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Workforce drivers in the French dairy production

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Jean-Noël Depeyrot

French Ministry for agriculture and food
Center for studies and strategic foresight

Workforce drivers in the French dairy production

1. Context and method: structural changes in the French dairy sector
2. Workforce key drivers
3. An econometric model on the ADEL database
4. First results

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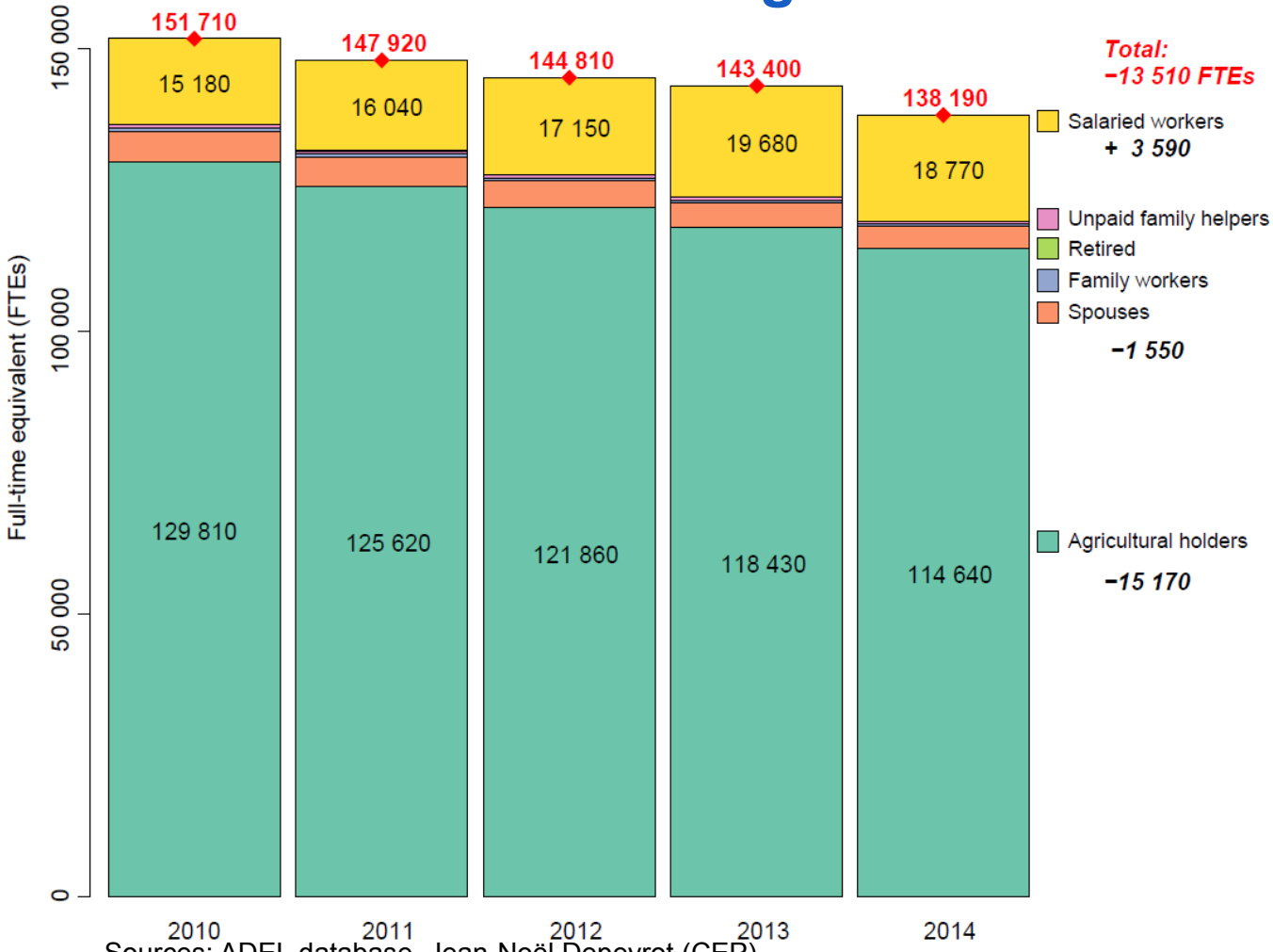
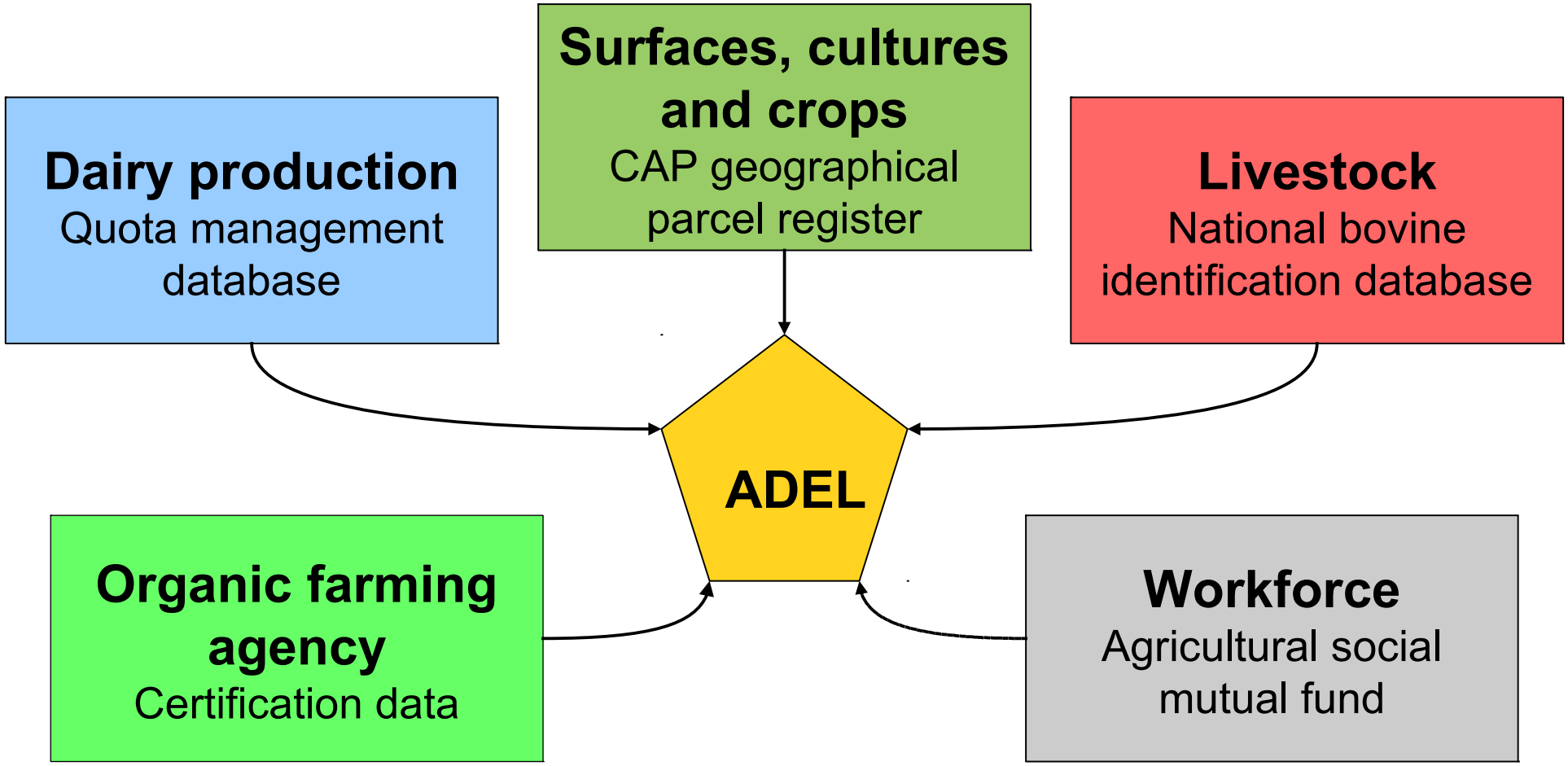
Context: structural changes in the French dairy sector



Sources: ADEL database, Jean-Noël Depeyrot (CEP)

- 13.500 job losses between 2010 and 2014.
  - Enhanced *volumic* productivity.
  - Employment development.
- Evolution of foraging systems (enhanced use of maize / alternative grass strategies)
  - Consequences on workforce ?
  - Link between environment and employment ?...

The ADEL database: Data pairing on dairy farms



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Question: identification, quantification and comparaison of workforce drivers in the French dairy production

Workforce informations (Agricultural Social Mutual Fund)

- Agricultural holders:
  - Number by farm, but no information on part-time farmers.
  - Hypothesis: 1 farmer = 1 FTE (2010 Agr. Census in dairy farms)
- Family helpers:
  - Hypothesis: spouses = 0,65 FTE, retired & family helpers = 0,45 FTE
- Salaried workers: effective worked hours number (FTE = 1820 h.)
- No information on the use of agricultural contractors.

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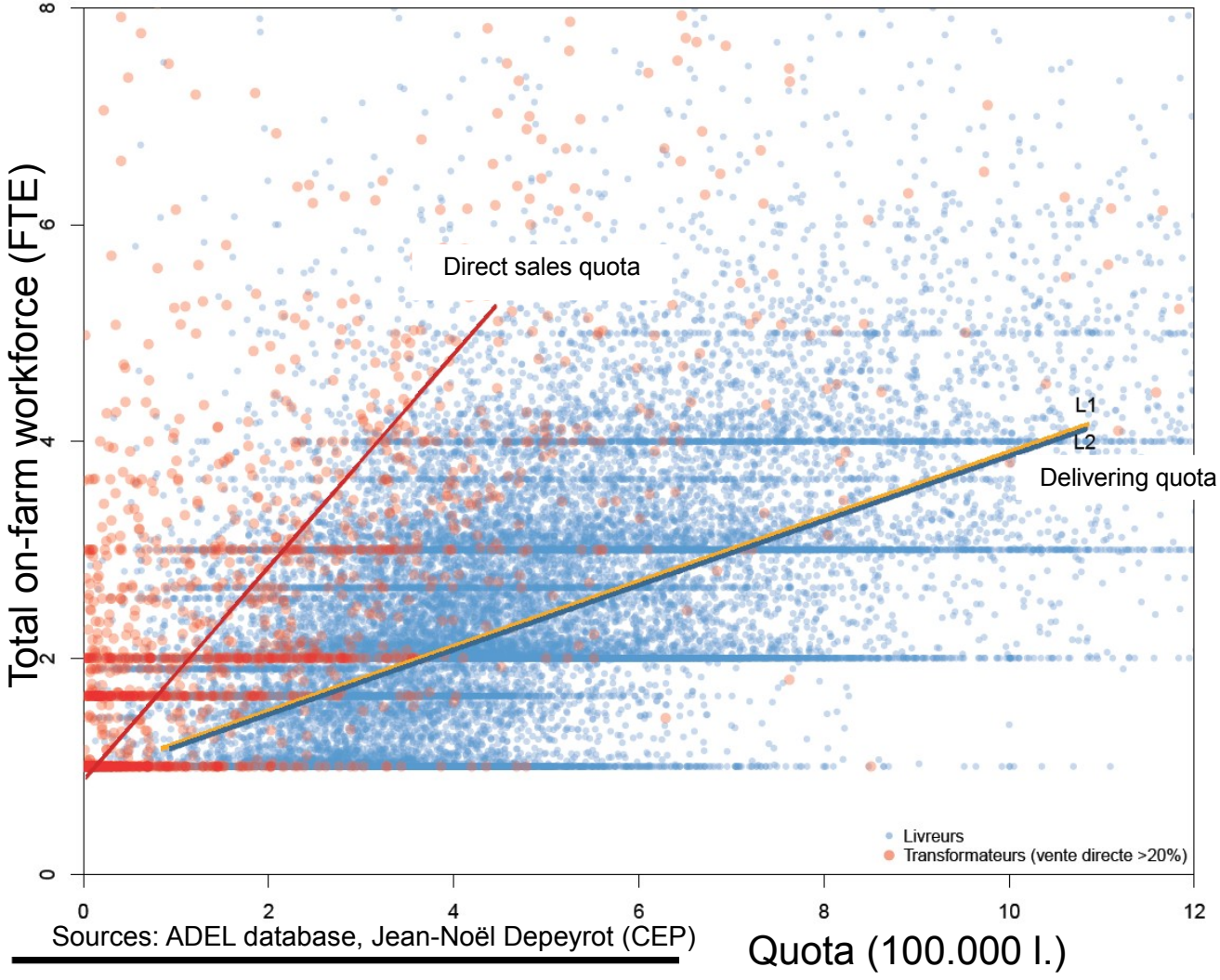
Workforce explanatory variables

- Milk production: proxied by milk quota
  - delivering quota,
  - on-farm transformation quota.
- Qualitative factors:
  - localisation in mountain areas,
  - class of foraging systems.
- Organic production.
- Scale / size effects of milk volume.
- Other farm productions:
  - Field crop surfaces,
  - Breeding cattle.

Milk volumes ~ milk quota:



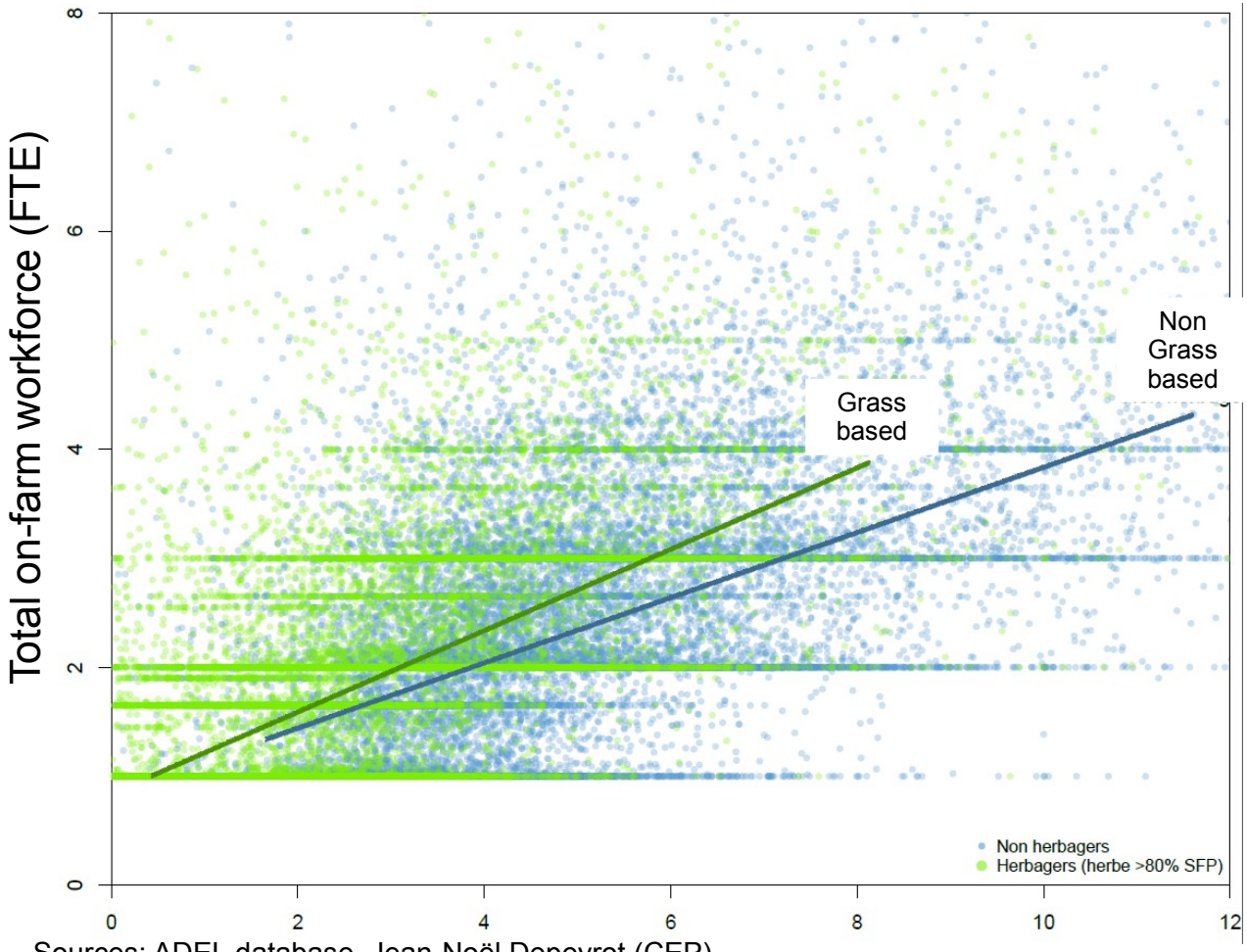
Sources: ADEL database, Jean-Noël Depeyrot (CEP)

- Delivering dairy farms.
- On-farm transformators.

Milk volume: a key factor for quite specialized farms.

Strong difference between delivering volumes and direct sales volumes.

Foraging systems:



Sources: ADEL database, Jean-Noël Depeyrot (CEP)

- grass based systems (grass >80 % foraging area)
- other systems

Key missing data

- Effective production.
- Part time farmers and other activities (contracting…).
- Off-farm workforce.
- Swine production (some farms in Brittany).
- Wineyards (rare, some in Charentes).
- Geographical indications.
- ...

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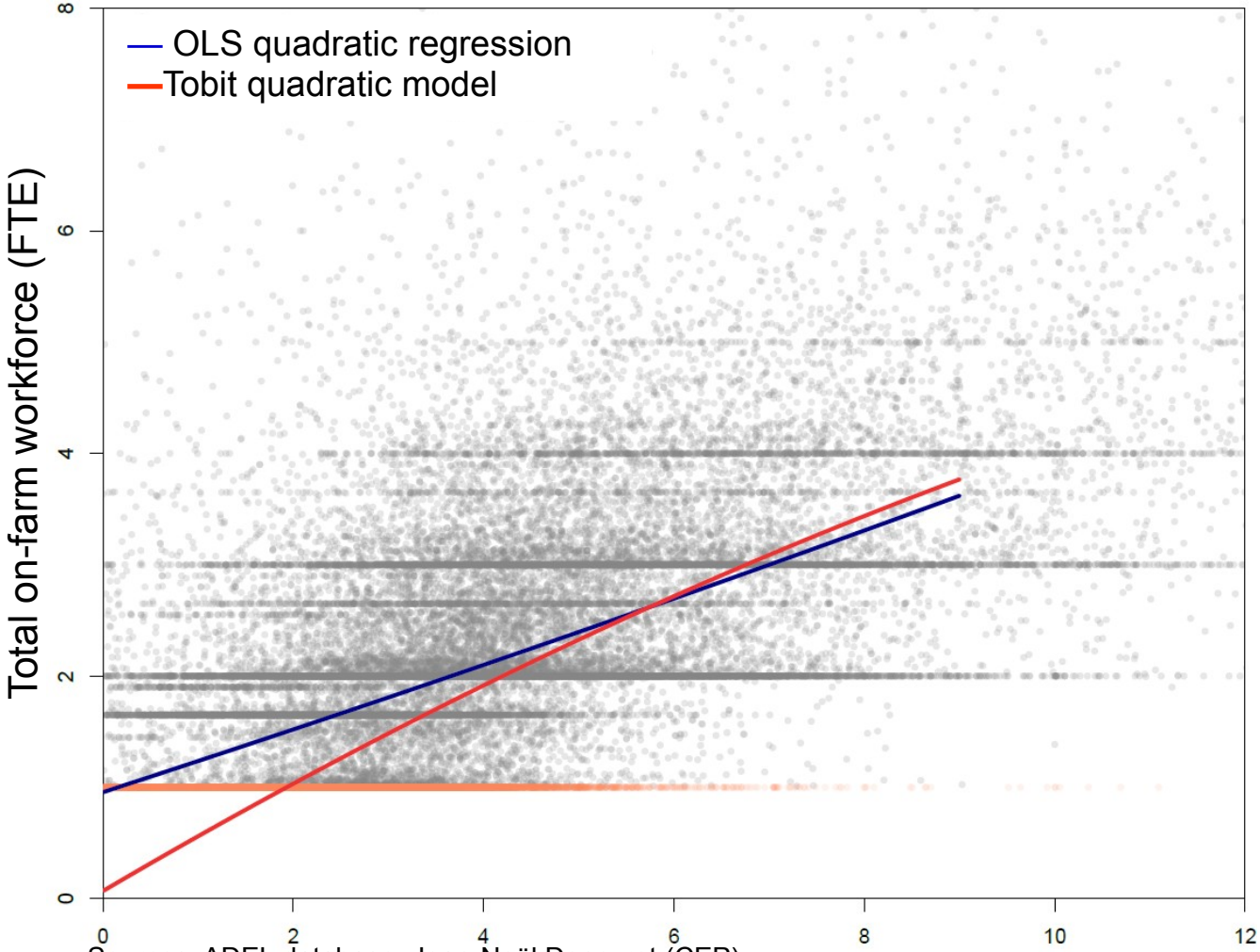
An econometric analysis on the ADEL database:

- Sample of 50.598 farms in 2014 (weighted).
- A test of the additive effects of identified key variables.
- Scale volumic effects: quadratic model on milk volumes.
- Four classes of farms:
  - Lowlands areas – non grass based systems (reference)
  - Lowlands areas – grass based systems
  - Mountains areas - non grass based
  - Mountains areas – grass based

The choice of a Tobit model:



Sources: ADEL database, Jean-Noël Depeyrot (CEP)

« censored » data : no information on part-time farming (and external activites)
=> FTE allways > 1

A Tobit model with a lower boundary to 1 FTE

=> results are more consistents for small farms.

Is a Tobit the most relevant model for our data structure ?

Model:

$$W = W^x \; if \;\; W^x > 1$$
$$W = 1 \;\; if \;\; W^x \leqslant 1$$
$$W^x = \sum_{i \in (1 \to 4)} T_i \left(\alpha_i Q_{del} + \zeta_i Q_{del}^{\,2} + \beta_i Q_{ds} + \psi_i Q_{ds}^{\,2} \right)$$
$$+ ORG * \sum_{i \in (1 \to 4)} T_i \left(\alpha_i^{bio} Q_{del} + \zeta_i^{bio} Q_{del}^{\,2} + \beta_i^{org} Q_{ds} + \psi_i^{org} Q_{ds}^{\,2} \right)$$
$$+ \left(\lambda_1 C_{bc} \right) + Z_m \left(\lambda_2 C_{bc} \right)$$
$$+ \delta S_{fc} + \sigma + \varepsilon$$

where:

W = Farm total workforce

Q_{del} = Delivery quota (10^5 l.)

Q_{ds} = Direct sales quota (10^5 l.)

S_{fc} = Field crops surfaces (excl. maize) (100 ha.)

C_{bc} = Breeding cows livestock (50 cows)

where:

$T_1 = 1$ (reference) and $(T_2, T_3, T_4) \in (0,1)$

$T_2 = 1$ for grass-based lowlands farms

$T_3 = 1$ for non grass-based mountain farms

$T_4 = 1$ for grass-based mountain farms

and:

$ORG \in (0,1)$

$ORG = 0$ for conventionnal farms

$ORG = 1$ for Organic certified farms

and:

$Z_m \in (0,1)$

$Z_m = 0$ for lowland farms

$Z_m = 1$ for mountains farms

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A significant model

Sources: ADEL database, Jean-Noël Depeyrot (CEP)

*** significance threshold 0,1 % (p. value <0,001)
** : significance threshold 1 % (p. value <0,01)
* : significance threshold 5 % (p. value <0,05)
. : significance threshold 10 % (p.value <0,10)
Non-significant factors are in grey

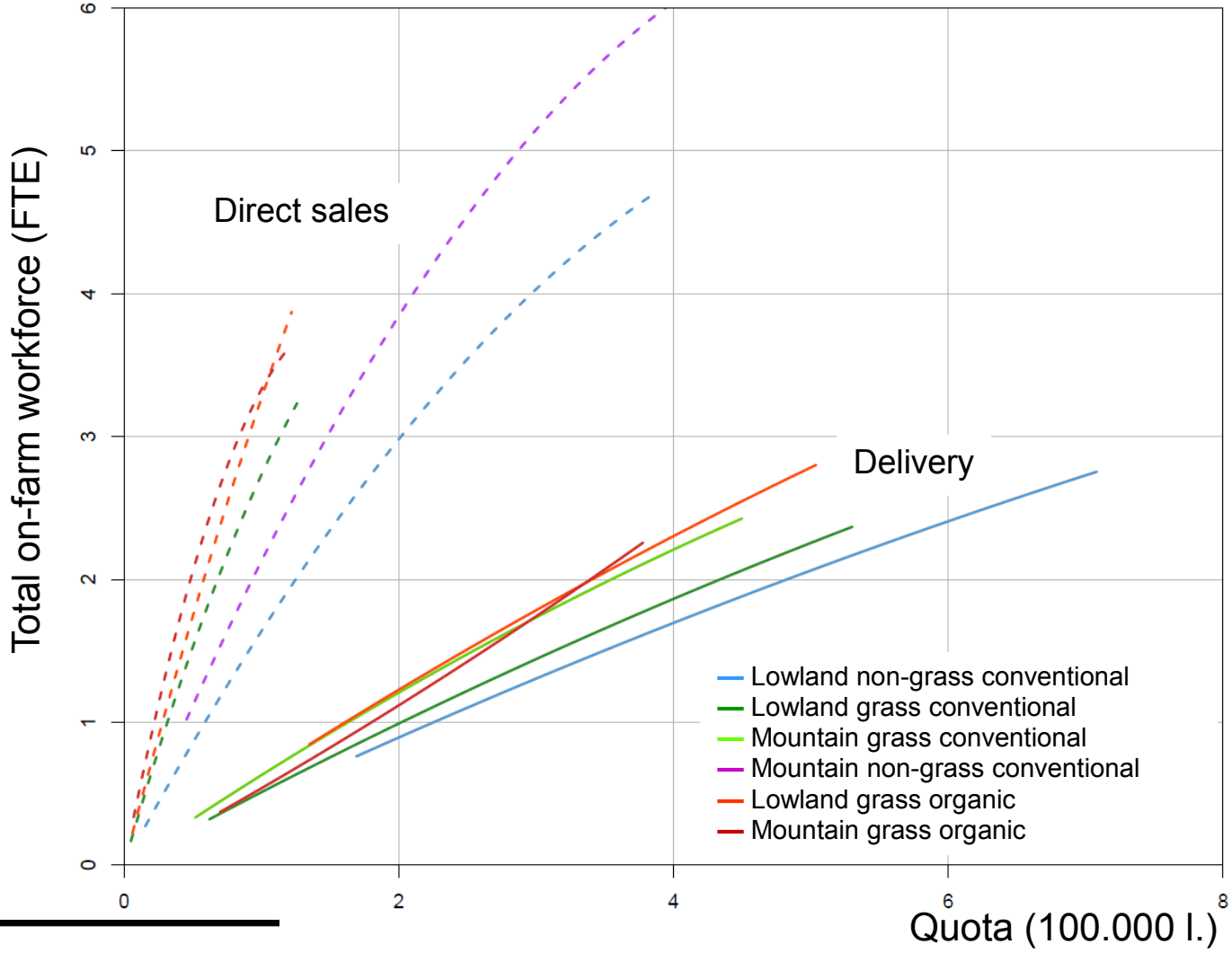
R^2 (Cox and Snell): 0,529

			Conventional (BIO=0)			+ if organic farming (ORG=1)		
			Pop.	Coeff.	p. value	Pop.	Coeff.	p. value
Delivery quota	1 : Total (low. non-grass)	α	49 872	0,469	< 2 .10-16 ***	1 496	0,202	3,7 .10-5 ***
	2 : Low land grass	α	7 441	0,056	2,7 .10-11 ***	1 087	-0,075	0,157
	3 : Mountain non-grass	α	1 452	-0,015	0,19	3	----	----
	4 : Moutain grass	α	9 582	0,186	< 2 .10-16 ***	308	-0,341	6,4 .10-6 ***
scale effect delivery quota	1 : Total (low. non-grass)	γ	49 872	-0,011	< 2 .10-16 ***	1 496	-0,012	0,084 .
	2 : Low land grass	γ	7 441	-0,003	0,011 *	1 087	0,008	0,32
	3 : Mountain non-grass	γ	1 452	-0,001	0,52	3	----	
	4 : Moutain grass	γ	9 582	-0,014	< 2 .10-16 ***	308	0,059	1,6 .10-4 ***
direct sales quota	1 : Total (low. non-grass)	β	3 324	1,783	< 2 .10-16 ***	338	-6,505	2,1 .10-5 ***
	2 : Low land grass	β	615	1,586	< 2 .10-16 ***	193	6,831	9,9 .10-6 ***
	3 : Mountain non-grass	β	135	0,550	1,3 .10-4 ***	0	----	----
	4 : Moutain grass	β	1 372	-0,073	0,25	133	9,678	5,1 .10-10 ***
scale effect direct sales quota	1 : Total (low. non-grass)	γ_1	3 324	-0,146	< 2 .10-16 ***	338	3,221	4,2 .10-11 ***
	2 : Low land grass	γ_1	615	-0,490	< 2 .10-16 ***	193	-3,011	1,5 .10-9 ***
	3 : Mountain non-grass	γ_1	135	-0,059	0,024 *	0	----	----
	4 : Moutain grass	γ_1	1 372	-0,024	0,079 .	133	-4,605	< 2 .10-16 ***
breeding herd	1 : Low lands	λ	21 793	0,522	< 2 .10-16 ***			
	2 : Moutains	λ	4 582	0,233	1,4 .10-9 ***			
Field crops		ϵ	42 238	0,702	< 2 .10-16 ***			
Constant			50 598	-0,16	< 2 .10-16 ***			

In summary:

- Grass based systems involve more work, for the same milk volume:
  - + 12%*** in lowlands areas
  - + 39%*** in mountain areas.
- Organic production has an important and significant additive effect (***): grass-based organic farms (93%) involve 55%*** more work than conventional ones.

In summary:



Sources: ADEL database, Jean-Noël Depeyrot (CEP)

Further analysis and developments

- Use of effective delivering volumes.
- Better inclusion of work on foraging surfaces (particularly for moutains areas).
- Panel data analysis (2010-2014 available at least).
- Discussion on the choice of a Tobit model.
- ...

For more information

- **On the ADEL database:**
  - Depeyrot J.-N., 2017, « Observer les changements structurels des exploitations laitières françaises : constitution de la base de données ADEL », *Notes et Études Socio-Économiques*, vol. 42.
  - Depeyrot J.-N., 2017, « Les transformations du paysage laitier français avant la sortie des quotas », *Analyse CEP*, Centre d'études et de Prospective.
- **Forthcoming publications:**
  - Depeyrot J.-N., 2019, « Analyse des déterminants de l'emploi dans les exploitations laitières », *Notes et Études Socio-Économiques*
  - Depeyrot J.-N. et Perrot C., 2019, « La filière laitière, un concentré des dynamiques à l'oeuvre », *in Actif'Agri*, *emploi travail et activités en agriculture*, Ministère de l'Agriculture.
  - Midler E. et. al, 2019, « Performance environnementale et emploi en agriculture », *in Actif'Agri*, *emploi travail et activités en agriculture*, Ministère de l'Agriculture.

Center for studies and strategic foresight :

http://agriculture.gouv.fr/le-centre-detudes-et-de-prospective-cep

http://veilleagri.hautetfort.com/

Thank you for your attention !

Jean-Noël Depeyrot **jean-noel.depeyrot@agriculture.gouv.fr**

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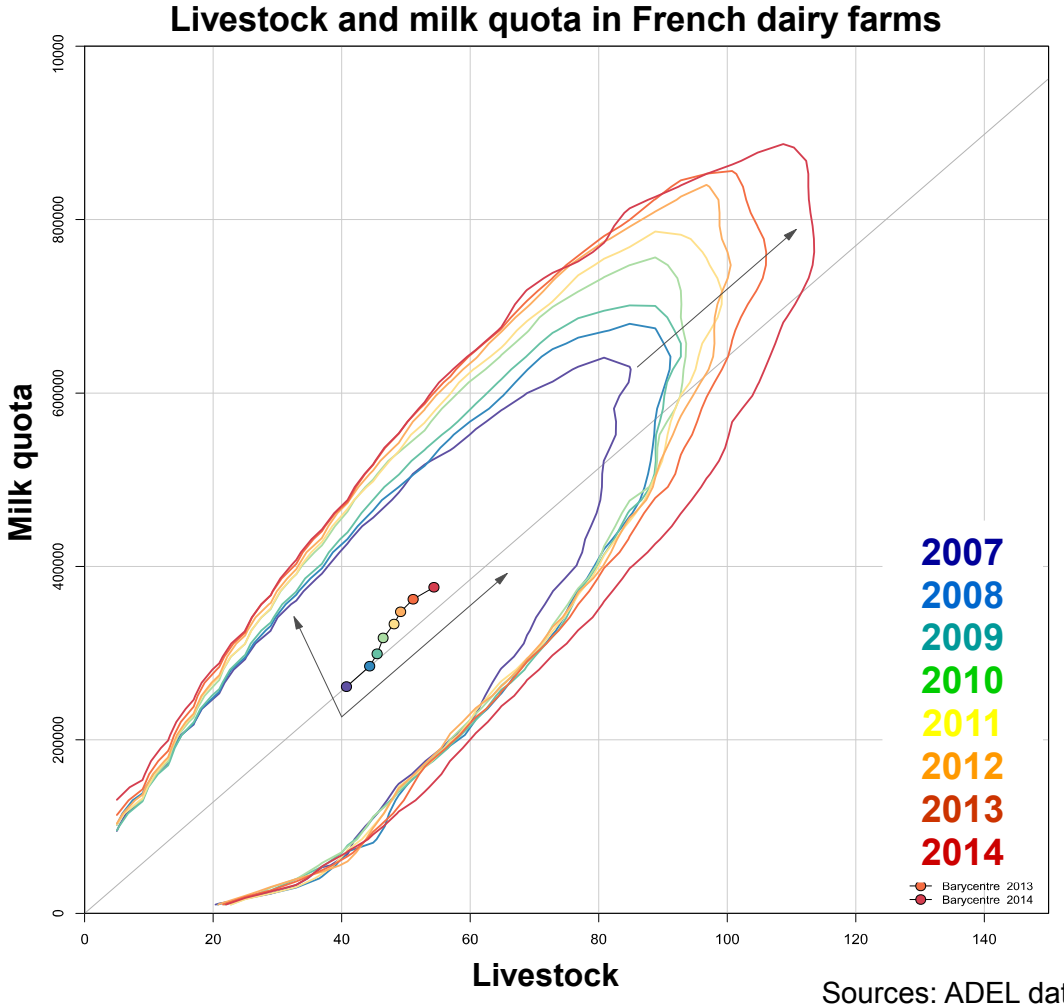
Workforce drivers in the French dairy production - *appendix*

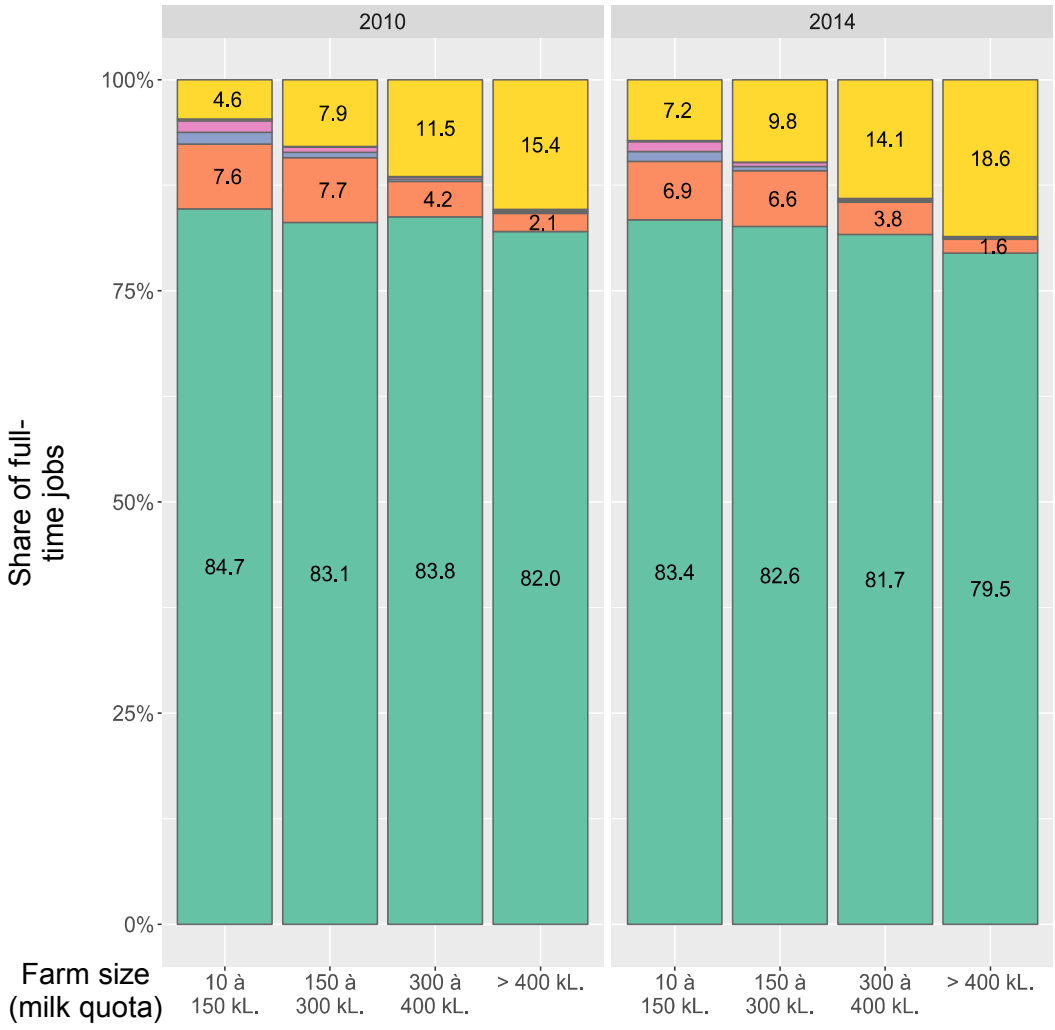
Context: structural changes in the French dairy sector



- Historical cluster analyses:
  - An annual cluster approach based on a two dimensionnal kernel analysis.
  - Areas of maximum density gathering 90% of dairy farms.
- Two dynamics:
  - **Increasing size** (livestock and milk quota together)
  - **Livestock intensification**.

Sources: ADEL database, Jean-Noël Depeyrot (CEP)

Workforce composition according to farm size: 2010 *vs* 2014



Worforce status évolutions:

- Increase of salaried workorce share
- In every farm size categories

Workforce categories:

- salaried workers
- retired
- unpaid family workers
- family workers
- spouse
- agricultural holders

ADEL: Data pairing on dairy farms

- Data management: *R-cran* open source program.
- Data pairing: recursive matching on different unique identifiers.
- Non cylindrical panel covering over 240.000 farms for the 1995-2015 period (cylindrical on 51.000 farms over 2010-2014).
- 208 technical variables at the farm level, workforce data at individual level, and dairy farm parcels GIS files.