Metal and Engineering Industries and Innovative Clusters in Turkey

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Abstract

Innovation activities in emerging economies, such as Turkey, have received relatively little attention from economic geographers and other scientists, despite the growing importance of those countries in the global economy. In the past decades, Turkey has witnessed an intense period of industrialization, with first import substitution (ISI) and then export oriented policies in place. Established knowledge suggests that in due course, growth in industrial production would be accompanied by increase in innovative activities, and this would take place in distinctive clusters. This paper studies innovation activity in Turkey's metal and engineering industries from 1980 to 2011, using national patent data. It is shown that innovative activity in those industries in Turkey only began to increase markedly in early 2000s, and at the same time distinctive innovative clusters began to emerge. Results also indicate that innovation activity in Turkey is concentrated in the traditional economic centres.

Key Words: Turkey; Innovation; Patenting; Metal and Engineering Industries

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1. Introduction

In recent years, the role of new growth economies in the global economy has increased prominently, the best known of those being the so-called BRICS (Brazil, Russia, India, China, South Africa). Following these, then, are what O'Neill (2001, 2007) has labelled as "the Next Eleven" or N-11 (Bangladesh, Egypt, Indonesia, Iran, Mexico, Nigeria, Pakistan, Philippines, Turkey, South Korea, Vietnam). However, innovative activities in these countries have received little academic attention, despite the widely recognised centrality of innovation in growth and development. Indeed, should the new growth economies be able to challenge the established economic powers in innovation, this will undoubtedly have a lasting impact in the global economy and politics.

A particularly interesting emerging economy to study in this respect is Turkey. Turkey has gone through many of the typical development stages and policies that are

witnessed in most developing countries, such as import subsidising industrialisation (ISI) and export orientation. While Turkey's possible accession to the European Union has been subject to lengthy negotiations, the country has demonstrated high rates of export and economic growth in recent years. This paper will study the development of innovative clusters in the metal and engineering industries in Turkey. The intention is to reveal whether innovativeness follows similar paths in a developing country, as has been already witnessed in various developed countries.

2. Literature survey

Yeung and Lin (2003) pointed out ten years ago that economic geographers have paid little attention to the world outside Europe and North America. Since then, there appears to be little improvement. Apart from economic geographers, other scientists interested in innovation as well have largely disregarded the emerging economies, despite their growing importance in today's world.

From the existing body of research focusing on innovation activities in emerging economies, it can be concluded that innovation in those countries indeed exists, and that it matters, all the way down to firm level (e.g. Chudnovsky et. al. 2006). Hasan's and Tucci's (2010) study of 58 countries 1980 – 2003 shows that increased innovation, as measured by patenting, increases economic growth. The main differences in opinion are concentrated on how innovation develops in those countries: or whether such development is linear, inverted linear or third way (Bernardes et da Motta e Albuquerque 2003). This also brings the issue of path dependency into the discussion. Previous studies have pointed out strong path dependencies in developed countries (e.g. Neffke et. al 2011), but some (e.g. Martin 2010) have begun to question whether path dependency is too narrow a few to study local and regional development.

There is also the established view that innovation emerges from clusters of companies and other relevant actors. Indeed, with Porter (1990, 1998, 2003) clusters have become a key word for development efforts all over the world, even though the benefits of industrial agglomeration were already noted much earlier by Marshall (1890). The traditional Marshallian view states that clusters which consist of companies in the same or closely related industries are the most innovative, and this has for decades formed the basis for innovation policies in various countries, not the

least in Turkey, where the government has actively encouraged companies in the same industries to locate next to each other in special industrial areas (*Organize Sanayı Bölgeleri*). Later however, Jacobs (1969) asserts that agglomerations of diverse industries are the most beneficial for innovation activity. In a review of empirical studies, Beaudry and Schiffauerova (2009) conclude that the kind of specialisation that Marshall advocated appears to be beneficial for innovations in low-technology and mature industries and regions, whereas diversity à la Jacobs gives the best results in high-technology clusters.

With clusters so much enthused by academic, business and political circles alike, it is easy to be carried away by it and assume that clusters would be innovative by default. However, one should remember that the mere fact that companies are located close to each other tells nothing of their capability or even willingness to innovate. As Akerlof (1970) points out, particularly in countries that follow ISI policies, a combination of lack of exposure to global technological developments and industrial agglomeration may rather result in "concentrations of mediocrity" than innovative clusters.

In global rankings, Turkey does not currently possess a high place when it comes to innovativeness. Some doubt whether Turkey can be called even a moderately innovative or competitive country (e.g. Önsel et al. 2008). On the other hand, those who have noted Turkey's rapid industrialisation and export growth wonder whether Turkey can be even called a developing country any more (e.g. Hoeschele 2002). Yet it is seen as evident that Turkey's export orientated growth policy, adopted in the 1980s, was not accompanied with technological development equivalent to South Korea and other Asian success stories (Özçelik et Taymaz 2004, 414). Akkermans et al. (2009), in their criticism of Hall and Soskice (2001) call Turkey as a "Mediterranean/Mixed Market Economy" (MME) and note that only about 100 US Patents were issued to inventors located in Turkey 1970 – 1995. The authors describe MME as "the 'Mediterranean' variety of capitalism [which] features strong reliance on nonmarket mechanisms in corporate finance and a focus on market mechanisms in labor relations" (Akkermans et al. 2009, 183).

The dearth of empirical studies on innovation in emerging economies is also evident when it comes to Turkey. A review of various economic geography and innovation related publications discovered less than ten papers relevant to the subject. Özağatan (2011) studies local suppliers to automotive industries in the city of Bursa and finds out that local companies have been allocated certain research and development (R&D) functions by their customers. However, the author is careful not draw too far-

reaching conclusions from these observation. “It is possible that a further study, aimed at a deeper examination of frontier suppliers, would reveal whether or not the competences of Turkish suppliers have truly increased: this is beyond the scope of this particular paper” (Özağatan 2011, 899). Studies of automotive industries in other emerging economies suggest that the core of R&D activity in the home base of multinational car companies (e.g. Pavlínek 2012).

Uzun (2001) studies the innovativeness of Turkish firms 1995 – 1997 by questionnaire and finds out that only 19% of Turkish firms applied for patents and even fewer were approved. The author is again well aware of the limitations of the research and stresses that “more detailed surveys over longer periods are needed to gather data for exploring the mainstream of the technological activities in Turkey” (Uzun 2001, 195). Using the same data, (Özçelik et Taymaz 2004) see a connection between the innovativeness and export performance of Turkish firms, an observation which is supported by other empirical studies in developed economies (e.g. Ernst 2001). Özçelik and Taymaz firmly believe that innovations will be crucial for better export performance of Turkish companies, and that devaluations and export subsidies provide only a temporary remedy (2001, 421 – 422). In a later paper, Özçelik and Taymaz (2008) study Turkish government’s support to corporate R&D activities and see that having a positive impact on innovation activities in Turkey.

Uzul’s (2001) call for studies covering longer time periods is partially answered by Karaoz’s and Albeni’s (2005) paper on technological learning in Turkish manufacturing firms 1981 – 2000. It is observed that Turkey’s policy change from ISI to export orientation in the 1980s increased technological learning in some industries, notably machinery, which could then compete in international markets successfully. However, for some other industries export orientation and economic opening proved detrimental. For instance, Turkish chemical companies could not invest enough in R&D in order to stay competitive after the economic opening and increased foreign competition in Turkey’s domestic market as well (Karaoz et Albeni 2005, 880).

Dereli and Durmuşoğlu (2009a) also cover a longer time period (1995 – 2006) when they study patenting activities in textile and paper industries in Turkey. Their research covers other industries as well, but only for 1995 – 2006. Nevertheless, the authors note an upward trend in Turkish patenting, even though the rejection rate of domestic patent applications remained relatively high, suggesting that Turkish industries are not very familiar with patentability yet (Dereli and Durmuşoğlu 2009a, 128). At the time of publication, Dereli’s and Durmuşoğlu’s paper was the first and

only study, which gives an overall picture of patenting in Turkey (2009a, 128), and none have emerged since. In another research, Dereli and Durmuşoğlu (2009b) study textile industry patenting in Turkey in greater detail, but their work (and none of the other studies cited here) is not concerned with the way issued patents are dispersed geographically.

3. Research Questions

As is evident from the literature survey above, there are no studies of innovation in Turkey which would both cover long time periods and focus on cluster formation in metal and engineering industries (or any other industries for that matter. This study aims to fill in that gap by answering the following questions:

1) *How have Turkish metal and engineering industry companies patented their inventions from 1980 to 2010?*

2) *Does the geography of patents in Turkey indicate the existence of innovative clusters in metal and engineering industries in the country?*

The time period under observation covers the change in Turkey's growth policy from ISI to export orientation, Turkey's entry into a customs union with the EU in 1995 as well as years of rapid economic and export growth in the early 2000s. Therefore, it is expected that patenting in these industries will show a consistently upward trend 1980 – 2010, and that during this time innovative clusters will have emerged in Turkey.

4. Methodology

This study will use patents to research innovation in Turkish metal and engineering industries. Patents are easily available from online sources, and the information they contain, not only the patented invention itself but the location of inventing company and inventors themselves, is very helpful for studying the geographical dispersal of innovation activities. Methodological benefits and drawbacks of patents have been widely discussed in literature, and with this study as well, one must be aware of the limitations of patent data. As Nagaoka et al. (2010) point out, patents only one

indicator of invention, and thus no far reaching conclusions should be drawn on patent data, unless accompanies by other methods such as surveys. However, for the purposes of this study, which is primarily concerned with the location of innovation activity, patents are deemed the best available data source.

US patents have for decades been a popular data source for similar studies. Especially when comparing innovation activity in several different countries, US patents which are granted along same standards are the most useful ones. However, in case of Turkey, as already indicated by Akkermans et. al (2009), there are only a few hundred US patents granted to inventors residing in Turkey in all industries, even when including the longest available time period, which is from1970 to present. Thus, Turkish domestic patents and utility models are employed instead. It is noted that in developing economies, companies and inventors have fewer resources to apply for US patents, and thus domestic patents may even give a better overall view of innovation activity in such countries. This is confirmed by Motta e Albuquerque (2000), who used both US and domestic patents when studying innovation in Brazil and sees the usefulness of the latter in an emerging economy context. Of course, extra caveats are in order when such data is compared internationally, due to the varying standards of national patent offices in granting patents.

The online database of the Turkish Patent Institute (*Türk Patent Enstitüsü*,www.tpe.gov.tr) was used to extract patent and utility model data. For metal and engineering industries, international patent classification (IPC) classes B04, B06, B09, B21, B22, B23, B24, B25, B26, B27, B28, B29, B30, B31, B66, F01, F02, F03, F04, F15, F17, F22 and F28 were deemed most relevant. It should be noted that the use of these classes only largely excludes Turkey's large vehicle industry from the study. Thus, the focus is on those metal and engineering industries, which produce investment goods such as machinery. Only those patents which are applied by Turkish residents (companies and individual inventors) are taken into account. This excludes Turkish patents granted to foreign companies (though not Turkish subsidiaries of multinational companies), and thus provides a more accurate view of innovation activity taking place on Turkish soil, in comparison to Dereli and Durmuşoğlu (2009a) who also included foreign patent applicants. Patent data was then organized by the year of application, which is closer to the actual time of invention than granting year. (As Dereli and Durmuşoğlu [2009a] note, the time between patent application and granting in Turkey is generally 12 – 18 months.)

5. Findings

As expected, Turkish patenting increased during the period of observation. However, no prominent increase is observable until the late 1990s. In 1980, not a single patent application belonging to the above-mentioned classes was filed. For the rest of the 1980s, only a few such patents per year were applied for. (In these years, almost all patents in Turkey were granted to foreign companies, which wanted to protect their inventions in the Turkish market as well.) The most rapid growth is observed from 1997 (10 patents) to 2007 (254) patents. After 2007, patenting appears to have decreased, possibly owing to the global economic crisis which hit Turkey hard in 2008 in particular.

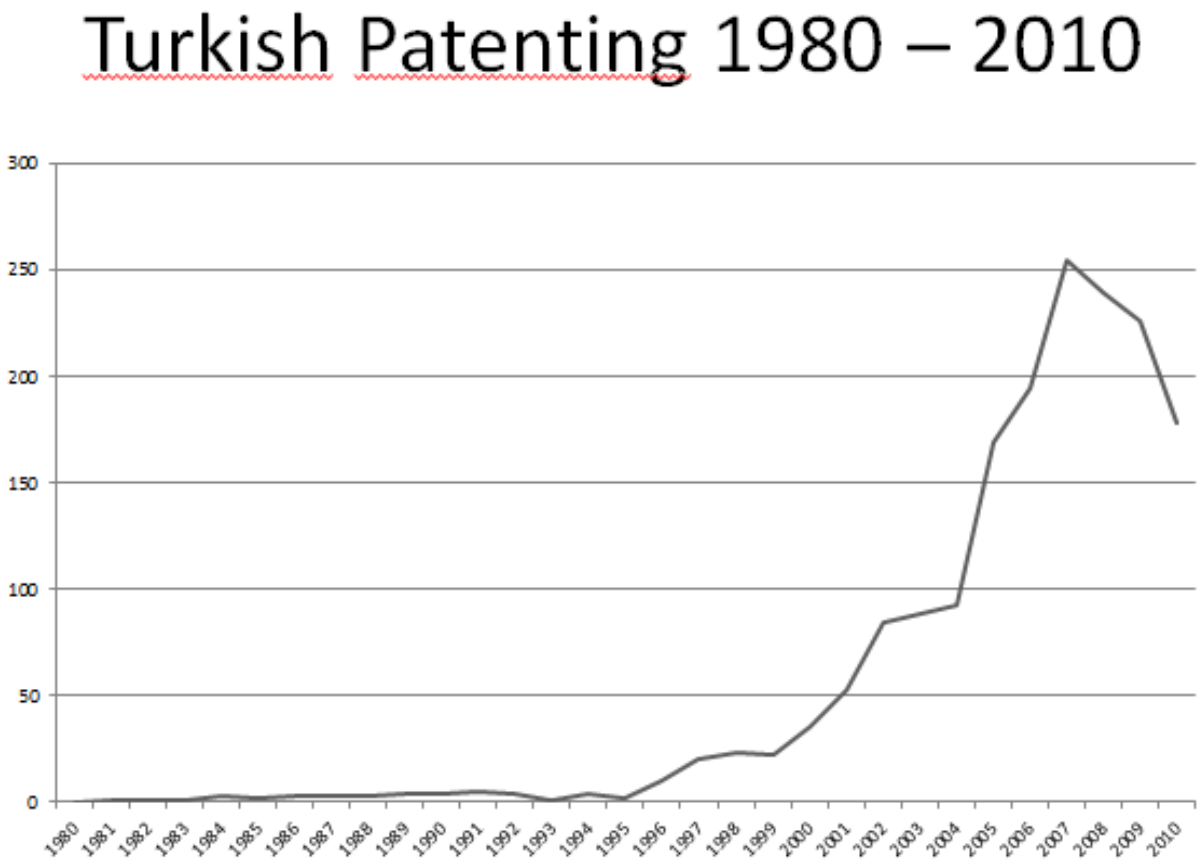

Figure 1: Patents and utility models issued in Turkey to Turkish residents (companies and individuals) in metal and engineering industries, 1980 - 2010. Source: www.tpe.gov.tr.

When looking at the geographic distribution of these patents, it comes hardly as a surprise that the Istanbul region (as the long standing economic hub of Turkey) emerges as the first and largest innovative metal and engineering industry cluster in the country. In the 1980s, the only area that can indeed be called a "cluster" in metal and engineering industries in Turkey is Istanbul. Only very few patents in 1980 – 1989 were applied from other cities than Istanbul.

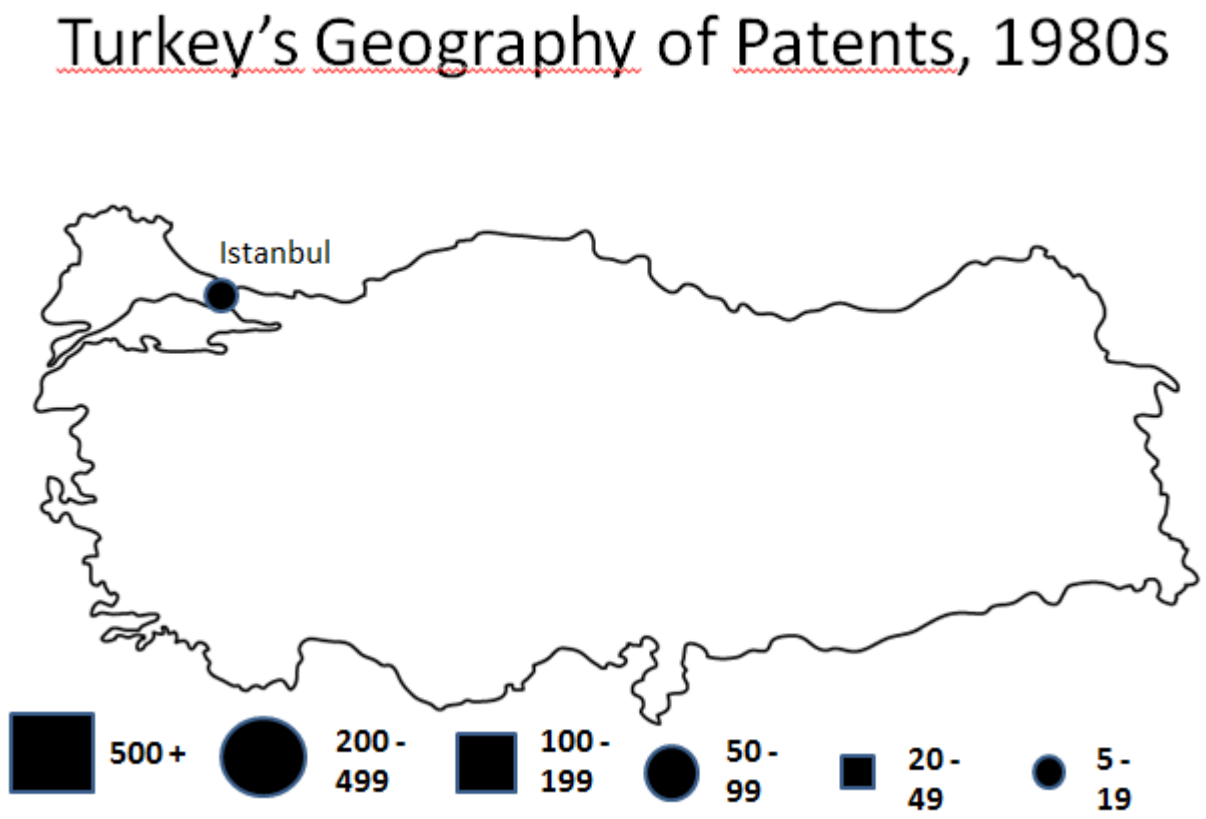

Figure 2: Geographical Distribution of Turkish Patents in Metal and Engineering Industries, 1980 – 1989.

In the 1990s, then, more innovative metal and engineering industry clusters appear to be emerging in Turkey. Bursa, which is particularly noted for these industries, shows nascent innovation activity, as well as the Turkish capital Ankara.

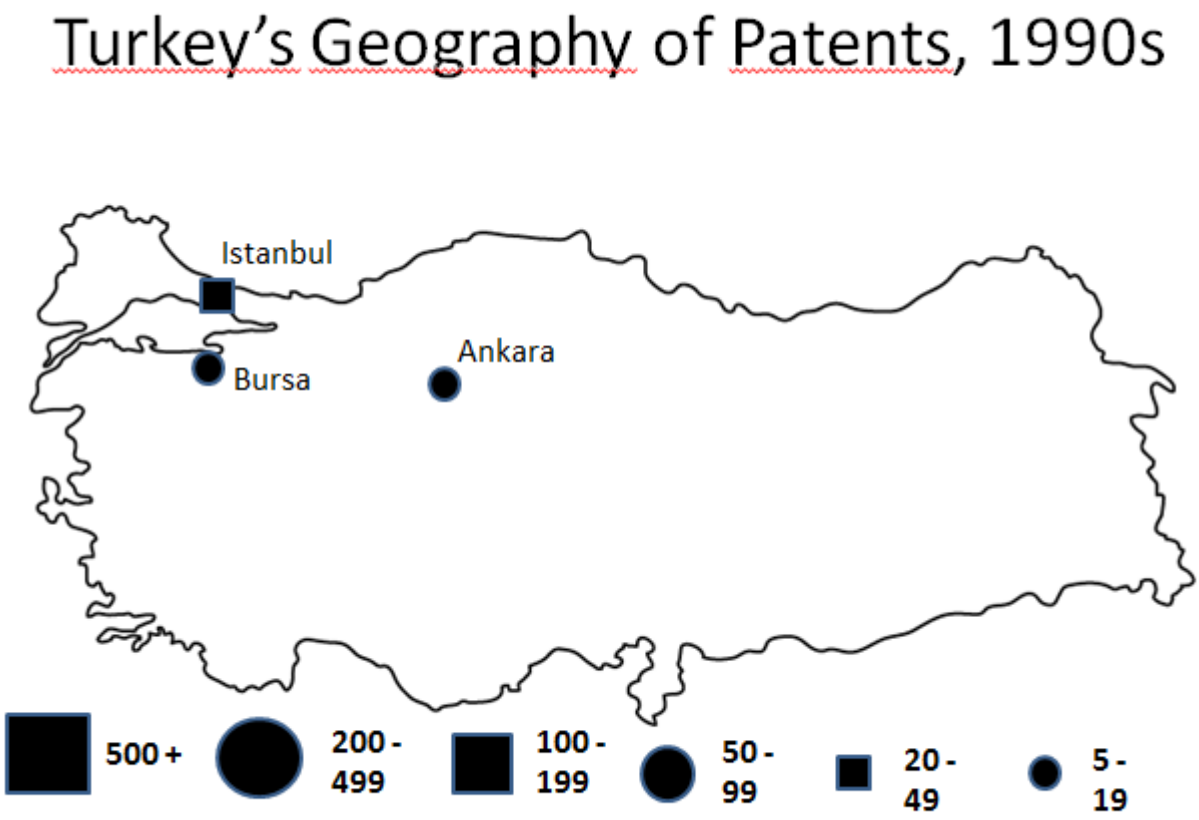

Figure 3: Geographical Distribution of Turkish Patents in Metal and Engineering Industries, 1990 – 1999.

When it comes to 2000s, metal and engineering industry innovation activity has clearly been distributed over a wide area in Turkey. While the traditional metal and engineering industry clusters in Istanbul and Bursa are still responsible for the bulk of innovation activity, such clusters are also emerging in Turkey's Southeast (Gaziantep), which has traditionally been the country's least industrialized part.

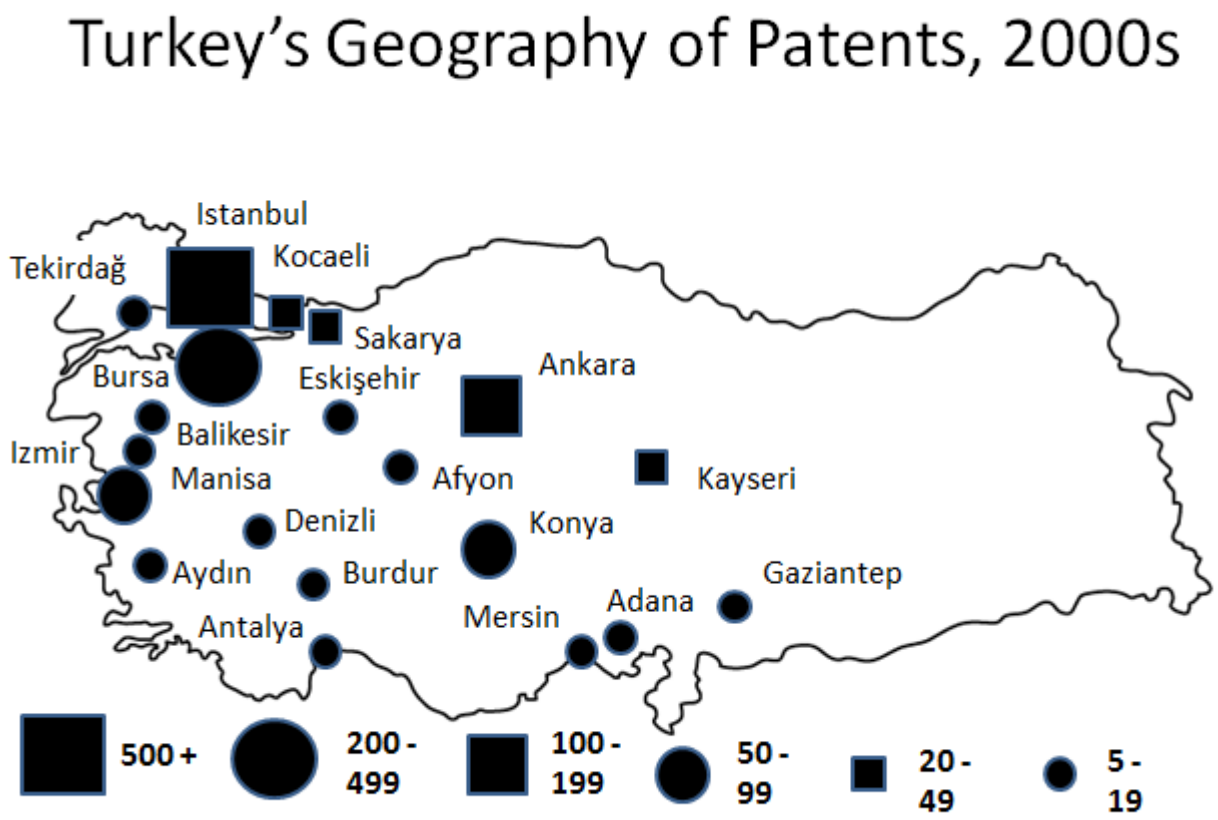

Figure 4: Geographical Distribution of Turkish Patents in Metal and Engineering Industries, 2000 – 2009.

6. Conclusions and Issues for Further Research

This study shows that innovation activity in metal and engineering industries has increased prominently, but only during the last ten years of the period of observation. It is also shown that innovation activity in metal and engineering industries in Turkey is increasingly found in clusters, most notably in Istanbul, Bursa and Ankara. In the 2000s, residents (companies and individuals) of these cities were responsible for nearly 70% of all patenting in these industries in Turkey.

Even though innovation activity, based on patent data, now appears to take place in various cities and regions in Turkey, these results should not be taken as a proof for the success of the development policies of successive Turkish governments, which have sought to promote industries outside Istanbul, particularly in the underdeveloped

Southeast, as most innovation still takes place in the above-mentioned traditional industrial centres.

More research is also needed regarding the patenting propensity of Turkish firms. As noted, Turkish firms have patented very little in the US, which suggests a lack of international ambition. However, this could be found out in reasonable certainty only by interviews, which are outside the scope of this paper. Interviews would also ascertain whether the drop in patenting in Turkey observed from 2008 is indeed the result of economic downturn (as assumed), or whether there are other reasons for this ostensible decreasing in innovation activity.

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