



IRPET Istituto Regionale
Programmazione
Economica
della Toscana

Expanding the network: from urban to metropolitan tramway in Florence

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the future of mobility”

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Overview of the research

Objective:

Assess and evaluate the territorial and economic impacts of the expansion of the railway system in the context of the Metropolitan Area of Florence.

Methodology:

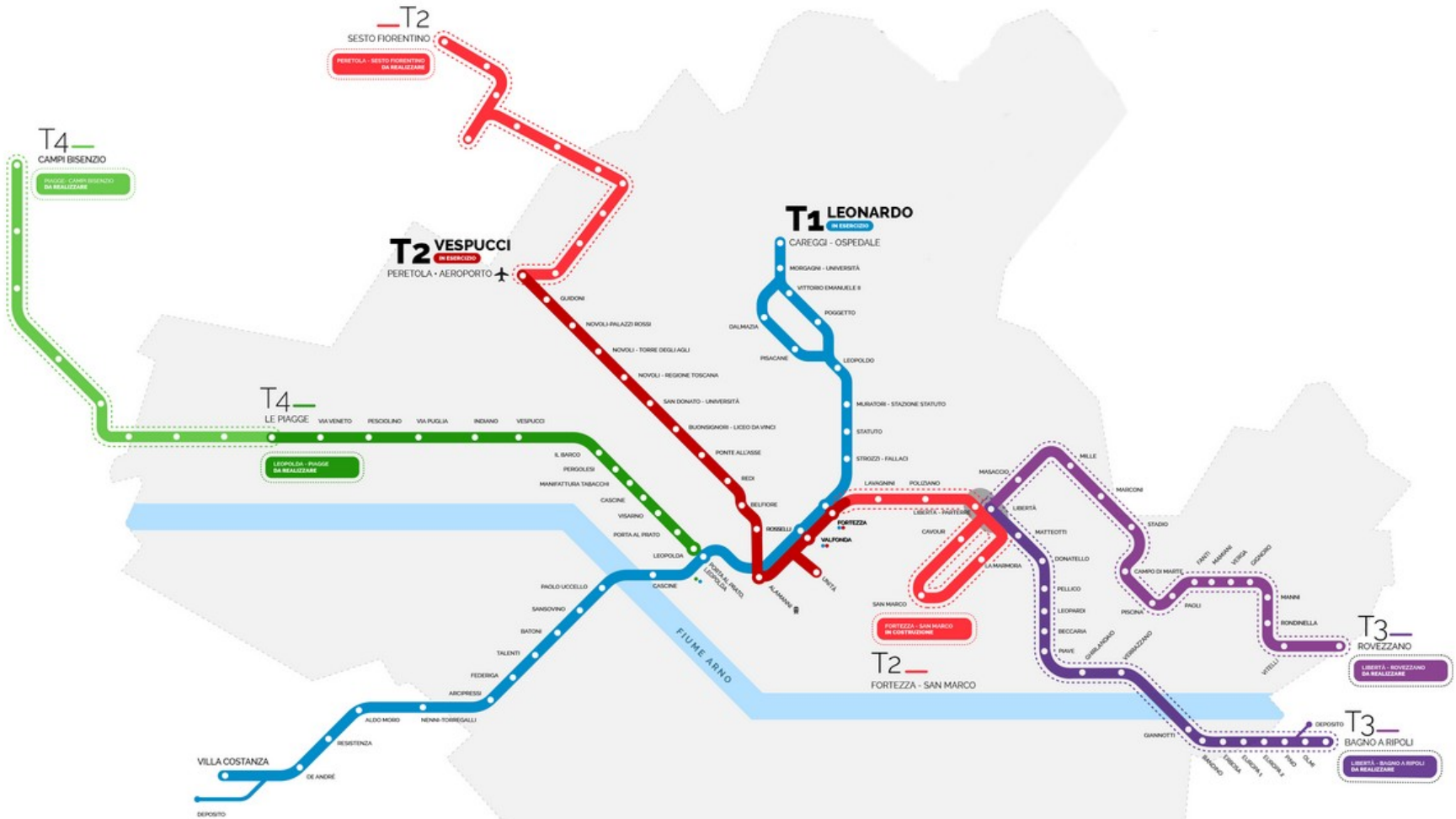
We use a mix of desk research (territorial planning analysis, impact on real estate values, estimation of external costs) and field survey (to evaluate the Willingness to Pay of the resident population).

Case study:

We focus on the planned expansion of the network towards north-west (connection between Florence Airport and the municipality of the Sesto Fiorentino) to draw broader conclusions on the expected impact of metropolitan connectivity.

Work still in progress, we present the general approach, descriptive results and some preliminary findings

The Project: from urban to metropolitan



The Project: the state of the network

Operating:

Line 1 - Firenze S.M.N. – Scandicci (since 4/02/2010) – 7.7 km

Line 3.1 - Careggi – Firenze S.M.N. (since 16/07/2018) – 3.8 km

Line 2 - Peretola – Piazza dell'Unità d'Italia (since 11/02/2019) – 5.3 km

Under construction:

Line 2 - Expansion towards the historical center (2.5 km - 57.8 MLN)

Planning stage:

Line 3.2.1 - Piazza della Libertà - Bagno a Ripoli (7.2 km - 447 MLN)

Line 2.2 - Airport - Sesto Fiorentino (6.8 km - 270 MLN)

Line 3.2.2 - Libertà – Rovezzano (6.2 km - 259 MLN)

Line 4.1 Leopolda – Le Piagge (6.2 km - 229 MLN)

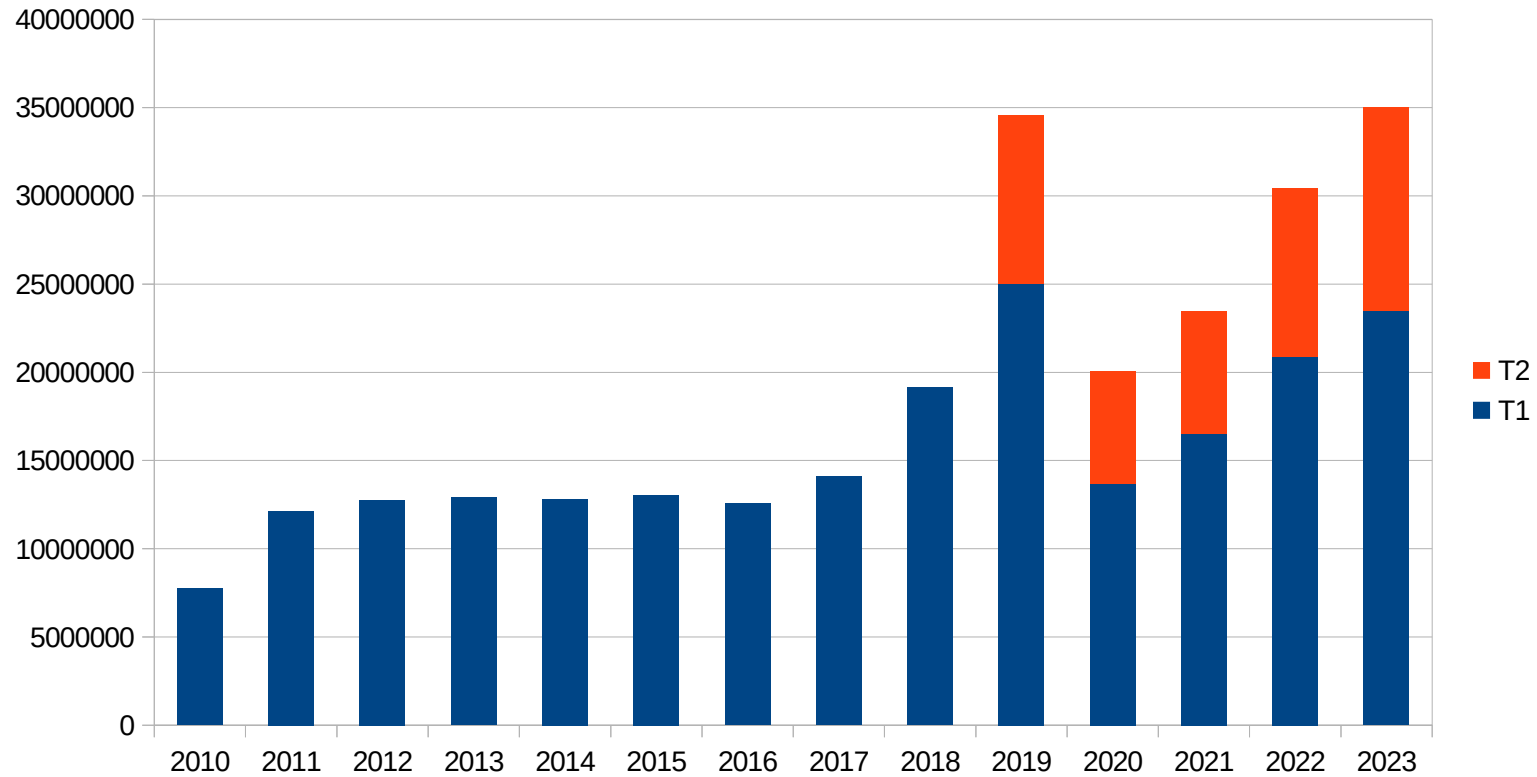
Linea 4.2 Le Piagge – Campi Bisenzio (5.4 km - 283 MLN)

Feasibility study:

Line 1 north extension, towards Ospedale Pediatrico Meyer
Metropolitan connection Florence – Prato

Good results in terms of passengers...

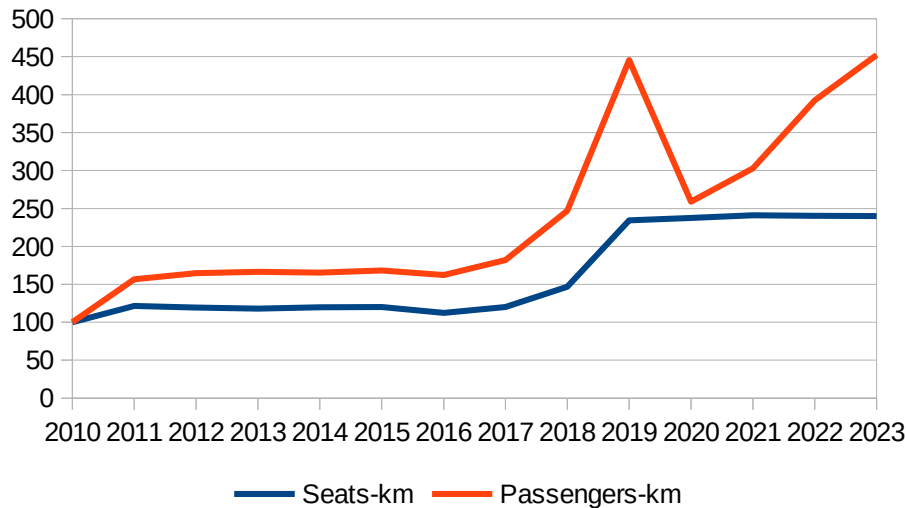
Yearly Passengers on the tramway network in Florence



Source: GEST

...but where do they come from?

Evolution of supply and demand on the Florence tramway system

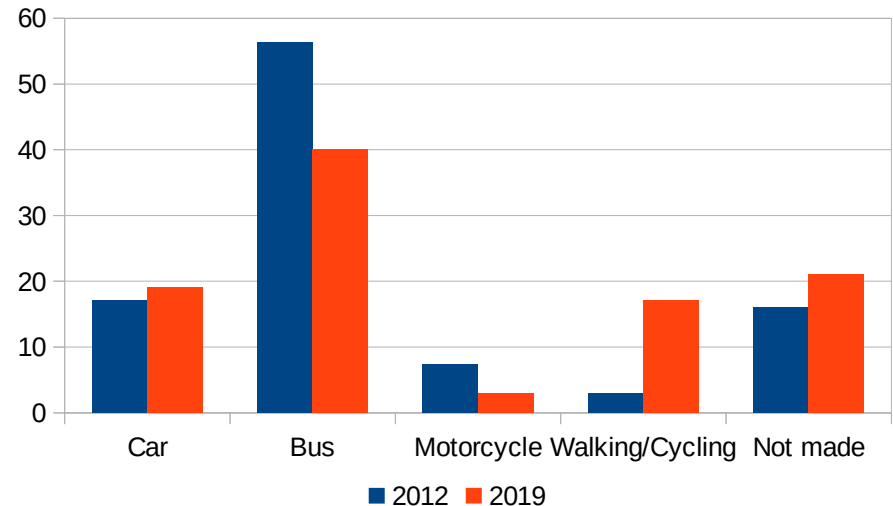


Substitution effect: the modal shift from cars was generally lower than 20%, substitution effect from previous LPT was relevant, both for T1 and T2.

Source: GEST

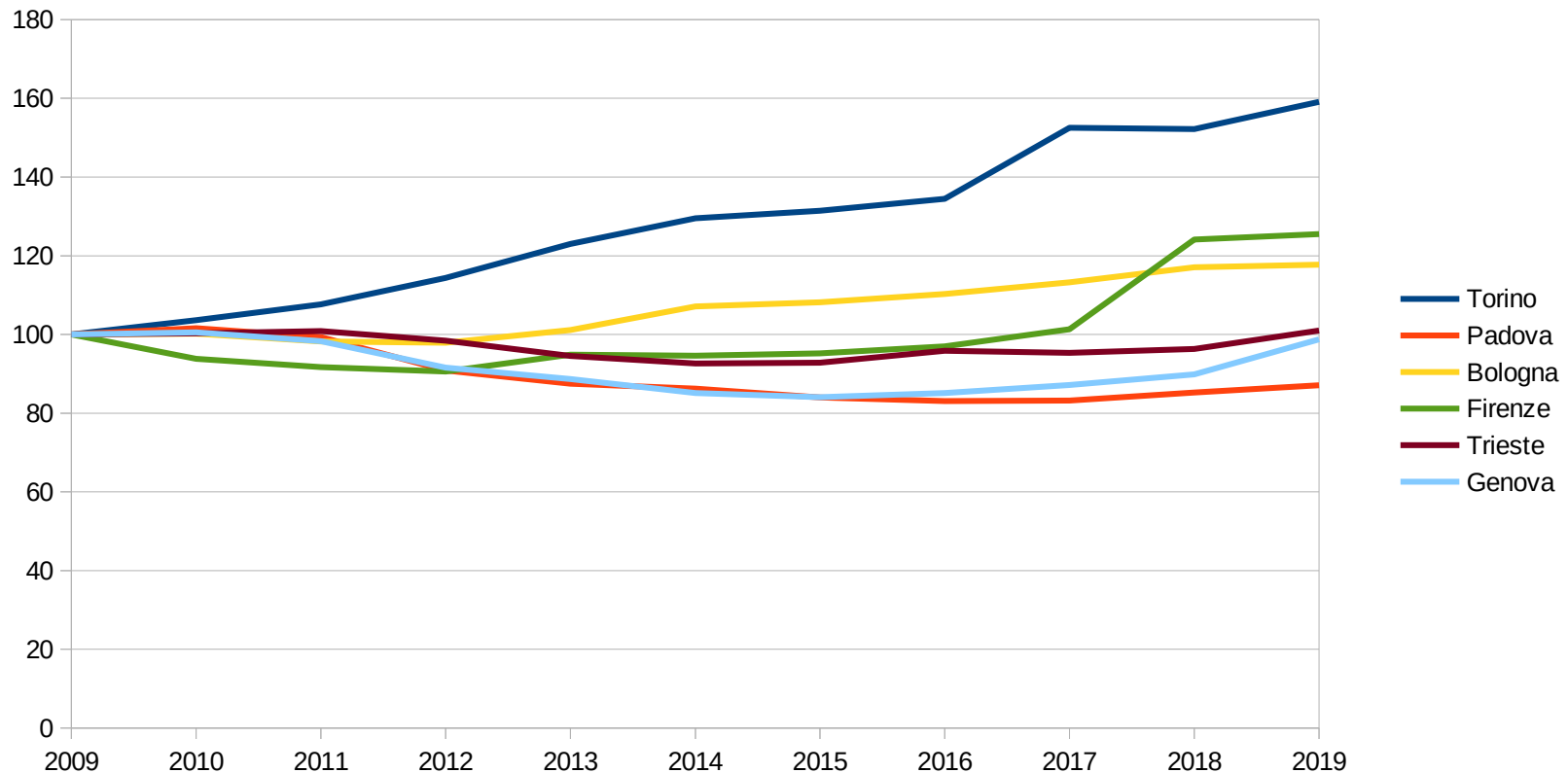
Network effect: the expansion in 2018/2019 pushed demand up proportionally more than the increase in offer. Then COVID hit.

Modal shift from pre-tramway (%)



Comparisons with other italian cities

Overall LPT demand in urban municipalities
(passengers/inhabitants, index 2009=100)



Source: ISTAT

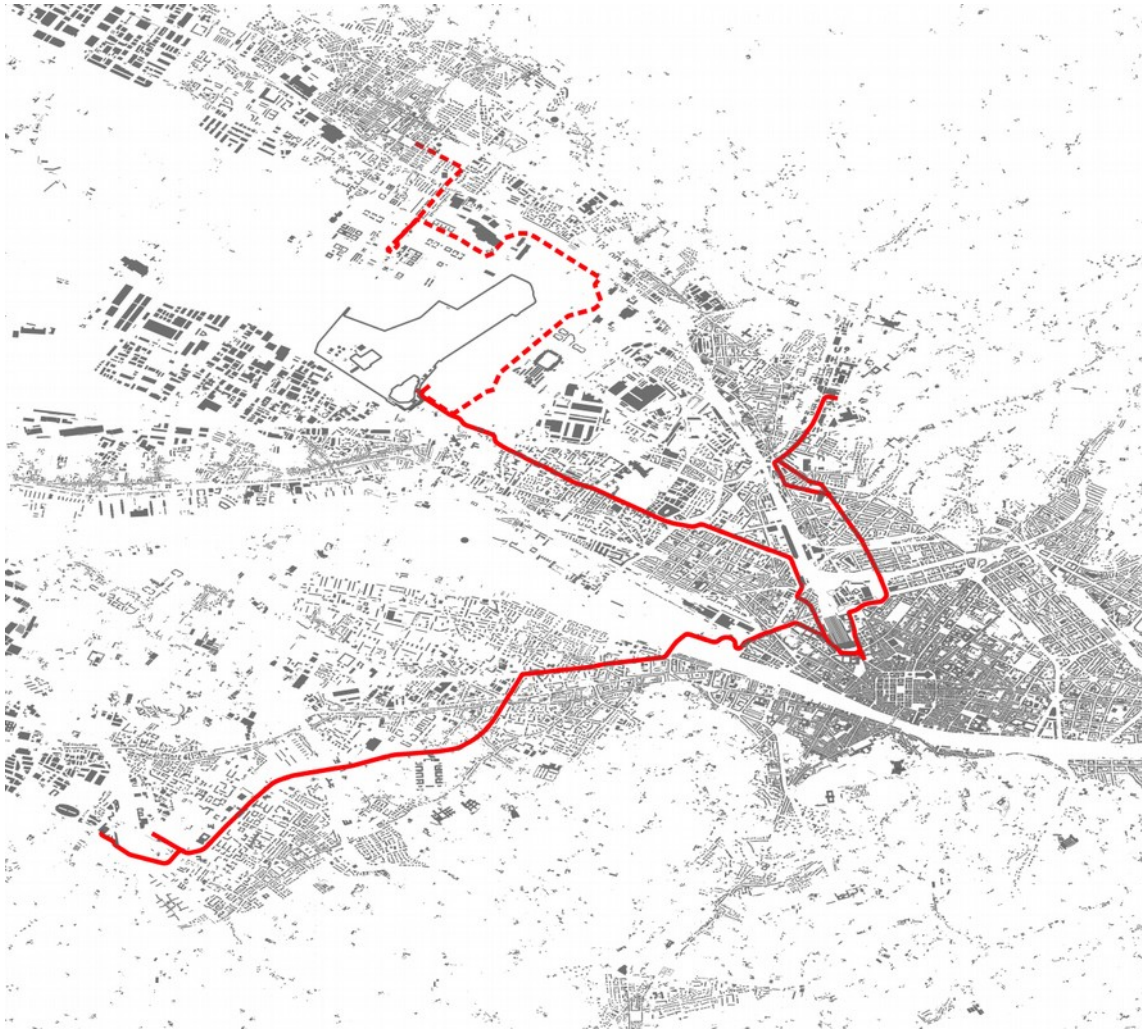
The Project: connecting the dots



The extension of Line 2 has an estimated cost of 270 million euros, covered by funds from the 2021-2027 PR FESR and the FSC 21-27 funds.

The line will connect Peretola Airport with the center of Sesto Fiorentino with 11 stops at key points in the area, such as the airport, the Carabinieri Academy, the University, and the center of Sesto. The line will also offer the possibility of modal interchange with the Florence-Prato railway at the Castello train station

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Competition with other modes of transport

Modal share of systematic home/work and home/school flows

	Metropolitan area	From Sesto F.no to Florence	From Florence to Sesto F.no
Train	15,18%	11,33%	3,39%
Bus	11,67%	12,53%	10,23%
Car/motorcycle	71,61%	74,41%	83,57%
Walking/Cycling	1,54%	1,72%	2,80%

Source: ISTAT

Train

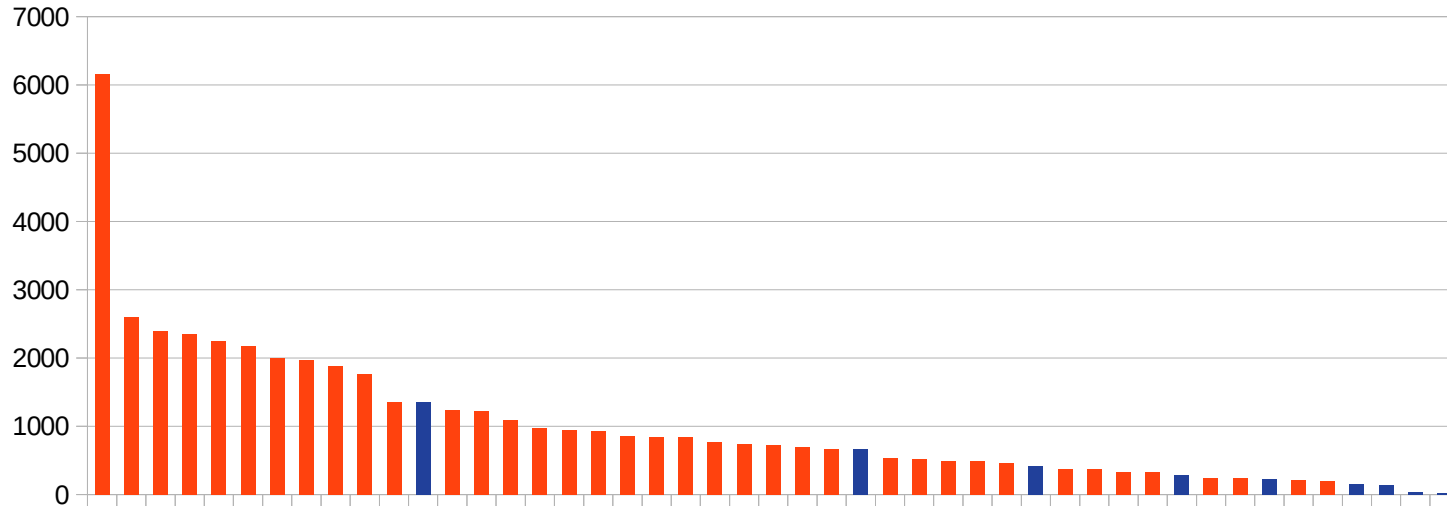
Approx every 20 minutes
15/20 minutes
Min 1/ max 3 intermediate stops

Tramway

Approx every 8 minutes
45/50 minutes
20 intermediate stops

Accessibility to economic activities

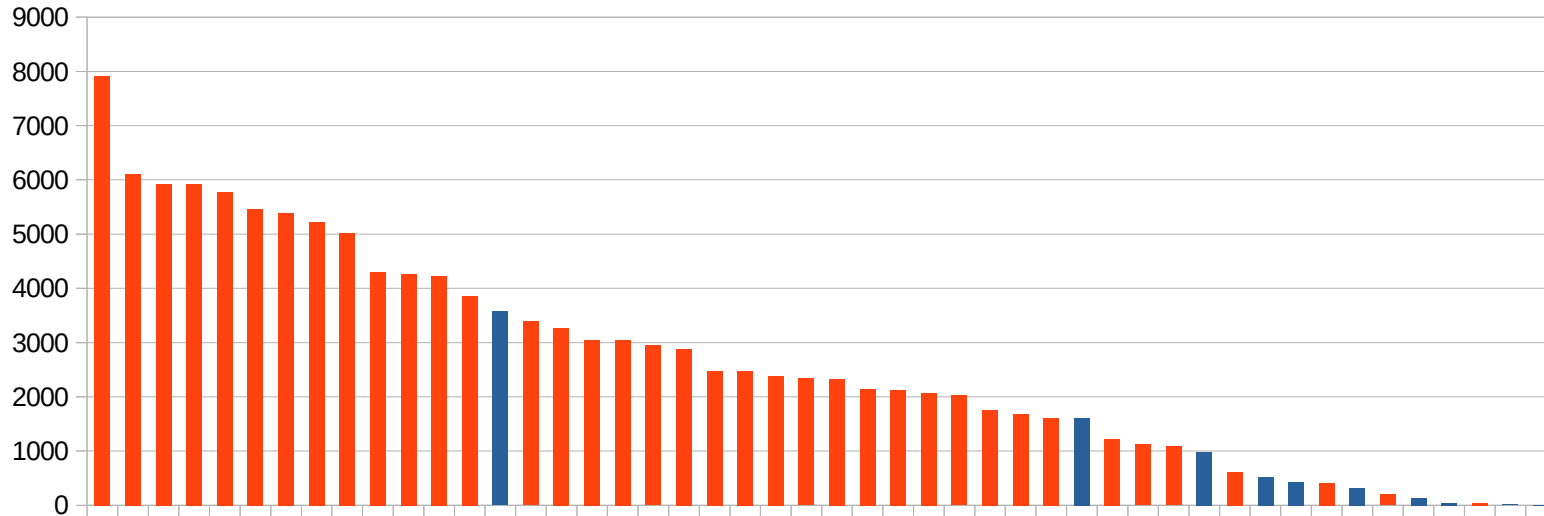
Number of jobs within 500m from the tramway stop
(blue bars are line 2.2 stops)



	Number of stops	Avg jobs >500m per stop	Avg firms >500m per stop
Existing lines	39	1134	342
Line 2.2	11	298	41

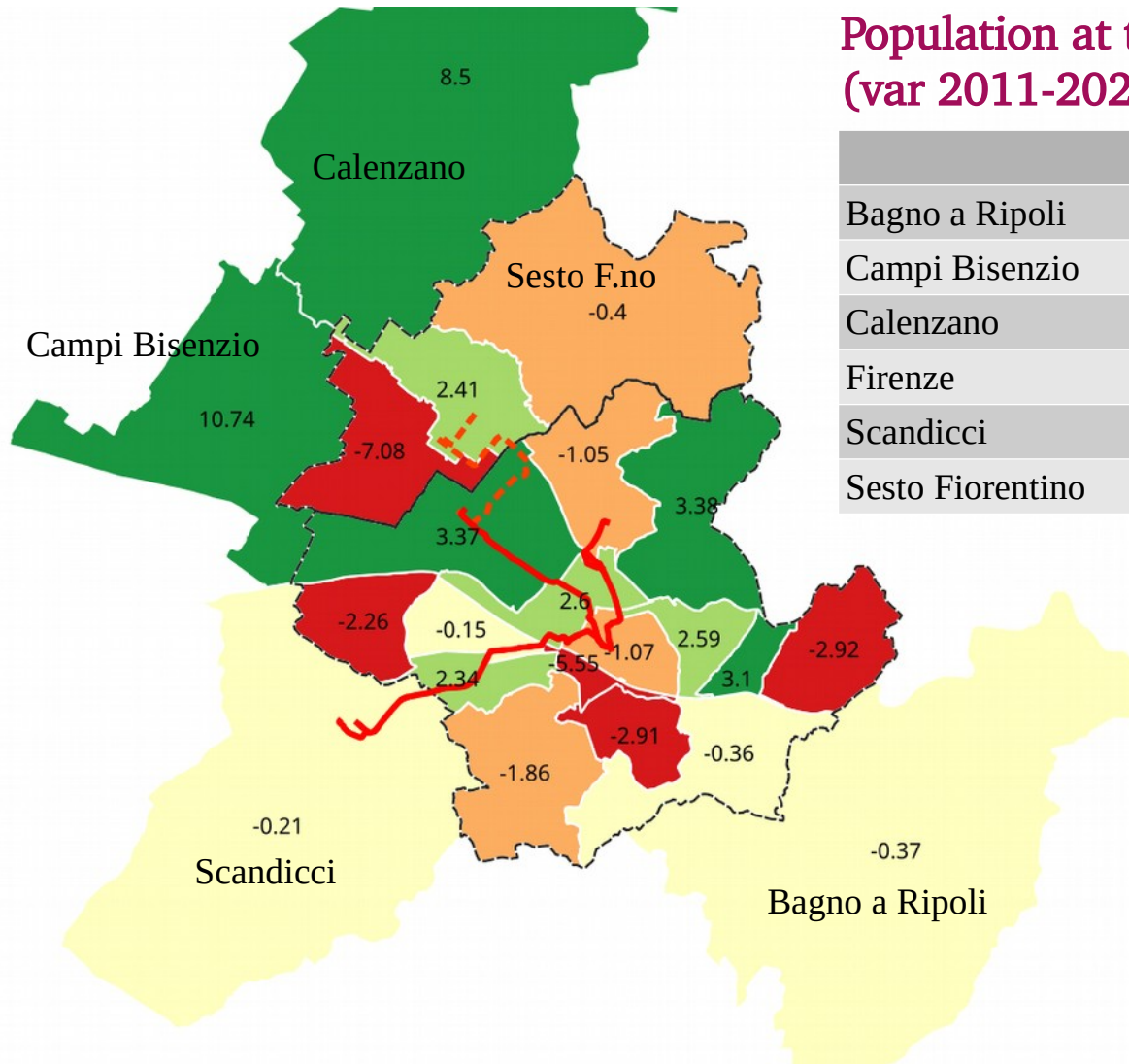
Accessibility to population

Number of residents within 500m from the tramway stop
(blue bars are line 2.2 stops)



	Number of stops	Avg pop >500m per stop
Existing lines	39	3027
Line 2.2	11	694

Relocation of population



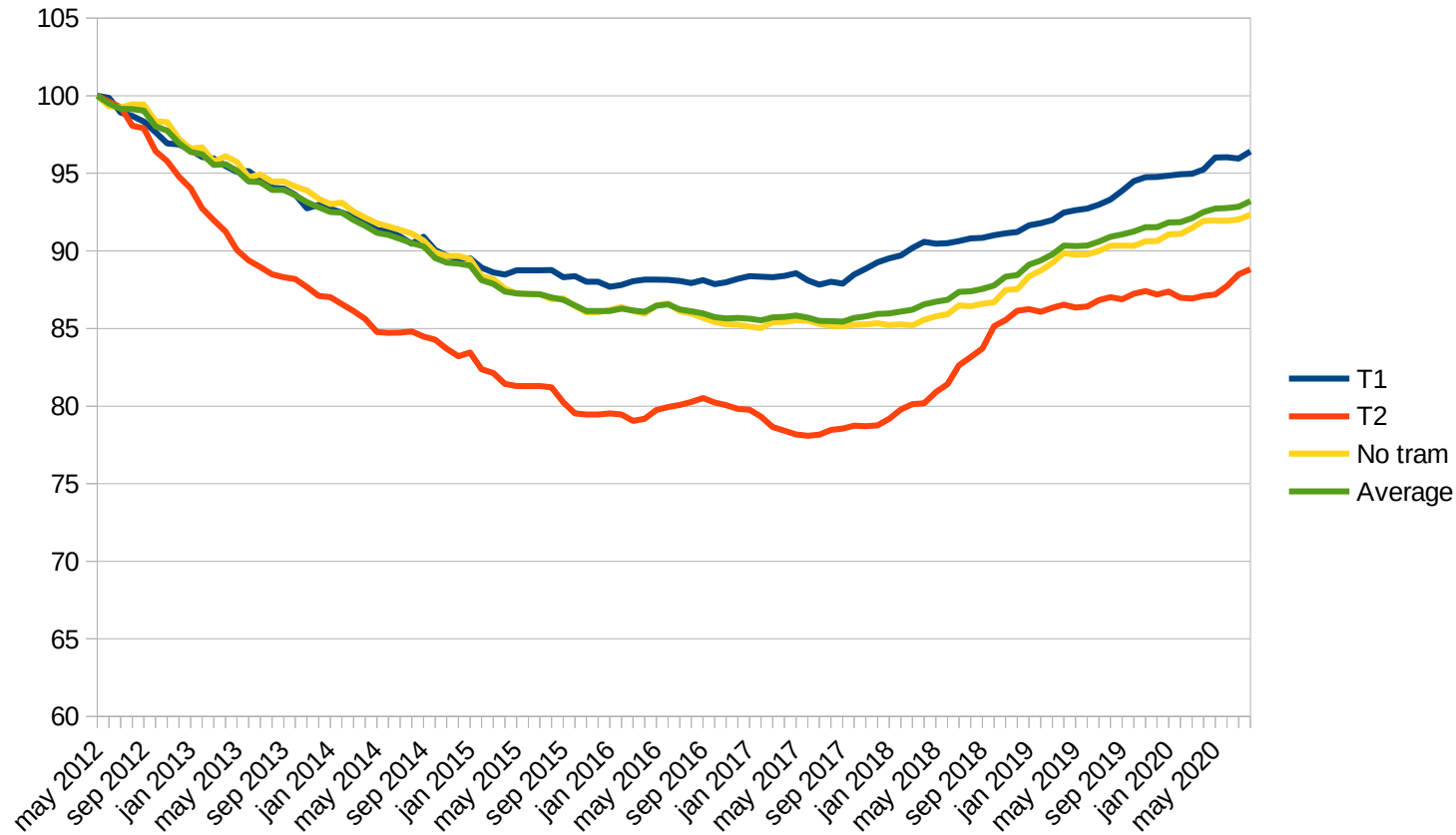
Population at the municipality level
(var 2011-2021)

	Pop 2011	Pop 2021	Var %
Bagno a Ripoli	25403	25314	-0,35%
Campi Bisenzio	42929	47541	10,74%
Calenzano	16637	18041	8,44%
Firenze	358079	361619	0,99%
Scandicci	49765	49659	-0,21%
Sesto Fiorentino	47742	48782	2,18%

Source: ISTAT

Impact on real estate values

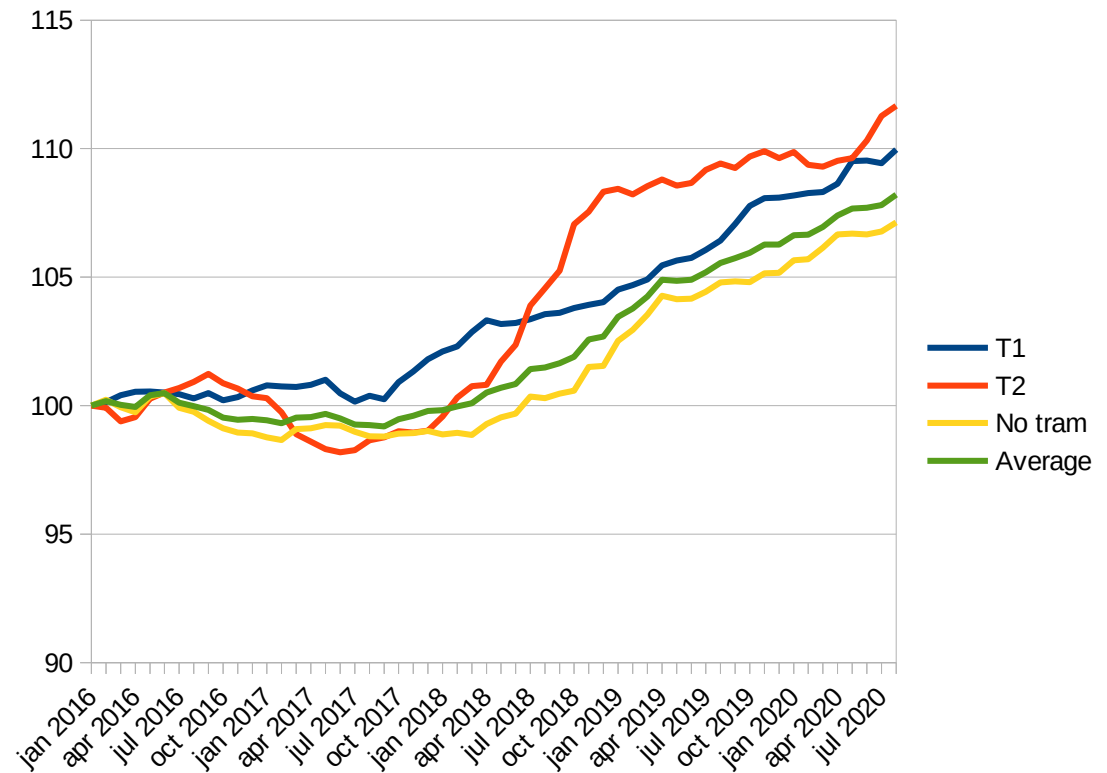
Real estate values in Florence, Sesto Fiorentino and Scandicci by zone, grouped by year of connection to the tramway system (base month may 2012)



Source: OMI, immobiliare.it

Impact on real estate values

Real estate values in Florence, Sesto Fiorentino and Scandicci by zone, grouped by year of connection to the tramway system (base month january 2016)



Source: OMI, immobiliare.it

External costs

Accidents

Accident and mortality rates per vehicle * unit cost per event (estimated at regional level through healthcare data) and Value of Life estimates

Pollution

Emission standards per vehicle * occupancy rate * cost per ton of pollutant (PM10, PM2.5, and Nox)

Noise

Population exposed to noise levels * WTP (Willingness to Pay) estimate

Congestion

Hours lost in traffic at peak hour * VOT (Value of Time) estimate

Climate Change:

Emission standards per vehicle * occupancy rate * cost per ton of pollutant (CO2 eq.)

Ref. Handbook on the external costs of transport - European Commission DG MOVE

External costs

Detailed estimation at regional level, then scaled down to metropolitan area (province of Florence)

	Dimension	Regional (MLN euro)	Metropolitan (MLN euro)	% Metropolitan
Accident costs	15111 accidents	1799	600	33,4%
Air pollution costs	2052 tons Pm10	419	117	28,0%
Climate change costs	7.4 MLN tons CO2	740	204	27,5%
Noise costs	714K pers >55Db	94	25	26,8%
Congestion costs	60K h/day lost	580	275	47,4%
Total		3632	1221	33,6%

Source: IRPET estimates

External costs: line 2.2 extension (hp1)

Difference in external costs of transport by expected modal shift for L2.2 extension
(MLN EURO)

	MLN Passenger s-km	Air pollution costs	Accident costs	Noise costs	Climate change costs	Congesti on costs	Total
Car/Motorcycle	2,76	0,96	0,06	0,01	0,03	1,13	2,2
Bus	18,49	0,08	0,02	0,09	0,09	1,26	1,5
Walking/Cycling	0,83	0,26	0,00	0,00	0,00	0,00	0,3
Trip not made (hp1)	5,52	0,00	0,00	0,00	0,00	0,00	0,0
Tramway	27,6	0,06	0,00	0,14	0,00	1,88	2,1
Difference		-1,24	-0,09	0,03	-0,12	-0,51	-1,9

External costs: line 2.2 extension (hp2)

Difference in external costs of transport by expected modal shift for L2.2 extension
(MLN EURO)

	MLN Passenger s-km	Air pollution costs	Accident costs	Noise costs	Climate change costs	Congesti on costs	Total
Car/Motorcycle	2,76	0,96	0,06	0,01	0,03	1,13	2,2
Bus	18,49	0,08	0,02	0,09	0,09	1,26	1,5
Walking/Cycling	0,83	0,26	0,00	0,00	0,00	0,00	0,3
Trip not made (hp2)	5,52	0,26	0,02	0,02	0,02	0,48	0,8
Tramway	27,6	0,06	0,00	0,14	0,00	1,88	2,1
Difference		-1,24	-0,09	0,03	-0,12	-0,51	-2,7

The Survey

Field survey to investigate the perceived utility of the tramway system extensions from the point of view of the general population

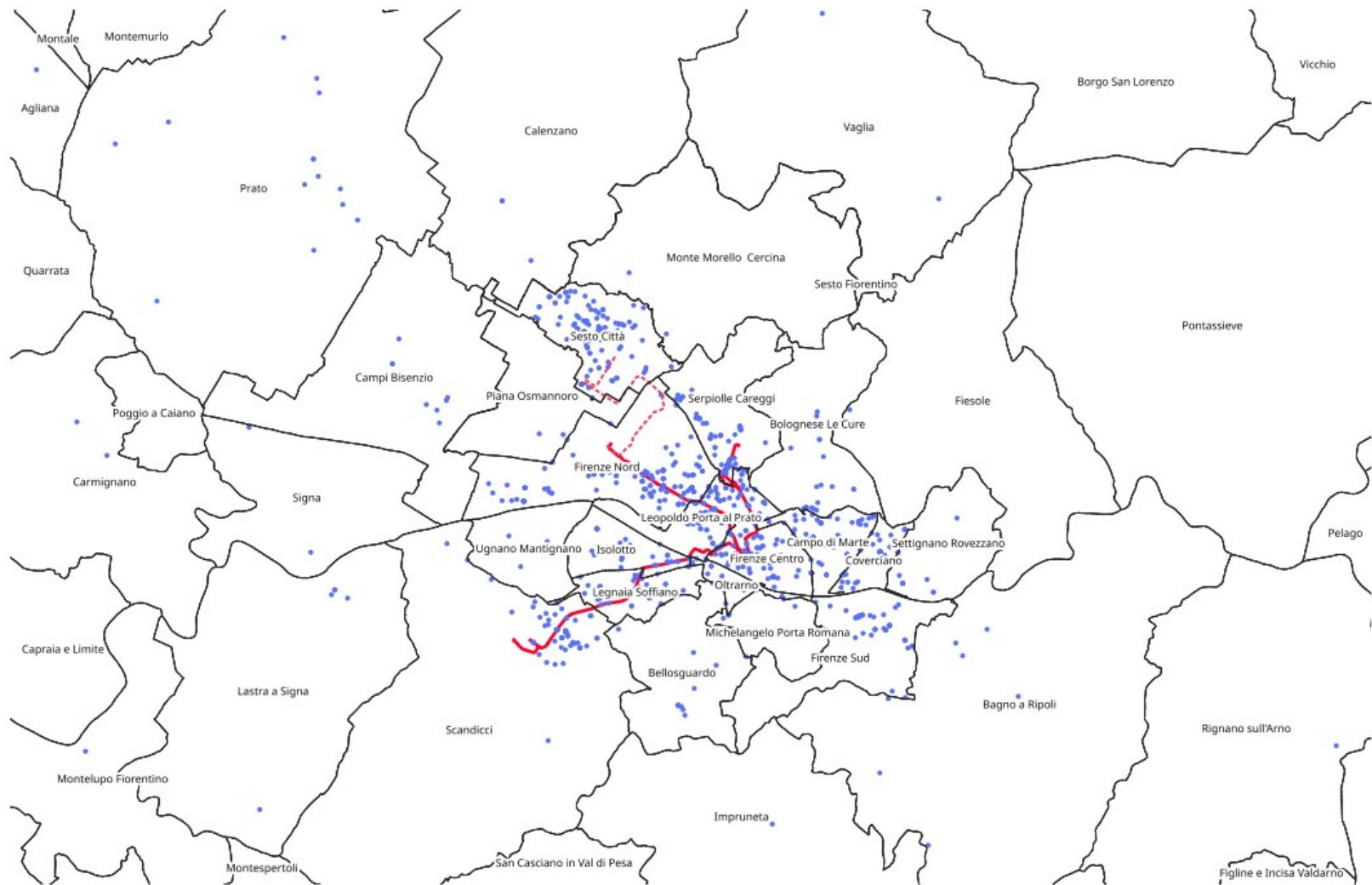
Structure of the survey

1. Individual data
2. Info on systematic trips
3. Choice between hypothetical alternatives
4. Economic value through WTP

CAPI/CAWI mixed method

1347 interviews: 500 (37.1%) face-to-face interviews, 284 (21.1%) through agency panelists, 563 (41.8%) through social media

The Survey: geographic distribution



The Survey: results (I)

Question 1: Availability and choice of transportation mode for a regular commute

	Walking	Car	Scooter	Bike	Train	Bus	Tramway
Not available (1)	59.5%	23.8%	62.6%	58.5%	73.9%	29.0%	54.4%
Available but not used (2)	35.1%	45.9%	18.7%	36.9%	20.3%	64.2%	17.1%
Used (3)	5.4%	30.3%	18.7%	4.6%	5.8%	6.8%	28.4%
Used/ available (3/(2+3))	13.4%	39.8%	50.0%	11.1%	22.2%	9.5%	62.4%

The Survey: results (II)

Question 1: Would you vote in favor of extending the tram network?

Question 2: Would you vote in favor of introducing a specific-purpose tax for 5 years to finance its construction and maintenance?

	Favorable to the extension of the tramway line	Favorable to the introduction of a tax to finance the tramway extension
Unemployed	78.85%	31.71%
Employed	80.33%	37.55%
Retired	86.47%	46.26%
Student	83.04%	18.31%
Other	66.67%	34.62%
Total	80.99%	35.93%

Conclusions

Early findings

- **Network effects:** the expansion of the tramway system seems to generate an impact also on existing lines in terms of passengers and accessibility
- **Externalities:** since the expected modal shift from cars is relatively low, the reduction in external costs is also low (but can be locally relevant)
- Residents and city users appear to be generally **favorable** to the expansion of the tramway network (significant difference with bus services), but seem less likely to be willing to pay for it
- Even **non-users** express a preference towards the expansion of the network

Future research

- Use **more granular data** on urban mobility flows
- Dig deeper in the results from the **field survey**

Conclusions

THANK YOU FOR YOUR ATTENTION!

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