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ABSTRACT

I identify quasi-exogenous variation in the introduction of mobility restrictions in the West Bank during the Second Intifada (2000-2006) to study the distribution of residents, jobs and firms in response to changes in the commuters' market access. A village experiencing a loss in market access equivalent to a 10% increase in travel time towards all destinations on average suffered a loss of 0.3% in residents. However, it also experienced an increase of 0.3% in jobs, with the effect being particularly strong in wholesale and retail trade. The decrease in residents and the increase in jobs is reconciled with a decline in commuting of residents working outside the village. In a model of commuting, the sign of the effect of changes in commuting costs on residents and jobs depends on the initial direction of the commuting flows and the spatial sorting in the city.

CHAPTER 1

INTRODUCTION

In 2000, the Israeli Defence Force (IDF) introduced measures to restrict the mobility within the Palestinian territories in response to increased political tension. The mobility restrictions served two main purposes: guarantee the safety of Israeli citizens, and engage/control the Palestinian population. These obstacles diverted or slowed down the traffic flow, resulting in an unprecedented, large-scale increase in commuting costs. Mobility restrictions in the West Bank went from 30 obstacles in 1995 to 547 in 2007. They increased median commuting time from 104 minutes to 190 minutes.[1] The increase in commuting costs as a result of the introduction of mobility restrictions was sizable, widespread, permanent, and largely unexpected.[2] Today, twelve years after the end of the Second Intifada, the UN still counts 572 obstacles in the West Bank.

Mobility restrictions are not unusual throughout the world. According to Barka [2012], there are between 1.8 and 3.2 checkpoints per 100 km along the corridors in West Africa, causing delays from 18 to 29 minutes per 100 km traveled. In Belfast, Northern Ireland, the so-called peace lines or peace walls separate predominantly Republican and Nationalist Catholic neighborhoods from predominantly Loyalist and Unionist Protestant neighborhoods. The city has worked towards the removal of such restrictions, but Brexit is now threatening to slow process or even revert it[3]. In Johannesburg, permanent checkpoints are used as a measure to fight crime, a practice also used by the police in the US (Clarke [2004]). Mobility restrictions in the world are also unintentional: railroads and highways separate and often segregate cities (Ananat [2011] and Johnson [2012]).

1. This figure is the average commute time for each possible village of origin and destination in the West Bank.

2. The geographic unit used in this paper is the locality, or, as referred here, the village. This is a very small unit: the average village has an area of 0.75 km^2 or 0.3 mi^2, and its center is 6.8 minutes by car away from the center of the nearest village.

3. Savage, *The Guardian*, 06/06/2018.

The West Bank is an interesting framework where to study these questions. Besides the scale of the policy, in the West Bank, the benefits of mobility restrictions and their costs fall on two different groups of people. Thus, this allows to focus on the latter, while abstracting from the first. Finally, in the West Bank, there is no possibility to substitute away from roads as in other contexts: no railroads or other modes of transportation are available.

The literature on commuting and transport infrastructure gives us a framework for estimating the reorganization of economic activity and welfare costs. Improving transportation infrastructure has allowed cities to reduce the demographic pressure in their centers and to redistribute residents towards the periphery. The literature agrees that a reduction in commuting costs is associated with a redistribution of residents away from the city centers.[4]

The effect of a reduction in commuting cost on job redistribution is less clear. On one hand, Baum-Snow [2010] points out the remarkably similar pace of job decentralization and resident decentralization in the US between 1960 and 2000 as a result of the construction of highways. On the other hand, the introduction of steam railways in 19th century London allowed for more commuting and the separation of workplace and residence, thus increasing jobs in the city center (Heblich et al., 2017).

This paper provides evidence on the joint redistribution of jobs and workers as a result of the introduction of mobility restrictions in the West Bank during the Second Intifada. Historical and political events allow us to identify quasi-exogenous variation in mobility restrictions, and to estimate the reduced-form effect on the distribution of jobs and workers at a fine geographic unit. The reduced-form findings are combined with a model of commuting zones. The model provides intuition on the mechanisms behind my findings. Finally, I estimate the welfare effect of this policy.

How may the same change in transportation infrastructure differentially affect residents

4. Highways built between 1950 and 1990 caused a reduction in city center population by 18% to the benefit of the outskirts (Baum-Snow, 2007). The construction of subways had similar effects (Gonzalez-Navarro and Turner, 2018). Reducing commuting costs contributed to suburbanization in Barcelona (Garcia-López, 2012), as well as in Bogotà (Tsivanidis, 2018).

and jobs within a city? What are the welfare implications of transportation investments via changes in spatial sorting? I explore these questions both theoretically and empirically. Two features make the West Bank during the Second Intifada an interesting re- search setting: (i) the unprecedented scale of the policy; (ii) the fact that this policy was largely motivated by military and strategic considerations for the benefit of a different group of people, rather than as an endogenous investment nurturing the economic development of the area.

To study the effect of mobility restrictions, I develop a model of a system of commuting zones based on Ahlfeldt et al. [2015] and Monte et al. [2015]. Workers choose a pair of residence and workplace based on house prices, wages, and exogenous characteristics. Commuting is costly but workers are free to change residence and workplace at no cost. When adjusting their commute, workers have two possible choices (i) they can move to a different residence, or (ii) they can switch jobs. If workers have more dispersed preferences over workplace location, if they are more sensitive to house price changes, or if house prices are more elastic, the first option will be more likely chosen. Vice versa, if workers have more dispersed preferences over residence location, if they are more sensitive to wage changes, or if wages are more elastic, the latter option will be more likely chosen. In response to commuting changes, moreover, firms optimally adjust their production. Since firms use two inputs in the production, labor and land, their ability to accommodate the supply of jobs is limited by the supply of land.

The initial level of spatial sorting determines the overall response to changes in commuting costs: when the commuting zone has areas specialized for residential use and areas specialized for industrial use, then an increase in commuting costs reduces the degree of land specialization: it increases the number of residents in areas that were initially net exported of jobs, and it increases the number of jobs in areas that were initially net importers of jobs. Positive production externalities strengthen this effect.

Based on this model, I derive an empirical measure of market access summarizing the changes in the entire network structure due to the mobility restrictions, similar to Donaldson and Hornbeck [2016]. This concept captures the idea that commuting flows are directly proportional to the size of the labor market at the destination, and inversely proportional to the distance between origin and destination. Using detailed census data on workers and establishments from the Palestinian Central Bureau of Statistics (PCBS) and the Israeli Central Bureau of Statistics (ICBS), I estimate the model's predictions by exploiting the changes in market access for a given village and changes in number of residents and jobs.

A number of endogeneity concerns threaten the identification. First, mobility restrictions were placed more frequently near settlements, to guarantee the safety of Israeli citizens, and settlements themselves are not established randomly. The presence of settlements may be correlated with other confounding factors: on one hand, villages with more mobility restrictions may have been on a higher growth path before the Second Intifada, because the proximity to Israeli settlements increased their possibilities of trade; on the other hand, villages with more mobility restrictions may have been on a lower growth path before the Second Intifada, because the proximity of settlements may have led to more expropriation of land and conflict.

Second, other characteristics of the village might raise concerns of endogeneity. The likelihood of suicide attacks and political violence is expected to be positively correlated with the mobility restrictions. The negative correlation between conflict and growth trends in residents and economic activity would introduce a bias moving the estimate away from zero for residents, and towards zero for jobs. The size of the population and the presence of more trafficked roads are also factors potentially positively correlated with higher growth paths and mobility restrictions.

I approach this issue in two ways, both of which give similar results. First, I attempt to control for observable confounders and estimate the OLS with additional controls. Second, I use an IV approach. A valid instrument would be a fixed geographic feature that affects the likelihood of mobility restrictions but does not affect growth in residents or jobs during the Second Intifada. This paper proposes an instrument based on settlements built as part of the Drobles Plan (1976-1982).

In 1967, as a result of the Six-Day War, Israel took control over the West Bank. This interrupted procedures to register land claims started by the Jordanian government. The incomplete registration of some land was not intentional, but it was a consequence of the unexpected timing of the war, which prematurely interrupted the process. As a result, in 1967, two-thirds of the West Bank did not have clearly defined property rights. Nine years later, in 1976, Israel shifted the burden of the proof to land claimants, making it more difficult for Arabs to retain the ownership of the land left unregistered since 1967. In the same period, the Drobles Plan was designed, which involved the establishment of new settlements. The "state land" was a good candidate for these settlements because it allowed Israel to declare that no Arab-owned land was used.

Accordingly, the identification strategy relies on the assumption that routes more exposed to Drobles settlements were more likely to experience increases in travel time. Conditional on the number of Drobles settlements near a village, the exposure of routes leading from that village to Drobles settlements does not have a direct effect on jobs and residents during the period of study. This research presents evidence of a strong and positive correlation between population trends before the introduction of the mobility restrictions and settlement proximity, even considering buffers as large as 10 km (one-fourth of the width of the West Bank). However, the same cannot be said for the Drobles settlements. *Ergo*, the identification strategy relies on the assumption that no confounding effects arose during the Second Intifada, conditional on the number of Drobles settlements near a village.

Thanks to the identification strategy described, this research is able to identify the causal effect of mobility restrictions. A village experiencing a loss in market access equivalent to a 10% increase in travel time towards all destinations on average suffered a loss of 0.3% in residents. However, it also experienced an increase of 0.3% in jobs, with the effect being particularly strong in wholesale and retail trade. The decrease in residents and the increase in jobs is reconciled with a decline in commuting of residents working outside the village. In a model of commuting, the sign of the effect of changes in commuting costs on residents and jobs depends on the initial direction of the commuting flows and the spatial sorting in the city. Given that, on average, the travel time between two locations increased by 38%, with peaks above 100%, the overall magnitude of the effect is quite sizable.

An increase in commuting cost unambiguously reduces commuting flows, as found in other contexts, such as Heuermann and Schmieder [2018] in the case of German cities. Duranton and Turner [2012] find that the vehicle-kilometers traveled increases proportionately to kilometer of highway built. Similarly, in the West Bank, the amount of time spent commuting did not change as a result of the introduction of the mobility restrictions, suggesting that people proportionately adjusted their commuting patterns.

My approach encounters some limitations. Most importantly, the point estimates may be capturing the increased risk of clashes and violence along the road, rather than increases in commuting costs. Benmelech et al. [2010] study the cost of a terrorist attack on the population perpetrating it and find that a successful suicide attack increases unemployment by 5.3% and decreases wages by 20%. Di Tella and Schargrodsky [2004] explore the effect of increased police presence in Buenos Aires on crime as a result of a terrorist attack on a Jewish target, and they find that the effect, although large, is also local. The empirical analysis explicitly controls for pre-Intifada terrorist attacks. Nevertheless, the increase in travel time may not be the only channel through which mobility restrictions operate.

My paper contributes to the literature on the Palestinian territories. Research on the Palestinian territories has primarily focused so far on labor market outcomes, since Angrist [1996] and Angrist [1998] studied the effect of the Arab-Israeli conflict on the Palestinian labor market. Calì and Miaari [2013] and Van Der Weide et al. [2018] both study the shortterm effect of mobility restrictions respectively to labor outcomes and night lights. My analysis relates to Abrahams [2018], who study the redistribution of residents as a result of the mobility restrictions. My work differs from his in a number of aspects: first, I use firm-level data to describe the job and firm reallocation; second, thanks to the use of new data from the 1967 Israeli Census, I find that settlements are correlated with pre-trends, and I argue that using only the variation in mobility restrictions due to settlements under the Drobles plan, rather than all settlements, allows to identify plausible quasi-exogenous variation; third, I develop a model of a system of cities to estimate the welfare effects.

My paper also relates to the literature con commuting. The literature on the effects of commuting costs focuses mostly on population distribution. There is instead little research on job distribution. Nevertheless, job distribution and spatial sorting are known to have welfare implications. Modifying the degree of spatial sorting of a city via land-use restrictions enhances welfare in the presence of spatial spillovers (Allen et al., 2015). Monte et al. [2015] point out the role of commuting in the elasticity of labor. The changes in the distribution of jobs within a commuting zone have the potential to increase the spatial mismatch, contributing to the decline of employment. My paper contributes to this literature by studying the determinants of the sign of the effect of changes in commuting costs on changes in number of jobs.

Despite the scarsity of research, the distribution of jobs within a commuting zone has important welfare implications. Production externalities are extremely localized (Ahlfeldt et al. [2015]; Arzaghi and Henderson [2008]). Lower transport costs enhance scientists' collaboration (Catalini et al. [2018]). Geography matters for production: the benefits of R&D diminish with distance (Lychagin et al., 2016), even when comparing establishments within the same firm (Adams and Jaffe, 1996). Moreover, job location also has important social implications. Job suburbanization in the US has differentially hurt African Americans relative to other demographic groups (Miller [2018]). In the presence of housing segregation, the response of jobs to changes in commuting patterns may reduce the level of employment segregation. My paper addresses directly the effect of a redistribution of jobs within a commuting zone due to changes in commuting costs.

The remainder of the paper proceeds as follows. In section 2, the most important elements of the institutional background are introduced. Section 3 introduces the model. Section 4 presents the empirical strategy. Section 5 describes the data. Section 6 documents the empirical results from the OLS and IV estimation. Section 7 details the procedure for the calibration and structural estimation of the model. Section 8 undertakes counterfactuals and evaluates the welfare impact of the mobility restrictions. Section 9 concludes.

CHAPTER 2

HISTORICAL BACKGROUND

This section introduces some background information on the West Bank.

The Palestinian territories consist of two areas, the West Bank and the Gaza Strip. This paper focuses on the West Bank because Israel implemented mobility restrictions in a more systematic way in this area.

The West Bank is a patch of land of the size of Delaware. It has an area of 5,655 km^2 (2,183 sq mi). The GDP per capita (including Gaza) was $3,689 in 2016. The largest economic sectors are manufacturing, wholesale trade, and retail trade. It is organized in 11 districts: Bethlehem, Hebron, Jenin, Jericho, Jerusalem, Nablus, Qalqiliya, Ramallah and Al-Bireh, Salfit, Tubas, and Tulkarm. The labor force participation in 2017 was 45.3%, but this is the result of a wide gap in rates between male and female population: only 19.4% of the female population participates to the labor force.[1]

The West Bank has a population of approximately 2.9 million people as of 2017. It also hosts 400,000 Israeli settlers.[2] Although these two groups share the same space, they live almost entirely separated. They do not share the same laws: Israeli law extends to Israeli citizens in the West Bank; Palestinians in the West Bank have lived under military rule since 1967 (Benvenisti, 1984). They do not share the same roads. Palestinians use a road network almost entirely separated from the roads serving Israeli settlers (UNOCHA [2007]). In particular, the traffic flow from the Israeli settlements to Israel occurs almost seamlessly, while Palestinians undergo document controls at crossings.

Additionally, Palestinians do not have the same ease of access to the Israeli labor market. Before 2000, 14,000 Palestinians had a permit to work in Israel, predominantly in the

1. Source: PCBS, Palestine in figures, 2017.

2. The figure does not include East Jerusalem.

construction sector. After 2000, this number sank to less than 4,000.[3]

The construction and population of Israeli settlements in the West Bank went through a number of phases, responding to different political and military strategies. In 1967, Israel was the winner of the Six-Day War. In line with the Allon Plan, Israel left control of the areas with the highest concentration of Palestinians to Jordan. Settlements were built in the residual areas, away from Palestinians, with the goal of defending from a Jordanian invasion of the most populated part of Israel, the part closest to the Jordanian border.

The Allon plan give way to the Drobles plan, *"setting the stage for the fragmentation of the West Bank."*[4] About 50 new settlements were established, a threefold increase relative to earlier numbers, while the Israeli population increased by five times. By 2000, there were about 200,000 Israeli settlers in the West Bank. The increase in political tension and violence in the following years did not reduce the expansion.

The 1949 Armistice Line to the West, and the Jordan river to the East, mark the borders of the West Bank (figure 1). The 1949 Armistice Line, also known as the Green Line, is the end result of the 1948 Arab-Israeli war. Palestinians, in what since has become the independent state of Israel, fled their home and became refugees, while Jordan took control of the West Bank. The 1949 Armistice Line is the result of the negotiations between Israel and Jordan at the end of that war. This line also has demographic and political significance. After 1948, Palestinians in Israel sought refuge east of the line, and it is still considered by the international community as the basis for negotiations for a Palestinian state. This small patch of land has witnessed a number of conflicts over the years. This study focuses on the conflict that came to be known as the Second Intifada.

The Second Intifada broke out in 2000. The political situation was already tense. In July of that year, at the 2000 Camp David Summit, peace talks between Israeli and Palestinian

3. Miaari et al. [2014] study the effect of the changes in the Palestinian participation in the Israeli labor market before and after 2000.

4. Cit: Farsakh [2005] A map of the Drobles Plan is available in Benveniste and Khayat [1988].

political leaders failed. Only a few months after, in September, Ariel Sharon, leader of the Likud party and soon-to-be Israeli Prime Minister, made a visit to the Temple Mount, a provocative move in the eyes of the Muslim worshipers. Temple Mount, also known as Haram esh-Sharif, is one of the most venerated places in Judaism and Islam alike, and it is at the core of the Israeli-Palestinian conflict. The following day, after Friday prayers, large-scale riots broke out in Jerusalem; this was the spark that led to the Second Intifada.

This political uprising was accompanied by a surge in suicide attacks in the West Bank and in Israel (Pape and Feldman, 2010). Never before had Israel felt so strong the need to protect its citizens. Israel's strategy was twofold. First, the IDF started the establishment of permanent facilities to control the mobility of the Palestinian people. Second, during the Second Intifada, Israel also started the construction of a wall separating the West Bank from Israel. These mobility restrictions, with few changes, are still in effect today.

Both the wall and the physical obstacles were not meant to be transitory. For instance, von Benda-Beckmann and von Benda-Beckmann [2016] describe the evolution of Qalandia, one of the biggest checkpoints in the West Bank. *"Before the start of the Second Intifada in late September 2000 there was no permanent Israeli military presence at Qalandia. However, as the Intifada progressed, a newly created checkpoint turned from a few concrete blocks to a sprawl of turnstiles, watch-towers, offices and loading bays. In order to pass through, people had to show identity cards and permits, as well as often have their bags and vehicles searched."* Aerial pictures over the years of Qalandia checkpoint confirm the timeline; these are available in the appendix to this paper.

The mobility restrictions have a two main functions. First, they deter attacks on the Israeli population in the West Bank. According to the United Nations UNOCHA [2007], *"the IDF states that the reason for the closure regime [...] is to reduce attacks on Israelis by Palestinian militants by limiting their ability to move freely by vehicle."* As a matter of fact, 25% of the obstacles in 2007 were in close proximity to an Israeli settlement or an Israeli military base. Second, mobility restrictions also regulate the traffic flow along the major highways in the West Bank. These restrictions allow the enforcement of roads to create Israeli-limited traffic, and the control of Palestinian IDs and permits within the West Bank.

Different types of obstacles change the structure of the road network in different ways.[5] Roadblocks (51 in 2007) and earthmounds (299 in 2007) are simply blocks of cement or dirt that completely prevent the traffic flow. As such, their impact on the road network is easily quantifiable and equal for all economic agents. Road gates (110 in 2007) prevent the access to a road, and they can be either open or closed. Since information on road gates in 2007 is unavailable, in this paper they are assumed open.[6]

The impact of checkpoints (118 in 2007) is harder to quantify.[7] Checkpoints can be permanent or transitory structures, staffed or unstaffed. They regulate the access to and from Israel, as well as the traffic within the West Bank. Crossing a checkpoint entails a process of permits and ID checks, which slows down traffic and often generates traffic jams. The delay depends on the time of the day, the political situation, and on other predictable factors.

For example, during the first Friday of Ramadan in 2014, when the situation in the West Bank was particularly tense following the abduction of three Israeli youths and the subsequent military operations to find them, the UN reports that only 11,000 Palestinian worshippers holding West Bank IDs were allowed to enter Jerusalem, a 90% decline compared to the first Friday of Ramadan in the previous year. During the same period, the UN also reports that the three main access points to Hebron city were blocked to vehicle traffic, while temporary checkpoints were established at the other entrances. The delay also depends on unpredictable factors generally unknown to the local population.[8]

5. The appendix contains a table decomposing the obstacles by type in 2007.

6. UNOCHA collects data for later years on whether road gates are open or closed.

7. This figure does not include Jerusalem checkpoints and checkpoints along the Green Line. It does include checkpoints along the Separation Wall.

8. Checkpoints also have a cost in terms of personal safety. Moreover, the delay at a checkpoint also

In addition to the obstacles on the ground so far described, the Separation Wall also had an impact on the internal traffic of the West Bank. The idea of a wall originated in July 2001, when the Israeli Defense Cabinet approved the erection of a security fence along the 1949 Armistice Line (Dowty, 2012). Although sections of the wall are still under construction today, construction has significantly slowed since the end of the Intifada.[9] According to Dowty [2012], this was due to budget considerations and the end of the uprising. The Separation Wall was presented in Israel as a necessary means to end the terrorist attacks of the Second Intifada. The Israeli Supreme Court, except for a few cases which led to modifications to the original plans in 2005 and 2007, agreed with this view.[10] By 2006, 58% of the total 709 km was completed, and 9% of the total project was under construction. Between 2006 and 2015, only 50 km were added.

The wall has the primary goal of regulating access to Israel, but it also impacts the traffic flow within the West Bank wherever parts of the wall extend into the Palestinian territory. The plan ensured a number of the settlements were West of the wall. Hence, the wall cuts into the Palestinian territory, particularly around the largest settlements near Salfit and Tulkarm, and in the Jerusalem governorate. As a result, internal traffic flow has been permanently diverted to circumnavigate it. According to the current plans, the wall will incorporate Israeli settlements near Jerusalem to the west of the wall and will almost severe the traffic flow between the North and South of the West Bank.[11]

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changes depending on personal characteristics. Since October 2003 (B'Tselem), Israel has put in place a system of permits regulating the right to move with various degrees of ease. Obtaining a permit can be a lengthy process, and its outcome is far from predictable. Lack of appropriate documents can greatly restrict the ability to move both between Israel and the West Bank, and within the West Bank. In addition, regardless of the permit held, Israel has regularly resorted to days of so-called closure, when the movement in and out of the West Bank, and sometimes also within the West Bank, was completely prevented for a short period of time. This policy has been particularly frequent during the Oslo period and later during the Second Intifada. According to B'Tselem, from 2000 to 2006, the West Bank underwent an average of 141 days of closure per year.

9. The figure on the construction progress is available in the appendix.

10. Rulings in 2005 and 2007 changed the plans of the wall and reduced the area between the 1949 Armistice Line and the Separation Wall to 9.5% of the West Bank.Dowty [2012]

11. Another effect of the wall, well documented by NGOs and international organizations, is the creation

Mobility restrictions affect the everyday life of people in the West Bank, since commuting between villages is frequent and widespread. Firstly, a large fraction of the population travel for work. In 1997, district capitals hosted 29% of the employed residents and 60% of all private jobs.[12] A considerable fraction of the population commute to their workplace: the Palestinian Central Bureau of Statistics (PCBS) reports that almost all the Palestinians who worked in establishments in the West Bank from 1999-2000 (24.8% of the total population, 43.7% of the male population) commuted to reach their workplace, and they spent on average one hour and 10 minutes traveling daily;[13] 3.8% of the population traveled 56 minutes per day to perform primary production activities (farming, breeding, etc.); 5% of the population traveled an average of one hour and 22 minutes per day for services related to other income activities (food processing, textile, maintenance, manufacturing not in an establishment, etc.). Overall, 33% of the total population commuted for work-related reasons in 1999, a sizable fraction of the 45.6% of the working population. This fraction is even higher for certain sections of the population: 62% of the male population between 40 and 49 years old travel to work in establishments, as does 61.8% of the male population between 30 and 39 years old, and 54.5% of the male population between 20 and 29 years old.

Secondly, commuting is necessary for other activities: 18.4% of the Palestinian population in the West Bank travel for household maintenance, management, and shopping (36 minutes); 17.8% travel for activities related to learning (3 hours 32 minutes); and 50.5% travel for social, cultural, and recreational activities (51 minutes). Overall, traveling was a common activity in the West Bank when restrictions were introduced. As these numbers suggest, Palestinians

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of a seam zone. This an area between the Green Line and the wall where Palestinian people can live while not being Israeli citizens. In these areas, even basic human rights, such as the access to education and health care, are under threat. Although I believe talking about these circumstances is extremely important, evaluating related effects on communities in the seam zone goes beyond the scope of this paper; it is left as a subject for further research.

12. For comparison,Glaeser and Kahn [2001] find that in the US "more than 3/4 of employment is more than 3 miles away from city centers."

13. Source: PCBS Time Use Survey 1990-2000.

are affected by mobility restrictions on a daily basis.

CHAPTER 3

MODEL-IMPLIED MEASURE OF MARKET ACCESS

Mobility restrictions change how workers and firms interact within the commuting zone. This section develops a model of cities with internal commuting to rationalize the relationship between commuting restrictions and the distribution of firms and workers.

Consider an economy with a fixed set of locations $i \in N$. These locations, or villages, are part of larger, possibly overlapping, commuting zones. Locations differ in endowment of floor space, H_i, taken as exogenous and used for residential or commercial purposes. They also differ in exogenous productivity, the level of residential amenities, and in access to the transport network.

There are two groups of agents in the model: workers and firms. There is a mass of workers, $\bar{L}$, who are mobile across cities and endowed with one unit of labor that they supply inelastically with zero disutility. They devote a constant share of expenditure, β, to the consumption of a homogeneous good, and the remaining share, $(1-\beta)$, to housing services. A representative firm in each location produces a homogeneous good with a constant returns to scale production function using labor and floor space as inputs. The good is costlessly traded across locations and chosen as a numeraire.

This model is similar to Ahlfeldt et al. [2015] and Ahlfeldt et al. [2016]. Relative to theirs, this model abstracts from the elastic housing supply. The simplicity of the model allows abstraction from the response in the housing market and focus on the labor market adjustments.

3.1 Preferences

Each worker has preferences over consumption, housing services, and location-specific amenities, that capture each location's attractiveness as a residence and as a workplace.

$$U_{ij}(z) = \frac{b_{ij}(z)}{\kappa_{ij}} \Big(\frac{c_i(z)}{\beta}\Big)^{\beta} \Big(\frac{h_i(z)}{1-\beta}\Big)^{1-\beta}, \tag{3.1}$$

where κ_{ij} is an iceberg commuting cost in terms of utility. The worker z, who works in j and lives in i, and who has idiosyncratic preference $b_{ij}(z)$, earns a wage w_j, which is common to all workers in workplace j, and spends her earnings in consumption $c_i(z)$ and housing services $h_i(z)$.[1]

$$w_j(z) = c_i(z) + r_i h_i(z).$$

Workers differ in their preferences due to an idiosyncratic shock that captures the idea that people have idiosyncratic reasons for living and working in different locations. Each worker, indexed by z, differs in her realization of the amenity shock for each location $b_{ij}(z)$. Following McFadden [1974], I assume this idiosyncratic component of utility is drawn from an independent Fréchet distribution,

$$F(b_{ij}(z)) = e^{-B_i b_{ij}(z)^{-\epsilon}}. \tag{3.2}$$

The scale $B_i > 0$ governs the average utility from living in location i: *ceteris paribus*, if B_i is larger, on average, workers are more willing to live in i. By allowing the scale parameter, B_i, to differ across locations, the model allows for the possibility of workers choosing their residence and workplace based on factors not explicitly accounted for. Therefore, considering the same level of wages, house prices, and commuting costs, different workers may make different choices due to a different realization of $b_{ij}(z)$. The shape parameter, $\epsilon > 0$, is common

1. Since the commuting cost enters multiplicatively in the utility function, this model is isomorphic to one in which workers have a time endowment of 1. In this alternative model, workers choose to allocate their time between commute, t_{ij}, and work, $(1 - t_{ij})$. This problem has the same indirect utility function as the model presented in other research, for $\kappa_{ij} = (1 - t_{ij})^{-1}$. See, for instance, Allen et al. [2015]. The specification chosen in this paper allows for more flexibility on the elasticity of commuting cost to commuting time.

to all locations and controls the dispersion of the distribution of idiosyncratic preferences. A larger parameter, ϵ, is associated with a more concentrated probability density function. The parameters of the Fréchet distribution do not enter the worker utility function directly. However, they contribute to determining the share of people choosing the pair (i, j), as we will see later in this section.

In equilibrium, workers spend a fraction, β, of their labor income on consumption goods, and the remaining on housing services. The resulting indirect utility function for worker z residing in location i and working in location j is

$$U_{ij}(z) = \frac{b_{ij}(z)}{\kappa_{ij}} \frac{w_j}{r_i^{1-\beta}}. \tag{3.3}$$

3.2 Residence and Workplace

After observing equilibrium wages, house prices, and the realizations of their idiosyncratic shock, $b_{ij}(z)$, workers choose their residences and workplaces to maximize utility. One of the properties of the Fréchet distribution is the possibility of explicitly solving for the share of workers choosing to live in i and to work in j:

$$\lambda_{ij} = \frac{B_i(\kappa_{ij} r_i^{1-\beta})^{-\epsilon} w_j^{\epsilon}}{\sum_i \sum_j B_i(\kappa_{ij} r_i^{1-\beta})^{-\epsilon} w_j^{\epsilon}} \equiv \frac{\phi_{ij}}{\phi}. \tag{3.4}$$

This equation clarifies the role of the Fréchet distribution. Higher values of the scale parameter, B_i, relative to the scale parameter in other locations, are associated with a higher share of workers willing to live in i. A change in wages w_j from $w_j^{(o)}$ to $w_j^{(1)}$ is associated with a larger change in the fraction λ_{ij} for higher values of ϵ. The same holds for changes in house prices and commuting costs. In this sense, ϵ is related to the partial elasticity of population shares, λ_{ij}, to wages, house prices and commuting costs.

3.3 Market Access

In order to account for the changes of the entire road network to an individual location, defining an index of market access, as in Donaldson and Hornbeck [2016], is useful. The model allows us to derive such a measure from the equations of resident shares and job shares.

Summing up across the population shares $\{\lambda_{ij}\}$ across residence locations i reveals the share of people working in j:

$$\lambda_{Lj} \equiv \sum_i \lambda_{ij} = \frac{\sum_i B_i(\kappa_{ij} r_i^{1-\beta})^{-\epsilon} w_j^\epsilon}{\sum_i \sum_r B_i(\kappa_{ir} r_i^{1-\beta})^{-\epsilon} w_r^\epsilon} \equiv \frac{w_j^\epsilon FMA_j}{\phi}. \tag{3.5}$$

This equation identifies the sources of attractiveness of location j as a workplace. Workers are more likely to work in j if wages are high and if i has access to better residential locations. The latter factor is captured by the firm market access, defined as $FMA_j \equiv \sum_i B_i \kappa_{ij}^{-\epsilon} r_i^{-(1-\beta)\epsilon}$. The firm market access can also be interpreted as the pool of workers a firm located in j has accessible, given the commuting technology needed to access j. If commuting costs between i and all other locations $j \neq i$ become infinite, then $FMA_i = \kappa_{ii}^{-\epsilon} B_i r_i^{-(1-\beta)\epsilon}$, and only the labor market conditions in the same place of residence enter the workers' location choices. An index of market access has the advantage of capturing the effect of the changes in the entire road network, taking into account that changes in commuting cost towards areas farther away or less attractive as residential choices are going to affect the labor market in j proportionally less.

Similarly, summing the shares $\{\lambda_{ij}\}$ across workplace locations j gives the share of people living in i:

$$\lambda_{Ri} \equiv \sum_j \lambda_{ij} = \frac{\sum_j B_i(\kappa_{ij} r_i^{1-\beta})^{-\epsilon} w_j^\epsilon}{\sum_s \sum_j B_s(\kappa_{sj} r_s^{1-\beta})^{-\epsilon} w_j^\epsilon} \equiv \frac{B_i r_i^{-(1-\beta)\epsilon} WMA_i}{\phi}. \tag{3.6}$$

Three factors make a location more attractive as a residence: cheap housing (low r_i), more amenities (high B_i), and better access to more remunerative labor markets, summarized by the worker market access ($WMA_i \equiv \sum_j \kappa_{ij}^{-\epsilon} w_j^{\epsilon}$).

The model also provides the conditional employment shares for each location,

$$\lambda_{ij|i} = \frac{\kappa_{ij}^{-\epsilon} w_j^{\epsilon}}{\sum_{j'} \kappa_{ij'}^{-\epsilon} w_{j'}^{\epsilon}}, \tag{3.7}$$

where $\lambda_{ij|i}$ is the share of people who work in j conditional on living in i. High conditional employment shares are associated with higher wages or closer locations.

Expected worker income conditional on living in location i is then equal to the wages in all workplace locations weighted by the probability of commuting to those places conditional on living in i:

$$v_i = \sum_j \lambda_{ij|i} w_j. \tag{3.8}$$

3.4 Production

There is one homogeneous good sold on the domestic market and traded at no cost. The homogeneous good is sold at the same price everywhere and taken as the numeraire.

One homogeneous good traded freely within the economy. Firms have the following production function,

$$y_j = A_j L_j^{\alpha} (\theta_j H_j)^{1-\alpha}, \tag{3.9}$$

where θ_j is the share of floor space used for commercial purposes in location j; H_j, the supply of floor space, is exogenous.

In equilibrium, the optimality conditions of the firm imply that wages are

$$w_j = \alpha y_j / L_j. \tag{3.10}$$

3.5 Housing Market

Both firms and households compete to rent floor space at a rate r_i. The housing supply is fixed to H_i. In locations where $\theta \in (0,1)$, in equilibrium, it has to be that both firms and households rent housing services at the same price.

$$r_i = (1-\beta)\frac{\bar{v}_i R_i}{H_i} \qquad \text{if } \theta_i = 0 \qquad (3.11)$$

$$r_i = (1-\alpha)y_i/(\theta_i H_i) = (1-\beta)\frac{\bar{v}_i R_i}{(1-\theta_i)H_i} \qquad \text{if } \theta_i \in (0,1) \qquad (3.12)$$

$$r_i = (1-\alpha)y_i/(H_i) \qquad \text{if } \theta_i = 1 \qquad (3.13)$$

3.6 Equilibrium

The general equilibrium is a set of locations characterized by a distribution of residents, jobs, share of land use, wages, house prices, $\{\lambda_{R,i}, \lambda_{Li}, \theta_i, w_i, r_i\}$, and a utility level $\bar{U}$ such that:

- workers maximize utility (equation 3.1), given house prices and wages;
- utility is equal across all locations (equation 3.14);
- firms maximize profits, given house prices and wages (equation 3.9);
- labor, goods, and housing markets clear (equations 3.6, 3.5, 3.11).

Proposition 1. *Consider locations with non-negative productivities, A_i, and non-negative amenities, B_i:*

- *locations with strictly positive amenities and strictly positive productivity have positive wages, w_i, have positive house prices, r_i, attract a positive share of workers, λ_{Li}, and attract a positive share of residents, λ_{Ri}. Finally, land market clearing implies no complete specialization, $\theta_i \in (0,1)$;*

- *locations with zero job shares, $\lambda_{Li} = 0$, and zero commercial land use, $\theta_i = 0$, have zero productivity, A_i;*

- *locations with zero resident shares, $\lambda_{Ri} = 0$, and zero residential land use, $\theta_i = 1$, have zero amenities, B_i.*

Proof. Assuming positive wages w_i, the support of the Fréchet distribution being unbound from above implies there will always be a positive measure of workers attracted to location i as a workplace. The Inada conditions on the firm's production function ensure that if wages were zero, the demand for labor would approach infinity. Therefore, as long as the productivity is positive, equilibrium wages are larger than zero. Similarly, as long as the productivity is positive, equilibrium house prices are larger than zero. The support of the Fréchet distribution being unbound from above implies that as long as B_i is strictly positive and the house price, r_i, is non-infinite, there will always be a measure of residents attracted to location i as a place of residence.

The second part of the proposition follows from the equilibrium equation for wages when $A_i = 0$ and from the market clearing condition for labor in location i. Similarly, the third part of the proposition follows from the market clearing condition for residents in location i. □

Proposition 2. *Assuming non-negative productivities, A_i, and non-negative amenities, B_i, there exists a unique general equilibrium vector $\{\lambda_{Li}, \lambda_{Ri}, q_i, w_i, \theta_i\}_i$, and $\bar{U}$.*

The proof to proposition 2 is in the appendix.

3.7 Welfare

Population mobility implies the same utility across space. That is,

$$\bar{U} = E[U_{ij}(\omega)] = \Gamma\Big(\frac{\epsilon-1}{\epsilon}\Big)\left[\sum_i \sum_j B_i(\kappa_{ij} r_i^{1-\beta})^{-\epsilon} w_j^{\epsilon}\right]^{\frac{1}{\epsilon}} = \Gamma\Big(\frac{\epsilon-1}{\epsilon}\Big)\phi^{\frac{1}{\epsilon}}, \tag{3.14}$$

where ϕ is defined as in equation 3.4.

In equilibrium, given perfect workers' mobility,

$$\bar{U} = \Gamma\Big(\frac{\epsilon-1}{\epsilon}\Big)\frac{w_i}{\kappa_{ii} r_i^{1-\beta}}\left[\frac{B_i}{\lambda_{ii}}\right]^{\frac{1}{\epsilon}}. \tag{3.15}$$

CHAPTER 4

EMPIRICAL STRATEGY

4.1 Empirical Specification

The model gives us an equilibrium condition for the distribution of residents and jobs in the economy:

$$\lambda_{Rit} = \frac{\sum_j B_{it}(\kappa_{ijt} r_{it}^{1-\beta})^{-\epsilon} w_{jt}^{\epsilon}}{\sum_s \sum_j B_{st}(\kappa_{sjt} r_{st}^{1-\beta})^{-\epsilon} w_{jt}^{\epsilon}} \equiv \frac{B_{it} r_{it}^{-(1-\beta)\epsilon} WMA_{it}}{\phi_t}, \tag{4.1}$$

$$\lambda_{Ljt} = \frac{\sum_i B_{it}(\kappa_{ijt} r_{it}^{1-\beta})^{-\epsilon} w_{jt}^{\epsilon}}{\sum_i \sum_s B_{it}(\kappa_{ist} r_{it}^{1-\beta})^{-\epsilon} w_{st}^{\epsilon}} \equiv \frac{w_{jt}^{\epsilon} FMA_{jt}}{\phi_t}. \tag{4.2}$$

Define $\Delta \ln X_i$ as the (log) change of a generic variable, X_i, between 1997 and 2007. Take the first differences of the (log) of the previous equation and obtain the following conditions:

$$\Delta \ln R_i = \alpha_R + \beta_R \Delta \ln WMA_i + e_{Ri}, \tag{4.3}$$

$$\Delta \ln L_j = \alpha_L + \beta_L \Delta \ln FMA_j + e_{Lj}. \tag{4.4}$$

R_i and L_j are respectively the number of residents in i and the number of jobs in j, so that $R_{it} = \lambda_{Rit}\bar{R}_t$, where $\bar{R}_t$ are the total residents in the West Bank in t. The coefficients α_R and α_L capture the growth rate in aggregate residents and jobs, and other trends common to the entire West Bank. In this empirical specification, variables constant over time (B_{it} and ϕ_t from equations 4.1 and 4.2) cancel out. The two indices of market access capture the change in residents and jobs due to the introduction of mobility restrictions. Finally, e_{Ri} and e_{Lj} capture changes in r_i in equation 4.1, and changes in w_j in equation 4.2, as well as measurement error and other factors not explicitly included in the model.

I define empirical counterparts of the indices of market access,[1]

$$WMA_{it} = \sum_{j \neq i} \frac{L_{j,1997}}{t_{ijt}} \frac{1}{FMA_{jt}} \approx \sum_{j \neq i} \frac{L_{j,1997}}{t_{ijt}} \qquad FMA_{jt} = \sum_{i \neq j} \frac{R_{i,1997}}{t_{ijt}} \frac{1}{WMA_{it}} \approx \sum_{i \neq j} \frac{R_{i,1997}}{t_{ijt}}, \tag{4.5}$$

where $R_{j,1997}$ is the resident count in location j in 1997, $L_{j,1997}$ is the number of jobs in establishments located in j in 1997, and t_{ijt} is the travel time between two locations based on the network structure at time t. In the empirical indexes of market access, the destinations j are all the district capitals, excluding Jerusalem, which is outside of the West Bank and on the other side of the Separation Wall. Palestinian access to Jerusalem requires specific permits, even simply for a visit. From the commuter point of view, the access to Jerusalem (including East Jerusalem) is as problematic as the access to Israel. The exclusion of smaller villages is done for computational simplicity. This is a good approximation, given that 60% of the employment is concentrated in the district capitals. Nevertheless, the appendix replicates part of the results using all the villages as destinations, and these are not sensitive to this choice.

Equations 4.5 are the empirical counterpart of the market access introduced in equations 4.1 and 4.2. The simplifications introduced allow us to compute the two indexes of market access in terms of variables we can measure. By disregarding the worker market access in the index for the firm market access and vice versa, we are excluding the possibility of spillover effects given by the changes in market access of neighboring villages.

The change in worker market access in equation 4.3 is defined as the (log) difference in market access between the two time periods:

$$\Delta \ln WMA_i = \ln WMA_{i2007} - \ln WMA_{i1997} = \ln \sum_{j \neq i} \frac{L_{j,1997}}{t_{ij2007}} - \ln \sum_{j \neq i} \frac{L_{j,1997}}{t_{ij1997}}.$$

1. For an overview of different measures of accessibility used in the literature, see Kwan [1998]. In the appendix I perform robustness checks and verify that results do not depend on the functional form used.

The firm market access is similarly defined.

Table 3 lists the summary statistics for the indices. The indices have a lower bound in zero and are unbounded upwards. The absolute values do not have an economic interpretation. Instead, the relative changes, both in space and in time, can be interpreted as changes in market access. Figure 6 reports the changes in market access for both firms and workers. The most affected regions are in the center of the West Bank, in the areas surrounding the city of Nablus.

4.2 Threats to Identification

There are some challenges to the identification of the coefficient in equations 4.3 and 4.4.

Firstly, the numerator in the definition of market access is endogenous. WMA_i also includes the jobs in location i, L_{it}, and FMA_i also includes residents in location i, R_{it}. This inclusion would generate an endogeneity bias in regressions 4.3 and 4.4. For this reason, R_{it} and L_{it} are excluded from the definition of the two indexes of market access. Similarly, changes in market access also involve changes in residences and jobs, thus raising endogeneity issues. For this reason, in the empirical indexes of market access, residents and jobs are held fixed at their initial level in 1997. Therefore, empirical indexes of market access, WMA_i and FMA_i, change between the two time periods only due to the introduction of mobility restrictions (the denominator in equation 4.5).[2]

However, mobility restrictions may be endogenous as well. One of the strengths of my setting is that, contrary to the construction of a highway or a subway, mobility restrictions were not enacted to target the Palestinian economy, rather they were enacted to satisfy increased security needs during the Second Intifada. Nevertheless, they were hardly exogenous.

There may be concerns that the IDF targeted villages with specific characteristics, which

2. A similar approach is taken by Donaldson and Hornbeck [2016] and Jedwab and A [2017], among others.

could, in turn, be correlated with the outcomes of interest. For instance, the IDF may have targeted villages with higher levels of religious fundamentalism, or villages more prone to hosting potential perpetrators of violence against Israel. Even if the IDF did not target specific Palestinian villages but instead held the protection of Israeli targets as their only goal, concerns may arise that the Israeli targets themselves are correlated with the outcomes of interest.

As a matter of fact, in 2007, 33% of the obstacles in the West Bank were as close as 0.5 km from the outer boundaries of settlements, and 31% were along the Separation Wall. This suggests that the security of these areas was a key concern when military restrictions were placed. However, proximity to a settlement may have direct effects on the outcomes of interest. Israeli settlements may provide jobs to local Palestinians, Israeli settlements may be associated with the land loss of villages nearby, or with increased tension between local Palestinians and settlers.

Importantly, the empirical specification allows for villages more and less affected by the mobility restrictions to differ in their initial levels. For instance, it is likely that more settlements and more Palestinian villages were placed where the topography was more favorable. This factor is already accounted for in the empirical specification. However, any factor affecting the growth rate in the outcomes of interest and correlated with the increase in mobility restrictions should be a concern.

On the contrary, the presence of settlements may be affecting the growth rate of local Palestinian residents and jobs in other ways besides the introduction of mobility restrictions: increased tension between Palestinians and settlers, demand for cheap Palestinian labor, dispossession of land, and so on. With a simple OLS of the baseline specification, we would not be able to address these and similar issues.

The proximity to the Separation Wall also may raise concerns of endogeneity. The path of the Wall loosely follows an old border between the area under Jordanian control and Israel, resultant from the Arab-Israeli War. The 1949 Armistice line, called the Green Line after the color used for it on the original map, was signed during negotiations between the two parties involved. This border became more and more inconsequential after Israel regained control over the territory in 1967.

Over the years, and particularly during the First Intifada, Israel imposed, from time to time, days of closure in the West Bank. During these times, people could not access Israel, but these were only transitory measures. When the Second Intifada erupted, Israel decided to permanently change the nature of this border and build a wall to permanently separate the West Bank from Israel.

Given that between 1967 and 2000 a number of Israeli settlements had been established as close as possible to the Israeli labor market, and therefore near the 1949 Armistice line, the path of the Wall is also correlated with proximity to these settlements. The construction of the Wall also involved extensive loss of Palestinian land, since the Wall is entirely built to the east of the 1949 Armistice line, the formal border of the West Bank. Thus, a loss in residences of villages close to the Separation Wall may be due to the increased mobility restrictions or to the loss of arable land.[3]

Finally, another challenge to the identification is the possibility of measurement error. This can be present on both sides of the equations. It is possible residents may be mismeasured, because of the presence of non-residents. As seen in the earlier section, the empirical indexes of market access are approximations of the same measures from the model, based on some assumptions. To the extent to which these assumptions do not hold perfectly, they will introduce measurement error in the regressions.

I run an OLS regression of population growth rate between 1997 and 1967 in each village

3. This paper does not take into account the issue of the Seam Zone, the Palestinian villages left to the west of the Separation Wall. The mobility restrictions imposed on them are extreme and therefore can be hardly associated with those that affected the rest of the West Bank.

on the number of obstacles around the village itself.

$$\ln R_{i,1997} - \ln R_{i,1967} = \alpha + \beta \# \text{ obstacles at x km from village i} + e_i, \tag{4.6}$$

and report the coefficient *beta* for different thresholds x in figure 8. This regression is intended to show the existence of a correlation between the location of the obstacles and one of the outcomes of interest, and it should not be interpreted as describing a relation of causality in either direction. The figure suggests that there is a positive and significant correlation between population pre-trends and the subsequent introduction of obstacles in the proximity of the village. The correlation is still positive and significant even when considering a 10-kilometer threshold.[4] The figure suggests the possibility of a bias in the estimation of the coefficient β in specification 4.3 towards zero, at least for the population.

The next section will describe the proposed solution to address the challenges to the identification described above.

4.3 IV Strategy

As claimed, the IDF placed more mobility restrictions near areas of military and strategic importance for Israel. The next step exploits the proximity to areas of strategic importance for Israel bearing the following characteristics: (i) they pre-existed the policy of mobility restrictions devised during the Second Intifada; (ii) they were placed in a quasi-exogenous fashion; (iii) they did not affect the Palestinian villages in different ways before and during the Second Intifada. I propose an instrument based on the proximity to the Israeli settlements built in the West Bank according to the Drobles Plan (1978-1982). In this section, I claim that the concerns generally raised by the proximity to Israeli settlements are attenuated, if not completely eliminated, within this specific subset of settlements.

4. 10km correspond to 6.2 miles and it corresponds to one fifth the shortest side of the West Bank.

In the West Bank, there are about 212 Israeli settlements and 134 smaller outposts.[5] Approximately 400,000 Israeli settlers live in the West Bank (excluding East Jerusalem). At the onset of the Second Intifada, the need to protect settlers in the West Bank increased, and as a matter of fact, we do observe a clustering of mobility restrictions near settlements.

However, the historical and legal circumstances around the establishment of the settlements built under the Drobles Plan make their position quasi-exogenous. In 1967, the Six-Day War concluded, with Israel gaining control over the West Bank. In 1968, Israel issued Order 291, entitled "Concerning the Settlement of Disputes over Titles in Land and the Regulation of Water," by which it suspended the proceedings, started under Jordanian rule, to allow Palestinians to claim their land. At that time, two-thirds of all the West Bank had not finalized the settlement of land claims; in some areas the process had started only months before the breakout of the war. In 1976, nine years later, claims still remained unprocessed.

That year, the Israeli government changed the interpretation of the law defining "state land." It shifted the burden to prove the ownership of the land to land claimants rather than the state. State land was redefined residually as *"all land [...], except what the [Arab] villages can prove is theirs under the narrowest interpretation of the law."*[6] As a result, part of the land Arabs had not had the time to claim before the war erupted was declared state land.

At the same time, Matitiyahu Drobles, head of the World Zionist Organization's Settlement Division, devised a new plan for the establishment of settlements in the West Bank, and identified 45 areas available to establish new Israeli settlements, *"built only on State-owned land, and not on Arab-owned land which is duly registered."*[7]

The locations of settlements proposed by the Drobles plan were based on the new inter-

5. An outpost is an Israeli settlement built without the authorization of the Israeli government.

6. See Benvenisti [1984], High Court of Justice Case 390/79, and Drobles [1978].

7. Drobles [1978]

pretation of the law allowing areas left unclaimed to be declared state land. This fact makes their location quasi-exogenous. The distribution of the Drobles settlements is detailed in the map in figure 4. The appendix provides the list of those settlements.

In figure 5 is represented the areas planned to be requisitioned by Israel as "state land".[8] This area constitutes 24% of the West Bank, excluding the Jordan Valley (from Benvenisti [1984]). This map allows to test a part of the identification restriction surrounding the location of the Drobles settlements. I find that 63% of the state land had pre-existing settlements, and 24% of the state land has Palestinian buildup (as of 2005). Pre-existing Israeli settlements and Palestinian buildup then account for 87% of the state land in the West Bank. The Drobles settlements occupied half of this remaining area. Moreover, 97% of the Drobles settlements is located on "state land". This suggests the following: first, the Drobles settlements were indeed placed on state-owned land, following Matitiyahu Drobles' stated intent; second, the Drobles settlements covered almost the entire area available, leaving little space to arbitrariness or other goals.

The next section provides direct evidence of the lack of correlation between the proximity to Drobles settlements and population growth rates before the introduction of the mobility restrictions. Nevertheless, to further strengthen the identification strategy, and ensure that the settlements do not have a direct effect on local Palestinian outcomes, the empirical specification controls for the number of Drobles settlements near each Palestinian village.

Given the lack of pre-existing correlation between Drobles settlements and population growth rates, my identification is valid if the proximity of Drobles settlements to a road servicing a Palestinian village affected the village only via mobility restrictions. The proposed identification strategy would fail, for instance, if commuters on the way to work were more likely to engage in confrontations with settlers and thus engage in violence, which might, in

8. I am not aware of the existence of data on the plots of land actually requisitioned by Israel and the extent to which these differ from the land identified as suitable. For the purpose of this research, I consider the area planned to be requisitioned as a reasonable proxy for the actual "state land".

turn, have effects on our outcomes of interest.

I create an instrumental variable summarizing the exposure of the roads serving a Palestinian village to the Drobles settlements. Everything else constant, the IDF is more likely to set up an obstacle near Drobles settlements (empirical evidence of this statement will be provided in the next sections). Therefore, the increase in travel time between 1997 and 2007 due to mobility restrictions is correlated with the fraction of travel time in 1997 spent in the proximity of a Drobles settlement. For instance, if in 1997 the shortest route between Bethlehem and Hebron was close to a Drobles settlement, then Bethlehem was more likely to experience a loss in market access due to the mobility restrictions.

The following instrument is created using the same aggregation functions as the indexes of market access:

$$WIV_i = \sum_{i \neq j} \frac{job_{j,1997}}{1 + F_{ij}(x)} \qquad FIV_i = \sum_{i \neq j} \frac{pop_{j,1997}}{1 + F_{ij}(x)}, \tag{4.7}$$

where $F_{ij}(x)$ is the fraction of travel time in 1997 between locations i and j spent on roads within x kilometers from a Drobles settlement. The index captures the fraction of travel time towards each destination spent near a Drobles settlement, weighted by the size of the destination.

To clarify the method of index computation, consider the example mentioned previously: the route between Bethlehem and Hebron. In figure 7, the 0.5 km buffer from the outer boundaries of the Drobles settlements is represented in a shade of red. The figure also reports the shortest route between Bethlehem and Hebron based on the 1997 road network. This route is the same route used in the two indexes of market access for 1997. As shown in the figure, the 0.5 km buffer intersects this route. To compute $F_{ij}(0.5)$, the fraction of road segments that intersect the 0.5 km buffer is identified. Then, $F_{ij}(0.5)$ is computed as the ratio of the sum of minutes traveled on road segments that intersect the 0.5 km buffer over total minutes traveled. Using the same approach, the other indexes are computed, with

$x = \{0.5 \text{ km}, 1 \text{ km}, 5 \text{ km}\}$.

The change in market access, $\Delta \ln WMA$ and $\Delta \ln FMA$, is instrumented respectively by WIV and FIV:

$$\Delta \ln WMA_i = \alpha_w + \beta_{1,w} WIV_{0.5,i} + \beta_{2,w} WIV_{1,i} + \beta_{3,w} WIV_{5,i} + e_{w,i}, \tag{4.8}$$

$$\Delta \ln FMA_i = \alpha_f + \beta_{1,f} FIV_{0.5,i} + \beta_{2,f} FIV_{1,i} + \beta_{3,f} FIV_{5,i} + e_{f,i}. \tag{4.9}$$

Different thresholds allow for a flexible structure of dependence between the index and the proposed instruments.

By construction, the indices take on values in the following range,

$$WIV_i \in \Big[\frac{1}{2} \sum_{i \neq j} job_{j,1997} \ , \ \sum_{i \neq j} job_{j,1997}\Big]. \tag{4.10}$$

The lower bound represents the case in which all the routes between i and all other destinations are entirely in the proximity of a Drobles settlement. The upper bound represents the case in which all the routes between i and all other destinations are outside of the buffer of any Drobles settlement.

The fraction of travel time near Drobles settlements, $F_{ij}(x)$, is expected to be positively correlated with the increase in travel time due to mobility restrictions, $\Delta t_{ij} \equiv \ln t_{ij2007} - \ln t_{ij1997}$: if the road between i and j is close to a Drobles settlement, there is a higher probability that the IDF introduced obstacles to that road. Consequently, there is a higher probability that the Palestinian commuters from i to j experienced an increase in travel time.

This strategy shares similarities with Banerjee et al. [2012], who study the access to transportation infrastructure in China. They draw straight lines linking historical cities, and they use the distance from those lines as a proxy for the investment in transport infrastructure. The identification strategy in this paper resembles theirs in that the changes in the transportation network at location i are instrumented by geographic factors affecting the routes accessing that location. In both their research and my own, these factors are based on historical events that originated in the past, and were, in the case of the West Bank, outside the control of the population under study.

This strategy also resembles one used by Abrahams [2018]. Both this paper and theirs rely on the assumption that the mobility restrictions were imposed, in large part, to guarantee the security of Israeli citizens in the West Bank. Proximity to sensitive areas for Israel instruments the presence of mobility restrictions. In this research, the attention is restricted to those settlements whose location was established in a quasi-exogenous fashion as a result of a change in the legal framework for the Israeli acquisition of land. This diminishes concerns of endogeneity originated by the proximity between settlements and Palestinian villages.

CHAPTER 5

DATA

This section provides an overview of the data used in the paper. Table 1 reports the summary statistics for the data described in this section.

Geographic unit. The primary geographic unit is the locality, or village. The Palestinian Central Bureau of Statistics (PCBS) defined the locality as *"a permanently inhabited place, which has an independent municipal administration or a permanently inhabited, separated place, not included within the formal boundaries of another locality."*[1] The West Bank is partitioned in 443 villages as of 2007.[2] Although villages have independent administrations, this geographic unit is rather narrow: the average village has an area of 0.75 km^2.[3] They are also close to each other. The average travel time between the centroid of two contiguous villages is only 6.8 minutes, with a median of 5 minutes, far less than the average time spent commuting to work (1 hour and 10 minutes for people working in establishments).[4]

Population and Establishment Census. My primary source of data is the PCBS Population Census and Establishment Census, waves 1997 and 2007; access has been negotiated by the author during several visits to the West Bank. The first Census wave occurred before the Second Intifada (2000-2005), the second wave occurred after the Second Intifada. The two Census datasets contain data on population, employment, establishments, and number of buildings for each village. This analysis exploits both the number of people in the

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1. PCBS Population Housing and Establishment Census 2007.

2. The initial number of villages in 2007 was 557. Between 1997 and 2007, the PCBS changed the definitions. I use 2007 as baseline. I drop or merge villages whenever necessary. The correspondence between years was provided by the PCBS. The number reported in the body of the text refers to the villages for which it was possible to have data for both Population Census years.

3. Equivalent to 0.3 mi^2. For reference, Hyde Park, the neighborhood where the University of Chicago is located, is 4.7 km^2 or 1.8 mi^2, Central Park in New York City is 3.4 km^2 or 1.3 mi^2.

4. The data includes 19 refugee camps. In the West Bank, according to UNWRA, there are currently about 800,000 registered refugees, a quarter of whom live in refugee camps. The fraction of people living in refugee camps in 2007, according to the PCBS, considered in this paper's sample, is 6%. See Alix-Garcia et al. [2018] for a analysis of the effects of living in a refugee camp in Kenya.

workforce based on the place of residence, R_i, and the number of people employed based on the place of work, L_i, often referred as the number of jobs in this research. Also, from this point of view, it is clear that the geographic unit is small: the median village in 2007 has a population of 1,996 people. The labor force is even smaller: only 456 people work in the median village.

The Population Census for 2007 also provides information on who works in the same village and who works outside of the village, and therefore commutes to their workplace. In 2007, only 32% of the people employed worked in the same village (including those who work in the house). The remaining 68% worked outside of the village, virtually half of which (36.35%) worked in the same district.

The data used from the Establishment Census includes jobs in non-farm private establishments, disaggregated by economic sector (ISIC4) and village. The analysis is restricted to establishments in operation at the moment of the data collection, with national or foreign ownership. Activities not classified as establishments or jobs in the public sector are not included in the job count.[5] Clusters of villages and economic sectors for which there were no jobs in either year were removed. Overall, the sample includes 396 villages. On average, clusters experienced a yearly increase of 4.4% over the ten-year period considered. However, this figure hides a large degree of heterogeneity. The bottom lower decile experienced a loss of 5.6% annually, while the upper decile experienced an increase of 13.4%.

Mobility restrictions. The data on the mobility restrictions, on the Separation Wall, and on the location of settlements and military areas comes from two different sources: the United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA) and the Applied Research Institute Jerusalem (ARIJ). Data is available for the year 1995, and

5. The data excludes clusters (economic sector * village) where the number of establishments was one or two. Moreover, between the two time periods, the ISIC classification changed. Some sectors have been merged, others have been disjoined. Economic sectors are reclassified based on the 2007 definition (ISICRev4). Whenever a sector is disjoined in 2007, I use a proportionality rule to assign the jobs in 1997 to the different ISICRev4 codes.

between 2000 and 2017 at a yearly frequency with gaps. The two data sources overlap for some years after 2003, and this allows us to verify the two methods are comparable. UNOCHA also kindly provided geo-referenced data on the road network. Each road segment is classified as regional, primary, secondary, tertiary, residential, or track. UNOCHA also collects data on the road regime, and it classifies roads as either restricted for Israeli cars or unrestricted.

Travel times. Travel times are computed using the shortest route between the centroid of two locations using ArcGIS. Table 2 summarizes the assumptions on the travel times and delays at each obstacle. Vehicles cannot pass through roadblocks, earthmounds, barrier gates, and across the Separation Wall. In absence of information on road gates, they are assumed to be open.

For the checkpoints, there are three independent sources. First, Eklund and Martensson [2012] conduct an extensive survey in 2009 in which they ask questions on the shortest delays at a checkpoint (ranging from 0 to 90 minutes, with responses concentrated between 0 and 30 minutes) and longest delays (between 0 and 1080 minutes, with responses concentrated between 0 and 360 minutes). They find an average shortest delay of 15 minutes. Van Der Weide et al. [2018] provide a similar average delay using information from the UN. The PCBS also conducted a survey on the topic in 2006 and found that the average shortest delay was 12 minutes and 35 seconds. In this paper, it is assumed that crossing a checkpoint entails a delay of 15 minutes.

The distribution of the resulting travel times is reported in figure 2.[6] In figure 3, the travel distances according to my calculations are compared to the travel distances reported by the PCBS connectivity survey in 2006 for selected pairs of origins and destinations.

Between 1997 and 2007, the road network is held constant. This is consistent with the

6. The bimodal distribution comes from the geographical structure of the West Bank. For more information, refer to the figure of travel times between each Palestinian village and the city of Hebron in the appendix.

evaluations from IEG [2010] that argue there has been little progress between 2000 and 2009 on the development of the Palestinian road network.

Additional data. Finally, additional information on villages comes from the Applied Research Institute Jerusalem (ARIJ) and from the 1997 Locality Survey conducted by the PCBS. The measure of political violence comes from the Global Terrorist Database (GTD).[7] The data on demolition orders is provided by UNOCHA.

The data on population in 1967 is supplied by Perlmann [2011]. The 1967 population census is the last census conducted before 1997 to the author's best knowledge.[8] This census was conducted by the Israeli Central Bureau of Statistics (ICBS) following the end of the 1967 Six-Day War.[9] Combining the data from the PCBS and from the ICBS by matching the names of the localities, it was possible to identify a total of 304 villages.[10]

7. See LaFree and Dugan [2007].

8. Until 1997, the Israeli Central Bureau of Statistics provided periodic assessments of the Palestinian population in the West Bank and Gaza strip until the establishment of the Palestinian Authority, but these were all based on administrative records and the Population Census of 1967.

9. Previous to the 1967 Census, Jordan conducted another census of the population of the West Bank in 1961. Based on the comparison between these two sources, the population in the West Bank decreased from 730,000 people to 599,000 within the time span of five years.

10. The author acknowledges the possibility of discrepancies in the definition of the geographic unit, but unfortunately, it was not possible to fully reconcile these. The ICBS defined a locality as a *"permanently inhabited place, which is situated outside the boundaries of another locality and in which at least 50 persons were enumerated. [...] Places inhabited by less than 50 persons at the time of the census were included in an adjacent locality or were grouped in the category of living outside settlements."*

CHAPTER 6

RESULTS

6.1 Pre-Trends

This section deals with the analysis of pre-trends in the data.

As discussed in the previous sections, the presence of settlements impacted the life of Palestinians in a number of different ways. Figure 9 provides initial empirical evidence of this fact. Using Arcpy, I create a measure of the number of settlements near a village. I use different cutoffs, from 0.5km to 10km, and computed the number of settlements included in that buffer. For each cutoff, I run a regression of the growth rate in population between 1967 and 1997 on the number of settlements near the village. I include all the settlements, and then restrict the analysis to the Drobles settlements only.

In 9, panel (a) reports the results for all the settlements. One additional settlement within a kilometer from the build-up areas of a village is associated with a 10.8% additional growth rate in population. One additional settlement within 2 kilometers from the build-up area of a village is associated with 8.8% higher population growth. At 5 kilometers, the correlation is 4.6%. The correlation decays in space, but using a 10-kilometer cutoff, the point estimate is small (1%), but still significant.

This exercise does not imply a causality relationship between the two variables. However, there clearly is a statistical relationship between the two, and, if unaccounted for, would introduce bias to the estimation. The sign of the relationship is positive. The effect is consistent with the fact that both Palestinian villages closer to the 1949 Armistice line have better access to the Israeli labor market, where settlements are more concentrated. However, controlling for the road distance from the 1949 Armistice line and for the fraction of people who were employed in settlements and in Israel in 1997 does not alter the results represented in the figure.

In 9, panel (b) reports the results when restricting the attention to Drobles settlements only. Contrary to the previous case, there is not a clear pattern in the effect of Drobles settlements on the pre-trends. The coefficient at the cutoffs, 4.5 km and 5km, are significant, respectively, at 5% and 10%, but we do not observe a clear pattern, such as when we include all the obstacles. Moreover, when accounting for the distance from the 1949 Armistice line, this effect vanishes. We cannot entirely exclude that there is no correlation between population pre-trends and the presence of Drobles settlements, but if there is, the concern is much smaller than in the case of the entire group of settlements.

Moreover, it is worth re-emphasizing that the identification strategy does not rely on there not being a direct effect due to the proximity to Drobles settlements. On the contrary, it relies on the assumption that the exposure to Drobles settlements on the routes servicing a Palestinian village, conditional on the number of Drobles settlements in the neighborhood of that village, does not have a direct effect on the outcomes of interest. Therefore, it is worth studying directly the variable that will be used in the IV approach.

Table 4 reports a reduced-form of the instrumental variables based on the exposure to Drobles settlements of the roads that lead to a village. Based on the F-test, we can accept the hypothesis that all the coefficients on the IVs are zero.

A possible concern is that the IDF specifically targeted villages that were growing at a faster pace. Table 5 compares the average yearly growth rate in the period before the introduction of obstacles (1967-1997) to the period after (1997-2007). The two equations are estimated jointly using a seemingly unrelated regression. Using a SUR allows to control for possible correlation between the errors of the same village across the two time periods. For the sake of comparison, the sample is restricted to the villages for which there is data available in 1967. The coefficient on the 1967-1997 period is small (0.04) and not statistically significant, whereas the coefficient for 1997-2007 is larger (0.05) and statistically significant at 5%. However, we reject the null hypothesis that the coefficients between the two periods are equal. Later, in the section 6.4, OLS and IV results are reported when explicitly controlling for the population growth rate between 1967 and 1997.

Some caveats qualify the conclusions reached so far. First, the data spans 30 years. During this period, the West Bank underwent countless changes. We cannot exclude the possibility that the 1967-1997 period is not a good approximation for understanding the underlying trends had there not been the introduction of mobility restrictions. Second, the census was conducted by the Israeli Central Bureau of Statistics. It is possible that the methodology across the two waves might have changes, and there is little information on the old census wave. The difference in the sample size suggests, at the very least, that the geographic unit might have been different. Third, we are able to verify the presence of pre-trends in population, but we do not have access to data on establishments and jobs. Nevertheless, the analysis on the pre-trends provides support to the identification strategy suggested.

6.2 OLS

Results for the OLS are reported in tables 6 and 7. Results for other variables are available in the appendix.

From column (1) in table 6, a 1% decrease in worker market access is associated with a 0.15% drop in the 25-54-year-old population between 1997 and 2007, with a 0.13% drop in labor force. On average, villages lost 37% of their worker market access. The average village lost 5.4% of their population and 4.8% of their labor force due to the mobility restrictions imposed.

In column (2), panels (a) and (b) of table 6, the same regression is presented controlling additionally for the number of terrorist attacks before the Second Intifada. A possible concern for endogeneity is the relation between mobility restrictions and conflict during the Second Intifada. It is *ex ante* unclear what is the direction of the causation. The IDF introduced more checks in more unstable areas and during more unstable phases, thus allowing for a deeper control over the territory. But it is possible that more restrictions may have led to increased conflict. Miaari et al. [2014] make this point with regard to the cut in employment permits granted to Palestinians during the Second Intifada, preventing them from accessing the Israeli labor market.

As a matter of fact, we do observe a correlation over time between the number of obstacles and the heightened tension during the Second Intifada as measured by the number of conflict-related fatalities. I address this issue by controlling for the number of terrorist attacks by location before the Second Intifada. Exploiting the high persistence in space of the areas subject to the terrorist attacks,[1] the number of terrorist attacks in each location before 2000 is used as a proxy for the likelihood of terrorist attacks during the Second Intifada in the absence of mobility restrictions. The results are robust to this additional control.

In column (3), the number of demolition orders between 1997 and 2007 is introduced as a control. It is possible that, besides introducing mobility restrictions, the IDF may have had to seize the land and demolish buildings near the obstacles themselves. Demolitions may also have been used as an alternative method of punishment (Gordon [2008]). Finally, demolitions may be correlated with the expansion of settlements nearby. In this case as well, results are robust.

In column (4), the share of people employed in Israel and in settlements in 1997 is introduced. Villages closer to the 1949 Armistice line have better access to the Israeli labor market because of proximity. Although controlling for location fixed effects, the geographic proximity to the Israeli labor market might still has differential effects on the population and economic growth of Palestinian villages. Until the end of the First Intifada, the Israeli economy heavily relied on Palestinian labor (Angrist [1996]).[2] However, over time, the Israeli

1. See for instance Blair et al. [2017] in the case of Liberia.

2. See also Farsakh [2005] for an overview of Palestinian labor in Israel.

economy relied less and less on Palestinians, thanks to the availability of cheap labor due to large immigration inflows.[3] During the Second Intifada, Israel heavily curtailed the number of work permits reserved for Palestinians. However, *ex ante*, the direction of the bias is unclear. On one hand, the reduction of work permits hurt villages closer to the 1949 Armistice line more than villages farther apart. On the other hand, although greatly restricted, the access to the Israeli labor market might still guarantee an advantage to Palestinian villages closer to the border. In practice, the results in table 6 suggest that this factor does not alter the quantitative results on the coefficient of interest.

In column (5), the initial population level is introduced. Since one of the goals of the mobility restrictions was to control the Palestinian traffic flow, and to allow the IDF an opportunity to engage the Palestinian population, it is possible that more mobility restrictions may have been introduced closer to the denser urban clusters. If the population growth rate was correlated with its initial level (either converging or diverging), then the regression would be biased. However, the introduction of this control does not modify the results. The stability of the coefficient across the columns suggest that issues of endogeneity caused respectively by the presence of terrorist attacks, demolition orders during the period considered, changes in the Israeli labor market access, and initial population level dependent pre-trends are minor.

While the introduction of mobility restrictions during the Second Intifada is associated with a drop in prime working age population and labor force, the effect is opposite for jobs. Table 7 reports the same regressions as table 6 for the growth rate in jobs. A 1% decrease in firm market access is associated with a 0.14% increase in jobs. The effect is particularly large in the wholesale trade and retail trade sectors, for which a 1% decrease in firm market access is associated with a 0.32% increase in jobs. The average firm lost 37% of their market access. Therefore, the average village gained 5.25% of jobs due to the mobility restrictions,

3. See Cohen et al. [2001] for more on the role of the Russian immigration in Israel during the early 90s.

and 11.84% of jobs in retail trade and wholesale trade. Also, in the case of changes in jobs, results are robust to the introduction of controls.

All the regressions on jobs include fixed effects for the economic sectors. The Second Intifada introduced distortions in the accessibility of imported material inputs (Amodio and Di Maio, 2017). Therefore, sectors that rely more on material inputs might have been more affected than others. Similarly, the changes in access to the Israeli labor market might have freed labor, thus benefiting more labor-intensive sectors relative to less labor-intensive ones. Controlling for sector-specific fixed effects allows us to account for the industrial composition of a village when estimating the effect of changes in firm market access.

6.3 IV

In Figure 10, panel (a) reports the coefficients from a regression of the increase in travel time between 1997 and 2007 on the fractions $F_{ij}(x)$. We would expect a larger exposure to Drobles settlements to be positively correlated with the increase in travel time. Panel (a) confirms this hypothesis: a 10-percentage point increase in the exposure to Drobles settlements at 0.5 kilometers is associated with an increase in travel time of 0.61%. The effect decays with the increase of distance, and at 10 kilometers is no longer significant.

Figure 10 panel (b) reports the coefficients for worker market access from the first stage detailed in equation 4.8. The number of Drobles settlements at 5 kilometers from the village is included in the regression but not reported. In the appendix, the same figure is reported for the index of firm market access. An F-test suggests that instrumental variables are able to explain the changes in market access.

The sign of the relationship is the same as in panel (a), with the only exception of $WIV_{0.5,i}$.[4] Conditional on the instruments for the fraction of roads traveled within 0.5 km from Drobles settlements, the indexes $WIV_{1,i}$ and $WIV_{5,i}$ are positively correlated with

4. Controlling for $\sum_{j \neq i} job_{j,1997}$ does not alter the results on the sign of the IV coefficients.

the change in worker market access. The instruments are standardized. So, one standard deviation increase in $WIV_{1,i}$ is associated with a 0.11% increase in market access.

Table 8 reports the results for the second stage for residents (panel a) and jobs (panel b). Consistent with the previous belief that there was a bias towards zero in the OLS estimates, coefficients are larger in absolute value. In panel (a), the point estimate on the effect of a 1% decrease in worker market access on changes to the population growth rate goes from 0.14% for the OLS to 0.31% in the IV specification. Similarly, a 1% decrease in market access leads to a 0.36% decrease in labor force. In panel (b), the point estimate of the effect of changes in firm market access goes from -0.14% in the OLS estimates to -0.74% in the IV specification. In the appendix, the effect on the number of people employed estimated via the instrumental variable is significant, but smaller than the effect found on the labor force. However, a t-test cannot reject the hypothesis that the two coefficients are the same. Introducing controls does not alter the results.[5]

6.4 Summary of Robustness Checks

In this section, the outcome of a number of robustness checks is reported. The results are presented in the appendix to this paper. Here, the main findings are summarized.

The number of settlements around the village does not drive the results. A major concern is the extent to which the results I show can be attributed to the effect of the Israeli settlements around the village, rather than the obstacles leading to it. This concern is particularly relevant given the strong positive spatial correlation between the location of settlements and the presence of obstacles. Nevertheless, controlling for the number of settlements surrounding the village at different distance thresholds does not affect the results

5. The Hansen's J test easily fails to reject the over-identification restrictions in all specifications (not reported). However encouraging, these results should be taken with a grain of salt. The three instruments are based on the same identification assumption, and it is possible that the test might more easily accept the null if the bias introduced by the instruments point in the same direction.

reported in the main tables.

Smaller villages are affected more than larger villages. As predicted by the model, the strength of the direct effect of a loss in market access (an increase in κ) is inversely proportional to the size of the village, R_j and L_j. To explore whether the empirical findings are consistent with this prediction from the model, the sample of villages is partitioned into villages with populations above the median in 1997 and villages with population below the median. Consistently with the theory, the point estimate for the group of small villages (0.251) is larger than the estimate for the group of large villages (0.063). A formal test strongly rejects the hypothesis that the two coefficients are the same. Redding and Sturm [2008] find a similar heterogeneity when studying the division of Germany. My paper suggests that this empirical fact holds not only between commuting zones, but also within commuting zones.

Controlling for pre-trends does not alter the results. The population growth rate between 1967 and 1997 is introduced as a control. This set of regressions is not part of the baseline because of the need to restrict the sample to the villages for which there is data in 1967. It is useful to verify that, once the pre-trends are taken into account, results do not change. In the appendix, a logit of a dummy for the availability of the 1967 data is run on the growth rate of market access between 1997 and 2007, and is also run on a dummy for large villages. Villages larger than the median in 1997 are 10 times more likely to be included in the 1967 census than the villages smaller than the median.

Once accounting for this source of sample selection, the odds ratio on the change in market access is not significant. I also restrict the sample to the data available in 1967 and report the regression estimates controlling for the pre-trends. Point estimates for population and labor force are smaller but still significant, consistent with the finding that smaller villages were included in 1967 census. Results for jobs are unaffected.

The difference in the sample between residents and jobs in the sample does

not drive the results. It is possible that the different point estimates on resident outcomes and job outcomes are due to the sample selection. To account for this, a dummy equal to 1 is used if the data for establishments is available in the sample. The appendix reports a logit of this variable on the two measures of market access. No statistically significant effect is found. Moreover, when running the same regressions as the baseline of the restricted sample, the point estimates for the population growth rate are positive but smaller. This difference in point estimates in the two samples is explained by the heterogeneity of the effect illustrated earlier in this section. As a matter of fact, villages where no jobs are available are also smaller than average. The coefficient on labor force does not change relative to the baseline.

The choice of the weights does not alter the results. The appendix includes regressions using different weights. In the baseline regressions, no weights are used. When observations are weighted by population in 1997, larger villages have more weights, therefore the point estimates for population and labor force are smaller, confirming the heterogeneity of the effect. I also repeat the regressions in tables 7 and 8 for the number of jobs, weighting the observations for the number of sectors in each village.

As a matter of fact, in the baseline regressions, a village with many economic sectors has a higher weight in the estimation of the coefficients than a village with fewer economic sectors. When weighting for the inverse of the number of sectors in each village, I find that the results are not affected by this choice of weights. Finally, I run regressions using a weight directly proportional to the population in 1997 and inversely proportional to the number of sectors in each location. Results are not significant for the OLS; instead, in the case of the IV, the point estimates are significant, and their magnitude is close to the baseline case.

Exploring nonlinearities in the relationship between instruments and indexes of market access. We cannot exclude that the relationship between the instruments and the indexes of market access is nonlinear. As a matter of fact, the function used to aggregate the fraction of travel time spent near sensitive areas might introduce nonlinearities. The coefficients on the second stage remain stable. The only exception is the coefficient on jobs, equal to -0.529, more than a third smaller than the baseline estimates.

The index of market access includes all villages. For computational simplicity, in the baseline regressions, the index of market access and the instrumental variables are computed only for the district capitals as destinations. In the appendix, results are replicated using an index of market access computed on all the villages.[6] The results are not affected in important ways by this modification.

Different assumptions on the impedance function. Results rely on a specific functional form for the impedance function, i.e., for the way in which commute time is translated into commuting cost. The literature has explored alternative impedance functions. Ideally results are not sensitive to the choice of the functional form. In the appendix, results are reported for the following alternative impedance functions:

$$\begin{aligned} \text{Inverse power: } & \sum_{j \neq i} W_j t_{ij}^{-\alpha}, \\ \text{Exponential: } & \sum_{j \neq i} W_j e^{-\beta t_{ij}}, \\ \text{Gaussian: } & \sum_{j \neq i} W_j e^{-t_{ij}^2/\nu^2}, \end{aligned}$$

where an inverse power function with $\alpha = 1$ corresponds to the index of market access in the baseline regressions. Different values for the parameters α, β, ν are explored. The appendix reports the coefficients of OLS, first stage, and second stage regressions for all the different impedance functions. As for the baseline regressions, each W_j is, respectively, $pop_{j,1997}$ in the case of the firm market access, and $job_{j,1997}$ in the case of the worker market access. The same impedance functions are also used to aggregate the fraction of travel time near

6. The instruments are the same as the baseline regressions.

sensitive areas:

$$\text{Inverse power: } IV_i = \sum_{j \neq i} W_j [1 + F_{ij}(x)]^{-\alpha},$$

$$\text{Exponential: } IV_i = \sum_{j \neq i} W_j e^{-\beta[1+F_{ij}(x)]},$$

$$\text{Gaussian: } IV_i = \sum_{j \neq i} W_j e^{-[1+F_{ij}(x)]^2/\nu^2}.$$

In spite of the fact that the coefficients of the first stage change in important ways across the different functional forms assumed, the results in the second stage, once normalizing for the standard deviation of the regressor, are remarkably stable.

Permutation test. In the appendix, I report the coefficients from a series of OLS regressions in which I randomly assign the observed changes in market access to the villages. For each dependent variable, I compute 10,000 possible permutations of the pair (Δ ln dependent variable, Δ ln market access). The effect found in the baseline regressions is significantly larger than the distribution of placebo effects estimated with this approach.

6.5 More results, interpretation and discussion

The results presented in the previous sections describe the redistributive effect of commuting costs. A decrease in market access in a village, *relative to the market access of other villages,* led to a decrease in the fraction of West Bank residents living in the village and an increase in the fraction of West Bank jobs located in the village.

In order to show how the model introduced in section 3 might be able to generate such results, consider the following parametrization. The economy is organized on a line, and it takes 30 minutes to commute from one extreme to the other. A total of 100 villages is distributed evenly along the line. For simplicity's sake, I am allowing for labor to be the only input in a production function with constant returns to scale. From this assumption, in equilibrium, it follows that the local wages are equal to the productivity in each location. Locations have the same level of amenities but the center of the segment, which we will call the central business district, is more productive than the periphery. Figure 11, left panel, illustrates the distribution of productivity in the economy.[7]

The properties of the Fréchet distribution over the workplace-residence locations imply that for any combination of workplace-residence there is always a positive commuting flow unless either the residential amenities or the workplace productivity are zero. However, the particular assumption introduced on the spatial dispersion of the productivity implies that, in equilibrium, there is a larger fraction of workers willing to commute from the periphery towards the center, relative to the fraction of workers commuting in the opposite direction. As a result, the central business district is a net importer of workers, whereas the outskirts are net exporters (figure 11, right panel).

An obstacle is places on the segment, resulting in a 30-minute delay when commuting from villages to the right of the obstacle to villages to the left of the obstacle, and vice versa. For commuters who do not have to cross the obstacle, there is no change in travel time.[8] Figure 12 reports the initial equilibrium and the new one for some of the endogenous variables.

An increase in commuting costs unambiguously leads to a decrease in commuting flows. For workers who desire to reduce their commute there are two alternative choices: they can either relocate and move closer to their workplace location, or they can switch job and start working locally. In the numerical example, some of the workers residing on the left part of the line do indeed move away, and the share of residents in the periphery decreases (figure 12, panel a). On the other hand, some workers prefer to remain in their residence location, and

7. In this exercise, ϵ is set to 3 and the commuting costs are equal to the travel time between each pair of locations. There is the same fixed amount of housing in each location, normalized to 1. The consumption share is equal to 0.6.

8. In the numerical example, the obstacle is placed between villages 20 and 21.

stop commuting: the fraction of people who commute for work decreases, and the fraction of people who do not commute increases in the locations to the right of the obstacle (figure 12, panel b).

If enough people to the right of the obstacle start working locally, the number of jobs in the outskirts increases at the expenses of the central business district. This is what happens in the simulated economy, as figure 12, panel c, suggests.

Going back to the empirical evidence from the West Bank, the jobs created in the most affected villages, at the expenses of the other locations in the West Bank, are mainly in the retail and wholesale trade sector. These are mostly establishments with no employees other than the entrepreneurs themselves. As a matter of fact, firm size does not significantly changes with the mobility barriers. Interestingly, unemployment and participation rates are not significantly affected by the changes in market access.[9] Hence, in response to the increase in obstacles, a large fraction of people preferred to remain in their house, either by choice or by need. Rather than being unemployed or drop out of the labor force, they would often open their own grocery store or convenience store to earn a living.

Notice that the analysis does not imply that the introduction of mobility barriers has a positive effect on the total number of jobs in the West Bank, as my results only pertain to the *redistribution* of the jobs within the West Bank, rather than having any implication on job creation/destruction.

9. These results are available in the appendix and are not shown here.

CHAPTER 7

STRUCTURAL ESTIMATION

In this section, the model described in section 3 is estimated.

The share of consumption expenditure, β, is set to 0.6, the value for the West Bank in 2014, estimated by the Office of Quartet Representative in a study co-financed by the World Bank. This value is also consistent with estimates from Davis and Ortalo-Magné [2011] for the US. Because there is consensus in the literature, the share of firm expenditure on commercial floor space is set to 0.20. Commuting costs are parametrized as $\kappa_{ij} = t_{ij}$ where t_{ij} is the travel time between the locations i and j, measured in minutes, as in Allen et al. [2015]. κ_{ii} is normalized to 1.

The share of floor space is estimated as the fraction of the buildings declared as being used for commercial purposes.[1] Similarly, the amount of floor space for each location is estimated as the total number of buildings available either for commercial or for residential use. Building data is from the Population Census 1997.

7.1 Model Inversion

Proposition 3. *Given observed data on jobs, residents, and commuting time* $\{L_i, R_i, \tau_{ij}\}$, *and given a value for the Fréchet parameter,* ϵ, *there exists a unique vector of wages* $\{w_i\}$ *which rationalizes the observed data as equilibrium in the model, up to a scale parameter.*

Wages can be computed inverting the following equation:

$$L_j = \sum_i \frac{\omega_j / \tau_{ij}^{\epsilon}}{\sum_s \omega_s / \tau_{is}^{\epsilon}} R_i. \tag{7.1}$$

1. Unused buildings are disregarded. If a household declared the building to have mixed use, the assumption that 50% of the building is used for commercial purposes is introduced.

This equation defines transformed wages, $\omega = w^{\epsilon}$, as a function of the entire distribution of observed employment and residents and of the matrix of commuting costs. The appendix shows that the vector solving equation 7.1 is unique, and it explains the procedure to compute it.

Proposition 4. *Given observed data on employment, wages, share of floor space for commercial use, and the total floor space, $\{L_i, w_i, \theta_i, H_i\}$, and given the parameters for the share of floor space used by firms, α, there exists a unique vector of composite productivities $\{A_i\}$ which rationalizes the observed data as equilibrium in the model, up to a scale parameter.*

To recover productivities, I exploit the optimality conditions of the firm with respect to labor, equation 3.10:

$$\ln A_i \propto \ln w_i - (1-\alpha)(\ln \theta_i + \ln H_i - \ln L_i). \tag{7.2}$$

The resulting solution for productivities captures unobserved factors, such as natural resources, that make a location more attractive from the point of view of a firm.

I follow a similar approach for the estimation of amenities.

Proposition 5. *Given observed data on residents, average residential income, share of floor space for commercial use, and the total floor space, $\{R_i, \bar{v}_i, \theta_i, H_i\}$, and given values for the parameters for the share of floor space used by residents and by firms, $\{\beta, \alpha\}$, on the commuting costs, $\{\kappa_{ij}\}$, for the Fréchet scale parameter, ϵ, and given an estimate for wages, $\{w_j\}$, there exists a unique vector of composite amenities, $\{B_i\}$, which rationalizes the observed data as equilibrium in the model up to a scale parameter.*

It is possible to derive earnings from the estimates of wages using equilibrium condition 3.8. The relation between observed data and unobservable amenities can be recovered from the equation of the share of population taking residence in location i (equation 3.6), and the demand for housing

$$\ln B_i \propto \ln R_i + \epsilon(1-\beta)\ln \bar{v}_i \frac{R_i}{(1-\theta_i)H_i} - \ln \sum_j w_j^{\epsilon} \kappa_{ij}^{-\epsilon}. \tag{7.3}$$

Intuitively, higher amenities are associated with a larger fraction of residents, higher house prices, and better access to the labor markets nearby. Contrary to productivities, which can be computed directly from observables and calibrated parameters, amenities require an estimate of the commuting costs, of the Fréchet scale parameter, and of wages for all locations. The next section explains how to estimate these.

7.2 Fréchet Shape Parameter

In equilibrium, it has to be that the variance of the observed wages proportional to the variance of the transformed wages as estimated from Proposition 3, *i.e.* $Var(\log w_i) = (1/\epsilon^2)Var(\log \omega_i)$, where w_i is data from the Labor Force Survey, and $\omega_i = w_i^{\epsilon}$ is computed using equation 7.1:

$$\mathbb{E}\Big[\ln w_i - \mathbb{E}[\ln w_i]\Big]^2 = (1/\epsilon^2)\mathbb{E}\Big[\ln \omega_i - \mathbb{E}[\ln \omega_i]\Big]^2. \tag{7.4}$$

I use data from the Labor Force Survey for the years 2000-2007. I regress the observed daily wages on quarterly fixed effects and individual characteristics, including but not limited to: a second order polynomial in age, a second order polynomial in years of school, education attainment, occupation, industry, and marital status. The remaining variation is residually associated to location characteristics. As in the model, I normalize wages by subtracting the geometric mean. For the right-hand side, a value $\epsilon = 3$ is guessed, and I solved the for transformed wages.

Equation 7.4 is satisfied for $\epsilon = 2.8$, very close to the initial guess. This value is also similar to other in the literature. For instance, Monte et al. [2015] find a parameter value of 3.30.

7.3 Externalities

In the previous section, we find the distribution of productivities and amenities in each year, $\{A_{i,1997}, B_{i,1997}, A_{i,2007}, B_{i,2007}\}_i$ as the residuals that rationalize the job and resident spatial distribution for both years.

We can decompose the changes in productivity and amenities in two parts: an exogenous component and an endogenous component. The latter depends respectively on the number of jobs nearby, for productivities, and the number of residents nearby, for amenities.

$$\Delta \ln A_i = \Delta \ln a_i + \psi_A \Delta \ln \Psi_i^A \tag{7.5}$$

$$\Delta \ln B_i = \Delta \ln b_i + \psi_B \Delta \ln \Psi_i^B \tag{7.6}$$

with $\Psi_{it}^A = \sum_s e^{-\delta_A \tau_{ist}} L_s$ and $\Psi_{it}^B = \sum_s e^{-\delta_B \tau_{ist}} R_s$.

To disentangle between the two, I use the Drobles instrumental variable. The identification relies on the assumption that the exogenous changes in productivity between 1997 and 2007 are independent of the proximity to the Drobles settlements. This assumption is weaker than the assumption from the reduced-form, since in that case, we'd need the entire changes in productivity to be independent of the proximity to the Drobles settlements.

$$E[\Delta \ln a_i \quad FIV_{\text{Drobles } x \text{ km}}] = 0$$

$$E[\Delta \ln b_i \quad WIV_{\text{Drobles } x \text{ km}}] = 0$$

with $x = 0.5, 1, 5$ kilometers.

Table 9 reports the results from the GMM. Coefficients are significant only for productivity. In the case of amenities, point estimates are large but not significantly different from zero. Therefore, I am going to set the endogenous component of amenities to zero. Figure 13 illustrates how fast productivity externalities decrease with travel time. From the figure, externalities halve after a 3-minute commute from the village outer boundary, indicating the presence of very localizes production spillovers, and highlighting the importance of firm clustering for the Palestinian economy.

CHAPTER 8

QUANTIFYING THE AGGREGATE EFFECTS OF MOBILITY RESTRICTIONS

The effects of mobility restrictions on both GDP and workers' welfare is large (table 10): mobility restrictions decreased welfare by 2-4%, depending on whether externalities are taken into account or not. The loss in GDP is estimated to be between 4 and 9%. This can be interpreted as the GDP loss incurred each year relative to the baseline year 1997. Given that the model does not have long-run growth, these numbers can be reinterpreted as deviations from the long-run GDP trend.

Figure 14 describes how the residential and job shares adjusted due to mobility restrictions. The counterfactual is computed using 1997 as initial level and changing the commuting costs to match the year 2007.[1] Panel (a) describes the relation between the initial size of the villages in terms of residential shares and the changes in residents. Consistent with the empirical findings, smaller villages lost population in favor of larger urban centers. On the contrary, in panel (c), smaller villages in terms of initial number of jobs gained jobs relative to the larger villages. However, the right part of the figure tells us another important story: the villages that experienced the largest loss in residents and jobs were also the villages with the higher level of residential amenities and productivities, respectively.

Therefore, mobility restrictions reduced welfare, not just directly, by increasing commuting costs, but also indirectly by redistributing population away from the most amenable areas, and by redistributing jobs away from the most productive areas. The loss in average productivity (weighted by the distribution of employment) due to the changes in job locations is estimated to be 3.8% (without externalities) or 20.4% (with externalities).

The loss in welfare should not be interpreted as a full account of the cost of the Second Intifada or the consequences of the Israeli presence in the West Bank. The goal of this

1. This figure refers to the economy without externalities.

exercise is to quantify a very specific aspect of the Palestinian economy, i.e. the impact of changes in the redistribution of workers and jobs within the West Bank as a consequence of the increase in commuting times due to the mobility restrictions introduced during the Second Intifada. Many other events, relevant to explain the overall changes in the economic conditions of the Palestinian population, occurred during that time period.

In addition, the quantities here presented do not account for changes in welfare due to the possible migration of workers abroad, or the increased costs to access the Israeli labor market. I refer to future research to incorporate these elements in the analysis.

CHAPTER 9

CONCLUSIONS

The paper focuses on the differential redistribution of jobs and residents in response to changes in commuting. I show that the sign of the effect of increases in commuting cost on the local job and resident shares is ambiguous. The general equilibrium effect via prices may counteract and even overcome the direct effect from the loss in commuting flows, depending on the initial spatial sorting. I then provide an example in which locations that suffered the most loss in market access experience a loss in residents but an increase in jobs, mostly in the retail sector. Finally, I use a structural model to evaluate the welfare effect of the mobility restrictions and how this is affected by the change in workplace and residence.

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APPENDIX A

FIGURES AND TABLES

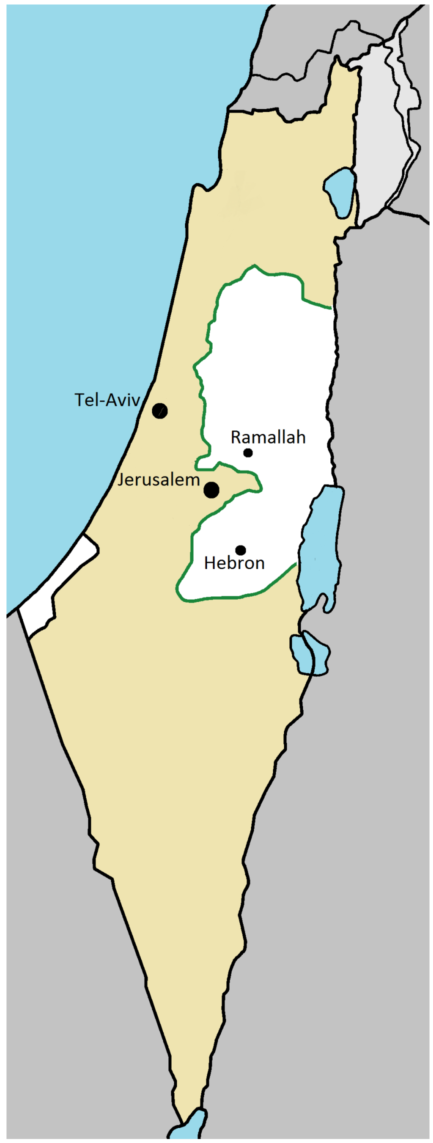


Figure 1: Israel and the Palestinian territories

Table 1: Summary statistics

	year	N	mean	std	p10	p50	p90
population	1967	304	1714.78	3645.3	201	862.5	3660
population	1997	443	3427.17	8597.12	148	1568	7061
population	2007	443	4542.83	11387.64	211	1996	9079
pop, growth	67-97	304	0.95	0.46	0.49	0.93	1.44
pop, growth	97-07	443	0.3	0.24	0.1	0.29	0.46
population 25-54 yo	1997	443	950.42	2499.2	36	406	1833
population 25-54 yo	2007	443	1334.2	3411.35	62	592	2768
population 25-54 yo, growth	97-07	443	0.39	0.27	0.17	0.38	0.57
labor force	1997	442	835.14	2255.51	32	345	1705
labor force	2007	437	1039.56	2771.83	47	456	2180
labor force, growth	97-07	437	0.25	0.32	-0.02	0.23	0.49
n. estab. per village * ISIC	1997	1827	744.1	1509.16	27	168	2265
n. estab. per village * ISIC	2007	2527	753.15	1559.12	40	225	2109
jobs per village * ISIC	1997	1827	2137.44	4533.92	43	300	6571
jobs per village * ISIC	2007	2527	2166.47	4768.8	85	441	6793
jobs, growth	97-07	1483	0.44	0.83	-0.56	0.5	1.34
share employed, house	1997	443	0.96	1.27	0	0.57	2.5
share employed, same district	1997	443	62.44	20.98	34.69	62.12	90.83
share employed, Isr and sttlm	1997	443	29.35	20.54	1.69	27.78	60
share employed, house	2007	443	2.14	2.84	0	1.66	4.55
share employed, same village	2007	443	31.01	19.09	12.1	26.92	55.56
share employed, same district	2007	443	36.35	20.97	12.32	33.3	66.79
buildings, residential use	1997	442	257.34	348.89	11	134	685
buildings, commercial use	1997	442	26.57	50.2	1	12	69
buildings, mixed use	1997	442	27.42	66.07	0	8	70
buildings, residential use	2007	443	458.49	826.94	31	236	992
buildings, commercial use	2007	443	58.17	133.09	4	26	131
buildings, mixed use	2007	443	61.9	184.31	0	19	144
land area (km2)		443	0.75	1.74	0.05	0.33	1.61
attacks before 2nd Intifada	-1999	443	1.44	10.27	0	0	1

Note: Data is aggregated at the village level for all variables except for jobs and number of establishments, which are aggregated at the village * ISICRev4 level. UNOCHA is the United Nations Office for the Coordination of Humanitarian Affairs. GTD is the Global Terrorism Database. In 1997, the share of employed people who work in the same district also includes the people who work in the same village.

Table 2: Assumptions on travel times

Average traveling times by type of road	
regional	60kmh
primary	50kmh
tertiary	30kmh
residential	20kmh
track	10kmh
Israeli only	0kmh
Roadblocks, earthmounds, barrier gates, separation wall (planned and under construction)	infinite
Checkpoints	15min

Note: Source for average travel times by type of road: Van Der Weide et al. [2018]. Source for checkpoint travel time: PCBS, Eklund and Martensson [2012], and Van Der Weide et al. [2018].

Table 3: Summary statistics

	year	N	mean	std	p10	p90
Worker market access	1997	443	1317.96	674.68	747.73	2012.51
Worker market access	2007	443	936.17	627.9	464.07	1385.4
Δ ln worker market access	2007-1997	443	-0.38	0.3	-0.76	-0.09
Firm market access	1997	443	6982.87	3307.73	4267.49	10353.41
Firm market access	2007	443	5030.36	3128.61	2412.9	7323.73
Δ ln firm market access	2007-1997	443	-0.37	0.28	-0.72	-0.09

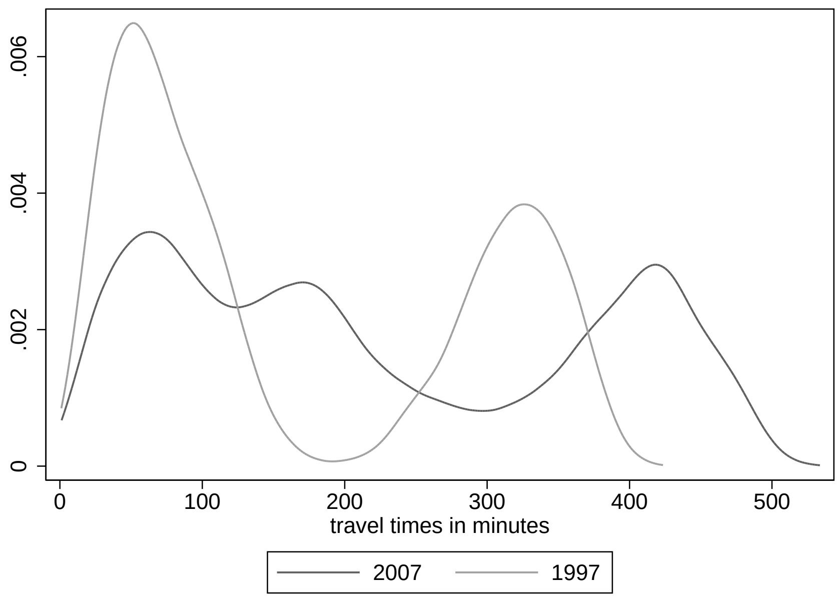


Figure 2: Kernel density of travel times (in minutes)

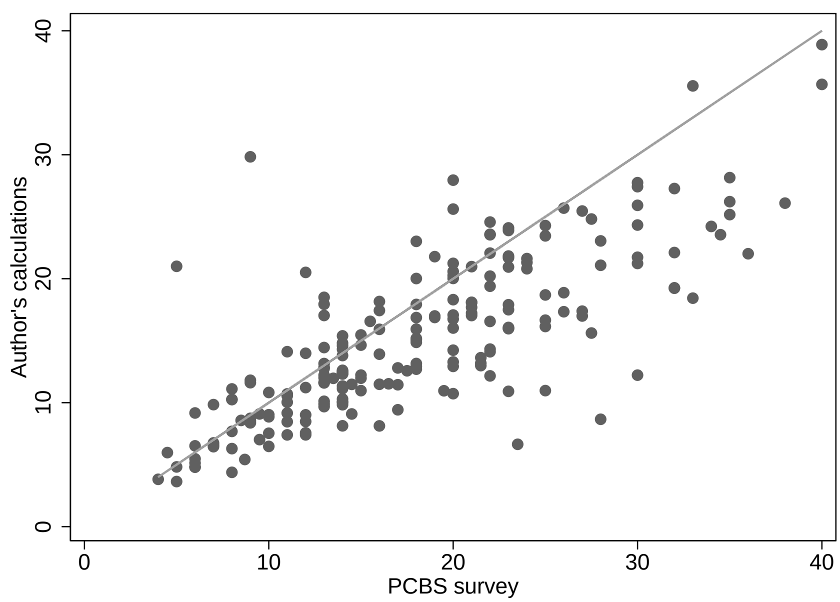


Figure 3: Comparison between travel distances according to author's calculations and PCBS survey

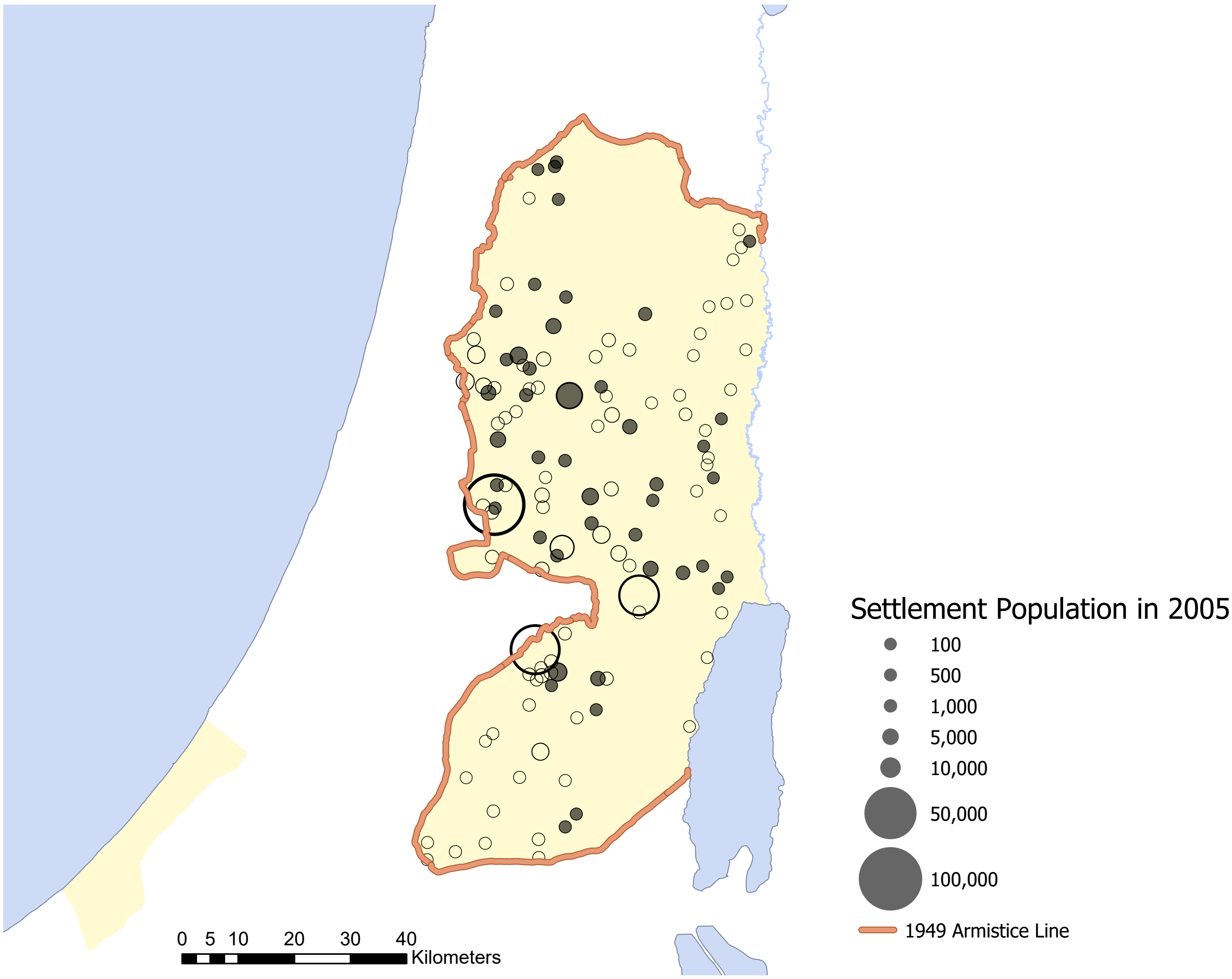
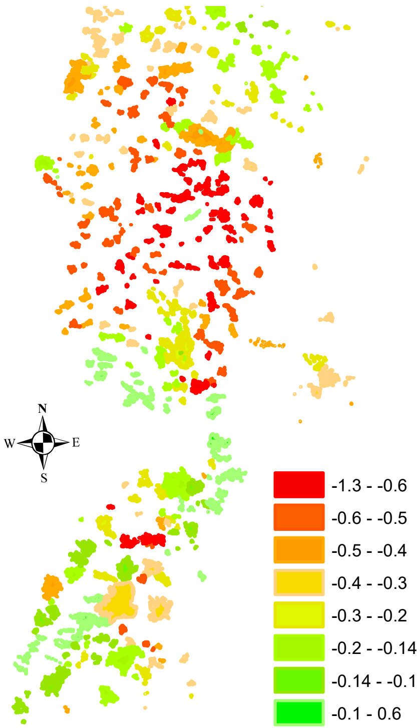


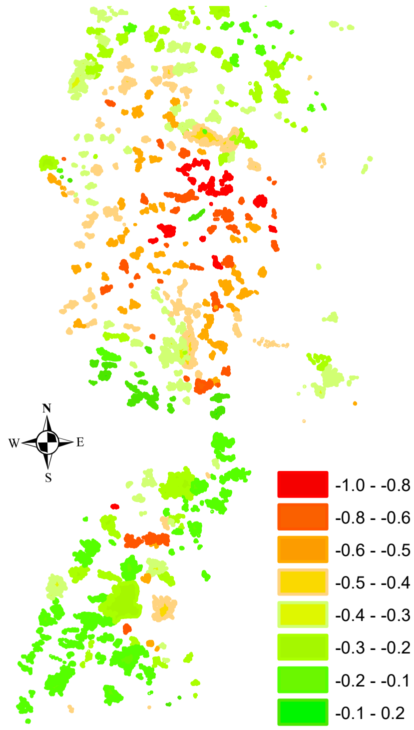
Figure 4: Areas strategically sensitive for Israel

Notes: The full dots represent the settlements in the Drobles Plan. The hollow dots are all other settlements as of 2005. The size of the dot is weighted by the settlement population in 2005.

Figure 5: Areas indicated for Israeli land requisition as of 1984



(a) Worker Market Access



(b) Firm Market Access

Figure 6: Changes in market access between 1997 and 2007

Notes: A polygon is a Palestinian village. The changes in market access are computed as log differences of the measures of market access specified in the paper, holding the village population constant to 1997 levels. The changes in market access are entirely due to changes in the travel time between two villages. Larger negative changes in market access are associated with the introduction of obstacles having a larger impact on the village.

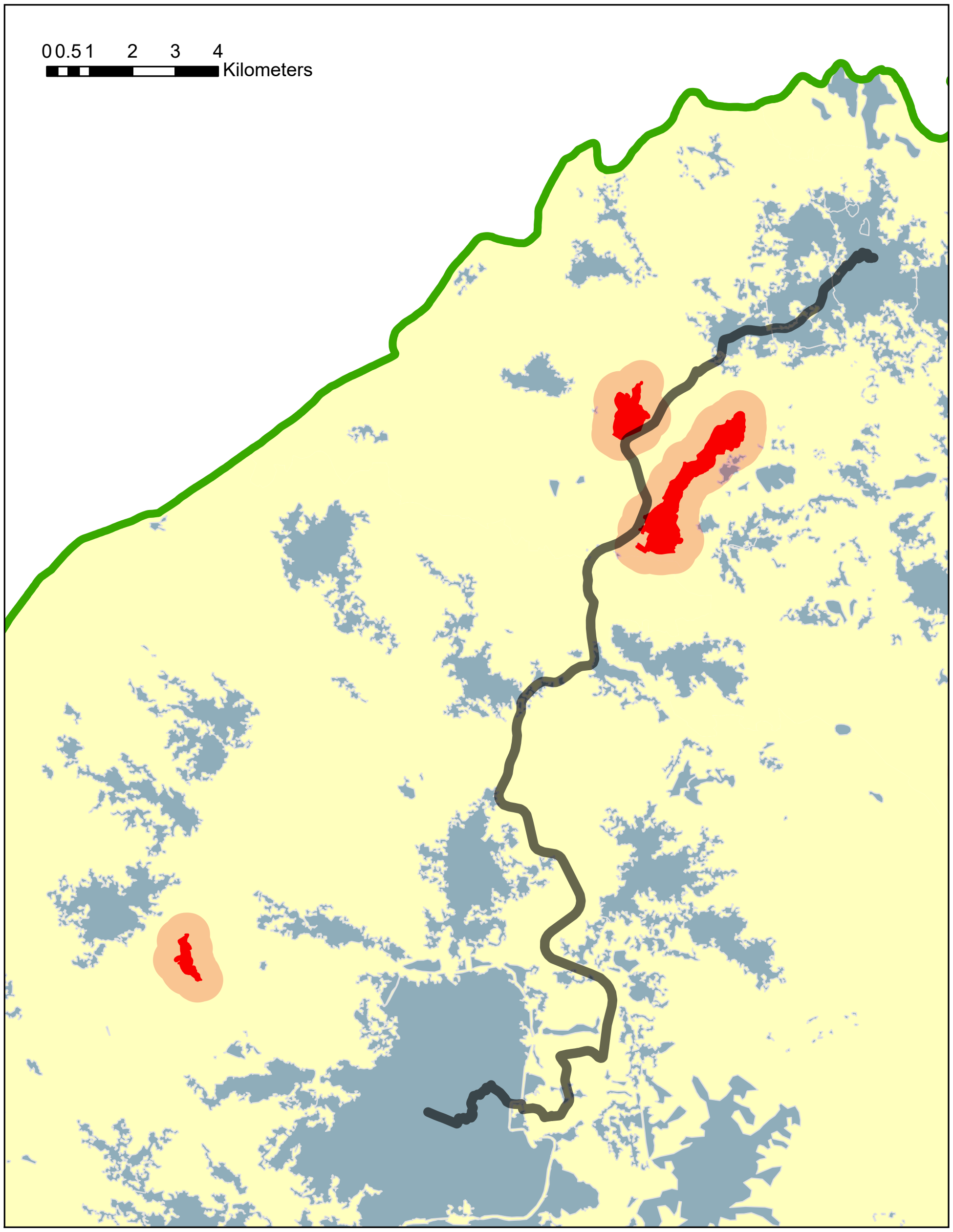


Figure 7: Exposure of the 1997 route between Bethlehem and Hebron to Drobles settlements

Notes: Palestinian villages, including Hebron city and Bethlehem, are represented in grey. Drobles settlements are represented in red, together with a 0.5 km buffer surrounding their outer boundaries (represented in a lighter shade of red). The shortest route between Bethlehem and Hebron city in 1997 is reported in black. The time needed to travel the 1997 route intersecting the red shaded area is $F(ij)|_{\text{Drobles(0.5km)}}$ where i =Bethlehem and j =Hebron city.

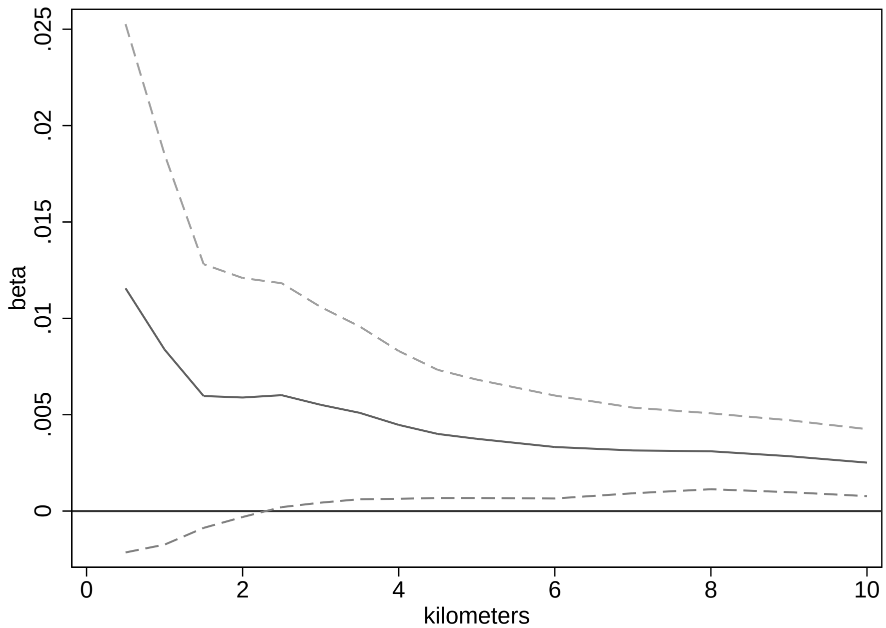
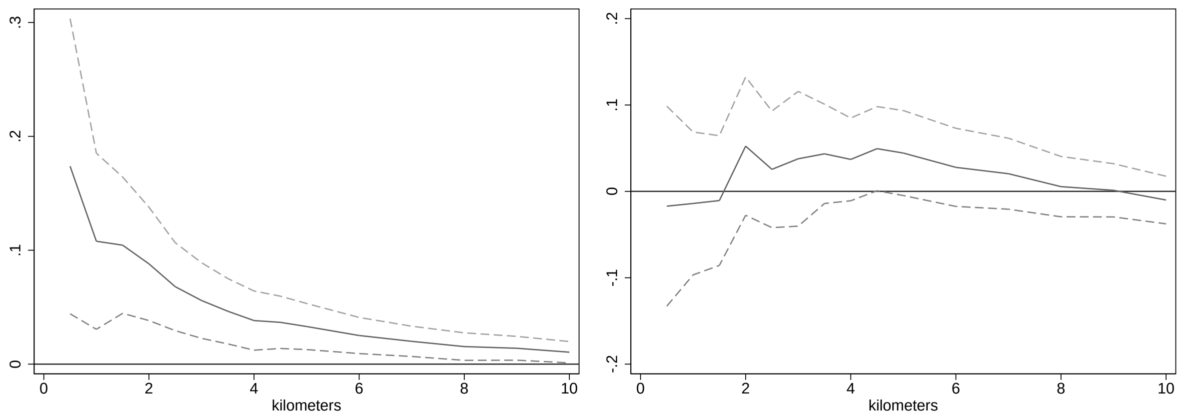


Figure 8: Correlation between population growth rates between 1967 and 1997, and the number of obstacles in 2007

Notes: Each point corresponds to a regression of the growth rate in population between 1967 and 1997 on the number of obstacles in 2007 at x distance from the village outer boundaries. The y-axis reports the value of the coefficient. The x-axis reports the distance considered. 95% confidence intervals are computed using robust standard errors and reported in the figures.



(a) All settlements (b) Drobles settlements

Figure 9: Correlation between population growth rates between 1967 and 1997, and the number of number of Israeli settlements in 2005

Notes: Each point corresponds to a regression of the growth rate in population between 1967 and 1997 on the number of settlements at x distance from the village outer boundaries. The y-axis reports the value of the coefficient. The x-axis reports the distance considered. 95% confidence intervals are computed using robust standard errors and reported in the figures. In panel (a), I regress the population growth rate between 1967 and 1997 on the total number of settlements at x kilometers from the village outer boundaries. Panel (b) reports the same regressions using only the number of settlements established during the Drobles plan.

Table 4: Correlation between population pre-trends and IV

	Population growth between 1967-1997
IV Drobless settlements , 0.5 km	-0.071
	(0.049)
IV Drobless settlements , 1km	0.060
	(0.057)
IV Drobless settlements , 5km	-0.004
	(0.025)
n. Drobles settlements within 5km	0.037
	(0.029)
Observations	326
R-squared	0.012
F-test	0.742
Prob > F	0.528

Notes: F-test for the significance of at least one of the coefficients of the instrumental variables. Robust standard errors in parentheses. $***p < 0.01, **p < 0.05, *p < 0.1$

Table 5: Pre-trends: Population growth 1967-1997 and 1997-2007

	Average yearly population growth rate	
	1967-1997	1997-2007
Δ ln worker market access	0.004	0.005**
	(0.003)	(0.002)
Observations	305	305
R-squared	0.005	0.016

Notes: Seemingly unrelated regression. The sample is restricted to the villages available from the 1967 Israeli census. Robust standard errors in parentheses. $***p < 0.01, **p < 0.05, *p < 0.1$

Table 6: OLS results

Panel (a) - $\Delta \ln$ population 25-55 year old					
	(1)	(2)	(3)	(4)	(5)
Δ ln worker market access	0.146***	0.148***	0.149***	0.148***	0.139***
	(0.033)	(0.034)	(0.034)	(0.033)	(0.035)
Terrorist attacks before 2^{nd} Intifada		-0.001	-0.001	-0.001	-0.000
		(0.000)	(0.001)	(0.001)	(0.000)
Demolition orders 97-07			0.001	0.001	0.001
			(0.001)	(0.001)	(0.001)
Share employed				0.001	0.001*
in Israel and sttlm in 1997				(0.001)	(0.001)
ln population 1997					-0.037*
					(0.019)
Observations	443	443	443	443	443
R-squared	0.025	0.026	0.027	0.033	0.073

Panel (b) - $\Delta \ln$ labor force					
	(1)	(2)	(3)	(4)	(5)
Δ ln worker market access	0.130**	0.131**	0.132**	0.132***	0.131**
	(0.051)	(0.051)	(0.051)	(0.051)	(0.052)
Terrorist attacks before 2^{nd} Intifada		-0.001	-0.001	-0.001	-0.001
		(0.001)	(0.001)	(0.001)	(0.001)
Demolition orders 97-07			0.000	0.000	0.000
			(0.001)	(0.001)	(0.001)
Share employed				0.001	0.001
in Israel and sttlm in 1997				(0.001)	(0.001)
ln population 1997					-0.004
					(0.017)
Observations	440	440	440	440	440
R-squared	0.011	0.012	0.012	0.014	0.014

Notes: An observation is a Palestinian village. $\Delta \ln$ worker market access is defined holding constant endogenous variables to 1997 levels. Its variation comes from changes in travel times between 1997 and 2007. Robust standard errors in parentheses. $***p < 0.01, **p < 0.05, *p < 0.1$

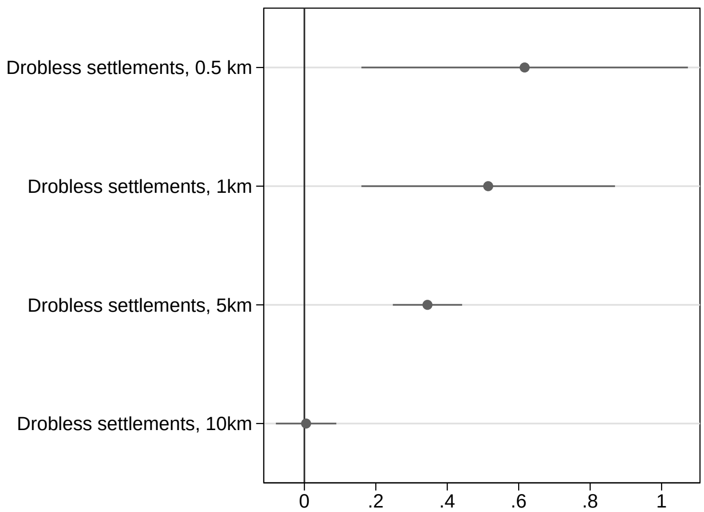
Table 7: OLS results

Panel (a) - Δ ln jobs					
	(1)	(2)	(3)	(4)	(5)
Δ ln firm market access	-0.142*	-0.131*	-0.135*	-0.122*	-0.118*
	(0.072)	(0.072)	(0.072)	(0.070)	(0.070)
Terrorist attacks before 2^{nd} Intifada		-0.005*	-0.007***	-0.005**	-0.004*
		(0.003)	(0.002)	(0.002)	(0.003)
Demolition orders 97-07			0.001*	0.001*	0.001*
			(0.001)	(0.001)	(0.001)
ln population 1997				-0.052*	-0.048*
				(0.028)	(0.027)
Share employed					0.002
in Israel and sttlm in 1997					(0.002)
Observations	1,496	1,496	1,496	1,496	1,496
R-squared	0.112	0.121	0.125	0.128	0.129
Economic Sector FEs	Yes	Yes	Yes	Yes	Yes

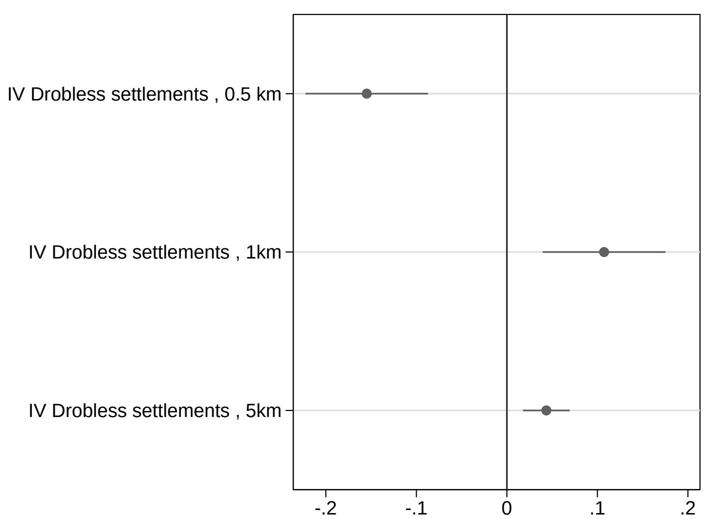
Panel (b) - Δ ln jobs in wholesale \retail					
	(1)	(2)	(3)	(4)	(5)
Δ ln firm market access	-0.320***	-0.302***	-0.305***	-0.275**	-0.273**
	(0.114)	(0.114)	(0.113)	(0.114)	(0.115)
Terrorist attacks before 2^{nd} Intifada		-0.010**	-0.007	-0.003	-0.002
		(0.004)	(0.005)	(0.005)	(0.006)
Demolition orders 97-07			-0.002	-0.001	-0.002
			(0.002)	(0.002)	(0.002)
ln population 1997				-0.076**	-0.072**
				(0.036)	(0.035)
Share employed					0.003
in Israel and sttlm in 1997					(0.002)
Observations	418	418	418	418	418
R-squared	0.017	0.039	0.042	0.052	0.056

Notes: An observation is an economic sector * village. Δ ln firm market access is defined holding constant endogenous variables to 1997 levels. Its variation comes from changes in travel times between 1997 and 2007. Standard errors clustered by village in parentheses. $***p < 0.01, **p < 0.05, *p < 0.1$

Figure 10: First stage: relation between the exposure to Drobles settlements and the introduction of obstacles



(a) Regression of $\Delta \ln$ time traveled, t_{ijt}, on $F(ij)|_{S(x\mathrm{km})}$, the fraction of travel time within 0.5, 1, and 5 km from settlements established during the Drobles Plan (1978-1982). In the figure, the coefficients for each regressor are reported. An observation is a road between a village and all the district capitals. Number of observations: 4457. No additional controls in the regression. Robust standard errors are used. 99% confidence intervals reported. R-squared is 29.18%. $F(6, 4450) = 149.96, Prob > F = 0$.



(b) First stage - coefficients from a regression of the growth in worker market access, on the instrumental variables based on the percentage of travel time within 0.5, 1, and 5 km from settlements established in the Drobles plan (1978-1982). A control for the number of Drobles settlements within 5 km from a village is also included and not shown in the figure. IV variables are standardized. Robust standard errors are used. 95% confidence intervals reported. R-squared is 13.22%. $F(4, 446) = 22.99, Prob > F = 0$. F-test of the joint significance of the instrumental variables: $F(3, 446) = 13.38, Prob > F = 0$.

Table 8: IV - second stage

	Δ ln population 25-54 yo			Δ ln labor force		
	OLS	IV	IV	OLS	IV	IV
Δ ln worker	0.146***	0.321**	0.276**	0.130**	0.423***	0.399***
market access	(0.033)	(0.135)	(0.130)	(0.051)	(0.118)	(0.117)
Observations	443	443	443	440	440	440
R-squared	0.025	-	-	0.011	-	-
Controls	No	No	Yes	No	No	Yes

	Δ ln jobs			Δ ln jobs in wholesale \retail		
	OLS	IV	IV	OLS	IV	IV
Δ ln firm	-0.142*	-0.924**	-0.614**	-0.320***	-1.743***	-1.441***
market access	(0.072)	(0.386)	(0.306)	(0.114)	(0.523)	(0.476)
Observations	1,496	1,496	1,496	418	418	418
R-squared	0.112	-	-	0.017	-	-
Economic Sector FEs	Yes	Yes	Yes			
Controls	No	No	Yes	No	No	Yes

Notes: In panel (a), an observation is a village. Robust standard errors in parentheses. In panel (b), an observation is an economic sector * village. Standard errors clustered by village in parentheses. Controls included in all columns: the number of Drobles settlements within 5 km. Controls included in columns (3) and (6): number of terrorist attacks before the Second Intifada, number of demolition orders between 1998 and 2007, and (log of) population in 1997. $***p < 0.01, **p < 0.05, *p < 0.1$

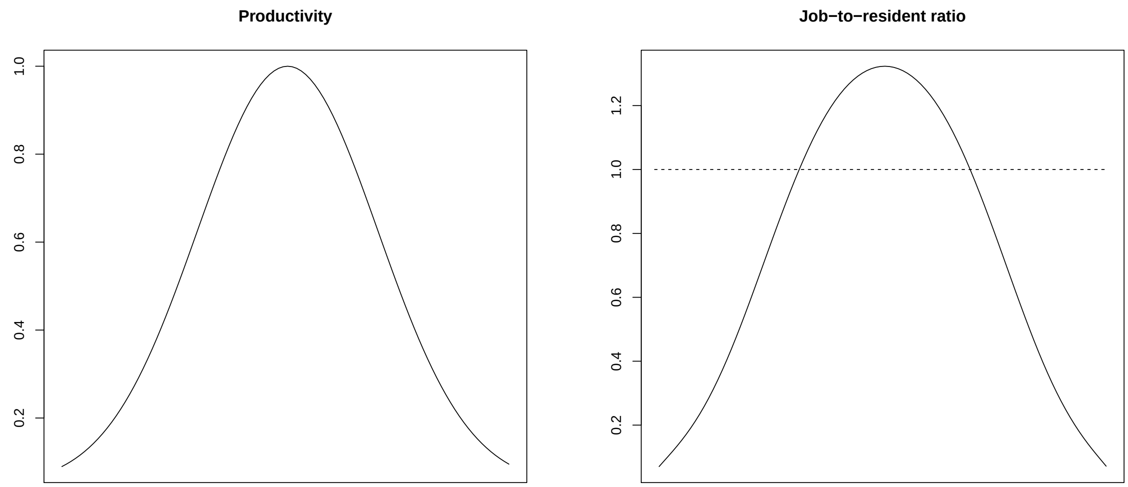
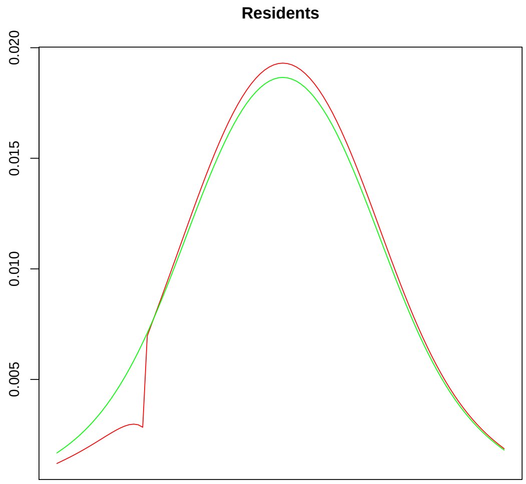
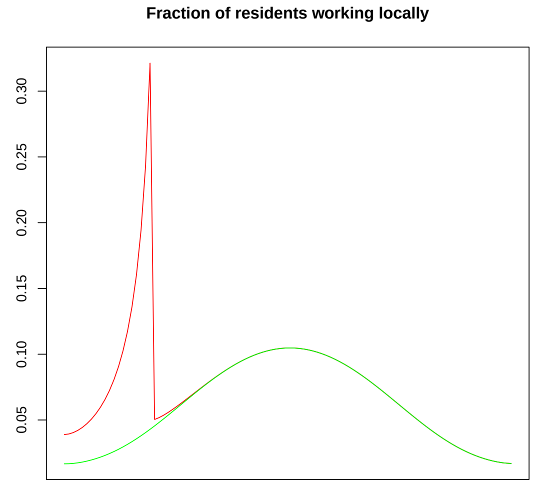


Figure 11: Example of an economy on a line: initial spatial distribution of productivity and worker commuting flows

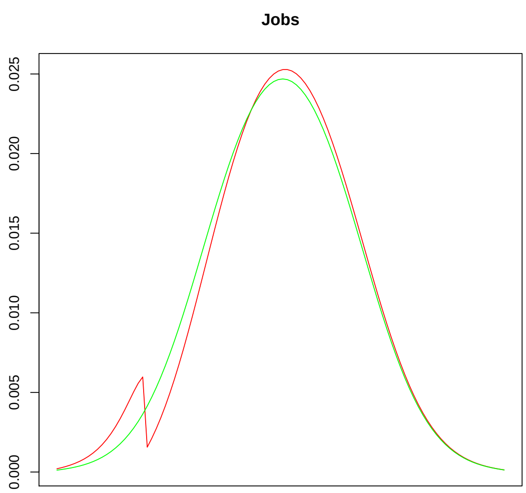
Notes: Left panel, distribution of productivity. Right panel, resulting job-to-resident ratio in each location.



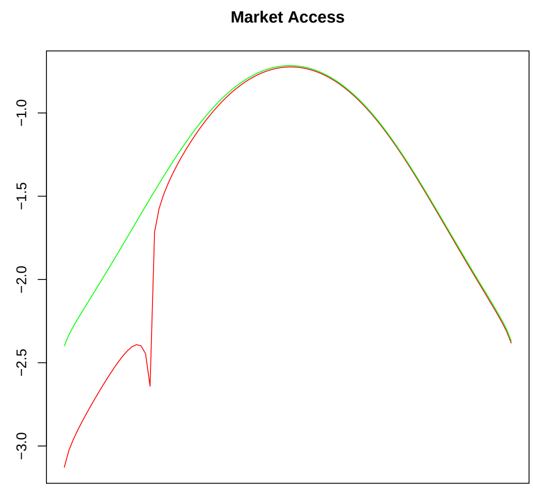
(a) Residential shares, λ_R



(b) Population shares, λ_{ii}



(c) Employment shares, λ_L



(d) Empirical measure of (worker) market access

Figure 12: Example of an economy on a line: effect of the introduction of an obstacle

Notes: Green line, initial equilibrium. Red line, equilibrium when a 30-minute delay is introduced between the central business district and the left extreme point of the segment.

Table 9: GMM results on productivities and amenities

	Productivity	Amenities
	(1)	(2)
δ	0.449***	1.250
	(0.149)	(4.837)
ψ	0.258**	2.523
	(0.112)	(1.843)
Observations	442	442
Note:	*p<0.1; **p<0.05; ***p<0.01	

Table 10: Welfare effect of the mobility restrictions

	without externalities	with externalities
Change in welfare	-4.3%	-2.3%
Change in total GDP	-4.54%	-9.9%

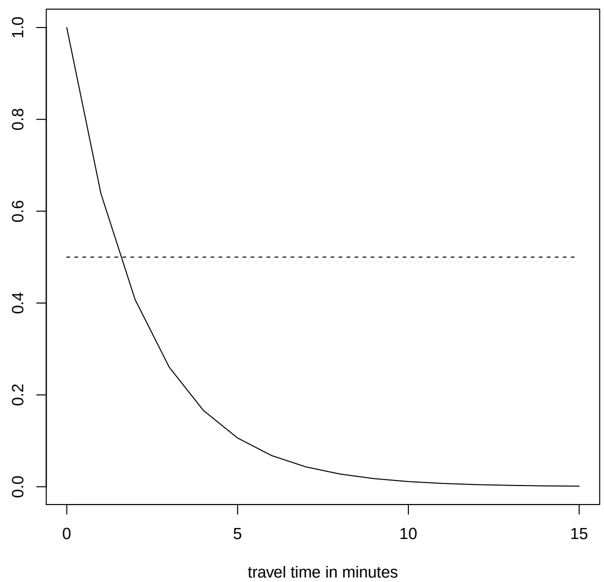
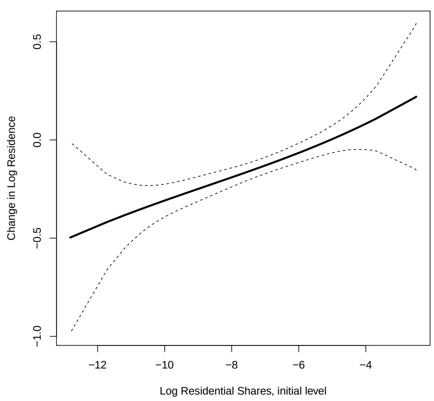
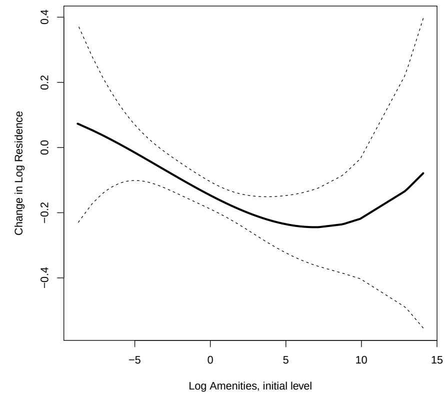


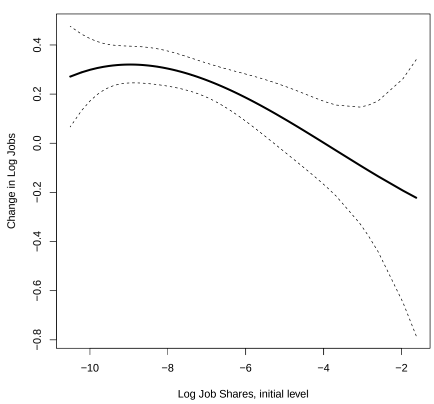
Figure 13: Endogenous externalities



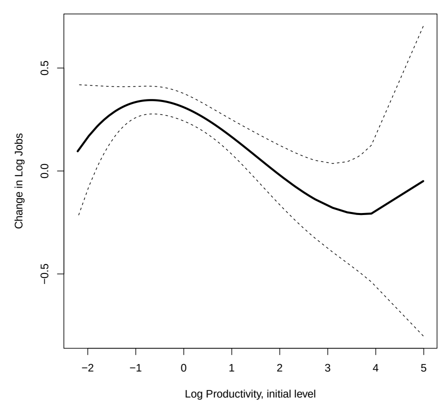
(a) changes in residents relative to initial residential shares



(b) changes in residents relative to residential amenities



(c) changes in jobs relative to initial job shares



(d) changes in jobs relative to productivities

Figure 14: Counterfactual experiment from the structural model

Notes: Simulated changes in the spatial distribution of jobs and residents when travel times are modified according to the estimates from 2007. Productivity and amenities are held constant at the 1997 levels.