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## Agglomeration and Human Capital Spillovers

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# Chapter 6

## Conclusion

Over the past decades, great progress has been made in our understanding of the urban economy. The increasing availability of microdata, which has been a key factor for this success, helped researchers to identify agglomeration and human capital spillovers, while accounting for spatial sorting effects. Despite this progress, there are still many open questions. In particular, we do not yet fully understand which mechanisms drive the agglomeration and human capital spillovers. Furthermore, there are only a few studies that attempted to analyze the spatial and temporal scope of these spillovers. With this thesis, I have aimed to fill some of these gaps in the empirical literature. In this last chapter, I will briefly summarize the main findings of the thesis and discuss the implications for policy making in the Netherlands. The chapter ends by making recommendations for future research.

### **6.1 Main findings of this thesis**

Chapter 2 has focused on estimating the spatial scope of agglomeration economies in the Netherlands. The results indicate that this spatial scope is more complex than is often assumed in the literature. We provide insight into this issue by showing that agglomeration on short distances (<5 kilometer) does not significantly affect wages, whereas it has a significant and positive effect on medium distances (5–10 kilometer). This effect attenuates rapidly across geographic space, becoming insignificant after 40–80 kilometer. We offer several explanations for this observed distance decay

pattern. For instance, diseconomies of agglomeration, such as traffic congestion and pollution, may dominate over the positive agglomeration spillovers on short distances. Also, agglomeration spillovers may capitalize into the price of land rather than labor. The results do not imply, however, that nearby agglomeration is irrelevant to the wage formation: only large urban areas benefit from agglomeration on longer distances. The economic magnitude of the identified agglomeration spillovers is also quite substantial. The region of Amsterdam benefits most, enjoying a wage advantage of 7.5 to 10 percent, while The Hague, Rotterdam and Utrecht have a wage benefit of five to 7.5 percent. Finally, Chapter 2 finds no evidence that foreign economic mass affects wages in the Netherlands, which suggests that national borders are still a substantial barrier for economic interaction.

The next chapter has aimed to identify the urban wage-growth premium in the Netherlands. In accordance with the literature on this topic, we find a positive association between city size and individual wage growth for many different types of workers. Yet, this result does not withstand a correction for wage-growth determining characteristics of firms and individuals. The main conclusion of this chapter is, therefore, that the urban wage premium is not primarily the result of an agglomeration spillover, but rather driven by spatial sorting. The chapter also examines heterogeneities across workers. Having controlled for spatial sorting, we do find a significant urban wage-growth benefit for a sample of young workers: 10 years of work experience in Amsterdam, compared to a rural area, results in a total wage-growth benefit of 7.2 percent on top of the wage-level benefit of four percent. This substantial urban wage-growth effect for young workers is intuitive because the young are expected to be more receptive to external influences. Wage-level benefits of urban areas are important to all types of workers, especially the highly educated. No convincing evidence is found for differences on the basis of gender or knowledge intensity of the economic sector.

Chapter 4 unravels the spatial, sectoral and organizational scope of the external return to higher education. The results indicate that the scope of the higher education spillover is very limited. Most of the identified spillovers occur within firms, being a factor of 2–3 larger than those operating outside the firm. The spillovers that take place outside the firm are restricted within the own sector and only occur on short

distances from the working place. The limited scope of the spillover confirms the view that higher education fosters aggregate productivity through the exchange of tacit knowledge, which is heavily dependent on face-to-face contact. The small spatial scope of human capital spillovers stands in sharp contrast to the results of Chapter 2, which estimated a spatial scope of 40–80 kilometer for agglomeration spillovers. This discrepancy is, however, not particularly surprising because human capital spillovers are expected to percolate through the transmission of ideas, while agglomeration spillovers are driven by sharing and matching mechanisms as well. It is evident that these mechanisms differ in terms of the distance they can cover. The external return to higher education is also of sizeable economic significance: an increase of one standard deviation in the share of highly educated workers within the firm leads to a wage increase of 4.0 percent, while a one standard deviation increase in the share of highly educated workers within 10 kilometer within the own sector adds 1.3 percent to individual wages.

The final chapter of this thesis has analyzed the relationship between house prices and accessibility by studying a quasi-experiment in transport infrastructure: the Westerscheldetunnel. The results show that a one percent increase in accessibility leads, on average, to a 0.8 percent increase in house prices. We also find support for the idea of anticipation: about half of the accessibility effect already materializes more than one year before the opening of the tunnel. Delayed response, on the other hand, appears to be absent. Finally, our analyses suggest that the impact of accessibility differs substantially across regions. Several explanations have been tested, of which resident heterogeneity appears to be the most plausible explanation for the differences across regions.

## 6.2 Policy implications<sup>91</sup>

The existence of externalities is perhaps the most widely accepted legitimization of economic government intervention. An externality arises when a spillover yields uncompensated benefits or costs to other individuals such that the privately optimal

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<sup>91</sup> Some of the policy implications in this chapter are based on: Verstraten, P., Verweij, G. and Zwaneveld, P.J. (2018). *Opties om de stedelijke productiviteit te bevorderen*. CPB Policy Brief (No. 2018/05).

economic behavior fails to meet the socially optimal behavior. In such a case, a Pigouvian (1920) tax or subsidy can be implemented to achieve a socially desirable outcome. In the presence of agglomeration externalities, this implies that welfare can be fostered by introducing a wage subsidy for firms in urban areas. This first-best policy option, however, lacks political feasibility because it would go at the expense of the periphery, which is generally perceived as relatively poor.<sup>92</sup> Nevertheless, since there are plenty of (government-induced) distortions in the urban economy, this thesis is able to offer a few other policy options to increase aggregate welfare.

The spatial scope of agglomeration spillovers is relevant from a policy perspective because it tells us whether agglomeration economies can be fostered by densifying or by connecting cities. The results in Chapter 2 indicate that agglomeration spillovers stretch across 40–80 kilometer, which suggests that substantial productivity benefits can be achieved by connecting cities. However, on the basis of this thesis alone, it is not possible to dismiss densifying cities as an effective way to stimulate agglomeration economies. In particular, there are a number of studies that have reported a more narrow spatial scope. Also, the efforts to connect cities may go at the expense of open space for nature conservation and recreation. Hence, given the current state of knowledge, it is recommended to connect cities when the negative effects of losing open space can be mitigated, and to densify cities when congestion costs are expected to be limited. A social cost benefit analysis is a useful tool to identify and quantify the social welfare effects of investments in transport infrastructure.

Another key finding of Chapter 2 is that national borders still hinder economic interaction. This is detrimental to border regions because it makes it difficult for them to reap the benefits of foreign agglomeration spillovers. Consequently, it can be concluded that the economies of border regions will benefit from breaking down border barriers. Unfortunately, not much is known about the effectiveness of policy instruments to reduce border barriers (CPB, 2016). Most border barriers originate from cultural and language differences (Bonin et al., 2008), which are known to be

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<sup>92</sup> The Netherlands does have a municipality fund ('gemeentefonds'), which can be regarded as an indirect subsidy for living and working in a big city. The distribution key of this fund, which is used to shift financial resources from the central government towards municipalities, contains a fixed component for the four biggest cities in the Netherlands (Amsterdam, Rotterdam, The Hague, Utrecht).

very persistent and difficult to degrade (Falck et al., 2012). The most promising policy measure is arguably the cross-border recognition of diplomas and qualifications, as this has proved to be effective in stimulating cross-border commuting (e.g., Peterson et al, 2014). Tax agreements can also contribute to the decision to work abroad, although evidence for this is relatively weak (Knowles and Matthiessen, 2009).

Chapter 3 demonstrates that the magnitude of agglomeration spillovers differs across workers. In particular, urban wage-level benefits appear to be most important to highly educated workers, whereas young workers are most receptive to the urban wage-growth benefits. This observation does not necessarily legitimize government intervention because, in the absence of market distortions, we expect workers to internalize these private benefits by sorting themselves into areas where they are deemed most productive. The Dutch housing market, however, is heavily regulated and a flawless spatial selection process is therefore unlikely to occur. In particular, large subsidies in the social housing sector and the home mortgage interest deduction have led to a relatively small private rental sector in the Netherlands. This may lead to distortions in the consumption of housing, especially for the young and highly educated workforce. These people, after all, are generally not eligible for social housing, due to their relatively high incomes, while they often cannot meet the capital requirements for mortgage loans. Also, various housing policies in the Netherlands make it economically unattractive for real estate developers to realize affordable housing in the private rental sector (Groot et al., 2016). Taking all these considerations into account, I conclude that the urban economy can benefit from reducing subsidies on the housing market and by increasing the supply of affordable housing in the private rental sector, as this will enable young and highly educated workers to self-select themselves into the optimal work locations.

Human capital spillovers have significant policy implications because they are potentially a source of market failure, and can lead to an underprovision of education in the absence of government intervention. However, as noted by Moretti (2004b), not every spillover is a market failure. In particular, human capital spillovers are likely to be internalized when the scope is limited within a firm. If this happens to be the case, the spillover may not represent a market failure and government intervention may not be necessary to obtain a socially desirable outcome. Given these considerations,

Chapter 4 questions the role of a central government in subsidizing higher education because the results indicate that the higher education spillovers occur primarily within firms. There are, however, plenty of other arguments for the public provision of higher education. For instance, education is expected to foster social equality, alleviate credit constraints, reduce crime and benefit democratic political decision making (Moretti, 2006). Also, firms may lack the power to internalize all external benefits of education because employees are free to resign from their jobs and move to other employers. In recent years, this aspect has become even more relevant for the Netherlands because of the increasing occupational flexibility and mobility. All in all, I conclude that the findings of this thesis do not reject government subsidies for higher education, although they do suggest that business participation in the funding of higher education deserves more serious attention.

Policymakers often aim to promote the economic development of the periphery by improving its infrastructure. However, this thesis calls for caution when deploying public infrastructure funds to promote the economic development of specific regions. Although Chapter 5 finds that improved accessibility leads to higher house prices, which in turn signals increased attractiveness of the region due to more opportunities for economic activity, it also indicates that this result cannot be generalized across all regions. In fact, the region with a less educated population appeared to be insensitive to the change in accessibility. Hence, the results question the effectiveness of transport infrastructure investments in stimulating the economies of the periphery. Instead, it is recommended to target public infrastructure funds towards the reduction of traffic congestion, which has a direct and demonstrable positive effect on mobility. Moreover, the social costs and benefits of infrastructure investments can be analyzed more accurately when the goal is to save on travel time rather than to achieve economic development.

### **6.3 Future research**

In this final section, I will reflect on promising directions for future research. An interesting topic for further research is, for example, the spatial scope of agglomeration economies. The existing literature on the spatial scope of agglomeration economies shows us that studies find a much wider spatial scope when

they are based on wages rather than rents. This observation raises some interesting questions. Do agglomeration spillovers with a small spatial scope capitalize into rents, whereas those with a large spatial scope capitalize into wages? Or is this observation the result of a bargaining game between the owners of labor and land over the gains of agglomeration? It is difficult to answer these questions on the basis of the existing literature because studies on rents do not account for the spatial sorting of high-skilled labor, while studies on wages generally ignore spatial differences in the price of land. Our understanding of the spatial scope of agglomeration economies could, therefore, be enhanced by analyzing wages and rents in one unified empirical study.

Chapter 3 of this thesis reveals that the average individual in the Netherlands experiences no significant urban wage-growth benefit once we account for spatial sorting effects. Of course, it is possible that this is merely the result of the geographic and socioeconomic flatness of the country. On the other hand, it does make intuitive sense that the most ambitious people sort themselves into larger cities in order to find scope for their potential. Future research should indicate whether the results in this thesis also apply outside the Netherlands. My expectation is that other studies will confirm the importance of spatial sorting in explaining the urban wage-growth premium, although it is definitely possible that a significant, though smaller, urban wage-growth benefit exists.

It is also interesting to investigate whether individual wage growth is affected by other characteristics of regions and sectors, such as specialization, diversity and competition. Finally, it would be valuable to analyze the role of firm size in generating agglomeration spillovers. In Chapter 3 I decided to control for firm size because productive firms may sort themselves into bigger cities. However, it is also possible that the economic mass of cities allow large firms to exist, which makes firm size one of the mechanisms through which the agglomeration spillovers percolate. In this case, firm size can be considered as a 'bad control'.

Micro-evidence on dynamic human capital spillovers is, to the best of my knowledge, still lacking. Hence, it is evident that much work is to be done in order to fill this gap in the empirical literature. A promising start would be to analyze dynamic human capital spillovers on a spatial level, by using the equations provided in Chapter

3. If positive evidence is to be found on a spatial level, the analysis could be extended towards unraveling the scope at which the dynamic human capital spillover operates.

Finally, regarding the literature on accessibility and economic development, I encourage any effort to evaluate other infrastructure projects that qualify as a quasi-experiment. As with any case study, it remains unclear to what extent the results in this thesis have external validity to other regions or other types of infrastructure, such as railway stations. In particular, it may be promising to look for other events where the opening of new infrastructure coincided with the abolishment of old infrastructure. Also, it would be informative to analyze the effect of improved accessibility on other economic indicators, such as employment and productivity. Finally, it would be interesting to see whether other studies can substantiate the claim that the accessibility elasticity of house prices increases in the average education level of the region.