Adjustment costs and factor demand: new evidence from firm’s real estate

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Plan

1. Introduction
2. Theoretical framework
3. Empirical analysis
4. Conclusion
5. Appendix
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1. Introduction
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Introduction

- How important are the distorsive effects of the costs associated with the adjustment of premises’ size on inputs dynamic?
- More generally: adjustment costs, factor demand and inputs’ allocation.
  → Land identified as playing an key role in the misallocation of production factors: Duranton et al. (2015)
- Empirically: heterogeneity in the relocation costs
  - Firms’ tenure status
  - Tax on real estate capital gains as a friction on premises’ size adjustment
Equivalence between adjustment of premises’ size and local relocation of establishments:

- Relies on:
  1. no access to adjacent land or buildings
  2. branching is costly
  3. no sublease of unused premises

- Implies:
  1. costly adjustments
  2. fixed-part: lumpy adjustments
  3. adjustment costs vary across firms

- Allows empirical investigation of the effect of the adjustment costs
Stylized fact 1: employment growth and relocation

- Using a firm-level database: workforce growth and relocation of firms
  - more than 100K single-establishment firms

![Scatter plot](image)

**Notes:** propensity to move (y-axis) against employment growth (x-axis)

- Suggests that:
  - Relocating is strongly associated with employment adjustments
  - Employment and premises size are highly complementary
Stylized fact 2: The impact of relocation costs

- Relocating: more costly for real estate owning firms (notably, taxes associated with real estate transactions)

![Graph showing propensity to move (y-axis) against employment growth distribution (x-axis) - owners vs renters]

Notes: propensity to move (y-axis) against employment growth distribution (x-axis) - owners vs renters

Suggests that:

- Adjustment costs alter the link btw reloc. and emp. dynamics: for a given propensity to move, owners exhibit higher growth rates
Contribution and findings

- **What we do:**
  - A general equilibrium model to formalize the effect of fixed adjustment costs of real estate on firms’ reaction to idiosyncratic prod. shocks
  - Qualitative predictions on the consequences of such costs on relocation and moments of employment growth distribution
  - Test these predictions, notably using the tax on capital gains that introduces heterogeneity in the relocation costs faced by firms

- **What we find:**
  - Confirm the relationship between relocation and employment dynamic
  - Document the negative impact of adjustment costs on relocation
  - Validate empirically the theoretical prediction on the negative effect of the real estate adjustment costs on emp. growth of growing firms:
    - A one s.d. deviation increase in a measure of the tax lowers yearly emp. growth of growing firms by .25 pp; but no significant effect of declining firms
Contribution and findings

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A quick literature review

- Non-convex adjustment costs:
  - capital: Caballero, Engel, Haltiwanger, et al., 1995, Cooper and Haltiwanger, 2006 and Bloom, 2009

- Misallocation of production factors:
  - lower aggregate total factor productivity: Hsieh and Klenow, 2009
  - size-contingent regulation: Garicano, Lelarge, and Van Reenen, 2016

- Few papers on the determinant of firms’ relocation:
  - descriptive statistic on firms’ mobility in France: Delisle and Laine, 1998
  - determinants of firms relocation: Pellenbarg, Van Wissen, and Van Dijk, 2002; Brouwer, Mariotti, and Ommeren, 2004

- The literature on the effect of tax friction on real-estate transactions and households’ mobility
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The model set-up (1/2)

- A simple two-period general equilibrium model
- A continuum of monopolistic firms producing differentiated products
  \( i \in [0, 1] \) using labor and real estate as inputs:

\[
y(i) = \theta(i) \left( \frac{l(i)}{\alpha} \right)^{\alpha} \left( \frac{r(i)}{1 - \alpha} \right)^{1 - \alpha}
\]

- where \( \theta(i) \) is firm prod. and \( \alpha \) is the elasticity of production to labor
- A final good sector uses all products \( i \) as inputs to produce \( Y \), with a CES aggregator, sold at price \( P \)
- Firm’s i revenue is given by:

\[
p(i)y(i) = \Omega(i) \left( \frac{l(i)}{\alpha} \right)^{\alpha(1 - \varepsilon)} \left( \frac{r(i)}{1 - \alpha} \right)^{(1 - \alpha)(1 - \varepsilon)}
\]

- where \( \varepsilon \) is the inverse of the elasticity of substitution and
  \( \Omega(i) = \theta(i)^{1 - \varepsilon} Y^\varepsilon P \) is the revenue productivity.
Firms face idiosyncratic unanticipated shocks on $\theta(i)$ in period 1
Factors optimally allocated before unanticipated prod. shocks
Factors’ adjustment following the shocks:
  - Friction-less adjustment of labor
  - Adjusting real estate associated with fixed costs: $ar_0(i)$

Firm $i$’s profit maximization problem can be written:

$$\max_{z(i) \in \{0,1\}} z(i) \max_{r(i)>0;l(i)>0} [\pi(i, l(i), r(i)) - ar_0(i)] + (1 - z(i)) \max_{l(i)>0} [\pi(i, l(i), r_0(i))]$$

where $z$ denotes relocating choice, $\pi$ denotes profit defined as $p(i)y(i) - wl(i) - ur(i)$, with $w$ the wage and $u$ the user cost of re

General equilibrium effect: re and labor are in fixed supply and wages and re costs clear the markets
The relocation decision

- Frictionless case:
  - All firms relocate and optimally adjust premises size
  - Optimal allocation of factors

\[ \Delta re^* \]
The relocation decision

- Frictionless case:
  - All firms relocate and optimally adjust premises size
  - Optimal allocation of factors

- Case with frictions:
  - Firms relocate only if induced changes in profits cover the relocation costs
  - Implies a non-relocating interval (NRI) in $\Delta_{re^*}$
  - The NRI widens with $a$
  - Non linearity implies that the NRI is not centered in 0 and $|\Delta_{re^*}^+| > |\Delta_{re^*}^-|$
The relocation decision

- **Frictionless case:**
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- **Case with frictions:**
  - Firms relocate only if induced changes in profits cover the relocation costs
  - Implies a non-relocating interval (NRI) in $\Delta_{re^*}$
  - The NRI widens with $a$
  - Non linearity implies that the NRI is not centered in 0 and $|\Delta^+_{re^*}| > |\Delta^-_{re^*}|$

- Numerically solve the model for varying parameter values of $a$ while keeping the same productivity shocks
  - 100,000 draws from $N(1, 0.1)$
  - $\varepsilon = 0.2$ and $\alpha = 0.925$
(i) Relocating firms are characterized by larger employment growth

(ii) Because of asymmetrical effect of adj. costs, the growth diff. is larger for growing firms
Frictions and share of relocating firms: share of relocating firms for different values of $a$

- For given prod. shocks, the share of relocating firms is decreasing with the level of the adj. costs
Frictions and moments in the employment growth distribution: mean emp. growth as a function of $a$

- (i) overall mean emp. growth decreases with the level of adj. costs
- (ii) mean emp. growth of growing firms markedly decrease with $a$ whereas mean emp. growth of declining firm slightly increase
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Data

- Firm-level database built by the Banque de France
  - panel data between 1993 and 2013: 112K single-establishment firms over an average period of 9.75 years
  - location (code commune), workforce size in FTE, financial statements, sector

We can identify inter-municipality relocations of a firm:
- A relocation corresponds to a change in the code commune
- Relocations are not so rare: almost 18K have relocated their activities (c.16%)
- For 75% of the moves, the "as-the-crow-flies" distance is inferior to 15km

Relocation cost 1: BS data indicate firm's tenure status
Relocation cost 2: tax on real estate capital gains
Tax only paid if real estate transac. but latent level at a yearly freq

Firm level variations of Tax \( i, t \) driven by interaction of holding period and local price dynamics between acq. date and obs. date

Bergeaud and Ray (BdF, AMSE and PSE)
Adjustment costs and factor demand
December 2017
Data

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- Relocation cost 1: BS data indicate firm’s tenure status
- Relocation cost 2: tax on real estate capital gains
  - Tax only paid if real estate transac. but latent level at a yearly freq
  - Firm level variations of $Tax_{i,t}$ driven by interaction of holding period and local price dynamics between acq. date and obs. date
How does the occurrence of a move interact with the employment growth?

$Δl_i = \beta_1 z_i + X_i \beta_2 + \varepsilon_{i,s,d}$

<table>
<thead>
<tr>
<th></th>
<th>All (1)</th>
<th>Growing (2)</th>
<th>Declining (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relocate</td>
<td>0.125***</td>
<td>0.209***</td>
<td>-0.063***</td>
</tr>
<tr>
<td></td>
<td>(0.012)</td>
<td>(0.021)</td>
<td>(0.005)</td>
</tr>
<tr>
<td>Age</td>
<td>-0.078***</td>
<td>-0.116***</td>
<td>0.020***</td>
</tr>
<tr>
<td></td>
<td>(0.004)</td>
<td>(0.008)</td>
<td>(0.001)</td>
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<tr>
<td>Size</td>
<td>-4.078*</td>
<td>-8.476***</td>
<td>4.334***</td>
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<tr>
<td></td>
<td>(2.095)</td>
<td>(3.102)</td>
<td>(1.608)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.059</td>
<td>0.110</td>
<td>0.158</td>
</tr>
<tr>
<td>Observations</td>
<td>118,980</td>
<td>56,983</td>
<td>46,605</td>
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</tbody>
</table>
## I - Local relocations and employment dynamics: evidence of the asymmetric effect - Panel

<table>
<thead>
<tr>
<th>Dependent variable: Employment growth at t (in %)</th>
<th>Growing (1)</th>
<th>Declining (2)</th>
<th>Growing (3)</th>
<th>Declining (4)</th>
<th>Growing (5)</th>
<th>Declining (6)</th>
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<tr>
<td>Relocate (t)</td>
<td>3.663***</td>
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<td></td>
<td>(0.674)</td>
<td>(0.369)</td>
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<tr>
<td>Relocate (t - 1)</td>
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<td>0.805</td>
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<td>(0.694)</td>
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<td>(0.606)</td>
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<tr>
<td>Relocate (t - 2)</td>
<td>-0.259*</td>
<td>-0.199</td>
<td>-0.256*</td>
<td>-0.197</td>
<td>0.062</td>
<td>-0.118</td>
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<td></td>
<td>(0.145)</td>
<td>(0.150)</td>
<td>(0.145)</td>
<td>(0.150)</td>
<td>(0.146)</td>
<td>(0.159)</td>
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<td>-75.674***</td>
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<td>-69.808***</td>
<td>-27.582**</td>
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<td>(23.791)</td>
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<td>(23.852)</td>
<td>(8.266)</td>
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<td>R(^2)</td>
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<td>574,352</td>
<td>426,728</td>
<td>516,131</td>
<td>379,077</td>
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</table>
II - Relocation costs and mobility (1/3)

- How do the relocation costs affect the propensity to move?
- Moving costs as captured through the tenure status (col. 1):
  \[ z_i = \mu_1 T_{ei} + \mu_2 X_i + \varepsilon_{i,s,d}, \]
- Restricting the sample to owning firms (col. 2 to 6):
  \[ z_i = \beta_1 T_{axi} + \beta_2 X_i + \varepsilon_{i,s,d}, \]
### II - Relocation costs and mobility (2/3)

<table>
<thead>
<tr>
<th></th>
<th>All (1)</th>
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<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
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<tbody>
<tr>
<td>Real Estate Owner</td>
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<td></td>
<td>(0.036)</td>
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<td></td>
<td>(0.491)</td>
<td>(0.498)</td>
<td>(0.561)</td>
<td>(0.579)</td>
<td>(0.588)</td>
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<td>Age</td>
<td>-0.022***</td>
<td>-0.014***</td>
<td>-0.013***</td>
<td>-0.008***</td>
<td>-0.006***</td>
<td>-0.007***</td>
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<td>(0.001)</td>
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<tr>
<td>Size</td>
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<td>5.314*</td>
<td>5.050*</td>
<td>5.041*</td>
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<td>(1.746)</td>
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<td>(0.005)</td>
<td>(0.005)</td>
<td>(0.005)</td>
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<tr>
<td>Age Real Estate</td>
<td>-0.024***</td>
<td>-0.023***</td>
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<td>(0.005)</td>
<td>(0.005)</td>
<td>(0.005)</td>
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<tr>
<td>R²</td>
<td>0.087</td>
<td>0.121</td>
<td>0.121</td>
<td>0.121</td>
<td>0.160</td>
<td>0.160</td>
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<tr>
<td>Observations</td>
<td>118,980</td>
<td>45,181</td>
<td>45,181</td>
<td>44,412</td>
<td>44,412</td>
<td>44,412</td>
</tr>
</tbody>
</table>
II - Relocation costs and mobility: the graphical impact of the tax (3/3)

Notes: propensity to move (y-axis) against the importance of the tax on capital gain
What are the direct effects of relocation costs on the employment growth?

Moving costs as captured through the tenure status (col. 1 to 2):

$$\Delta l_i = \mu Te_i + \mu_2 X_i + \varepsilon_{i,s,d},$$

Restricting the sample to owning firms (col. 3 to 6):

$$\Delta l_i = \beta_1 Tax_i + \beta_2 X_i + \varepsilon_{i,s,d}.$$
### III - Direct effects of relocation costs on employment: evidence of a significant impact on growing firms

<table>
<thead>
<tr>
<th></th>
<th>Growing (1)</th>
<th>Declining (2)</th>
<th>Growing Owners (3)</th>
<th>Declining Owners (4)</th>
<th>Growing Owners (5)</th>
<th>Declining Owners (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real Estate Owner</td>
<td>-0.987***</td>
<td>0.228***</td>
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<td></td>
<td>(0.149)</td>
<td>(0.046)</td>
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<tr>
<td>Tax</td>
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<td></td>
<td>-4.855**</td>
<td>-0.243</td>
<td>-5.260**</td>
<td>-0.127</td>
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<td>(2.309)</td>
<td>(0.767)</td>
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<td>(0.737)</td>
</tr>
<tr>
<td>Age</td>
<td>-0.076***</td>
<td>0.010***</td>
<td>-0.035***</td>
<td>0.006***</td>
<td>-0.035***</td>
<td>0.006***</td>
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<td>(0.007)</td>
<td>(0.001)</td>
<td>(0.008)</td>
<td>(0.002)</td>
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<td>(1.531)</td>
<td>(6.220)</td>
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<td>(6.221)</td>
<td>(4.082)</td>
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<tr>
<td>Age Real Estate</td>
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<td>-0.087***</td>
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<td>(0.024)</td>
<td>(0.007)</td>
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<td>(0.007)</td>
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<tr>
<td>Volume Real Estate</td>
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<td>0.079</td>
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<td>-0.034**</td>
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<td></td>
<td>(0.017)</td>
</tr>
<tr>
<td>R²</td>
<td>0.105</td>
<td>0.216</td>
<td>0.243</td>
<td>0.310</td>
<td>0.243</td>
<td>0.310</td>
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<tr>
<td>Observations</td>
<td>72,375</td>
<td>46,605</td>
<td>24,855</td>
<td>19,557</td>
<td>24,855</td>
<td>19,557</td>
</tr>
</tbody>
</table>
Misallocation
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Concluding remarks

- This paper investigates the effect of fixed adjustment costs of real estate on inputs’ dynamic, notably using firm level heterogeneity introduced by tax on cap. gains

- We build a general equilibrium model to derive the effect of the fixed adj. costs on moments of the workforce growth distribution

- We derive asymmetrical effects of adjustment costs: dampen the propensity to relocate and distort the emp. growth of growing firms

- A one s.d. deviation increase in a measure of the tax lowers yearly emp. growth of growing firms by .25 pp but no significant effect on declining firms

- An example of fixed adjustment costs, induced by taxes, that is non neutral on input distribution and affect optimal allocation of resources
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Co-variance between $r(i)$ and $\theta(i)$ as a function of $a$
Relocation and employment dynamics - Quantile regression results

![Quantile Regression Coefficient](image)

- **Regression coefficient**
- **Quantile Regression Coefficient**
- **95% Confident Interval**
Relocation costs and employment dynamics - Quantile regression results

![Graph showing quantile regression results with regression coefficient values and 95% confidence interval](image)

- **Quantile Regression Coefficient**
- **95% Confident Interval**

Bergeaud and Ray (BdF, AMSE and PSE) December 2017