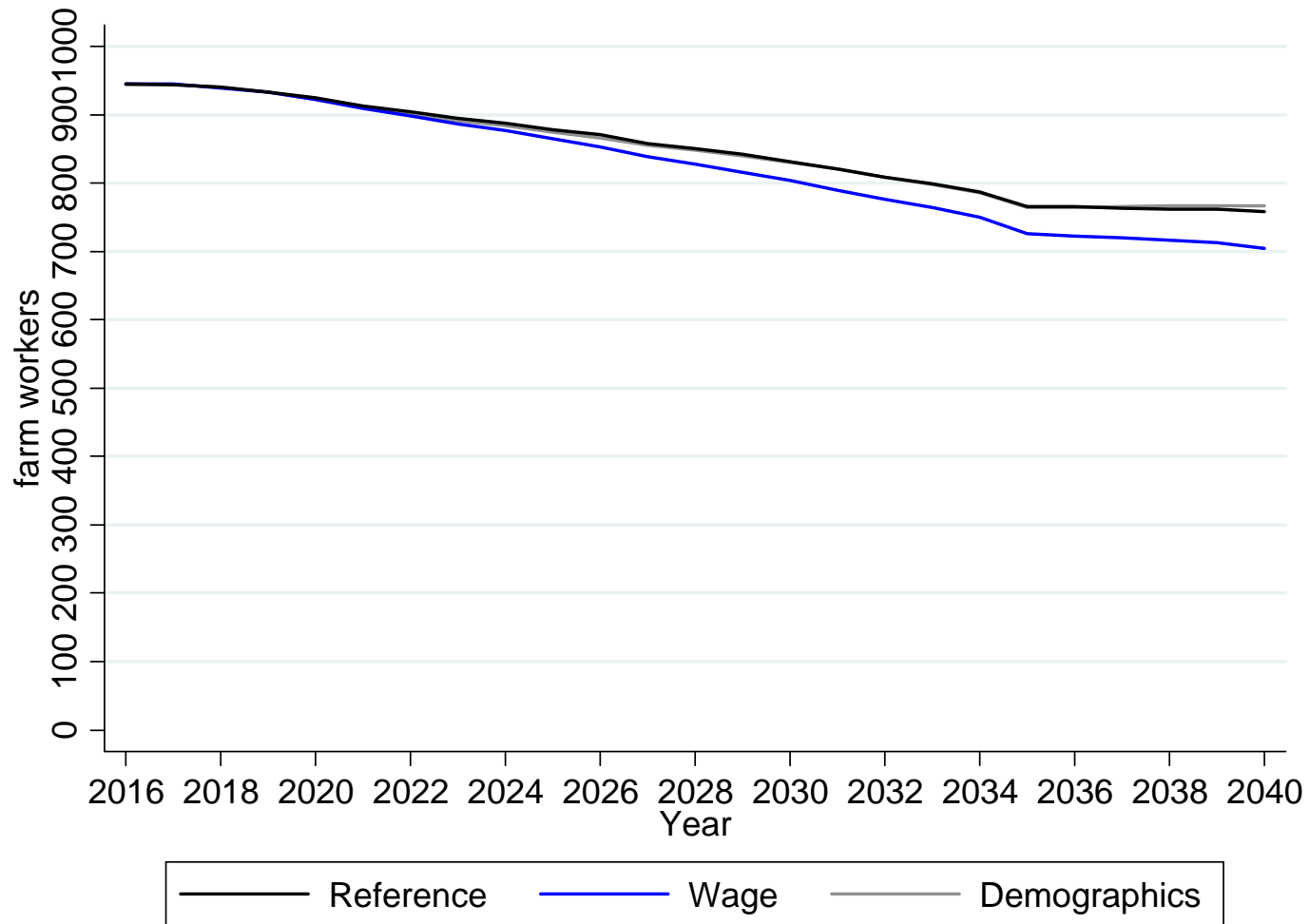
## Farms by size class 2026



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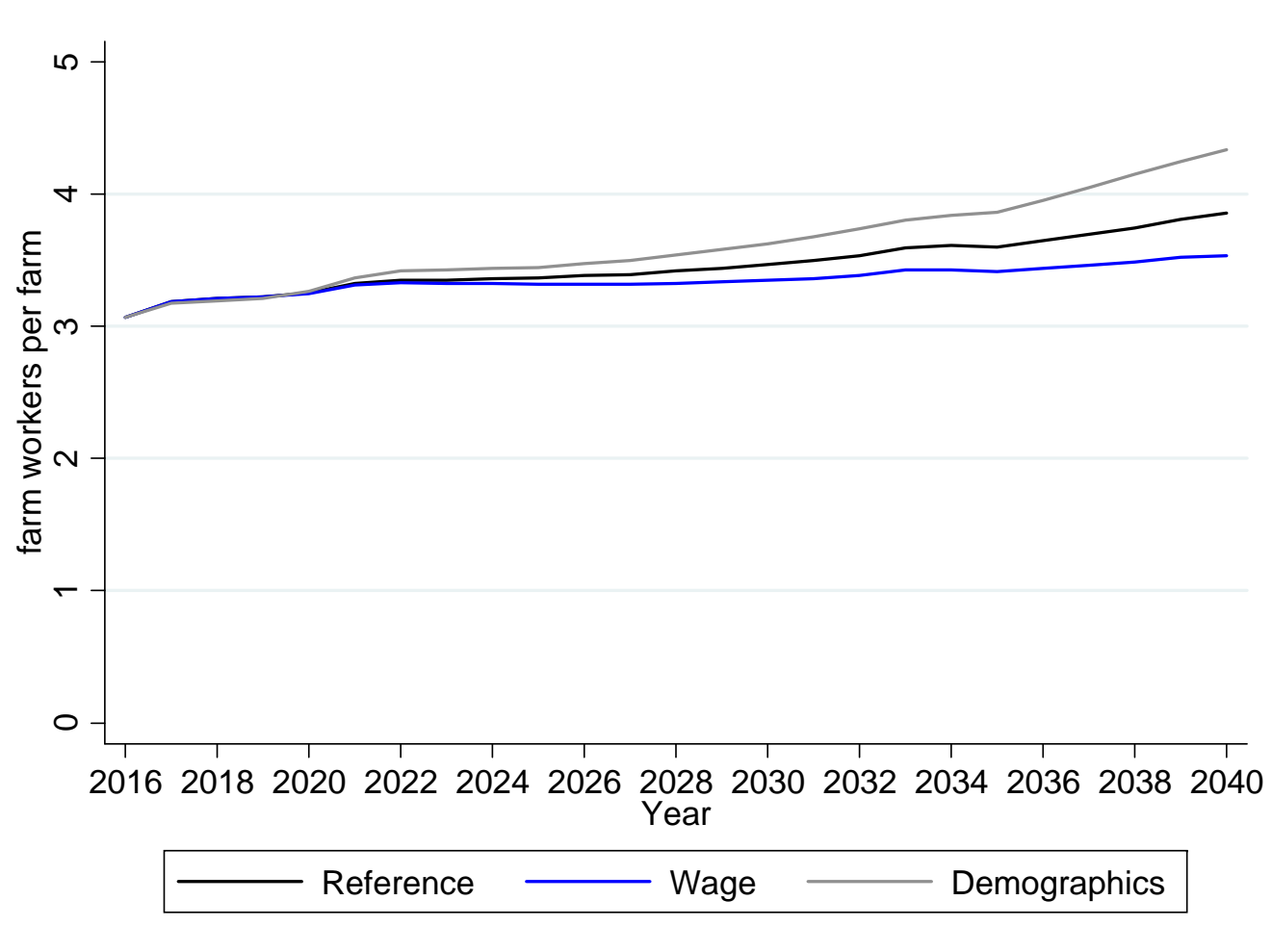
# Workers in region



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# Workers per farm

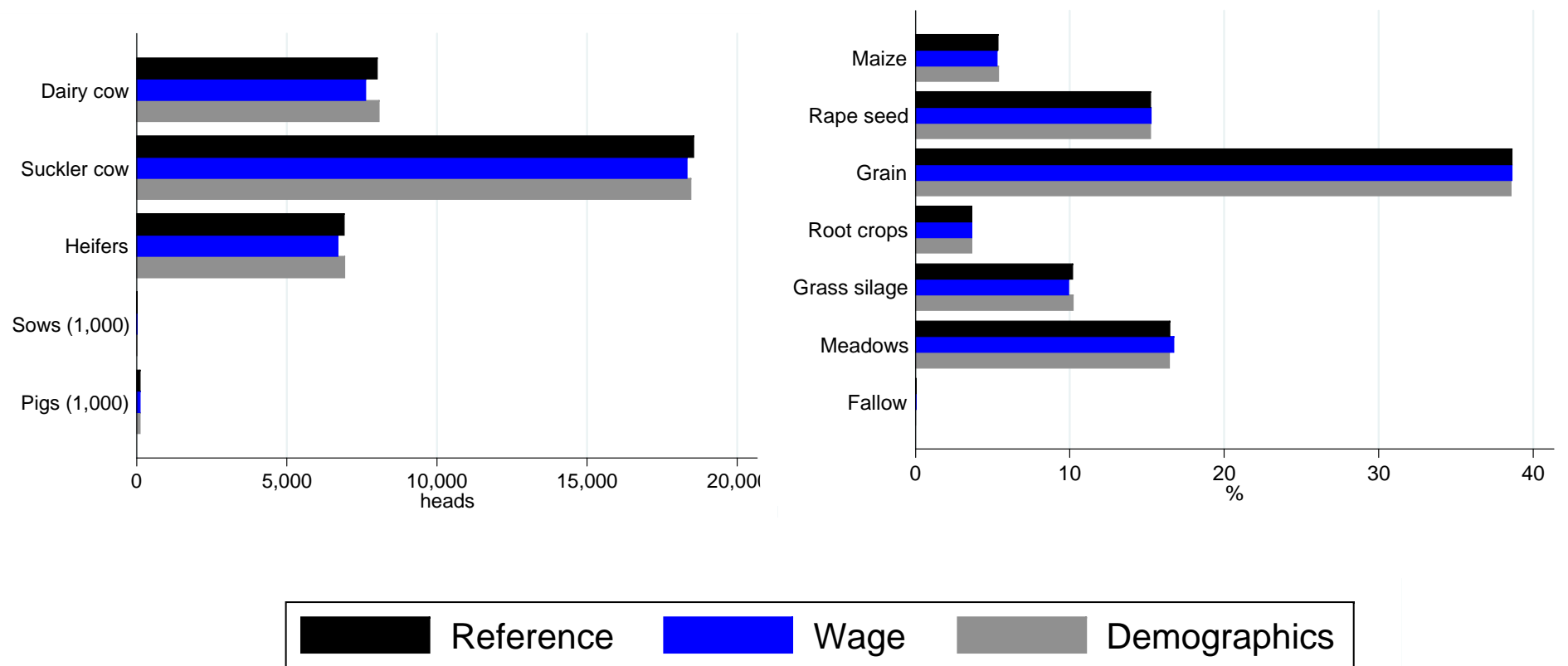


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# Production choices

Production in 2026



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# Resilience Analysis (Meuwissen et al., 2019)

## Robustness:

Region withstands wage increases for ~8 years before adapting

Region maintains production levels in face of demographic change

## Adaptation:

Individual farm level:

Failure to adapt to pressures of structural change: farm exit

- Illiquidity & opp costs

Regional level:

- Increasing wage costs: production shifts after ~8 years

## Transformation:

No evidence; weakness of model



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Coordinated by:

Partners:

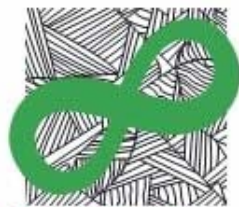


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