

Social Interaction and Urban Agglomeration: Understanding the Early Growth of Tel Aviv

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Acknowledgements: thanks to Chen Greenberg and Ron Horne for research assistance and to Tamar Sofer from the Cartographic Unit, Geography Department, Hebrew University for Figure 1.

Abstract

We claim that agglomeration in “social externalities” explains urban growth. We base this claim on a study of the early urban growth of Tel Aviv. While Tel Aviv was only founded in 1909, by 1939 it had already established itself as Israel's largest city surpassing its nearest challenger, Haifa. We suggest that this was due to urban amenities and increasing returns to social capital rather than production externalities. A simple model of urban agglomeration is presented, which emphasizes the role of social externalities and integrates them with externalities in production. We use this model to interpret available empirical data. We find that despite the proximity of Tel Aviv to the port in nearby Jaffa, this made no difference to agglomeration forces in Tel Aviv. Nor did the port in Haifa promote agglomeration there. Instead Haifa functioned as a conduit channeling immigrants to Tel Aviv. The latter also grew as a catchment location attracting internal migration from other parts of the country. Finally, we empirically estimate for Tel Aviv the point beyond which social externalities no longer contributed to urban agglomeration.

1. Introduction

Agglomeration theory is inherently difficult to test because it requires time series data that date back to before the agglomeration process began, which is typically a matter of centuries and even millennia. Nearly all major cities were established so long ago that it is difficult to investigate why, for example, London and Tokyo grew up where they did and not elsewhere. Ideally, we would like to catch fledgling cities in their infancy and track them over time so that we could compare the cities that agglomerated with those that did not. Both Krugman (1998) and Glaeser (2005) suggest reasons why Philadelphia did not become New York. However, due to lack of data it is impossible to go much beyond this.

We use Tel Aviv as a case study in agglomeration because we are able to track its development from birth. Throughout the paper, we juxtapose its growth with that of Haifa, which but for Tel Aviv might have been the leading contender to develop into Israel's foremost city. The comparison of Haifa and Tel Aviv like the comparison of Philadelphia and New York constitutes a sample of one. We ideally require many such comparisons for purposes of statistical inference and hypothesis testing, and we recognize that we cannot generalize from a single empirical example. We leave it to others to find other empirical examples and to see whether these examples share common features which support one theory of agglomeration against some rival.

Agglomeration theory has been usefully reviewed by Fujita and Thisse (2002). Not surprisingly, agglomeration theory entails externalities and scale effects in which the whole is more than the sum of its parts. One theory, originally proposed by Marshall (1911), focuses on externalities in know-how, which like viruses spread more rapidly in dense populations and increase total factor productivity. The latter increases wages, induces in-migration and further increases the population. Another theory, originally proposed by Krugman (1991) is based on the theory of imperfect competition. Markets are bigger where populations are larger. In bigger markets firms enjoy pecuniary scale economies since under the theory of imperfect competition average cost varies inversely with scale. Living standards are therefore higher where the “market size effect” is greater. The latter increases wages, induces in-migration and further increases the population.

More recently, a new theory of agglomeration (Glaeser 2001) focuses on scale economies in social capital, amenities and social interaction. This theory predicts that the “lights burn brighter” in big cities, and that agglomeration would take place even in the absence of market size effects and Marshallian externalities. Bright lights attract in-migration, which makes the lights burn yet brighter. We have tried to integrate these theories (Beenstock and Felsenstein 2009) and we draw on this material below. Our main conclusion is that agglomeration in Tel Aviv is more to do with scale economies in amenities and social capital than in production.

This paper proceeds in the following manner. After reviewing the historical context for the development of social interactions and urban amenities, we present a simple model of urban agglomeration. This emphasizes the role of social externalities and integrates them with externalities in production. The model is then used to interpret available empirical data. Our findings suggest that that the proximity of Tel Aviv to the port in nearby Jaffa made little difference to agglomeration forces in Tel Aviv¹. Nor did the port in Haifa promote agglomeration there. Rather, Haifa functioned as a conduit channeling immigrants to Tel Aviv. The latter also grew as a catchment location attracting internal migration from other parts of the country. Finally, we empirically identify the point of agglomeration in Tel Aviv beyond which social externalities no longer had any effect.

2. Social Interaction and Urban Amenities: The Historical Context

2.1 Seeding the Agglomeration

A century ago (1909) Tel Aviv was founded by the Ahuzat Bayit building society movement in the sand-dunes of Ottoman Palestine’s coastal plain. This movement seeded the agglomerating forces that eventually led to the creation of modern Tel Aviv. Indeed, but for Ahuzat Bayit, it is very doubtful that Tel Aviv would have agglomerated as it did. Ahuzat Bayit was located in what became Tel Aviv simply because it happened to be close to Jaffa. We claim that Ahuzat Bayit would have been just as successful had it been elsewhere because the agglomeration mechanism was mainly social and was therefore not location specific. Other building projects had attempted to create a Jewish neighborhood outside Arab Jaffa predating Ahuzat Bayit. For example, Neve Tzedek (19886), Neve Shalom (1890) and Ohel

¹ For an alternative view on the role of the Jaffa port see Gonen (2003)

Moshe (1903) all offered new standards for residential housing (Figure 1). However their essentially Mediterranean style and social environment were not distinguishable enough from Jaffa. In contrast, Ahuzat Bayit offered a new European urban and social lifestyle designed in the spirit of the garden suburb movement (Kallus 1999). An additional factor in generating the conditions for social agglomeration relates to the role of the shore-line. It is difficult to imagine Tel Aviv in the 1920s without its shore-line culture. This illustrates the reciprocity between first and second nature effects in generating urban agglomeration.

In 1909 it would have been hard to predict that Tel Aviv would agglomerate into the economic heartland of what eventually became Israel. There were several other candidates consisting of fledgling townships established in the 1880s and 1890s such as Zichron Yaakov, Rishon-le-Zion and Petah Tikva and there were incumbent cities including Haifa, Jaffa and Jerusalem (Figure 1). Perhaps the most likely candidate was Haifa, which by the turn of the 19th century was already an industrial center. However, by 1930 agglomeration in Tel Aviv seems to have passed a critical point of no return. It only took a quarter of a century of agglomeration to establish Tel Aviv and its surrounds as the economic and social heartland of the country. This prominence continues until today.

Figure 1 here

At that time, the incipient Tel Aviv neighborhood had little aspiration to urban primacy. Jaffa, Jerusalem or Haifa were all equal candidates for developing into the center of Jewish life in mandatory Palestine². Each one had an initial advantage that did not exist in Tel Aviv. Jaffa was a developed port city and the main lifeline for foreign trade and immigration while Jerusalem was the administrative center and of historic and religious significance. However both these two cities bore the weight of history, tradition and Jewish-Arab tensions. In contrast, Haifa was touted as the emerging modern city closely resembling the utopian 'city of the future'. Indeed, in his landmark book *Altneuland* the founding father of modern Zionism, Theodore Herzl, writes glowingly of the economic strength of Haifa rather than Jerusalem or other ancient cities. Haifa's favorable location made it a focal regional hub: a central juncture in the Hedjaz railway from Egypt to Beirut and Damascus, a terminus for the

² Gonen (2009) compares Tel Aviv's development with that of Jaffa and Jerusalem while Ben Artzi (1989) does similarly in relation to Haifa.

oil pipeline from Northern Iraq with its attendant large scale refineries and the future site of the first deep water port in the area. Augmented by the arrival of Jewish immigrants from Europe and the foundation of the Technion (originally the 'Technikum') in 1912 as a foreign (German) language university, Haifa of the mandatory period had all the makings of a cosmopolitan city and the focus of the revival of Jewish life in Palestine.

Given these opening conditions, the rise of Tel Aviv is all the more remarkable. While Haifa ostensibly seemed to offer a similar economic and social environment, we suggest that the difference between the cities lay in consumption and social externalities as well as urban amenities that led to 'agglomeration in the sand' of Tel Aviv and not of Haifa.

2.1 The Role of Immigration

The social and cultural milieu of Tel Aviv have to be understood against the historical backdrop of waves of Jewish immigration to Ottoman and Mandatory Palestine. Each wave left an indelible social and cultural footprint that was also of economic significance. While these waves of immigration varied in motivation and human composition, the ports in Jaffa and Haifa made these cities the first point of contact for the vast majority of new arrivals. However in reviewing the historical context of immigration it becomes clear that for many new entrants physical shelter was not the only criteria for residential preference. We make the case that social externalities and urban amenities were highly potent forces for population agglomeration which from early on entrenched the attraction of Tel Aviv.

Jaffa has long since been absorbed into Greater Tel Aviv. Indeed, Tel Aviv – Jaffa has been formally one city since 1949. However, a century ago Tel Aviv and Jaffa were two separate entities (Figure 1). While geographically close, they were culturally distant. In the period under discussion they are therefore considered separately.

For much of the 19th century, Jaffa's primary function was as a conduit for pilgrims and visitors on their way to Jerusalem. The city was totally destroyed by Napoleon's army in 1799 en route to the French conquest of Acre but recovered under Ottoman control in the early 19th emerging as a walled port city. By 1840, the population of Jaffa was 4,500 and like any port city it attracted a sizeable immigrant population comprised of Christians (German Templars) hoping to build a model

community in the Holy Land, Egyptian traders and Jewish immigrants who were not interested in agricultural settlement or in the religious atmosphere of Jerusalem. With a population of over 30,000 at the end of the 19th century Jaffa was running a close second to Jerusalem as the largest urban center in the Holy Land.

However a qualitative social difference divided the Jewish communities in the two cities. The Jewish population in Jerusalem was steeped in tradition, religious practices and dependent on financial support from Jewish communities abroad. In contrast, the Jewish community in Jaffa was comprised of immigrants engaged in commercial and economic activity related to Jaffa's location as a port and shipment point for the agricultural produce of its hinterland. As such, when the subsequent waves of Zionist immigration began to arrive in Palestine in the early 20th century they found the urban environment of Jaffa (and not Jerusalem) more attuned to the life-style that they hoped to adopt.

In 1890 2.5 percent of the Jewish population in Ottoman Palestine lived in Haifa while 7 percent were resident in Jaffa (Table 1). Originally the Jewish populations of Haifa and Jaffa were therefore not too dissimilar. By the time Tel Aviv was founded these proportions were 3 and 9 percent respectively. Twenty years later (1931) Tel Aviv with 27 percent of the Jewish population of Mandatory Palestine had outstripped Haifa (10 percent) by far.

Table 1 here

Over the period post World War I (1919-1924) with Palestine now under British mandatory control, some 35,000 immigrants entered the country - a mixed bag of ideologues, working class laborers and middle class bourgeoisie. Many of them settled in Tel Aviv metamorphosing Ahuzat Bayit from a neighborhood to a suburb and consolidating the growth of Jewish urban life outside of Jaffa. The Jewish population of Tel Aviv-Jaffa increased tenfold over this period from 2000 in 1919 to 21,000 in 1924 (5000 of these in Jaffa). This process was aided by Arab disturbances in Jaffa (1921) that caused many Jewish residents to move to Tel Aviv.

The urban consolidation of Tel Aviv was stimulated by a wave of immigrants over the period 1924-1931. This growth was driven by a further surge of immigrants from Eastern Europe (Poland, Russia, Lithuania and Romania) and their residential preferences. During 1924-25, 65,000 immigrants arrived in Palestine. More than half settled in Tel Aviv doubling the cities population and making it the major urban center of Mandatory Palestine.

This was the era of accelerated construction and physical expansion of Tel Aviv. The construction of low density apartment buildings, shopping centers, hotels, cinemas and public transport, all changed the physical environment of the city. This rapid but piecemeal development called for a comprehensive physical plan to guide the growth and ensure urban spatial contiguity. Patrick Geddes, a leading British urban planner from the 'garden city' school of urban design, was recruited to fashion a cohesive urban identity for the various neighborhoods that had developed outside of historic Jaffa. The Geddes Plan of 1926 envisaged a metropolitan center of up to 100,000 inhabitants in an urban environment grounded in the living standards of the garden city movement as formulated for European cities (controlled densities, emphasis on open green spaces such as parks and boulevards). Geddes tried to adapt the garden city planning principles to the needs of local Mediterranean conditions with respect to both design elements (greenery and shaded areas, the use of balconies, windows sizes etc) and the utopian social message generally associated with the garden city movement.

This wave of immigration also heralded an era of cultural institution-building in the city with the development of theater, opera, symphony orchestra, daily newspapers and cultural and literary circles. In both physical and cultural expansion, Tel Aviv was attempting to recreate the European urban environment so familiar to the immigrants. The burgeoning Tel Aviv café lifestyle that emerged on the sands of the Mediterranean coastline attempted to reproduce the ambience, service, architecture, dress code and even menu of the places the immigrants had left through creating "an island of European culture in the emerging Tel Aviv" (Carmel 2007, p8).

The city became the symbol of the new independent Zionist urban lifestyle. Municipal control was solely run by Jewish authorities unlike Arab Jaffa and the mixed Jewish-Arab city of Haifa. Tel Aviv desired to divorce itself as much as possible from Jaffa and its administrative, municipal and social culture.

The immigrant's residential preference for Tel Aviv, aside from reflecting a Jewish urban tradition was also a social reaction to the official national ethos that glorified pioneering agricultural settlement. Like New York in its time, Tel Aviv was built in classic immigrant-driven style, grounded in private investment and bourgeois entrepreneurship. Tel Aviv was also the destination of much imported private capital from abroad that served as the engine of growth during the Mandate times. It was also

the trans-shipment point for much of the agricultural production from the rural hinterland along the coastal plain of Palestine.

In contrast, this wave of immigration was of less significance for Haifa. With the main stream of new arrivals destined for Tel Aviv, Haifa's population growth was much slower. The economic downturn that hit Mandatory Palestine during 1927-9 and halted the expansion of Tel Aviv had less impact on Haifa. In addition the Arab disturbances of 1921 and 1929 served to entrench further the internal geographies of each city. They accelerated the Jewish exodus from Jaffa to Tel Aviv and the relocation of Jews from the downtown area of Haifa towards the new neighborhoods on the Carmel foothills. However, 'Red Haifa' with its proletarian and working class image simply did not generate the urban culture and social environment to attract many of the ideologically-neutral immigrants leaving Europe for Palestine. While the city had an international port atmosphere in the Lower City (downtown) area this never managed to spawn the café and consumption subculture in the Upper City dominated by quiet Jewish residential neighborhoods (such as the Hadar neighborhood). By the time Haifa managed to accumulate the necessary (production) conditions to respond to Tel Aviv in the mid 1930's, the latter's growth was too entrenched for this to have any effect.

A further wave of immigrants over the period 1931-1939, following the rise of Nazism, saw both the tripling of the Jewish populations of both Tel Aviv and Haifa (Table 1). As the economic and cultural center of Jewish life in Mandatory Palestine, Tel Aviv received official municipal status in 1934. This was simply *de jure* recognition of the new urban reality that the various waves of immigration had created. From the start of the Mandate period up till 1934, over 155,000 immigrants arrived in Palestine. Despite the official Zionist commitment to rural settlement, over 120,000 (80 percent) opted for urban destinations. Of this share, more than half chose Tel Aviv (Biger 1984). In 1933 Tel Aviv accounted for slightly more than 30 percent of the Jewish population of Mandatory Palestine. However its share in commercial (non industrial) activity was much greater with 75 percent of all wholesale trade establishments in Mandatory Palestine located in the city, 35 branches of banks and 1500 small factories and workshops employing over 10,000 workers etc (Biger 1984).

The social composition of these immigrants (middle class and of central European origin) was highly instrumental in consolidating the demand for social externalities and urban amenities. Over the period 1933-36, 35,000 German Jewish

immigrants arrived in Palestine, 12,000 settled in Tel Aviv and a further 8,000 in Haifa (Gelbar 1989, p107). Shavit and Biger (2001) estimate that from 1933-9, some 20,000 German immigrants settled in Tel Aviv. Many of them were trained in professions and liberal arts while others were engaged in business activities. They actively stimulated both the supply and demand for cultural goods and a quasi-European urban lifestyle. Over this period many of the cultural institutions of Tel Aviv were established and by the mid 1930's the city was recognized as the undisputable focus for cultural and artistic activity in Mandatory Palestine.

Prior to 1933 the vast majority of immigrants entered the country via the port in Jaffa, however, some also entered via the port in Haifa (Figure 2). The port in Haifa was mainly for goods while the port in Jaffa was mainly for passengers. In 1933 a new deep water port was opened in Haifa, which was intended for passengers as well as goods. Subsequently, the vast majority of immigrants entered the country via Haifa rather than Jaffa. The port in Jaffa became further disadvantaged following the Arab riots of 1929. Immigrants were frightened of entering via Jaffa. Indeed, a make-shift port was rapidly constructed in Tel Aviv. However, the transformation of Haifa as the major port of entry made little difference to the agglomeration race with Tel Aviv. Had the port in Haifa opened in 1923 instead of 1933 matters might have been different. By the mid 1930s the agglomeration race had already been won by Tel Aviv.

Figure 2 here

The British Mandate blockade of new arrivals to Palestine from 1939 onwards (the White Paper era) led to rising tensions between the Jewish population of the city and the Mandate government. As a result, Tel Aviv's population over the war years grew marginally from about 160,000 to 190,000 due to natural growth and 'illegal' immigration that tried to run the British blockade. In parallel, the population of Jaffa grew from 80,000 to 100,000 (roughly two thirds Arab and one third Jews). The picture over the first half of the 1940's was similar in Haifa. From 111,00 residents in 1940, the cities' total population by 1944 grew to nearly 129,000, split roughly between Jews (66,000) and Arabs (63,000) (Ben Artzi 1989).

3. The Role of First and Second Nature

Among pre-existing factors contributing to Tel Aviv's early urban development were classic location factors including Jaffa's port, which was

conveniently nearby, and the Jaffa – Jerusalem railway line, which served to link Tel Aviv with its burgeoning agricultural hinterland. However it was second nature factors that really reinforced this process. A case in point relates to the role of the sea front in Haifa and Tel Aviv. This topographical (first nature) attribute was a formative factor in the development of the Tel Aviv social and cultural life. The Tel Aviv café environment developed against this backdrop and in this sense first and second nature were mutually reinforcing. In Haifa things were very different. The shore line was of economic importance only. To access the sea front from the Jewish neighborhoods of the Upper City (Hadar) meant traversing the Arab areas of the Lower City. This prevented the development of the sea front as a source of cultural interaction (Helman 2003).

The modern-city character and emerging urban culture of Tel Aviv were a result of the symbiotic relationship between population growth, physical expansion, urban fabric and lifestyle. The social externalities of the emerging Tel Aviv lifestyle converted into economic advantage as Tel Aviv became the place to pursue new ideas, entrepreneurial business practices and innovative urban management. Increasing returns to urban size in turn meant greater urban amenities and a process of self-generating economic agglomeration grounded in a large home market and growing demand for a wide array of products and services.

Haifa was endowed with more first nature advantages than Tel Aviv (a pleasant climate, sea front, deep water harbor). The major distinction lay in the second nature conditions. As a port city and major junction for the Hedjaz railway, Haifa had a favorable geographic location whose potential for development was recognized by the Ottoman Empire. Haifa became a regional logistics and administrative center for the Ottoman interests and a trans-shipment point for goods and passengers. Under the British mandate, these first nature conditions were further reinforced by an expansion of the Haifa port (1933) into a deep water facility capable of handling international trade and by the extension of Northern Iraq pipeline to the city (1934). This spawned the concentration of industrial and cargo activity in the Haifa and the location of ancillary economic activities such as the oil refineries and the establishment of heavy industry activities such as the manufacture of metals, steel and building materials.

These developments fashioned the role of second nature factors in Haifa's urban growth. In contrast to the private capital and personal initiative that characterized the economic development of Tel Aviv, much of Haifa's agglomeration

inducing activity was public-sector led. The development of heavy industry created a large working class population and a socially stratified city with a strong labor identity. The strata of middle class businessmen, professionals and service sector employees in Haifa was smaller than in Tel Aviv. As such their demand for urban amenities and their ability to generate a rich web of non-market (social) interactions was also that much more limited.

4. A Model of Urban Social Externalities

To shed light on the differential urban growth of Tel Aviv, we use a model of urban agglomeration, based on Beenstock and Felsenstein (2009), that stresses the role of external economies in general and social externalities in particular. First nature plays no role in the model and agglomeration is entirely driven by second nature. Total factor productivity is assumed to be scale dependent through “cafeteria effects” and knowledge networking in production. Amenities, broadly defined are also assumed to be scale dependent since bigger populations allow greater social choice and interaction. Our model integrates ideas on production externalities due to Glaeser (1999), Charlot and Duranton (2004), Helsley and Strange (2004) and Fu (2007), and ideas on amenity externalities in Glaeser (2001, 2006) and Roback (1988).

We assume 2 cities (A and B) which produce a homogeneous traded good that is freely traded between them so that there is a common price in A and B. Because capital is mobile returns to capital are identical in A and B. Firms produce with a constant-returns-to-scale technology. However, while internal returns to scale are identical in A and B, total factor productivity varies with population size. Also amenities vary with population size. Scale effects are identical or symmetric in A and B. Agents have heterogeneous preferences over wages and amenities. The model is closed by migration of workers between A and B. However, because they have heterogeneous preferences real wages in A and B are not equated in equilibrium. Also, there may be multiple equilibria.

The model can be represented on a simple diagram in which the wage gap (y) between A and B is measured on the vertical and A's population share is measured along the horizontal (Figure 3). In the beginning at E_1 A and B are identical so that wages, population and amenities in A and B are identical. In the absence of amenities schedule M would plot the relationship between residential choice and the wage gap.

As the wage gap opens in A's favor more people prefer to live in A and less in B. Schedule M is naturally asymptotic since A's population share cannot exceed 100 percent. Amenities also affect residential choice. The model assumes that as the amenity gap opens in A's favor as A becomes more populated. Since individuals are prepared to pay for amenities, schedule M' plots the actual relationship between the wage gap and A's population. The vertical distance between M and M' measures the compensating wage differential that residents are prepared to pay in return for amenities. Because amenities are scale dependent the gap between M and M' varies directly with A's population.

Figure 3 here

Schedule Q plots the relationship between the wage gap and A's population share due to externalities and scale economies (pecuniary or Marshallian) in production. As A's population increases and B's decreases scale economies in production are gained in A and forgone in B. Therefore firms can afford to pay higher wages in A when A's population increases, while the opposite happens in B. Schedule Q is assumed to be convergent so that the wage gap does not increase without limit when A's population increases.

The equilibrium in Figure 3 is determined where schedules M' and Q intersect, i.e. when the population choosing to reside in regions A and B is equal to the demand by firms to employ them. Schedules M' and Q have three intersections, so there are multiple equilibria. The first E_1 is at the initial equilibrium where the populations and wages in A and B are equal. The second is at E_2 where there is agglomeration in favor of A, the majority of the population lives in A and wages and amenities in A exceed their counterparts in B. The third is at E_3 where there is agglomeration in favor of B. Since the model is symmetric E_3 is the mirror image of E_2 . E_1 is an unstable equilibrium because if the population in A happened to increase, relative wages in A would increase according to schedule Q and yet more inward migration in A's favor would take place. This happens because schedule Q lies above schedule M' over the relevant range. This process converges to an agglomerating stable equilibrium at E_2 where schedules M and Q intersect. Its symmetrical counterpart E_3 is also stable.

Since E_1 is unstable agglomeration is inevitable, and it is a matter of time before either A or B agglomerate. It is a matter of historical accident whether A agglomerates at the expense of B or vice-versa. Once the snowball begins to roll in

one direction or another agglomerating forces are released until the agglomerating equilibrium is reached at E_2 or E_3 . If A represents Tel Aviv and B represents Haifa, the historical accident which set-off the agglomeration process from E_1 to E_2 was the Ahuzat Bayit movement launched in 1909. This was a movement that had nothing to do with production but everything to do with amenities and the quality of life.

Figure 3 here

Suppose that schedule Q is relatively flat because production externalities and the market size effect are small. Suppose also, that people have strong residential preferences so that schedule M is relatively steep, and therefore E_4 lies close to E_1 . If amenities did not matter there would be little agglomeration because the equilibrium would be at E_4 . However, if amenities are important E_2 would lie far to the right of E_4 because in this case schedule M' would be considerably below schedule M. Therefore, even if the agglomerating forces in production are weak, agglomeration will occur provided the agglomerating forces in social capital and amenities are sufficiently strong. In this case the majority choose to live in A and the wage gap is small. It may even be negative in some circumstances (Beenstock and Felsenstein 2009) because the compensating wage differential that residents are prepared to pay in return for amenities is sufficiently large.

5. Data

The data available for this study are to great extent ad hoc in nature. This dictates the scope of the empirics which are essentially descriptive and indicative. While systematic census data is available for the period studied³, most of it is available on the basis of administrative districts. Urban statistics are reported in a much less consistent way. This has led to the piecemeal collection of the relevant data for Tel Aviv and Haifa. Since both cities only emerged as sizeable urban entities after World War I, data prior to that date can only be partial.

Data on population growth are available on a consistent basis from post-World War I through to 1948. These data include population stocks which include natural

³ No institutional data is available for the Ottoman period. The British Mandate conducted population censuses in 1922 and 1931. The Statistics Department of the Jewish Agency for Palestine conducted censuses in 1918, 1924, 1939 and 1944. Additionally, this department ran periodic surveys throughout the period relating to topics such as Agriculture, Industry and Trade (Gurevich 1931, 1939)

growth (Metzer 1989) and population flows which include immigration (Beenstock, Ziv and Metzer 1995) and point of entry (Gurevich 1944). The latter relates to the place of registration for each new immigrant on arrival as recorded by the Jewish Agency. This is recorded as either Haifa or Jaffa for immigrants who came by sea. Some immigrants entered by land e.g. via Egypt. We observe the changes in the magnitudes of these flows over different periods in an effort to assess the extent to which these cities served as entrepots (conduits) or seedbeds for urban agglomeration. By observing the absolute change in population stocks in both cities we can estimate the relative attraction power of Tel Aviv versus Haifa.

The population stock data for each city are much less consistent. They are culled from a variety of disparate sources, generally individual studies or anthologies relating to the development of Haifa and Tel Aviv over this period, for example Kark (1984) on Jaffa, Shavit and Biger (2001, 2007), Gonen (2009) and Kallus (1997) on Tel Aviv, Naor and Ben Artzi (1989) on Haifa. The data we use to illustrate our argument relates first to urban populations (Jewish and Arab population). No consistent series exists for this indicator and for the early years the data are particularly piecemeal. In addition we utilize urban indicators on productivity, economic activity, port activity and the existence of cultural activities and amenities. This is all available for selected years only and can be regarded as suggestive evidence at best.

6. Some Empirical Evidence

We would expect incipient agglomeration to be reflected in productivity differences between Tel Aviv and Haifa. With incoming immigrant labor largely mobile and without any preconceived residential preferences we might anticipate that that workers would have gravitated to the increasing returns location. The benefits of a larger market would also then show up in higher wages. The piecemeal data available supports the increasing returns argument. As can be seen in Table 2, from the fourth wave of immigration (1924-9) onwards, between one third to one half of industrial establishments and employment were concentrated in Tel Aviv. This level of concentration reduced over time as other urban locations began to develop. It should be noted that the beginning of this period (1925) coincided with the wave of

immigration that consolidated the primacy of Tel Aviv. Throughout the period Haifa remained a distant second.

Table 2 here

Data for 1937 give an insight into the nature of the productivity of the two agglomerations (Table 3). While in terms of absolute magnitude the Tel Aviv cluster was certainly greater, the Haifa concentration seems to have been comprised of larger, more industrial establishments and with greater capital intensity. The capital-labor ratio of establishments in Tel Aviv was only 51% of that in Haifa and output per worker only 62%. We have shown elsewhere (Beenstock and Felsenstein 2009) that the effect of agglomeration on productivity is ambiguous. If positive externalities are strong enough agglomeration will occur. Scale effects should widen the wage differential between locations in favor of the increasing returns regions.

Table 3 here

The limited data we have for wages (relating to 1930, 1943 and 1948) in Tel Aviv and Haifa do not corroborate this claim (Table 4). Only in 1930, are wages higher in Tel Aviv than Haifa. The two latter data points point to higher labor productivity in Haifa. This seems to imply some other factor at work in the formation of the Tel Aviv agglomeration. We suggest that social interaction and urban amenities provide the unobservable 'glue' holding the agglomeration together. Semi-anecdotal evidence can be used to support this contention. As noted in section 2, many observers have commented on the 'cafes in the sand' atmosphere that prevailed in the fledgling Tel Aviv through the 'long 1920's' (1919-1931) (Helman 2007). We suggest that these urban amenities and the non-market social interactions that they spawned were of significant value in entrenching Tel Aviv's position in the urban hierarchy and generating inter-regional disequilibria that persist to this day.

Table 4 here

Table 5 looks at comparable urban amenities in Tel Aviv and Haifa. By the mid 1930's, Tel Aviv was home to the full complement of cultural institutions (Philharmonic Orchestra, Opera, Theaters, Museums and the like). Haifa only reached a parallel standing in the early 1960's and then with a more meager collection of institutions. In the mid 1930's, nearly 60 percent of all theater performances were held in Tel Aviv and they attracted over 50 percent of all theater visitors (Table 6).

Tables 5 and 6 here

As noted earlier, the development of Tel Aviv was largely private sector-led. In contrast, the development of Haifa especially in the Mandate period, benefited from many large-scale public works projects such as the completion of the first deep water port in the region in 1933 and the establishment of the oil refineries in 1938. While the new port (and the Arab riots in Jaffa in the 1930's) served to deflect import and export activity and the arrival of new immigrants to Haifa, this effect was not a sufficient condition to counterweight the amenities and social externalities that Tel Aviv could offer. By the end of the 1930's, the Haifa port had eclipsed Jaffa (and Tel Aviv) in terms of volume of shipments (Figure 4). However, this public investment was not a sufficient stimulant to counteract the effects of Tel Aviv's social amenities.

Figure 4 here

Were personal residential preferences a factor in Tel Aviv's growth? We try to gain an insight on this issue by observing the extent to which Tel Aviv and Haifa acted as conduits channeling new immigrants to other locations or were themselves preferred destinations for the new arrivals. To estimate the preferences of new arrivals, we use annual national and city population stock data and the annual flow data relating to internal migrants and new immigrant arrivals in Jaffa and Haifa.. These arrivals are clustered and roughly correspond to the Third, Fourth, Fifth and World War II waves of immigration covering the years 1919-1945.

Figure 5 divides the sources of urban growth into three components for each of the groups of years: natural increase (the difference between birth and death rates) immigration and internal (within-country) migration. For example, in 1922, national population was 92,300. National population change 1922-33 was 99,800 such that the national population in 1933 was 192,100. National population change was comprised of 89,300 immigrants and the rest natural increase. The Tel Aviv component of this growth breaks down into a gain of 19,342 (immigrants or 'potential stayers' as not all them would continue to reside in Tel Aviv) a loss of 51,358 through internal; migration and natural increase). Despite being the main point of entry over this period, Jaffa functioned as an entrepot channeling immigrants and internal migrants to other parts of the country (rural settlements, Haifa, the new towns around Tel Aviv etc). Tel Aviv registered a negative population balanced by the end of the period of -32,016 (-62%) much of this resulting in high rates of internal migration and low local retention. Over this same period, Haifa returned a very small positive balance. However, over the next period, 1931-1945, the tables turned. Despite the development

of Haifa port and the city as the main point of arrival, Haifa served as a conduit for immigrants to move elsewhere (in particular Tel Aviv) with a negative population balance of -51,634 versus a positive balance of 39,371 in Tel Aviv much of it due to high retention rates. This would seem to be the period in which increasing returns, a large home market effect and migrant mobility coalesced to contribute to Tel Aviv's urban ascendancy.

Figure 5 here

6.2 The Role of Ports

We now formalize the above approach to stocks and flows of population. Starting with flows, we estimate the year by year population change in Tel Aviv as directly related to the flow of immigrants arriving in Jaffa and Haifa and the general (lagged) growth of the Jewish population and inversely related to the size of the natural increase in Tel Aviv (lagged Tel Aviv population). This is expressed as:

$$\Delta\text{POP}_t = \alpha + \beta J_t + \gamma H_t + \lambda \text{POPT}_{t-1} + \theta \text{POP}_{t-1} + u_t \quad (1)$$

where:

ΔPOP_t = annual change in Tel Aviv's population

J and H = immigrants arriving annually at the ports of Jaffa (J) and Haifa (H)

POPT_{t-1} = lagged national Jewish population

POP_{t-1} = lagged Tel Aviv population

We expect β to be positive if immigrants arriving in Jaffa tend to settle in nearby Tel Aviv. We also expect γ to be positive if Haifa is a conduit for Tel Aviv and elsewhere. Since Tel Aviv is closer to Jaffa than Haifa it might reasonably be expected that $\beta > \gamma$. We expect λ to be positive since internal migration to Tel Aviv varies directly with the Jewish population outside Tel Aviv. Finally, θ may be positive or negative since it depends on two countervailing forces. It will be negative insofar as out-migration from Tel Aviv naturally varies directly with the population in Tel Aviv. On the other hand, it will be positive due to natural increase.

We have estimated equation (1) using annual data during 1920-45. The estimated coefficients for this model are presented in Table 7. The main surprise is that the estimate of β is not statistically significant, suggesting that the proximity of the Tel Aviv to the port in Jaffa made no difference to Tel Aviv's demographic growth. On the other hand, the estimate of γ is statistically significant suggesting that Haifa overwhelmingly served as a conduit for immigration into Tel Aviv. Indeed, the

estimate of γ is not significantly different from unity. The estimate of λ is also statistically significant indicating that the rate of in-migration to Tel Aviv was the order of 25 percent. Finally, the estimate of θ is negative, small but statistically significant, suggesting that out-migration from Tel Aviv was approximately counterbalanced by natural increase. However, the retention rate in Tel Aviv seems high for otherwise θ would have been more negative. Given that Tel Aviv wages were lower over this period than in Haifa, this also might indicate that people were prepared to pay a premium to live in Tel Aviv. This suggests that even if Tel Aviv did not happen to be close to the port in Jaffa, it would have still become the focus of agglomeration. It does not seem to be the case that the immigrants, who predominantly landed in Jaffa in the 1920s, stepped off the boat, were captivated by Tel Aviv's bright lights, and saw no reason to move on.

Table 7 here

6.3 The Role of Social Amenities

We now turn to the level of population and carry out a direct test of our claim that agglomeration in Tel Aviv was driven by social forces. In the absence of time series data on social amenities, we assume that social amenities (A) are produced through social interaction. We also assume that social interaction varies directly with population, since more social amenities are produced by larger populations. However, social amenities also suffer from depreciation. We propose that:

$$A_t = (1 - \delta)A_{t-1} + \alpha P_{t-1} \quad (2)$$

where P denotes population, δ the rate at which amenities depreciate, and α is the rate at which social amenities are created. Equation (2) states that if the population is constant at P , amenities in the stationary state converge to $A^* = \alpha P / \delta$, and if the population grows at the rate g , amenities in the steady state are equal to:

$$A_t^* = \frac{\alpha P_0 (1 + g)^{t+1}}{g - \delta} \quad (3)$$

where P_0 denotes the population in the base year. Equation (3) requires that $g > \delta$, i.e. amenities depreciate slower than they accumulate. Social agglomeration theory predicts that the population share should vary directly with relative social amenities.

In Figure 6 we plot the share of Tel Aviv's population against social amenities in Tel Aviv relative to social amenities in the rest of the country using the assumption

that $\delta = 0.7$ and $\alpha = 1$. Figure 6 shows that Tel Aviv's population share varies directly with relative amenities, as predicted by amenity theory, but it does so nonlinearly. The relationship is positive until Tel Aviv's population share is about 35 percent. We use nonparametric regression to estimate the relationship between Tel Aviv's population share and relative social amenities. We estimate the regression using a cubic spline and show the regression relationship in blue. We find that setting δ to 0.7 provides the best fit with $R^2 = 0.984$ and unexplained error (SSE) = 0.012.

Figure 6 here

Although the data in Figure 6 are trending and therefore nonstationary, Wang and Phillips (2009) have suggested that standard nonparametric estimation methods may be used without modification. The residuals from Figure 6 should be stationary for the nonparametric regression to be genuine rather than spurious. Unfortunately, there is currently no available cointegration test statistic for residuals generated by nonparametric estimation methods. Therefore the results in Figure 6 are indicative only.

7. Conclusions

Established in 1909, by the beginning of the 1930's Tel Aviv's urban consolidation was already complete. From the outset it would seem that Haifa was unable to assemble the critical mass necessary for inducing agglomeration. Despite its head start, its port, priority status to the Mandate authorities, public investment and favorable transportation linkages, Haifa never really managed to challenge the primacy of Tel Aviv. By the beginning of the 1930's the city switched from being a net catchment location to a conduit funneling new immigrants to Tel Aviv.

We show that the agglomeration process in Tel Aviv did not depend on its proximity to the passenger port in Jaffa. The hypothesis that immigrants landing in Jaffa simply gravitated to nearby Tel Aviv is strongly rejected by the data. Instead, we show that the agglomeration process was driven by social externalities and amenities. However, the relationship between agglomeration and amenities is nonlinear. In the early stages of agglomeration the marginal effect of amenities is increasing, but it subsequently decreases, and eventually tends to zero. This point of saturation was reached in the mid 1930s by which time Tel Aviv accounted for 35 percent of the Jewish population. In terms of Zipf's law of the size distribution of cities, 35 percent is very large (Ioannides and Overman 2003, Black and Henderson 2003, Soo 2005),

and testifies to the power of the forces of agglomeration that prevailed after World War 1.

Despite the mobility of the immigrant population, our results point to high retention rates for Tel Aviv. The data suggest that immigrants were prepared to pay a premium in terms of lower wages in order to enjoy the social externalities of the city. It seems that immigrants actively sought out these urban amenities and that agglomeration was not built on immigrant inertia at the first point of arrival.

Therefore it was the urban lifestyle, culture and amenities of Tel Aviv that were mainly responsible for agglomeration. Externalities in consumption rather than production were the key driving force behind the urban primacy of Tel Aviv. Mutually reinforcing second nature conditions operated in Tel Aviv that did not exist for Haifa. Despite the contradictions of a predominantly east European population, trying to re-create the social ambience of central and west European cities in a Levantine setting, bereft of the weight of history, tradition and colonial intervention, Tel Aviv succeeded in setting in motion the somewhat chaotic and not always aesthetic, urban growth dynamic that Haifa failed to generate.

Figure 1: Urban Development of Tel Aviv, 1840-1944

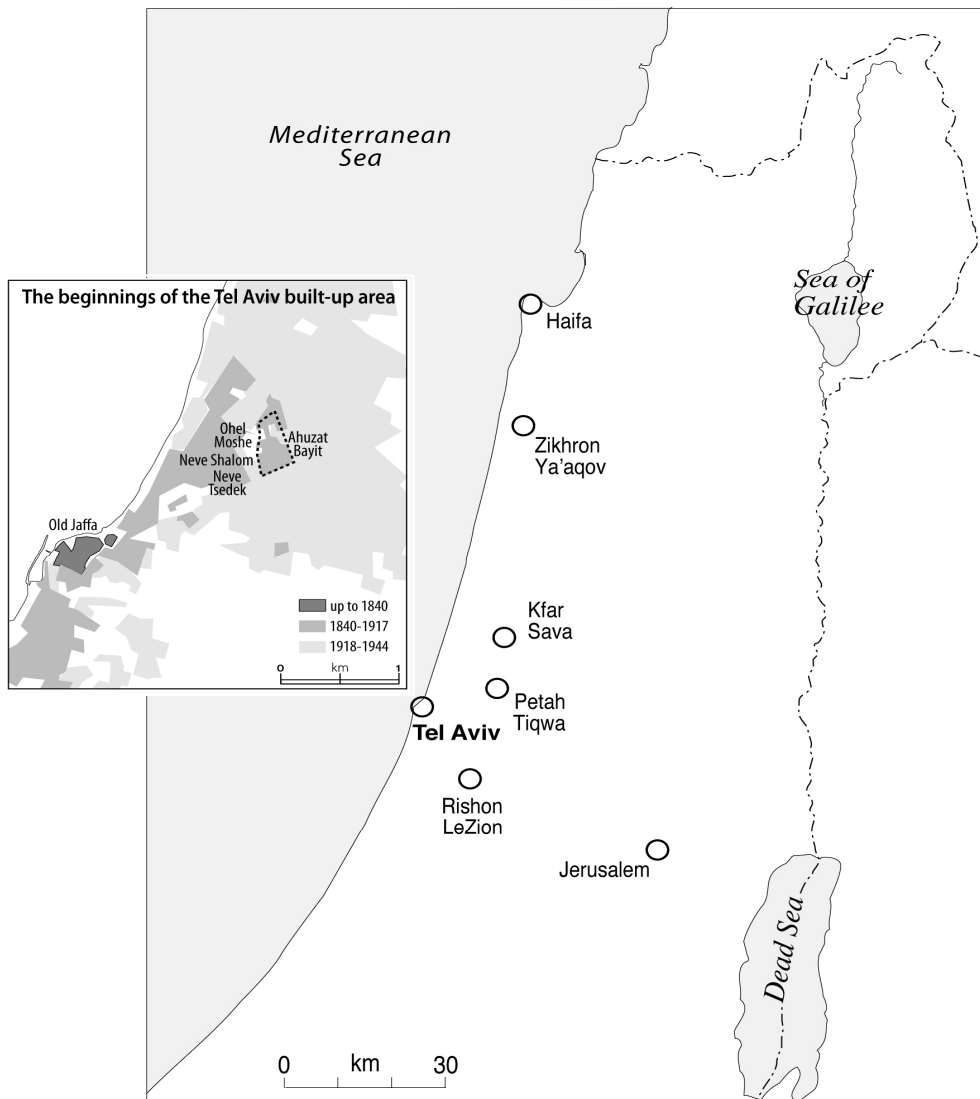
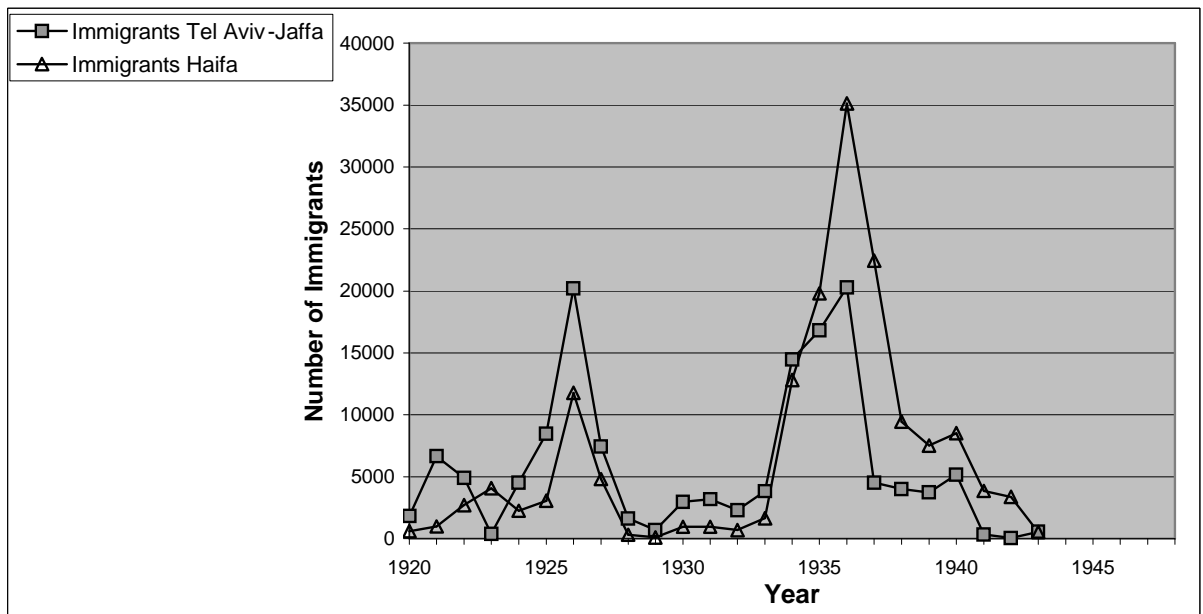


Figure 2: Immigration through Jaffa (Tel Aviv) and Haifa ports, 1920-1943



Source: Gurevich (1944)

Figure 3: The Role of Social Externalities

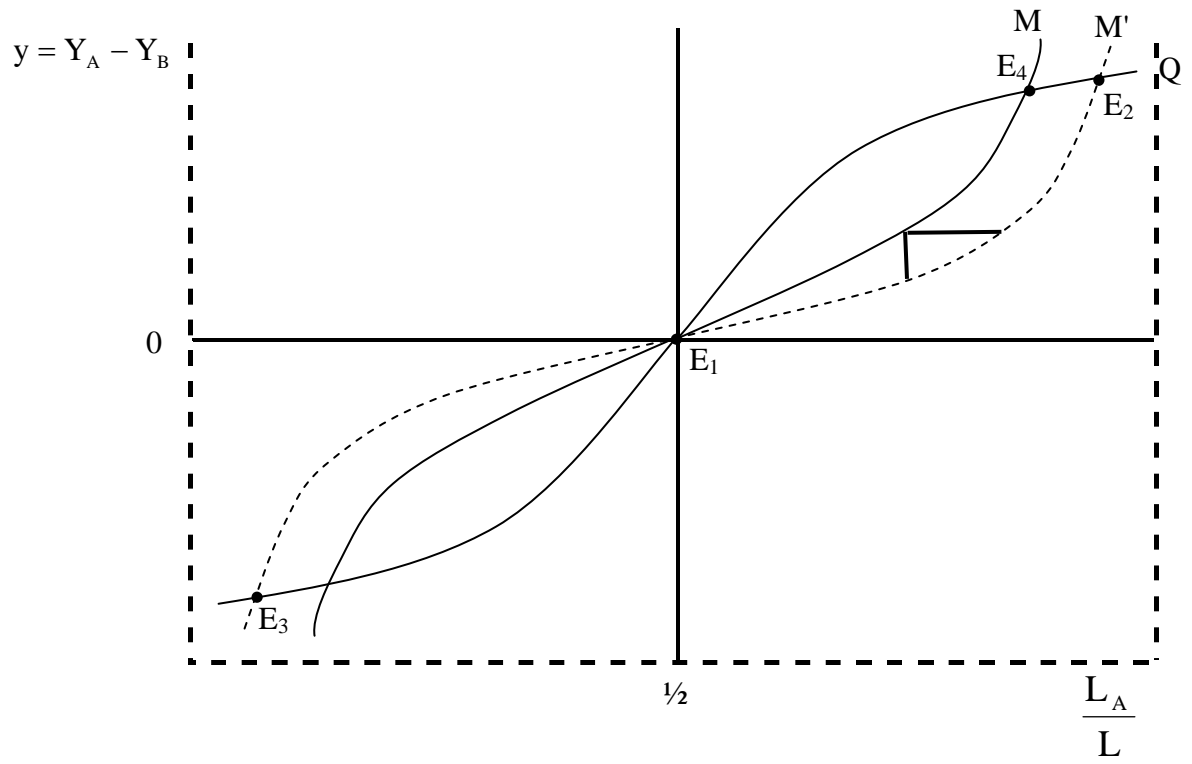
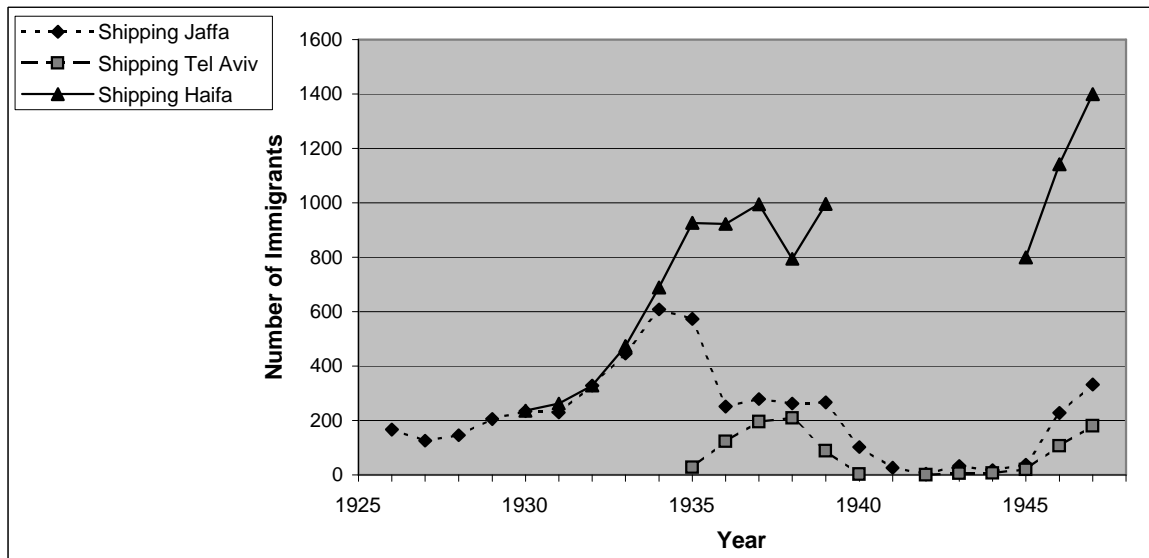


Figure 4: Volume of Shipping (Th tons) through Jaffa, Tel Aviv and Haifa ports, 1926-1947



Source: Stern (1989), p87

Figure 5: Sources of Urban Growth, Tel Aviv 1919-1945

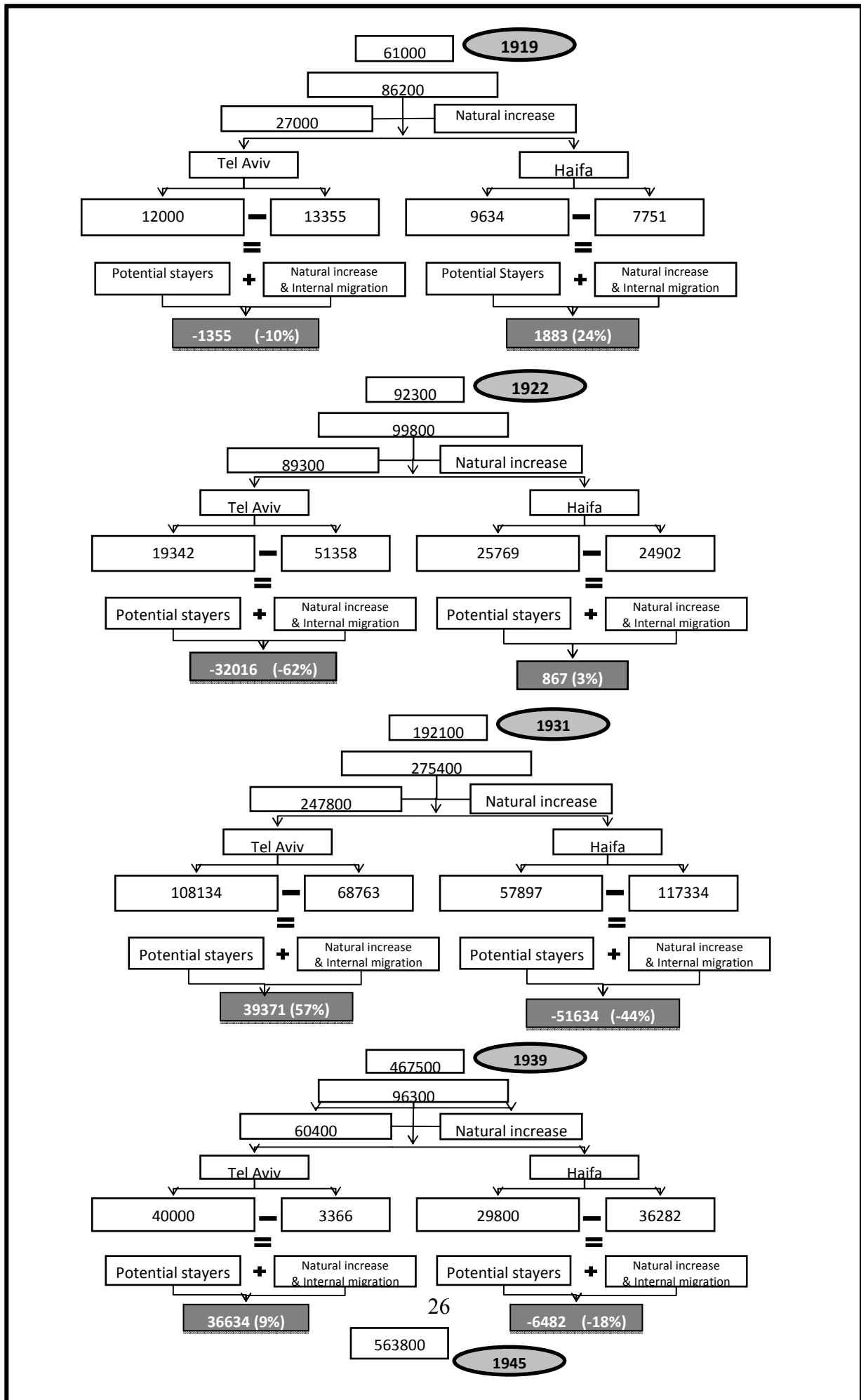


Figure 6: The Relationship between Tel Aviv's Share of Population and Tel Aviv's Relative Share of Amenities

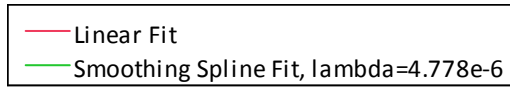
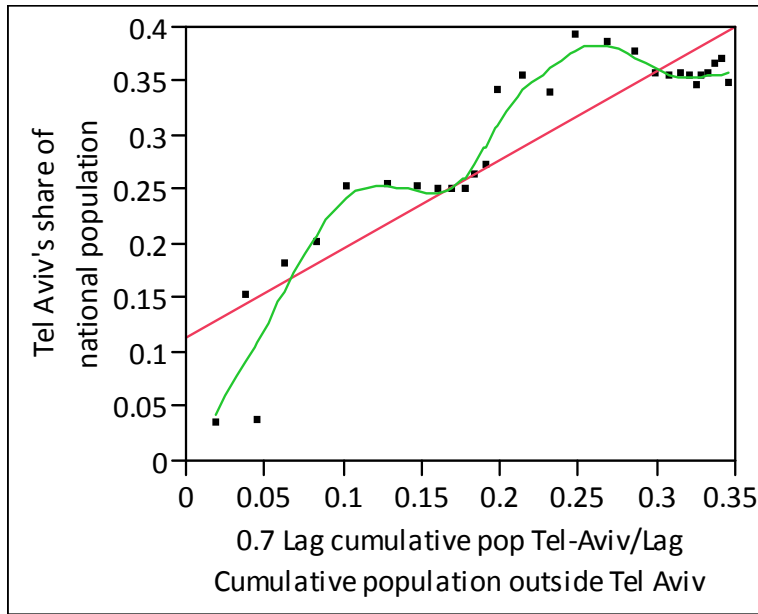


Table 1: Haifa, Jaffa and Tel Aviv: Population 1910-1948

	Haifa	Jaffa	Tel Aviv
<u>Jewish Population</u>			
1910	3,000	8,500	300
1922	6,230	5,087	12,897
1931	15,923	7,209	46,101
1938	54,118	22,000	132,000
1948	94,718	31,000 ¹	183,000 ¹
<u>Total Population</u>			
1910	18,000	50,000	300
1922	24,600	32,524	12,897
1931	50,483	51,866	46,101
1938	100,200	79,000	132,000
1948	98,284	104,000 ¹	183,000 ¹

Sources: Haifa data: Bachi (1977), Gurevich (1944), Roi and Yasur (1954).
Jaffa and Tel Aviv data: Bachi (1977), Gurevich (1944), Golan (1999)

1. 1947 figures.

Table 2: Industrial Establishments and Employment (% of National Total)

	1925	1935	1943
No Establishments			
Tel Aviv	49	51.3	32.8
Haifa	11.7	17.5	11.5
No Employees			
Tel Aviv	45.6	41.7	39.7
Haifa	16.8	18.5	15.4

Source: Sofer (1989)

Table 3: Industrial Productivity, Tel Aviv and Haifa, 1937

	<u>Tel Aviv</u>					<u>Haifa</u>				
	Estab.	Emps.	Value Output	Value of Cap ¹ .	K/L ²	Estab.	Emps.	Value Output	Value of Cap. ¹	K/L ²
Total	2681	12,518	3.41	2.45	–	718	4,738	2.07	1.91	–
Indust.	708	8,597	2.81	2.18	253.6	261	3,804	1.89	1.83	496.8
Craft	1973	3,921	0.61	0.27	–	457	934	0.17	0.78	–

¹ Value of Output and Capital , M. Lira, 1936.

² Cap: Lab ratio in Th. Lira, 1936.

Source: Gurevich (1939)

Table 4: Wages in Tel Aviv and Haifa 1930-1948

	TA	Haifa
Monthly wage 1930	4820	2420
Avg weekly wages 1943 (liras)	5,654	5,735
Median weekly wages,1943 (adjusted for firm size)	384	389
Avg. Weekly Wages 1948 (liras)	1748	2073

Sources:

1930- Gurevitch D (1931) General totals from Agriculture and Industry Survey, Statistics Department , Jewish Agency, Jerusalem

1943- Cyderovich G and Gurevich D (1945)Investigation into Workers wages and earnings in Jewish Industry 1943, Department of Statistics, Jewish Agency

1948 – Histadrut Workers Federation, Department of Information and Statistics, Te; Aviv, p8. Table 6

Table 5: Cultural Institutions by Year of Establishment

Tel Aviv		Haifa	
Tel Aviv Philharmonic Orchestra	1936	Haifa Symphony Orchestra	1950
Israeli (Tel Aviv) Opera	1923		
Habima theatre	1926	Haifa Theatre	1961
Cameri theatre	1944		
Matateh theatre	1928		
Ohel theatre	1925		
Haaretz Museum	1936	Haifa Art Museum	1951
Tel Aviv Art Museum	1932	Antique Art Museum	1948
Casino "Galei Aviv"	1923	Bat Galim Casino	1933

Table 6: Performance and Visitors at Theaters 1935, 1936

	1935	1936
Number of theater performances-National	731	633
Of this- in Tel Aviv (%)	57	62
No of theater visitors	384,385	321,736
Of this -in Tel Aviv (%)	51	56

Source; Shavit and Biger (2001)

Table 7: Factors explaining the annual change in Tel Aviv population, 1920-1945

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	-13200.89	4967.051	-2.66	0.0155
Arrivals Jaffa	0.0115559	0.225144	0.05	0.9596
Arrivals Haifa	0.9577558	0.164448	5.82	<.0001
Lag total Jewish pop	0.2619406	0.074753	3.50	0.0024
Lag Tel Aviv population	-0.000641	0.000179	-3.57	0.0020

N=24; Adj R²= 0. 0.742504

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