The Impact of Amazon on Italian Local Labor Markets: a Staggered Difference-in-Differences Approach[*]

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Abstract

Amazon is the dominant digital platform in e-commerce. Its diffusion in Italy began in 2011, with a sudden expansion of coverage between 2018 and 2021, in which the company has built 35 new facilities. Amazon's local impact on wages and employment is an empirical question of relevance for local decision-makers. E-commerce can be beneficial for wages and employment in core and complementary industries, such as logistics and transportation. It can however decrease them in brick-and-mortar retail and in trade-exposed goods producers. Further, buyer market power effects can be present in subcontracting, increasing employment yet decreasing wages. This paper, using income tax data at the municipality level coming from the Italian Ministry of Economics and Finance, estimates the net effect of two different types of Amazon facility, Fulfillment Centers (FCs) and Delivery Stations (DSs), on Italian local labor markets. FCs are located farther away from urban centers, and employ most logistics jobs. DSs are smaller facilities located in cities, where most consumers are and retail is more present. The centers are first pooled together to estimate a general "Amazon effect". An analysis differentiated between types of Centers then sheds light on potential heterogeneities between different typologies of local labor market. The paper relies on a staggered difference-in-differences methodology allowing for cohort-time heterogeneous effects, using not-yet-treated controls. Several robustness checks are performed.

Results indicate that the impact of Amazon on per capita wages is negative, while no impact is detected on unemployment rates. Amazon Delivery Stations decrease wages in local labor markets, while Amazon Fulfillment Centers increase unemployment. The results are interpreted as supporting the hypothesis of a negative net impact of Amazon Centers driven by losses in retail jobs.

Keywords: Amazon, local labor markets, e-commerce

JEL Codes: J30, L81, O33

Contents

1 Introduction

Digital platforms are widely considered one of the most important developments in the economy over the last two decades. Firms such as Meta, Alphabet, Microsoft, and Amazon have brought deep change in their respective industries and markets. Their digital model is based on connecting users, producers, developers and other sides of a market through an interface able to concentrate in a single place as many goods and services as possible. Doing so, digital platforms are able to generate important network effects. They become essential companions to economic actors and institutions. As a consequence, they command important shares in the markets in which they participate. Further, digital platforms have also built upon a shift in the world of work concerning the flexibility they can afford or impose to workers. Dominating a given market, a digital platform is able to exert significant pressure on workers on this and adjacent markets, accelerating tendencies towards precarity while, sometimes, increasing value-added as a whole, in a dynamic of productivity-led decrease of the labor share described by Autor et al. [2020] and other scholars. A digital platform may have an effect on workers in four distinct ways: 1) through the workers it hires in order to deliver its services and pursue its objectives; 2) by influencing the economic actors belonging in its ecosystem(s); 3) by disrupting existing industries and relative jobs attached to them; 4) by widening and facilitating market entry, increasing opportunities but also magnifying risks. In the first case, a digital platform behaves similarly to most firms, yet employing features stemming from its economic and technological position, using data flows as a way to control its workforce – in certain cases, replacing regular employment with algorithmic management – and exploiting its central position in product markets to impose contractual conditions. Directly managed workers thus experience increases in productivity, but the technological and market dominance of the platform in their field can reduce their marginal returns. The platform can also exert a similar buyer power on its externalized workforce, such as independent contractors. In the second case, the platform can have an impact on the behavior of economic actors present on its market/product space, such as users, advertisers,

independent sellers, service providers and producers (Cutolo and Kenney [2021]; Cirillo et al. [2023]; Cirillo et al. [2024]). Workers belonging to these firms can thus partly bear the brunt of increased uncertainty, changing fee structures, and shifting value distributions. In the third case, digital platforms may occupy a product space that previously belonged to other market actors, thus provoking a downward shift in profitability in their industry. Given the usually higher labor productivity platforms enjoy, this may come at a cost in terms of jobs in geographical and product markets impacted unevenly by the technological (Schumpeterian) transformation (Chava et al. [2024]). In the fourth case, digital platforms may host non-platform firms and workers that were previously not in competition with each other, for spatial or other reasons. Workers at these firms thus face increased competitive pressure, which may result in both positive and negative effects in terms of productivity, wages, and employment.

Amazon is poised to become the "everything store" and synonymous with e-commerce, notwithstanding its important position in server storage and cloud computing. As a consequence of its market share, but also of its techno-economic dominance, Amazon has been able to partly displace brick-and-mortar retail, control the independent sellers on its platform, and expand its logistics and transportation supply chain while controlling costs.

With the commercialization of the internet, e-commerce (online sale of goods and services) began to develop, and Amazon (founded in 1994) became the largest online retailer. Starting off with a warehouse in Seattle to sell books, Amazon relied on innovative methods of storage and lean selling strategies and gradually developed a large network of logistics facilities in the United States and later Europe. Amazon wanted to dominate the landscape of e-commerce, compete advantageously with other types of retail, and generate important feedback loops in search. To do so, it had to use its dominance to force maximum efficiency (in shipping, handling, delivery) and lowest cost (in labor, subcontracting, product). With the objective of achieving scale, Amazon kept its prices low, sometimes selling under cost and adopting predatory pricing, strategic acquisitions, and other strategies aimed at curbing

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its competition (Khan [2016]).

To retain customers and have them develop an habit of online shopping on its platform, the company developed the Prime program, through which it granted faster shipping and other perks, such as discounts and access to media.

Its recommender systems allow it to develop fine-tuned suggestions for complementary products to its customers. In this way, shopping at Amazon has become easier than doing so not only in other e-commerce websites, but also in physical locations.

To become the most convenient shopping venue, Amazon realized early on that it needed to ensure the fastest delivery times. Hence, it perfected its logistics systems making use of extensive algorithmic management and prediction (Delfanti [2021]). To enhance productivity and reduce operation timing, most workers in logistics and transportation are equipped with sensors, delivering instructions and keeping apace.

At the same time, Amazon has aimed at containing labor costs, which are its main expense, in order to offer the most competitive price for its goods. It does so by preventing unionization, but also by using more flexible labor contracts or by offering less-than-competitive wages in areas in which it enjoy labor dominance (i.e., monopsony).

Hence, Amazon has had many different impacts on local economies, reshaping supply and value chains around its needs and the demand it has generated.

The impacts of Amazon should thus be taken into account holistically when making decisions about its establishment on a local level. In the US, local and state elected representatives have often made decisions about concessions, tax breaks, land and infrastructural development related to Amazon facilities, accruing to a grand total of $6,7 billion as of 2024 (Good Jobs First, 2024).

Similarly, in Italy, Amazon facilities have been met with enthusiasm about the jobs they were bringing, and accommodated in their development by local administrators, but also by national representatives (Punto Critico, 2022). In truth, however, the impact of Fulfillment Centers and Delivery Stations has been mixed in terms of local development,

and the motivation for Amazon to establish itself in a given municipality or territory rather than another has been found to lie more with outstanding socio-economic characteristics rather than with specific policies targeted at facilitating the company (Good Jobs First, 2024; Punto Critico, 2022).

Further, for the United States, the impact of Amazon has been one of "creative destruction" in terms of retail jobs, sales, and firms. Closures and job losses have, on average, outweighed benefits connected with job creation in the logistics industry (Chava et al. [2024]).

Similar evidence concerning labor dynamics in Europe is weaker and less widespread (Hassel and Sieker [2022]), probably also due to the lower and more recent presence of Amazon in labor and product markets. Italy is a good case study to evidence European differences and similarities with the United States: densely populated, it has a peculiar industrial structure – heavily reliant on small firms – and a multicentric urban population, with four cities over 1 million inhabitants (Milan, Turin, Rome, Naples).

This paper aims to provide the first evidence on the impact of Amazon on local labor markets outside the United States. Relying on publicly available data, it exploits the staggered timing of opening of different Amazon facilities in order to identify their effects on single municipalities, further including a distinction between different types of facilities to proxy for the main channels of labor impact at play.

Data on incomes, wages, and rents is retrieved from the yearly release of income tax data by the Italian Ministry of Economics and Finance. The Italian National Institute of Statistics (ISTAT) provided the commuting matrices to aggregate the data into local labor markets (LLMs) and the LLM-wide unemployment rate, used as a (reverse) measure of employment. Further, ISTAT makes geographic information on municipalities publicly available. Thus, population and distance from major infrastructure are used as controls. Data on Amazon facilities (location, year of establishment, type) is obtained through mvpwl.com, a logistics consulting company, and cross-checked through Google Search for local newspaper articles.

Three types of Amazon facilities are present in the analysis. Fulfillment Centers (FCs),

larger facilities meant to handle and store large freight, are assumed to be more reliant on labor in logistics. They are also located in less urban local labor markets and municipalities. Delivery Stations (DS), smaller deposits meant to store goods that are to be delivered to end-customers, are instead located in mostly urban LLMs, employ less logistics personnel, yet render one-day delivery available through Amazon's Prime program. Hence, an effect of their presence would be more felt in retail. A third type of facility, Sortation Centers (SC), is present only in one case, and its workers are mostly in logistics.

The baseline methodology is a staggered difference-in-differences design in which treatment is defined as the presence of an Amazon facility. First, the simple ATT is retrieved; second, a dynamic analysis – event study – takes place aggregating single estimations. Further, the impact of Fulfillment Centers and of Delivery Stations is analyzed separately, so as to proxy for different channels of impact on local labor markets. The main robustness check is with not-yet-treated controls, thus employing as controls LLMs that will be treated in the future, but are not so in time t.

Further checks include using an increasing number of covariates: rents, income, population, and density.

After robustness checks, two main results emerge. 1) Log wages per capita decrease in local labor markets in which Amazon is present. After analyzing dynamic results, the effect is more pronounced for local labor markets with Delivery Stations. 2) The presence of Amazon in a given local labor market causes the unemployment rate to increase, on average; dynamically, however, robust results show that the effect is present only for local labor markets with Fulfillment Centers. This article interprets these results as showing that, consistent with the literature (Chava et al. [2024]) Amazon has an impact on the brick-and-mortar retail industry, translating in a decrease in wages – possibly associated with a decrease in hours worked. Moreover, Amazon does not have a positive impact on jobs. Therefore, the decision on whether or not to allow Amazon to come into a given local labor market should come with an appropriate cost-benefit analysis on the part of local decision-makers.

The remainder of this article is as follows. Section 2 briefly recalls the relevant literature concerning retail, e-commerce, digital platforms and their impact on labor, and it builds a theoretical framework of Amazon impact. Section 3 presents the data. Section 4 explains the different methodologies employed. Section 5 describes and comments upon results. Section 6 discusses the implications in light of the proposed theoretical framework. Section 7 concludes.

2   Literature Review

The present article draws from several streams of literature. The literature on retail impacts and the one on digital platforms are equally important. Amazon can be framed as a new retail phenomenon, akin to what Walmart has been in the past, and shopping centers before it. Amazon is also a transaction digital platform (Jacobides et al. [2024]) taking advantage of network effects and specific techno-economic features of the market it orchestrates. Hence, the literature on e-commerce platforms becomes preliminary to the one concerning Amazon as its own object of studies. This digital platform is also, more than others, a phenomenon that concerns geographies: two articles in particular address its effects on local labor markets in the United States. Concerning the EU, little evidence has been collected; however, a growing stream of literature addresses the local impacts of major industrial events, such as plant closures and openings. This literature review does not aim to be exhaustive in this respect; yet it acknowledges recent work conducted on the country of study. The main contribution of this article lies in a first assessment of the impact of a large e-commerce digital platform, Amazon, on local labor markets in Italy. To the best of the authors' knowledge, it represents the first study of this kind in a European context. Similar to other works, it describes and causally connects the emergence of a new industrial phenomenon with outcomes concerning wages and unemployment. While the article estimates the net impact of Amazon, it builds on pre-existing theories and evidence concerning creative destruction, market power, and trade, which are examined in turn so as to build a framework through

which to interpret the empirical results.

2.1 The research on retail and e-commerce

This article contributes to the literature on retail innovations and their impact on productive agents (firms and workers). Amazon can be framed as a retail innovation. It is an e-commerce platform, and as such it centralizes buyers and sellers on its interface, profiting from network positive feedback loops (Belleflamme and Peitz [2021]). Previous innovations, in retail, have already caused disruptions in the past, generating winners and losers among incumbent retailers and their workers (Jia [2008]; Mihaescu et al. [2024]). In particular, Walmart entry into US local labor markets has drawn attention, leading to cost and benefit analyses of its impacts on retail employment, local businesses, and communities (Mihaescu et al. [2024]; Holmes [2011]; Wiltshire [2022]). The results of Walmart entry point towards reductions in wages, as local businesses are outcompeted by the large retail chain and its Superstores. Concerning Europe, only IKEA has had a comparable influence on very specific markets, such as the one for Swedish durable goods (Daunfeldt et al. [2017]). However, it appears that IKEA did not substitute other brick-and-mortar retailers; it instead contributed to location and scale effects, with net benefits for jobs.

This article also contributes, more specifically, to a rich literature addressing the effects of e-commerce. Most of these focus on product markets, and on good producers on those markets. A first assessment noticed how e-commerce lowers prices for homogeneous products, increases consumer welfare, with a larger prevalence of used goods and low price dispersion (Brynjolfsson and Smith [2000]; Brynjolfsson et al. [2010]; Ghose et al. [2006]; Ghose and Yao [2011]). Later studies confirm that e-commerce led to increases in consumer welfare, and retrace the origin of such increase to a high-income consumer switch towards online merchants offering superior products (Dolfen et al. [2023]) and which have lower costs (Goldmanis et al. [2010]). Geography and skills generally played a role in distributing the gains and losses from e-commerce for firms and workers, as well as consumer preferences towards it vis-à-vis offline

retail (Forman et al. [2009]; Brynjolfsson et al. [2009]; Forman et al. [2012], Bar-Isaac et al. [2012]). The platform aspect plays a role: e-commerce websites can redesign search engines and recommendation systems so as to shape incentives for consumers and firms alike, leading to varying degrees of search frictions and price dispersion (Dinerstein et al. [2018]). Outside of the United States, a study documents a neutral effect of e-commerce on employment at the industry level in the EU (Biagi and Falk [2017]), while another links e-commerce with a permanent decrease in retail employment in Korean non-metro areas (Chun et al. [2023]). Finally, Cruz et al. [2020] document that online exports increase unskilled wages in developing countries, lending credibility (coupled with other evidence on employment in the US and EU after e-commerce) to a Stolper-Samuelson theory of redistribution of rewards to productive factors.

2.2 Previous studies on Amazon

This work also addresses the literature concerning Amazon. The company has been studied in the context of studies on e-commerce, on digital platforms, and on labor and digital technologies. As a digital platform, Amazon relies on recommender systems in order to interpret, direct, and predict consumer demand (Belleflamme and Peitz [2021]). Through an efficient product and lock-in strategies (Khan [2016]), Amazon has been able to grow its network of Fulfillment Centers, Sortation Centers and Delivery Stations, which led to decreasing overall shipping costs and ever-increasing market advantage, particularly absent sales taxes (Houde et al. [2023]; Bauer and Fernández Guerrico [2023]). Another source of market advantage comes from Amazon's dominance of consumer search, which has led it, for instance, towards self-preferencing strategies aimed at promoting its products and services (Farronato et al. [2023]; Chen and Tsai [2023]). Also in the EU these practices have been apparent (Waldfogel [2024]). Hence, Amazon enjoys strong market power, which it can use vis-à-vis its sellers. Arguably, the company can exert a similar degree of market power towards its workers and subcontractors in logistics, by rewarding firms and workers

downstream less while engaging in first and second-degree wage discrimination (Hassel and Sieker [2022]; Cattero and D'Onofrio [2018]).

Other impacts Amazon has had on employment concern retail workers, in a similar vein to what has been more generally documented for e-commerce as a whole. Bauer and Fernández Guerrico [2023] exploit the introduction of the Amazon Tax in the United States to show that Amazon primarily created employment in logistics and transportation, while diminishing it in retail. They further illustrate that the effect of the tax is to reallocate part of that employment back to retail. However, retail workers flow back to big-box stores, while the impact on brick-and-mortar is less apparent. Chava et al. [2024] represent the closest approach to the present work. Exploiting the staggered opening of Amazon Fulfillment Centers in the United States and the variation in delivery speed they represent, they document an increase in logistics jobs. However, they show that a wider decrease in retail employment, driven by firm closures, effectively resulted in net employment losses at the local labor market level.

2.3 Industrial events in Italy

Finally, the present article relates to other recent articles concerning the causal, place-based estimation of industrial events in post-war Italy, such as mass layoffs of industrial workers (Celli et al. [2023]; Seebauer et al. [2024]), investment inflows (Incoronato and Lattanzio [2024]), large mass hire or layoff events (Basso et al. [2023]). To the best of the authors' knowledge, it is the first article focusing on hiring events in Italian retail, and the first addressing the impact of digital platforms on Italian local labor markets.

2.4 Theoretical framework

In light of the literature, the theoretical framework used to interpret the results is four-pronged. First, Amazon is a retail phenomenon, making it relatively cheaper to order merchandise to be delivered, vis-à-vis going shopping. Therefore, workers in the retail industry

may experience adverse impacts (lower wages, reduction in hours worked, higher unemployment) as a result of the innovation Amazon represents, in a process of Schumpeterian creative destruction (Chava et al. [2024]). Second, Amazon relies on a different kind of workforce, increasing demand for complementary labor in the logistics and transportation industries to manage its storage facilities and the movement of the merchandise (Bauer and Fernández Guerrico [2023]). Third, as a result of its size and of its techno-economic features (Waldfogel [2024]; Farronato et al. [2023]), Amazon wields significant market power not only in product markets, but also in labor markets. Therefore, it can exert it by reducing posted wages with respect to optimal wages (that is, by altering the rewards to labor and capital) or by negotiating unbalanced conditions with subcontractors, which can then pass the cost through to their workers (Hassel and Sieker [2022]). Fourth, Amazon can act as a broker for foreign goods with respect to domestic ones (Cruz et al. [2020]). If the merchandise sold on the platform in a given local labor market is composed of more (less) foreign goods than it was previously the case, then the impact on local manufacturing may be negative (positive).

2.5 Fulfillment Centers vs. Delivery Stations

These effects are partially differentiated relying on a feature of the Amazon logistics network. On the one hand, Amazon Fulfillment Centers (FCs) are located farther away from major cities (while still close to highways and airports). They are larger centers, mainly generating logistics jobs. On the other hand, Amazon Delivery Stations (DSs) are mainly urban, smaller facilities. They represent better the competition Amazon engages with regular brick-and-mortar sellers within the urban context. Therefore, by estimating the impact of FCs and DSs separately, the present article aims to interpret it separately for logistics and transportation (FCs) vis-à-vis retail and tradable manufacturing (DSs).

3 Data

3.1 Data Sources

To analyse wages and the wage distribution, we retrieve publicly available data from the website of the Italian Ministry of Economics and Finance. The data is obtained from tax returns on the Italian income tax (IRPEF), and aggregated at the municipality level. The dataset contains information on incomes, wages ("redditi da lavoro dipendente", income from subordinate employment), retirement income, income from independent contracting, and (less reliably[1]) income from stocks, income from rents and income from the owning of a business. Further, exploiting the progressivity of the income tax, the dataset collects the number of taxpayers in each income brackets, allowing to compute rough measures of inequality. Through the MEF data, it is possible to retrieve such information from 2013 up to 2022.

The data at the municipality level is aggregated relying on the definition of Local Labour Market (LLM; "Sistemi locali del lavoro") provided by the National Institute for Statistics (ISTAT). Local Labour Markets are geographical and economic zones that capture most movements of workers between municipalities. Their construction is achieved through Commuting Matrices ("Matrici di pendolarismo") which are estimated during the ten-year census. We use the LLMs as defined in 2011. Further, ISTAT provides data on the activity, employment, and unemployment rate at the LLM level, by aggregation from the Italian Labour Force Survey ("Rilevazione delle Forze di Lavoro", RFL). Similar to MEF data, this type of information at the LLM level is available from 2013 through 2022. Istat further provides geographic information on LLM density and population. At the municipality level, Istat provides an already computed gravity model to measure the distance from and relative im-

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[1]The Ministry of Economics and Finance publishes every year a report on the "unobserved economy" tackling the longstanding issue of tax evasion in Italy, the "Relazione sull'economia non osservata e sull'evasione fiscale e contributiva." From the report (Page 5, table I.1) it's possible to observe that the gaps between actual and collected tax are larger for independent and business incomes (IRPEF lavoro autonomo e impresa), as well as somewhat larger for housing rents (locazioni).

portance of train stations, highways, airports, and ports. Data on the time and location of new Amazon facilities, as well as their specialization (Fulfillment Centers, Delivery Stations, or Sortation Centers) is obtained from mvpwl.com, a logistics consulting firm, which makes them available free of charge, and corroborated through online news stories. Such data is available from 2011, year of the first facility, through 2022. The observation from 2011 is however dropped from the panel.

3.2   Descriptive evidence

[Figure 1 and 2 about here]

As can be observed from Figure 1, the first Amazon facility was built in Castel San Giovanni (PC), in Northern Italy, in 2011. However, the main expansion in the network of Amazon facilities occurred between 2018 and 2021, with 35 new Centers. Fulfillment Centers (Figure 2) are used to stock large amounts of merchandise, which is then sent to Delivery Stations for local delivery to customers. Delivery Stations lie closer to cities, and are therefore in mostly urban local labour markets. Conversely, Fulfillment Centers tend to be farther away, in local labour markets with different specializations. Amazon is more present in the North, whereas in the South it only had, in 2022, 5 Delivery Stations, and no Fulfillment Center. In the North, Amazon spread earlier: the first non-Northern facility opened in 2017 close to Rome, in Passo Corese (RI). Hence, for the purpose of the econometric analysis, it is important to bear in mind that the effects estimated farther away in term of years might refer only to event-facilities located in the North.

[Figure 3 about here]

Figure 3 and 4 display the behaviour of the main outcome variables. As it can be observed, per capita wages (taking their log to avoid risks of extreme distributions and reduce the incidence of outliers) at the municipality level are higher in those places in which there is an Amazon facility, with little difference between local labour markets in which there is a Fulfillment Center and those in which there is a Delivery Station. Similarly, the unemployment rate is lower in those LLMs in which there is an Amazon facility. As can be observed, pre-trends are not per se different ex ante.

[Figure 4 about here]

4 Methodology

4.1 Baseline

The baseline specification consists in a staggered difference-in-differences approach with covariates (Callaway and Sant'Anna [2021]), allowing for heterogeneous cohort-time treatment effects. This methodology is first applied using never-treated control observations. Further, the exercise is repeated splitting the sample of events into those concerning Fulfillment Centers and those concerning Delivery Stations, to ensure more robust treatment homogeneity.

4.2 Not-yet treated

The exercise is repeated using not-yet-treated controls, under the assumption that LLMs that will be treated in the future are good-enough controls for treated observations in present time. The same specification is repeated splitting the sample in Fulfillment Centers and Delivery Stations.

4.3 Step-wise covariates inclusion

The exercise is repeated with the progressive inclusion of covariates. The first covariate included is log income from buildings, as a proxy for rents, which act as a measure of local returns to fixed capital (cfr. Chava et al. [2024]). The second covariate is the LLM-wide level of log income, to proxy for the affluence of a certain LLM. The third covariate is the population of working age (over 15) to control for migration. In the case of wages, we also perform an exercise including the unemployment rate as an independent predictor.

The equation is as follows:

$$ATT_{i=\{c,m\},t} = \alpha + \beta PostAmazon_{i=\{c,m\},t \geq g} + \gamma \chi_{i=\{c,m\},t} + \Phi_{i=\{c,m\}} + \Theta_t + \epsilon_{i=\{c,m\},t} \tag{1}$$

where

$i = \{c, m\}$ is a subscript in which $i = c$ if the equation refers to log wages (municipality level), and $i = m$ to the unemployment rate (local labour market level);

$PostAmazon$ is a dummy taking value 1 if the municipality is in a LLM where Amazon is present in year $t \geq g$, g being the year of Amazon opening;

χ is a vector of covariates (empty in the baseline);

Φ are municipality/LLM fixed effects;

Θ are time fixed effects;

ϵ are doubly-robust inverse-probability-weight errors, computed using a wild bootstrap procedure (Rios-Avila et al. [2021]).

5 Results

Overall, results indicate with some certainty that wages tend to decrease after the opening of a new Amazon facility, in particular after the opening of a new Delivery Station. While there is some evidence that this is compensated by decreases in unemployment in local labor markets with Delivery Stations, this evidence is not compelling. Instead, there is an quite robust increase in unemployment in those local labor markets in which Amazon is present with a Fulfillment Center.

5.1 Baseline

When estimating the simple ATT, baseline results appear unequivocal in pointing towards the fact that per capita log wages in municipalities decrease, both in local labor markets in which Fulfillment Centers are present and in local labor markets with only Delivery Station presence. Similarly, the unemployment rate increases, albeit with important differences – in FC LLMs, the increase is almost by half a point, while in DS LLMs it has one fifth of the magnitude.

[Tables 1 and 2 about here] [Figures 4 and 5 about here]

When looking at the dynamic aggregated ATT – which takes into account varying, heterogenous cohorts – the event study reveals that only wages in DS LLMs are consistently decreasing. This can be attributed to the fact that the impact appears short-lived for FC LLMs, while not so for their more retail-oriented counterpart. As for unemployment, it appears that the effect is consistent across the sample. Important differences in magnitude arise between pre- and post-treatment unemployment, and the specification over the whole sample shows that with event-study aggregation the increase amounts to 0,7%.

[Tables 3 and 4 about here] [Figures 6 and 7 about here]

5.2 Not-yet treated

The not-yet-treated specification, which compares treated LLMs at time t only using as controls those LLMs that will be treated at time t-1, confirms the fact that log per capita wages in municipalities decrease mostly in DS LLMs, with a simple aggregation. The unemployment rate, instead, displays a diverging behavior. In FC LLMs, it increases, while in DS LLMs it decreases significantly. The event study aggregations substantially confirm both results.

[Tables 5 and 6 about here] [Figures 8 and 9 about here]

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5.3 Covariates

The stepwise addition of covariates in the wage specification is shown to decrease the entity of the ATT, by filtering the endogeneity coming from Amazon business decision to locate its LLMs in places with specific characteristics, such as density, high income, and even possibly higher unemployment rates. Signs are however stable and consistent with the not-yet estimation, showing that wages consistently decrease in DS LLMs. The event-study aggregation somewhat decreases the significance of the results, yet it confirms the previous findings. As for unemployment, adding covariates has the negative sign (which implies decreases in unemployment) in DS LLMs lose significance. Instead, LLMs with FCs exhibit a consistent increase in unemployment in the simple aggregation. The event-study aggregation shows a more nuanced picture, in which DS LLMs, depending on the impacted cohort, exhibit erratic patterns of unemployment after Amazon entry. However, it appears hard to confirm the not-yet estimates.

[Tables 7 and 8 about here] [Figures 9 and 10 about here]

6 Discussion

6.1 Polarization and retail

The results presented in section 5 can be interpreted in light of the framework presented in section 2.4. Concerning wages, it would appear that Delivery Stations are the driver behind the only recognizable and stable effect, which is a decrease in the average per capita wage in the municipalities concerned. Hence, as per the assumptions made in section 2.5, it can be inferred that the impact of Amazon on these municipalities is one of increasing consumers' substitution of brick-and-mortar retail with e-commerce retail, provoking a decrease in the wages of those workers connected with the first. This evidence is consistent with previous findings concerning the United States (Chava et al. [2024], Bauer and Fernández Guerrico [2023]) while it is the first one addressing Delivery Stations specifically. Regarding unemployment, findings appear somewhat puzzling with respect to the theoretical framework proposed. In fact, unemployment increases mainly in those

local labor markets in which Amazon entered with a Fulfillment Center. This implies that neither direct positive scale effects nor monopsony dynamics are at work in the logistics sector, or that these are instead overcome by an impact on retail, even in FC LLMs, that surpasses the positive impact of logistics. Even for unemployment, then, results point to the evidence of a "retail apocalypse" (Bauer and Fernández Guerrico [2023]; Chun et al. [2023]) in which retail jobs are substituted away by e-commerce and logistics. In these LLMs, however, the main dynamics at work seem to have to do with employment, and not with wages. Overall, it would appear that the geographical variation in the reaction to Amazon entry in a local labor market results in an increase in territorial polarization, somehow distant from the ideal of jobs relocated away from cities as a result of online commerce (the so-called "death of distance", Dolfen et al. [2023]).

6.2   Limitations

These results are to be interpreted as partial. Due to data limitations, they do not display breakdowns by industry, occupation, type of contract and hours worked, nor they examine firm demographics. Each of these additions would contribute to a richer picture, particularly in a context such as the Italian one, in which employers make large use of part-time, fixed-term, and atypical labor contracts (Cirillo et al. [2024]), and the average size of firms is significantly smaller than the OECD average.

Further, while not-yet-treated controls and covariates help relieve the endogeneity of the location decision, they might not fully account for geographical variations and idiosyncratic, nonlinear patterns of diffusion of the impact. In future versions, this endogeneity will be addressed in several ways. First, by performing a matching between treated and control units across covariates. Second, by building a spatial model of diffusion of the impact, that could potentially account for non-linearities, even in a staggered setting. Third, by including as covariates geographical features of the territory, such as highway presence and altitude.

As a final warning, it might be worth to mention that, while LLMs are built around commuting matrices which measure the extent of moving patterns across municipalities, they might not completely account for industry-level variations in commuting patterns. This issue can be addressed by building alternative measures to identify treated units, such as simple, square, or normalized geographical distance.

7   Conclusion

The present article has provided the first evidence of the impact of an e-commerce platform, Amazon, on local labor markets outside the United States. Amazon Fulfillment Centers in Italy appear to have a negative effect on employment, possibly as a consequence of the loss of retail and manufacturing jobs. Amazon Delivery

Stations, instead, appear to have a negative effect on wages in local labor markets, implying that impacts on retail jobs could be different between more urban LLMs and more peripheral ones.

The present article does not hold the pretense of exhaustiveness. First, a higher degree of granularity would allow the decoupling of effects across different industry, and enable a deeper understanding of the mechanisms at work. A linked employer-employee set of information could also be beneficial, to explore dynamics in subcontracting, online market participation, and impacts on wages and employment. Second, a Europe-wide investigation across those countries in which Amazon maintains a direct presence with a dedicated website (UK, Spain, France, Germany, Sweden) could enable useful cross-country comparisons, possibly focusing on the role of unions and institutions (Hassel and Sieker [2022]). Third, it must be stressed that the geographic and economic impact of transaction (and innovation) platforms (Jacobides et al. [2024]), as a technological paradigm (Nelson and Winter [1982]; Freeman et al. [1988]) extends far beyond a single company, or the retail and e-commerce sectors. Further work using similar methodologies could be conducted in other industries, adopting regional, but also urban or national, scales.

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Tables

Table 1: Baseline specification - simple aggregation - wages

	(1) Whole sample	(2) Only FCs	(3) Only DSs
ATT	-0.00827***	-0.00616**	-0.0104***
	(0.000)	(0.002)	(0.000)
N	76,380		

p-values in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2: Baseline specification - simple aggregation - unemployment

	(1) Whole sample	(2) Only FCs	(3) Only DSs
ATT	0.364***	0.491***	0.0982***
	(0.000)	(0.000)	(0.000)
N	6610		

p-values in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3: Baseline specification - event-study aggregation - wages

	(1)	(2)	(3)
	Whole sample	Only FCs	Only DSs
Pre_avg	-0.00120**	-0.00192	-0.00214***
	(0.003)	(0.060)	(0.000)
Post_avg	-0.0157	-0.0119	-0.0179***
	(0.057)	(0.164)	(0.000)
Tm7	-0.00138	-0.00239	-0.00357*
	(0.413)	(0.702)	(0.033)
Tm6	-0.00275*	0.0000731	-0.00510***
	(0.032)	(0.978)	(0.001)
Tm5	0.000329	-0.000154	0.000258
	(0.749)	(0.948)	(0.828)
Tm4	-0.000135	0.00179	-0.00204
	(0.901)	(0.547)	(0.133)
Tm3	-0.00108	-0.000852	-0.00278
	(0.332)	(0.739)	(0.061)
Tm2	-0.00287**	-0.0107***	-0.000885
	(0.005)	(0.000)	(0.446)
Tm1	-0.000545	-0.00125	-0.000842
	(0.453)	(0.440)	(0.322)
Tp0	-0.00313***	-0.00619***	-0.00278**
	(0.000)	(0.000)	(0.009)
Tp1	-0.00431***	-0.00588**	-0.00474***
	(0.000)	(0.006)	(0.000)
Tp2	-0.00486***	-0.000239	-0.00602***
	(0.000)	(0.917)	(0.000)
Tp3	-0.00784***	-0.00360	-0.0113***
	(0.000)	(0.199)	(0.000)
Tp4	-0.0130***	-0.00325	-0.0223***
	(0.000)	(0.325)	(0.000)
Tp5	-0.0146***	-0.00526	-0.0269***

	(1)	(2)	(3)
	Whole sample	Only FCs	Only DSs
	(0.000)	(0.117)	(0.000)
Tp6	-0.0269***	-0.0116***	-0.0514***
	(0.000)	(0.000)	(0.000)
Tp7	-0.0215***	-0.0200***	
	(0.000)	(0.000)	
Tp8	-0.0255	-0.0247	
	(0.305)	(0.323)	
Tp9	-0.0253	-0.0239	
	(0.335)	(0.363)	
Tp10	-0.0245	-0.0232	
	(0.343)	(0.369)	
Tp11	-0.0175	-0.0155	
	(0.424)	(0.482)	
N	76,380		

p-values in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4: Baseline specification - event-study aggregation - unemployment

	(1)	(2)	(3)
	Whole sample	Only FCs	Only DSs
Pre_avg	0.0107	-0.0434***	0.0707***
	(0.120)	(0.000)	(0.000)
Post_avg	0.718***	0.731***	0.101***
	(0.000)	(0.000)	(0.000)
Tm7	-0.102***	0.197***	-0.0921*
	(0.000)	(0.000)	(0.010)
Tm6	0.242***	-0.308***	0.393***
	(0.000)	(0.000)	(0.000)
Tm5	-0.0878***	-0.0253	-0.0987***
	(0.000)	(0.527)	(0.000)
Tm4	-0.123***	-0.0985***	-0.0367
	(0.000)	(0.000)	(0.211)
Tm3	0.124***	-0.0467**	0.123***
	(0.000)	(0.001)	(0.000)
Tm2	0.115***	0.261***	0.128***
	(0.000)	(0.000)	(0.000)
Tm1	-0.0933***	-0.284***	0.0796***
	(0.000)	(0.000)	(0.000)
Tp0	0.135***	0.242***	0.00634
	(0.000)	(0.000)	(0.801)
Tp1	0.258***	0.433***	0.0681*
	(0.000)	(0.000)	(0.011)
Tp2	0.110***	-0.00829	0.0369
	(0.000)	(0.701)	(0.292)
Tp3	0.485***	0.348***	0.317***
	(0.000)	(0.000)	(0.000)
Tp4	0.641***	0.546***	0.289***
	(0.000)	(0.000)	(0.000)
Tp5	0.395***	0.511***	0.0668

	(1)	(2)	(3)
	Whole sample	Only FCs	Only DSs
	(0.000)	(0.000)	(0.230)
Tp6	0.783***	1.169***	-0.0743***
	(0.000)	(0.000)	(0.000)
Tp7	1.521***	1.443***	
	(0.000)	(0.000)	
Tp8	-0.148***	-0.170***	
	(0.000)	(0.000)	
Tp9	1.179***	1.134***	
	(0.000)	(0.000)	
Tp10	1.169***	1.101***	
	(0.000)	(0.000)	
Tp11	2.092***	2.019***	
	(0.000)	(0.000)	
N			

p-values in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5: Not-yet specification - simple aggregation - wages

	(1) Whole sample	(2) Only FCs	(3) Only DSs
ATT	-0.00918***	-0.00386	-0.0129***
	(0.000)	(0.353)	(0.000)
N			

p-values in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6: Not-yet specification - simple aggregation - unemployment

	(1) Whole sample	(2) Only FCs	(3) Only DSs
ATT	-0.0726*	0.286***	-0.308***
	(0.025)	(0.000)	(0.000)
N			

p-values in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7: Covariates: log rents, income level, unemployment rate, population over 15, density - simple aggregation - wages

	(1) Whole sample	(2) Only FCs	(3) Only DSs
ATT	-0.00342	-0.00475	-0.00880***
	(0.346)	(0.244)	(0.000)
N	76,380		

p-values in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 8: Covariates: log rents, income level, population over 15, density - simple aggregation - unemployment

	(1) Whole sample	(2) Only FCs	(3) Only DSs
ATT	0.128*	0.241***	-0.0438
	(0.023)	(0.000)	(0.119)
N	6610		

p-values in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figures
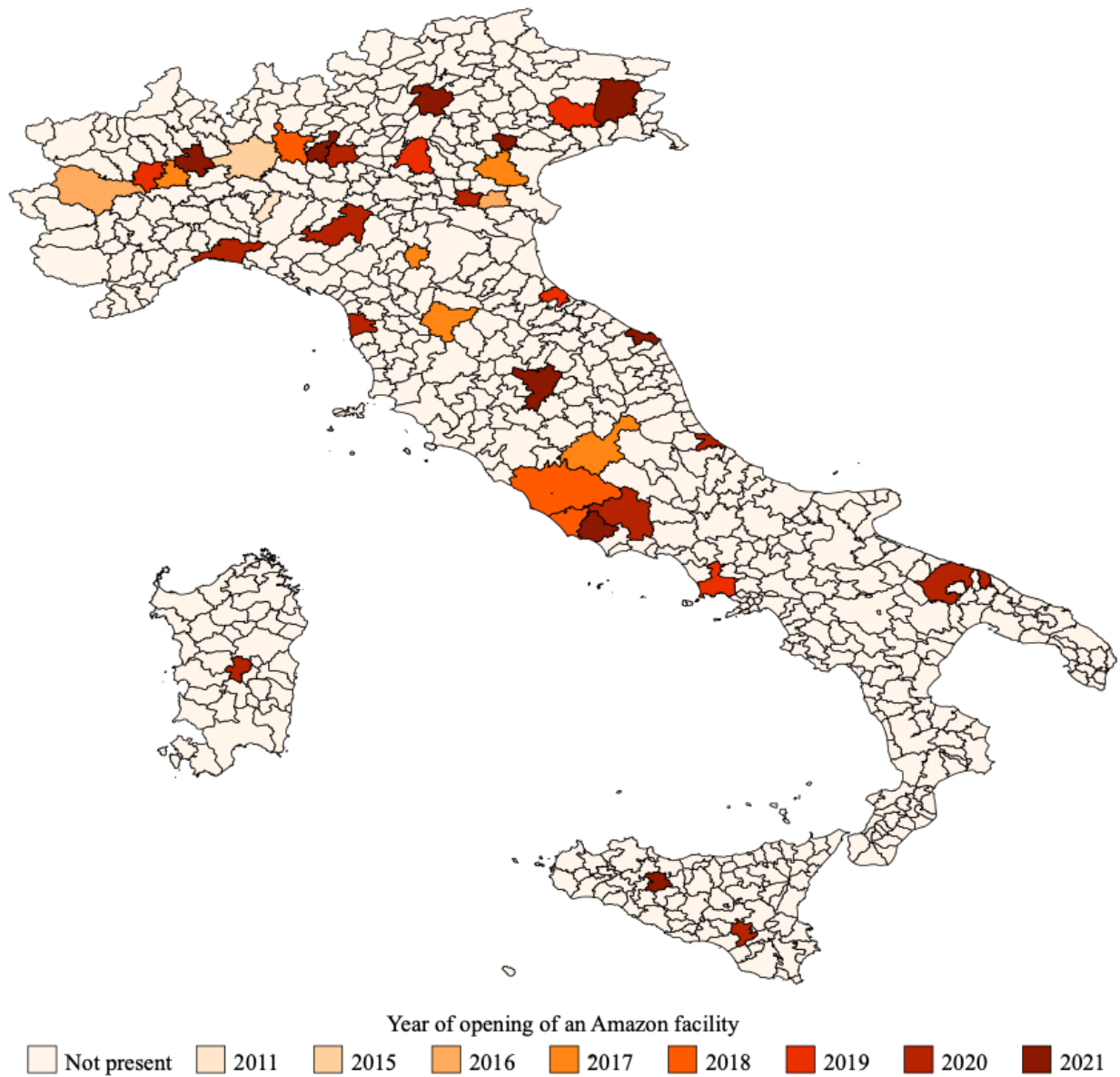
Figure 1: Development over time of Amazon facilities
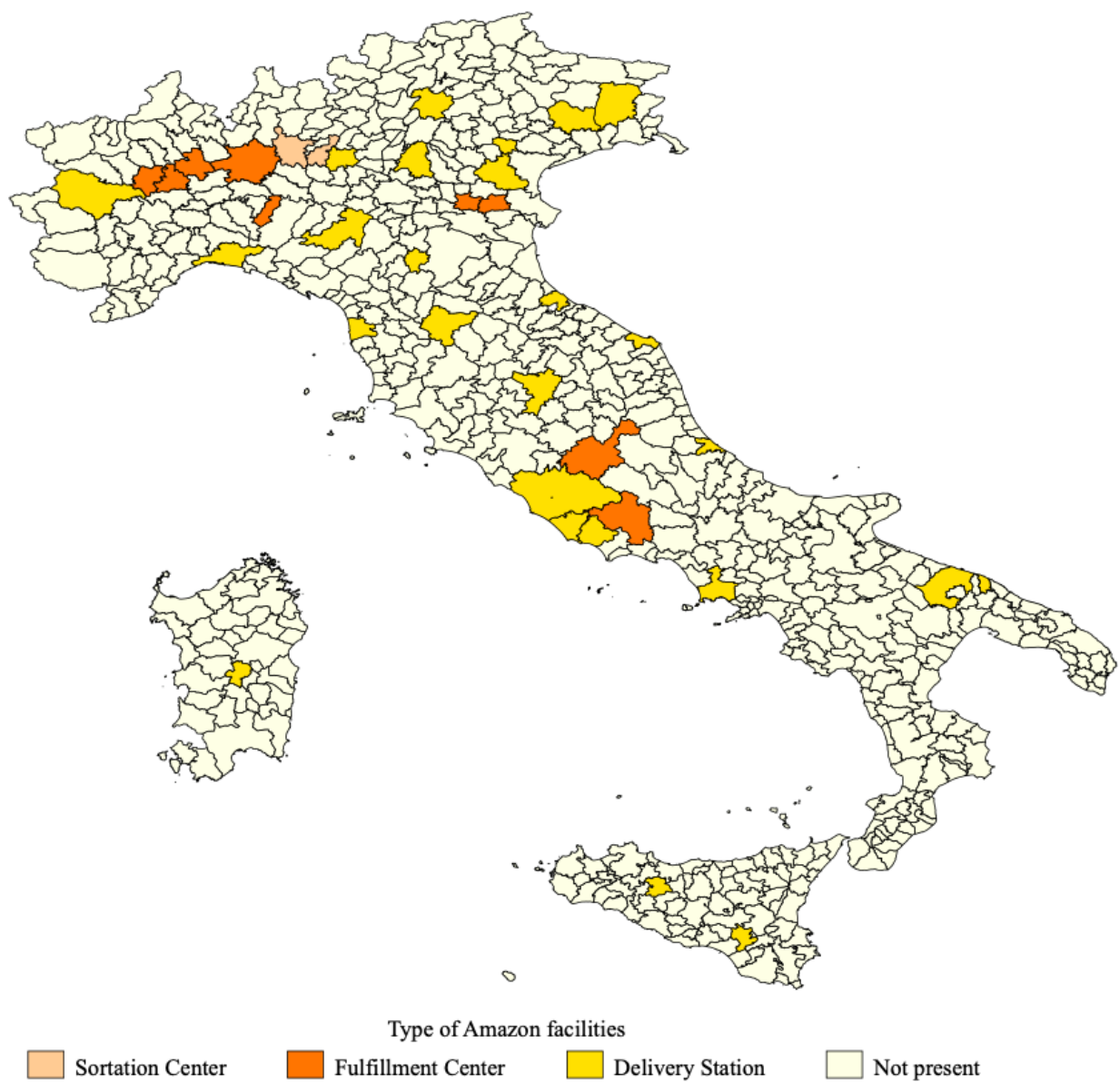
Figure 2: Types of Amazon facilities
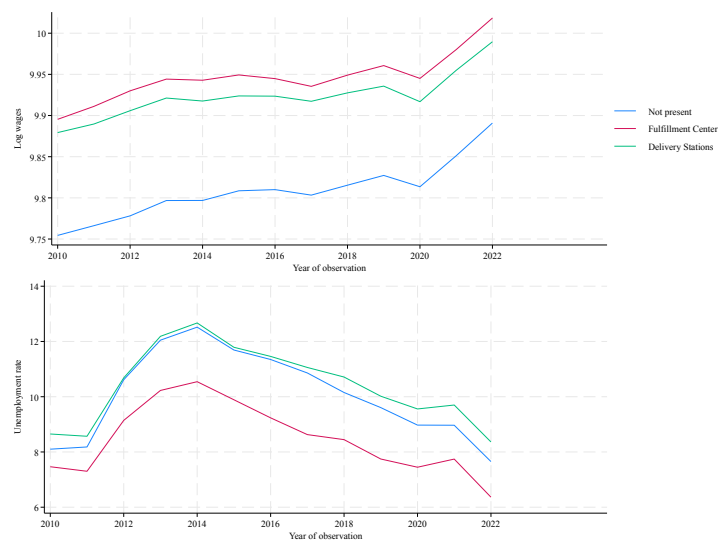
Figure 3: Wages and unemployment in Italian local labor markets
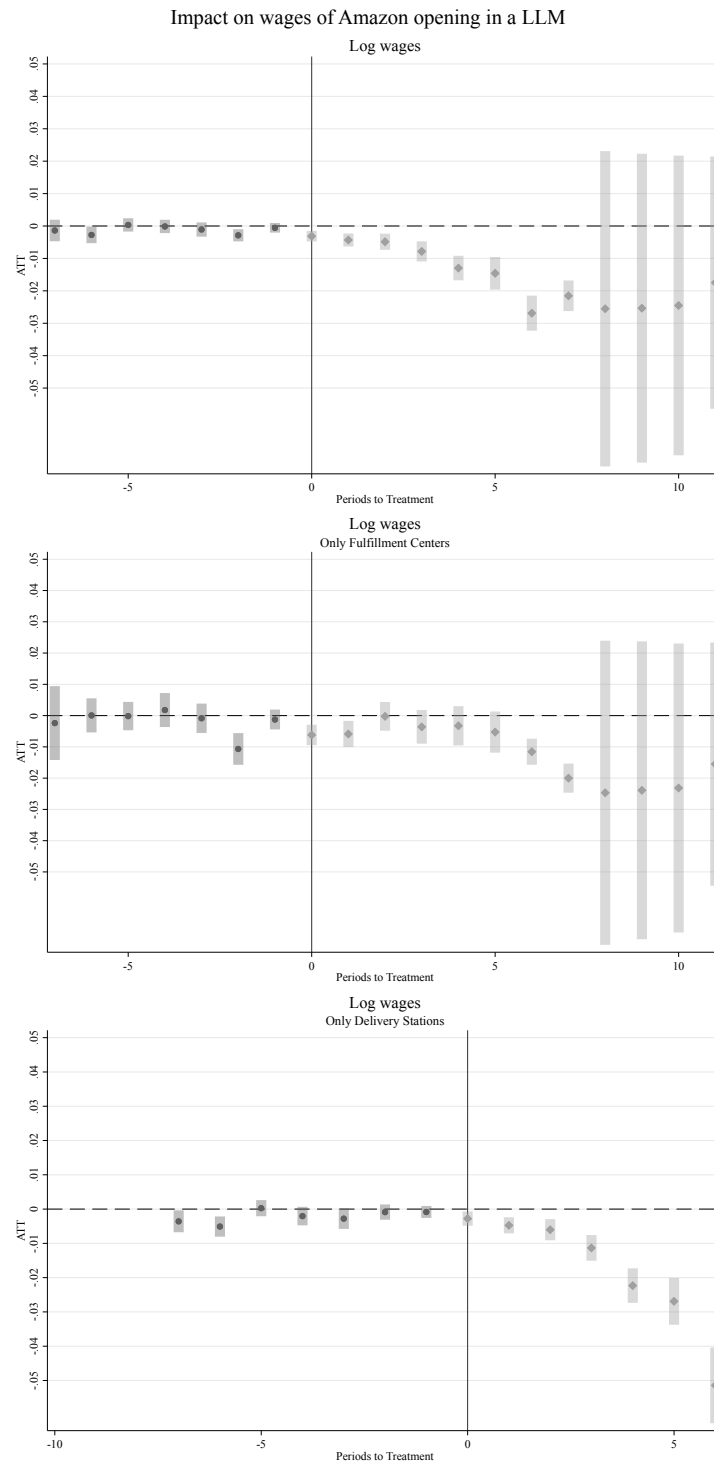
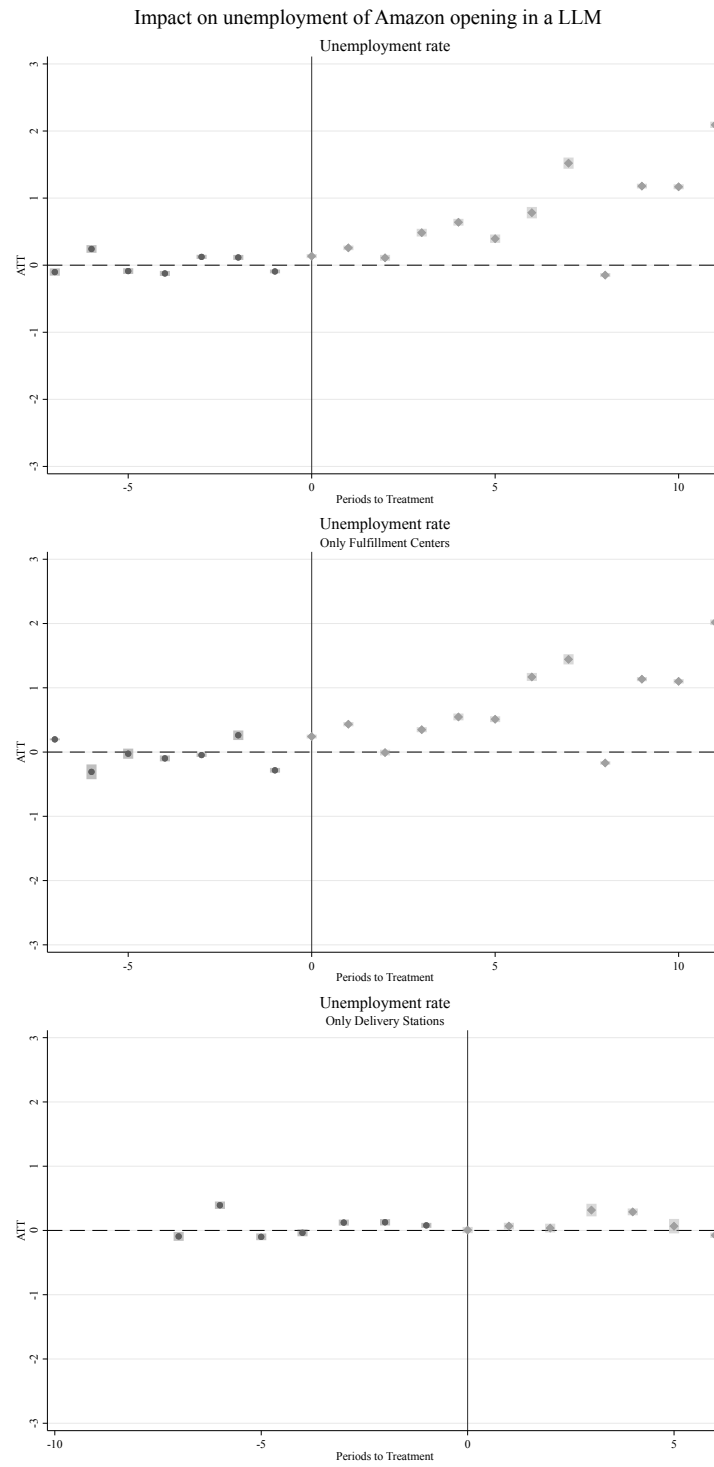Figure 4: Baseline specification - wages
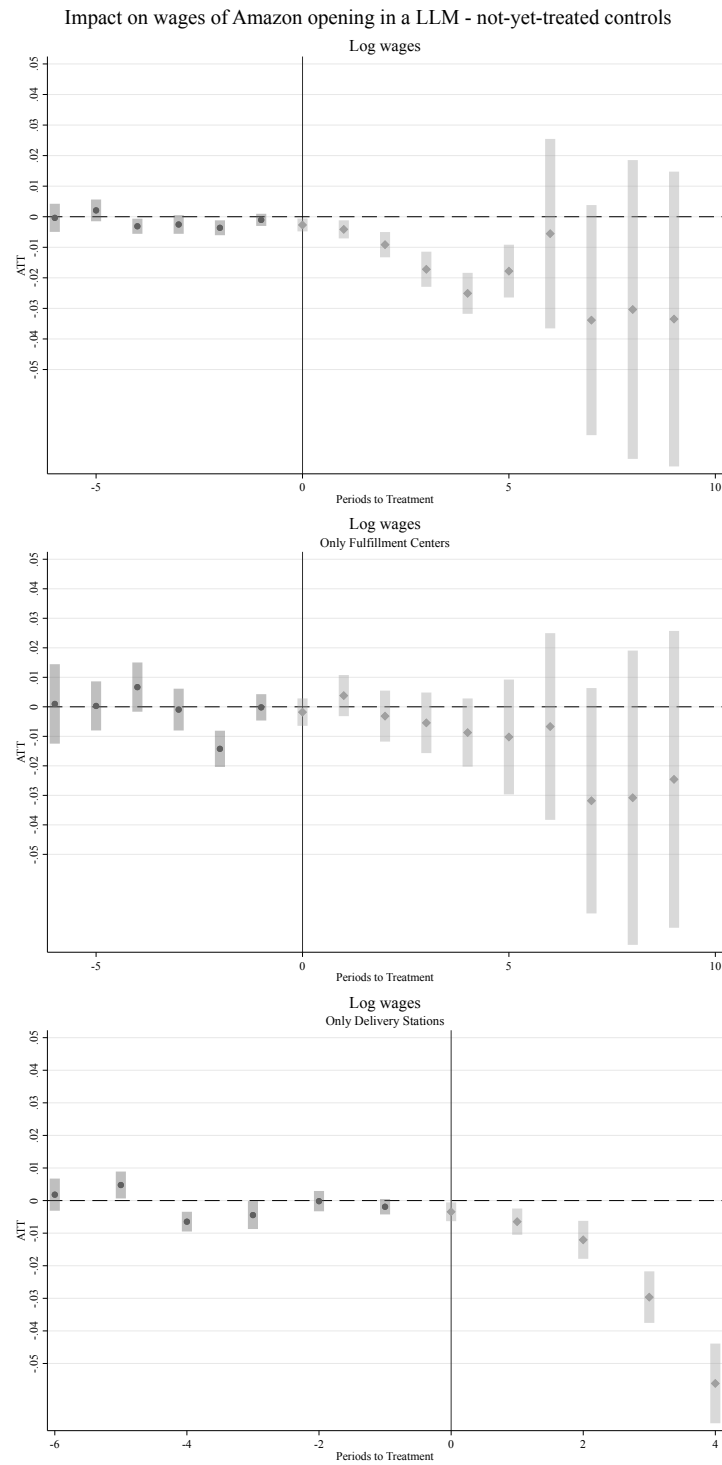
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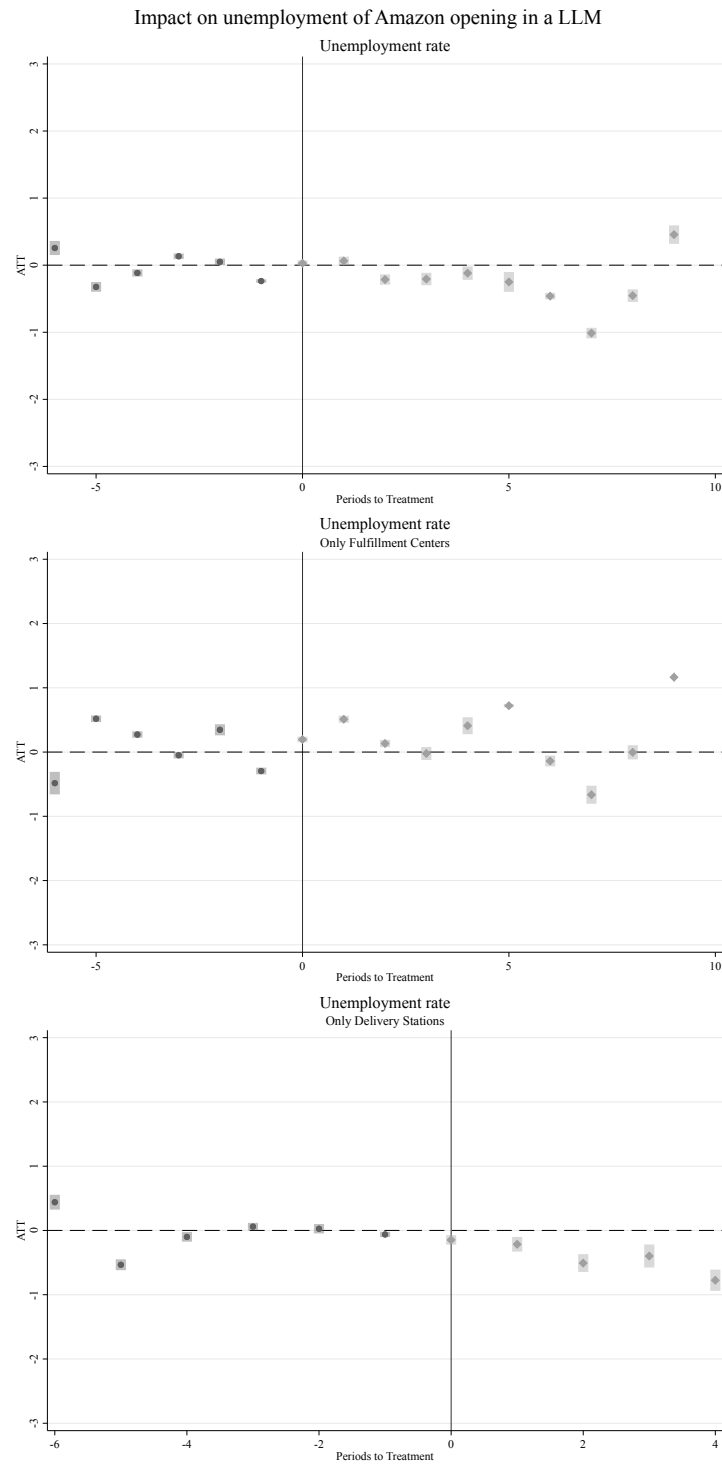
Figure 6: Not-yet specification - wages
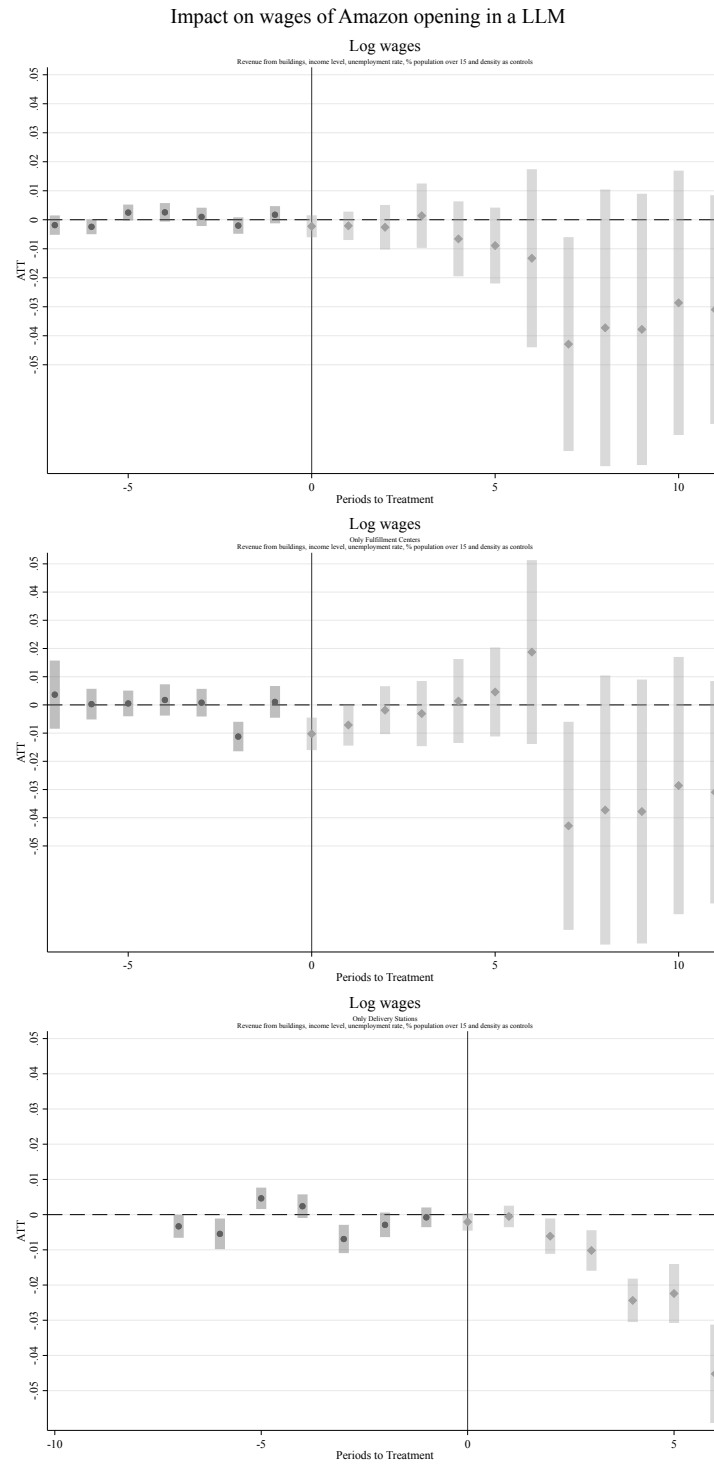
Figure 7: Not-yet specification - unemployment

Figure 8: Covariates: log rents, income level, unemployment rate, population over 15, density - wages
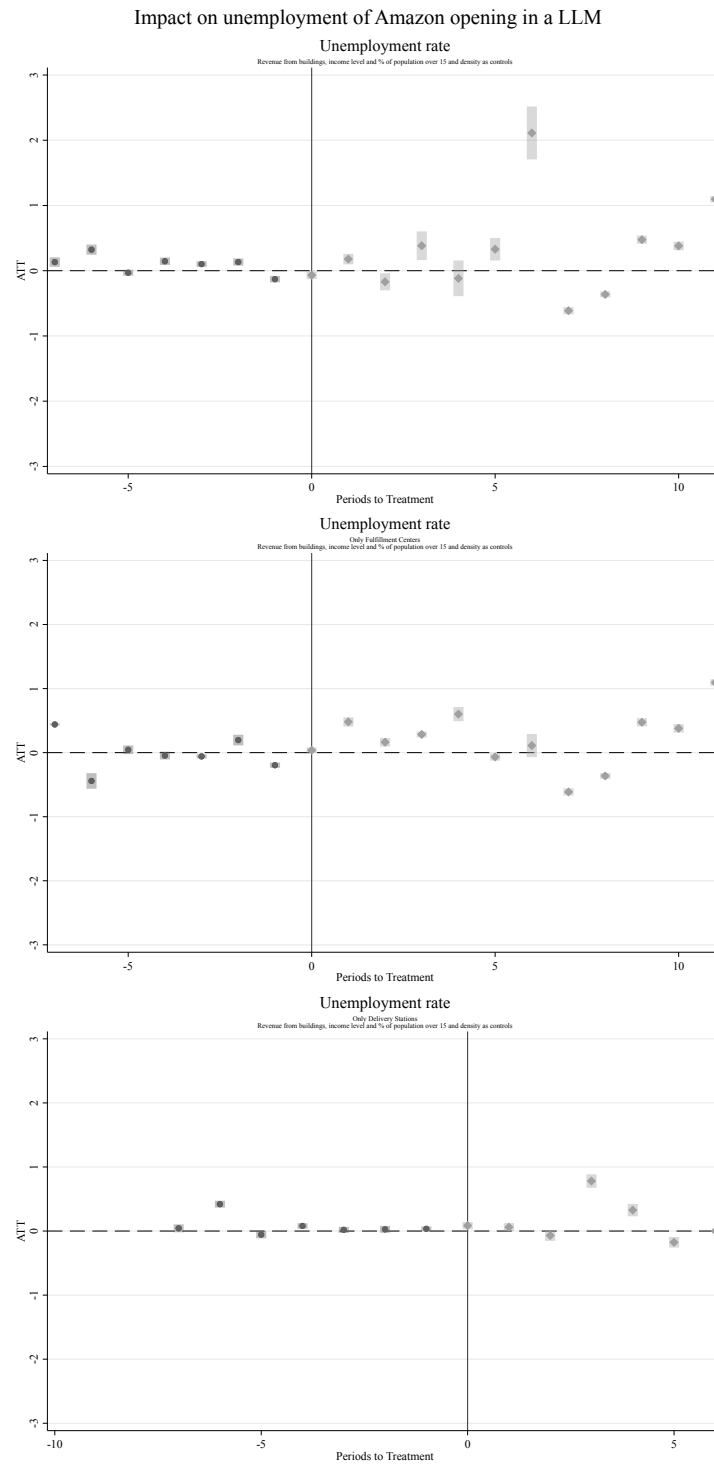
Figure 9: Covariates: log rents, income level, population over 15, density - unemployment

Online appendix