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When Agglomeration is Necessary but not Sufficient for Productivity in Egypt

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In a Nutshell

- *Spatial agglomeration has always been the most important driver of industrial growth in developing countries thanks to significant spillovers.*
- *Our main findings show that, in the Egyptian context, productivity spillovers gained from agglomeration measures outweighed the negative effects of competition implied by congestion. The latter is chiefly due to the lack of good infrastructure.*
- *From a policy perspective, it is important to boost clusters to help SMEs expand. Indeed, our results show that micro and small firms are more likely to benefit from localization and diversification compared to medium and large firms.*

This policy brief examines the nexus between firms' productivity and economies of agglomeration in Egypt. In the Egyptian context, productivity spillovers gained from agglomeration measures outweighed the negative effects of competition implied by congestion. The latter is chiefly due to the lack of good infrastructure. Moreover, micro and small firms are more likely to benefit from localization and diversification compared to medium and large firms. The brief shows that agglomeration economies are necessary for productivity but not sufficient since they require a good infrastructure.

Spatial agglomeration has always been the most important driver of industrial growth in developing countries. The linkage between spatial agglomeration of production and firms' productivity have received less attention, particularly in the Egyptian contexts. Indeed, agglomeration benefits economic agents according to two basic ways (Rosenthal

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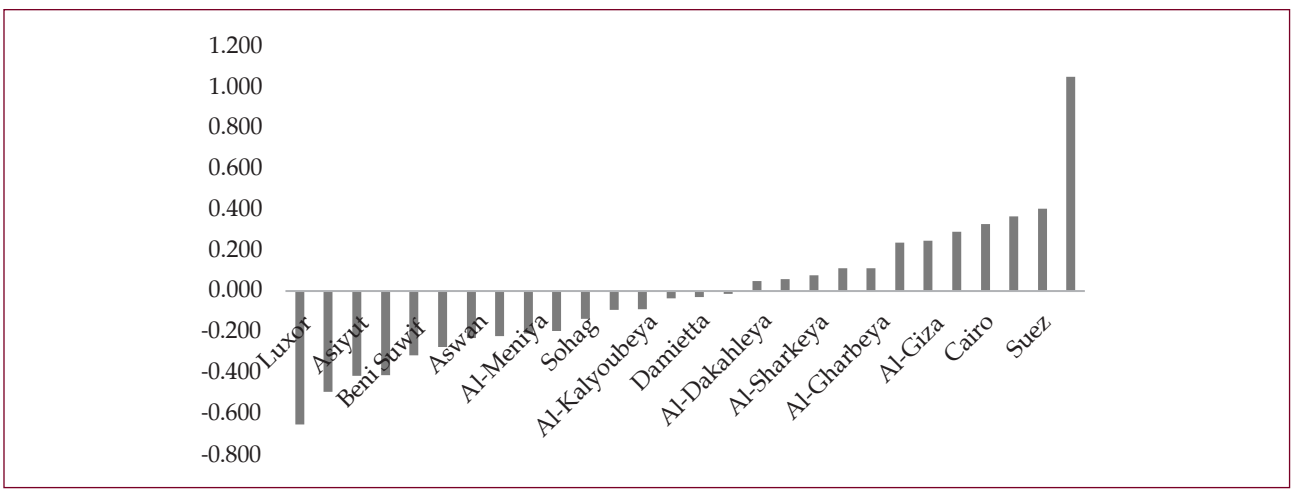
& Strange, 2004). The first, localization economies, arises from the concentration of firms in the same industry. The second is urbanization economies, which occurs from an increase in the city size that enables cross-fertilization of ideas among diverse economic activities (Jacobs, 1969).

The Egyptian economy is particularly interesting since the industrial sector has been facing several problems affecting its productivity and the government is currently implementing several structural reforms to improve its competitiveness. Hence, an evidence-based study on the link between clusters or agglomeration and firms' productivity is of a great importance from a policy perspective. Three measures of agglomeration are taken into consideration: *urbanization or firm diversification* measured by the number of firms by governorate, *localization and specialization* measured by the average productivity by governorate and sector and finally *competition* measured by the number of firm operating in the same governorate and the same sector.

Overview of agglomeration and productivity in Egyptian governorates

Firm productivity is heterogeneous among governorates in Egypt (Figure 1). The governorates that enjoyed higher than average productivity are either metropolitan governorates (Cairo, Giza, Alexandria and Suez) or highly populated governorates in Lower Egypt (Al-Sharkeya, AlBeheira and Al-Gharbeya). Al-Dakahleya is another highly populated governorate in Lower Egypt that enjoys relatively high firm productivity, yet lower than the country average. These governorates also exhibit relatively lower poverty rates, higher living standards, and easier connections to markets compared to the rest of Egypt. All governorates in Upper Egypt (with the exception of Giza) show lower productivity levels for their firms, which coincide with high poverty levels, lower welfare and difficult connectivity to markets. Furthermore, productivity is also surprisingly high in three frontier governorates; namely Matrouh, North and South Sinai (for the latter, mainly thanks to tourism).

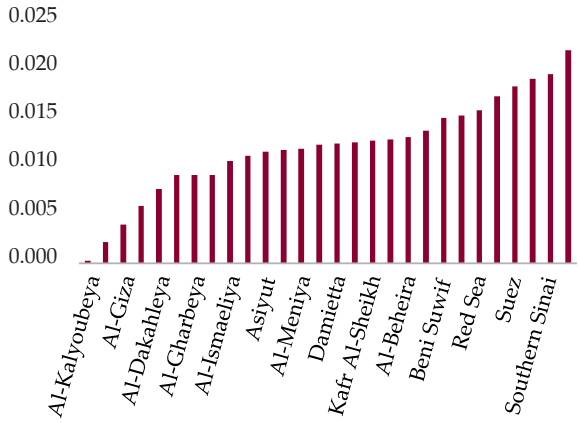
Figure 1: TFP by Governorate



Source: Constructed by the authors using the Economic Census data

Observing the measures of agglomeration shows that most of the governorates in Egypt have diverse industries with relatively low values of the Hirschmann-Herfindhal index (Figure 2). Moreover, few have positive externalities from industry specialization that is measured by the intra-industry index (Figure 3). Governorates with high specialization index, compared to the average, also enjoy higher productivity and relatively higher living standards (Cairo, Giza, Alexandria and Al-Kalyoubia).

Figure 2. Jacobs Externalities Index by Governorate

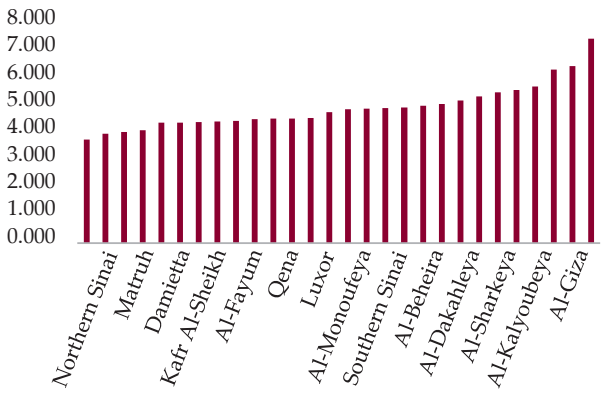


Source: Constructed by the authors using the Economic Census data.

Note: Jacobs externalities are measured by Hirschmann-Herfindhal index $\boxed{invH_N = 1/\sum_{i \in k} s_{ikg}{}^2}$

Where s is the share of firm i in sector k and regiong.

Figure 3. Marshallian Intra-Industry Index by Governorate



Source: Constructed by the authors using the Economic Census data.

Note: Marshallian externalities are measured by the intra-industry index $\boxed{IIS = \langle \sum_{i \in k} E_{ikg} - E_{ikg} + 1 \rangle}$ where E is measured by employment for firm i in sector k and regiong.

It is worthy to examine these measures for firms with different sizes. Indeed, Table 1 shows that smaller firms have higher productivity than larger ones. Larger firms have higher spillovers from diversification measured by the number of firms by governorate, while competition measured by the number of firms by governorate and by sector is higher for micro and small firms than medium and large ones. By contrast, externalities related to average productivity by governorate and by sector is higher for large and medium firms than for micro and small ones. This can be explained by the externalities related to the presence of high growth firms in particular sectors.

Table 1. Indices by Firm Size

	Micro	Small	Medium	Large	Total
TFP	0.11	0.00	-0.25	0.01	0.06
Ln(Age)	1.91	2.43	2.85	2.91	2.13
Firm Gov.	3655.46	4921.96	5395.78	5741.68	4138.07
Firm Gov. Sec.	100.01	106.26	85.02	66.94	99.34
Avg. TFP Gov.	0.03	0.10	0.13	0.19	0.06

Source: Constructed by the authors using the Economic Census data.

At the sectoral level, productivity and spillovers vary widely as well. Productivity by sector is heterogeneous, where mining enjoys the highest TFP, followed by agriculture, then manufacturing and services. However, the latter two sectors have the highest spillover from diversification and specialization compared to the former ones. Additionally, competition is higher for manufacturing and services compared to the other two sectors (Table 2).

Table 2. Indices by Economic Activity

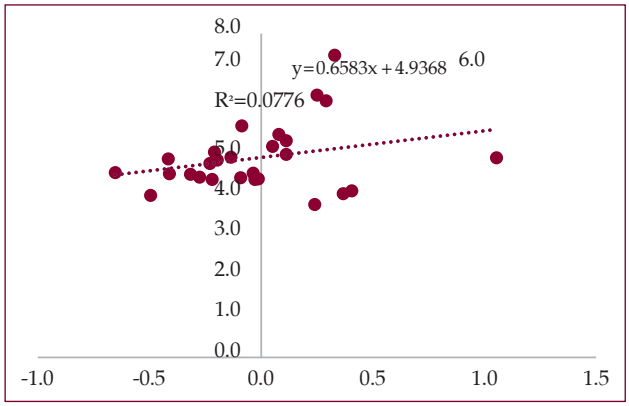
	Agriculture	Mining	Manufacturing	Services	Total
TFP	0.25	0.83	0.06	0.05	0.06
Ln(Age)	2.22	1.61	2.34	2.07	2.13
Firm Gov.	2789.54	2873.62	4147.25	4165.53	4138.07
Firm Gov. Sec.	21.08	41.38	64.54	110.34	99.34
Avg. TFP Gov.	0.02	-0.06	0.05	0.06	0.06

Source: Constructed by the authors using the Economic Census data.

Why does agglomeration matter?

Higher productivity is correlated with a high specialization index, measured by the average productivity by sector and governorate as shown in Figure 4. Indeed, simple regressions show that a 10% increase in the specialization index increases TFP by 6%, providing preliminary evidence that spillovers from specialization and business clusters enhance productivity, hence support the economies of agglomeration hypothesis in Egypt. Spatial concentration gives rise to pecuniary externalities (Henderson, 1988; Fujita, Krugman & Venables, 1999). For instance, it promotes the emergence of a large labour market, where it is easier to find highly skilled workers and reduces job search costs (Helsley and Strange, 1991). Moreover, large markets trigger entry in the production of intermediate goods that is sufficent to scale economies and allows firms to outsource a large share of their intermediate inputs and thus gain from specialization (Holmes, 1999; Rodríguez-Clare, 1996). Finally, forward and backward linkages in the production function arise thanks to such agglomerations (Hirschman, 1958).

Figure 4. Correlation between TFP and the Marshallian Intra-Industry Index

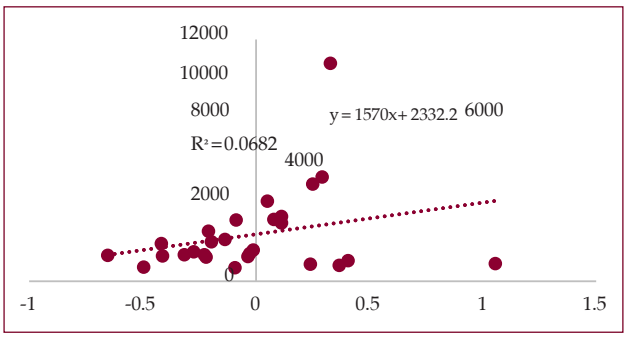


Source: Constructed by the authors using the Economic Census data.
Note: Each dot represents a governorate. The X-axis represents TFP and Y-axis Marshallian externalities that are measured by the intra-industry index $IIS_{ijr} = \langle \sum_{i \in jur} E_{ijr} - E_{ijr} + 1 \rangle$

In addition, urbanization measured (by the number of firms by governorate) boosts productivity (Figure 5). Urbanization charactrized by diversity of industries that bring benefits to all firms located in the region (Jacobs, 1984). Duranton & Puga (2004) offered

three mechansims for explaining urban increasing returns, namely sharing, matching and learning. Henderson (1997) found that diversity and narrower specializations of workers improved firm growth.

Figure 5. Correlation between TFP and Cluster Size



Source: Constructed by the authors using the Economic Census data.
Note: Each dot represents a governorate. The X-axis represents TFP and Y-axis the cluster size which is measured by the number of firms by governorate.

From an empirical perspective, it is important to examine the nexus between firms' productivity to see which type of agglomeration matters more for firms' productivity, with a special focus on small and medium firms.

Examining the impact of agglomeration economies on productivity

The empirical analysis is done in three stages: firstly, we estimate TFP using a large dataset of firms in 342 firms' four-digit activities in 27 regions (62,108 firms). TFP is estimated using a log linear Cobb-Douglas production function with constant returns to scale. Secondly, following Howard et al. (2014), we use several indices to measure economies of agglomeration: localization economies or specialization (the average productivity of activity and governorate), urbanization or diversification economies (the number of firms located in the cluster which is a governorate in our case) and competition (the number of firms in the same cluster that are operating in the same sector measured at the 4-digit level). The final stage of our analysis consists of using the estimated TFP as a dependent variable and regress it several variables, namely the firm age, whether the firm is privately owned or not, its legal status.

Furthermore, the analysis is extended in three ways. First, to capture location specific results, we run the regression by location for both the core (Cairo) and the periphery (other governorates). Second, to examine the differential impact of agglomeration economies on TFP of different firms, we run regressions for micro (less than 5 employees), small (from 5 to 19), medium (from 20 to 99) and large (greater than 100) firms. Finally, we run regressions for both the manufacturing and services sector as the former is likely to be more affected by agglomeration economies than the latter (Krugman, 1991). For the sake of robustness checks we run this regression using a TFP estimated using a translog function. We also control for the endogenous relationship between TFP and agglomeration measures.

Our analysis shows the existence of agglomeration economies in Egypt after controlling for firm age, location, economic activity and legal status. Similar to other work on Egypt (Howard *et al.*, 2014), we find that productivity spillovers gained from agglomeration economies outweighed the negative effects of congestion due to competition. The latter is probably due to the lack of adequate infrastructure. In fact, congestion that occurs from a dense firm location could be severe if infrastructure is a bottleneck to economic activities (Hu, Xu and Yashiro, 2015; Lall, Shalizi, and Deichmann, 2004). When regressions are run by firm size and activity, our main findings show first that micro and small firms are more likely to benefit from localization and diversification compared to medium and large firms. Finally, service firms benefit more from high level of diversification while manufacturing firms gain more benefits from knowledge spillovers and specialization in Egypt.

Agglomeration is necessary but not sufficient for productivity in Egypt

The brief highlights the importance of investing in business cluster development to enhance productivity through utilizing economies of agglomeration. One policy recommendation could be developing specialized business cluster based on each governorate's comparative advantage. Furthermore, these clusters should have the appropriate hybrid of different firm sizes. As highlighted in this research, smaller firms tend to have higher productivity. Furthermore, micro, small and medium firms benefit from specialization and diversification spillovers resulting from agglomeration.

From a policy perspective, *first*, facilitating mobility of factors of production (labor and capital) is integral to promote economies of agglomeration and consequently boosting firm productivity. Enhanced transportation and access to markets close to business clusters locations could be one policy advice to the government. *Second*, further development to the existing business clusters is needed. Government efforts should be focused on supporting the existing business clusters, expanding the supply chain, and linking it to markets (internal and external). Rigorous efforts are needed to expand and enhance the existing clusters, develop further the supply chain of feeding industries, and fostering specialization. It is recommended to establish specialized industrial zones for promising business clusters that have high growth potentials. *Third*, it is advisable that the government invest in human capital through providing vocational educations and training centers that is related to the business clusters. These human capital centers would be in the proximity of the business clusters. A tripartite arrangement among the ministry of trade and industry, the ministry of higher education and the private sector could be useful in setting vocational education and training programs for labor working in these industries. *Fourth*, enhancing access to finance for firms in these business clusters is important to ensure sustainability and growth. Access to finance is one of the obstacles facing firms in Egypt in general. However, the government and the banking sector are encouraged to enhance access to finance for firms in these clusters and develop customized financial product that could help in financing the working capital needs and increasing investments. Fifth, the government is advised to ensure proper infrastructure is well connected to the business clusters all over Egypt. Electricity, water, sanitation and waste disposal systems are important factors to attract business and to develop the clusters. *Sixth*, on the sectoral side, manufacturing will benefit most from specialization. Hence, promoting business clusters in manufacturing and creating a value chain that will greatly enhance productivity of the sector and promote forward and backward linkages. On the other hand, services will benefit most from spillovers resulting from diversification.

Further Reading:

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