Impact of Very High-Speed Broadband on Company Creation
Empirical Evidence

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Why governments, institutions promote investment in Next Generation Access (NGA) Network?

Superfast broadband is seen as a key enabler for socio-economic development.
- Positive effect on national economic growth
- Increase the competitiveness of companies
- But also attractiveness of territories for companies
- Social development (e-health, e-government)

Many countries have adopted a national broadband plan to ensure the whole coverage of their territory.
- The US, Australia, Japan, France, Spain, Sweden and New Zealand...

Deployment of public initiative networks to ensure the whole coverage of the territory.
Lack of Empirical Studies

- Lots of papers on:
  - The benefits of broadband for the national economy
  - Costs/benefits analysis with different scenarios...

- No so many empirical studies, at a fine-grained level, to quantify the benefit of very high-speed broadband on local economic growth
  - Especially, as regards their effects on companies creation, in particular entrepreneurship
  - Does very high-speed broadband boost company creation?
    Does it have an effect on individually owned and run companies?

- I use panel data analyses with municipal- and time-fixed effects
  - Count modeling approach: use territory as the unit of analysis
  - Robustness checks: nearest neighbor matching estimator
Literature review

- Numerous macro-level studies bring empirical evidence on the positive impact of broadband adoption on economic growth.
  - Gruber et al. 2014: Economic benefits are only marginally appropriable by firms, they mostly spill over to users.

- Limited empirical evidence of the effect of broadband on economic growth at the local level:
  - Mostly studies concentrate on the impact of broadband on employment (Czernich (2014), Whitacre et al. (2014))
  - As far as firms are concerned, literature focuses on broadband impacts on productivity and firm performance (Akerman et al. (2015), Bertschek et al. (2013))
  - McCoy et al. (2016) highlights the existence of a positive impact on new business establishment.

- Studies focus on the impact of old generation broadband technologies and are realized at a more aggregated level.
Using data on 5,000 municipalities over 6 years (2010-2015), I estimate whether superfast broadband networks have an impact on local economic growth.

Number of establishment creation

- 3 main types of non-farm market sectors:
  - Construction;
  - Industry;
  - Tertiary;
- Individually owned companies (companies owned and run by one individual).

Tertiary sector, the one expected to benefit the most from superfast broadband deployment: divided in 3 sub-sectors

- Commerce, service and transport; services to firms; services to households.
Methodology: Data Collection

For each municipality, I know whether:

- A fibre (FttH) network has been deployed by Orange, SFR or Free (French three main operators in the fixed broadband market)
- Numericable has upgraded its cable network to FttLA (or DOCSIS 3.0)

For each municipality, I know:

- The number of LLU operators (operators using the copper network via local loop unbundling to provide broadband services)
- VDSL (a faster technology than ADSL) has been deployed (since 2013 in France)

I collected from INSEE a bunch of socio-demographic characteristics (number of households, density, unemployment, income...)

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Entry into fibre and upgraded cable in municipalities in France

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orange</td>
<td>117</td>
<td>196</td>
<td>299</td>
<td>456</td>
<td>589</td>
</tr>
<tr>
<td>SFR</td>
<td>83</td>
<td>150</td>
<td>214</td>
<td>347</td>
<td>425</td>
</tr>
<tr>
<td>Free</td>
<td>93</td>
<td>103</td>
<td>104</td>
<td>106</td>
<td>107</td>
</tr>
<tr>
<td>Numericable</td>
<td>202</td>
<td>202</td>
<td>329</td>
<td>699</td>
<td>1067</td>
</tr>
</tbody>
</table>

Out of 36,080 municipalities.
Deployment of fibre and upgraded cable in France

Situation on 30/09/2015

- Municipalities with Ftth
- Municipalities with cable network >= 30 Mbits & < 100Mbits
- Municipalities with cable network >= 100Mbits
Econometric Setting

- I assess whether superfast broadband networks have a causal effect on the creation of new businesses.
  - Paris, Lyon and Marseille are excluded.
  - Keep municipalities with at least 2,000 inhabitants to define relevant control groups
    - Unlikely to have a superfast broadband by private operators in smaller municipalities

- Technology neutral approach $\text{superfastbb}_{it}$ includes FttH and upgraded cable (30Mbps and over)

- What could drive business location decisions?
  - Costs factors: tax regime, availability of infrastructures, cost and availability of human capital
  - Potential demand in the market for their products or services
Econometric Modeling

- Panel data analysis with fixed effects
  - Count modeling approach

\[ Y_{it+1} = superfastbb_{it} + X_{it-2} + Z_{it-2} + year + \eta_i + \epsilon_{it}. \]  

(1)

Where:

\[ Y_{it+1} = 0, 1, 2, \ldots \]  

(2)

- \( X_{it-2} \) is a matrix of location characteristics for municipality \( i \) at time \( t - 2 \)
- \( Z_{it-2} \) is a matrix of local labor characteristics
- \( year \) time fixed effects
- \( \eta_i \) time-unvarying fixed effects
- \( \epsilon_{it} \) iid error term clustered at the municipal level
Panel data analysis with fixed effects
- Log-transformation for better interpretation

\[ \log Y_{it+1} = \text{superfastbb}_{it} + \text{establishment}_{it-2} + \log \text{households}_{it-2} + \text{density}_{it-2} + \text{unempl}_{it-2}, \]
\[ + \text{income}_{it-2} + \text{perc uni diploma}_{it-2}, \]
\[ + \text{socio professional groups}_{it-2} + \text{year} + \eta_i + \epsilon_{it}. \]
Potential endogeneity

- Potential endogenous relationship between economic activity, number of companies operating locally, and the roll-out of superfast broadband network: **reverse causality**
  - Follow McCoy et al. argument: reverse causality more likely to affect the stock of companies, rather than the flow of company creation.
  - Use of lag variables of 2 years

- Omitted variable potential source of endogeneity
  - Use of fixed effects and region or department specific time trends

- Though mitigate, estimation results are likely to suffer from endogeneity and be biased upward
### Table: Summary of effects

<table>
<thead>
<tr>
<th>Geographic time trend</th>
<th>Panel FE (1)</th>
<th>Panel FE (2)</th>
<th>Panel FE (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>2.8%</td>
<td>1.6%</td>
<td>X</td>
</tr>
<tr>
<td>new estab</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>new industry</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>new construction</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>new comm serv transp</td>
<td>6.1%</td>
<td>3.9%</td>
<td>3.5%</td>
</tr>
<tr>
<td>new service firms</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>new service households</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>new individual_comp</td>
<td>1.8%</td>
<td>1.7%</td>
<td>1.4%</td>
</tr>
</tbody>
</table>

X: results are not significant
Impact of superfast broadband

- Positive effect on establishment creation (+2.8%)

- Positive effect only establishments creation in the commerce, service and transportation sector (+6%)
  - Uses ICTs the most to operate

- Positive impact of the creation of individually owned businesses (+2%)

- Effects are reduced with introduction of geographic specific time trends

- Firms are more likely to settle in
  - Areas with larger market size and higher population density
  - Richer areas and areas with a lower unemployment rate
  - On average: negative effect of the number of establishments operating locally \((t - 2)\)
Robustness checks: matching estimator

- Necessitate to determine the relevant set of matches (key parameter)
- Run a balance test for covariates between the treated group and the control group

Then, the set of relevant matches is:

\[ \text{log\_households}_{it-2}, \text{density}_{it-2}, \text{income}_{it-2}, \text{unempl}_{it-2}, \text{perc\_estab\_commserv}_{it}, \text{year}. \] (4)

Table: Covariate for Balance Test

<table>
<thead>
<tr>
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<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Variance</td>
<td>Skewness</td>
</tr>
<tr>
<td>estab_commserv_perc</td>
<td>65.2554</td>
<td>790.6751</td>
<td>-1.614831</td>
</tr>
<tr>
<td>density</td>
<td>1.543979</td>
<td>6.630078</td>
<td>4.605992</td>
</tr>
<tr>
<td>households</td>
<td>1.193238</td>
<td>1.146193</td>
<td>.7648062</td>
</tr>
<tr>
<td>income</td>
<td>26.73325</td>
<td>67.20517</td>
<td>2.088331</td>
</tr>
<tr>
<td>unemployment</td>
<td>7.989886</td>
<td>9.152099</td>
<td>.7750062</td>
</tr>
<tr>
<td>no diploma</td>
<td>32.56171</td>
<td>66.95298</td>
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<tr>
<td>diploma superior</td>
<td>26.32544</td>
<td>101.283</td>
<td>.9109169</td>
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Parallel line assumption

Figure: Parallel lines assumption: number of new establishments from the commerce, service and transportation sector
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Thank you
Any questions?

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