# Part III Policies for the future

*'A government could print a good edition of Shakespeare's works, but it could not get them written. When municipalities boast of their electric lighting and power works, they remind me of the man who boasted of 'the genius of my Hamlet' when he had but printed a new edition of it. The carcase of municipal electric works belongs to the officials: the genius belongs to free enterprise.'*
Alfred Marshall, 1907, *Social Possibilities of Economic Chivalry*, p. 22.

In *The Magic Circle* (1886) we see a dark-haired woman standing by a cauldron on a wood fire.[1] With a stick she draws a circle around herself and the cauldron. Where her stick touches the ground, it lights up; this is a magic circle. In her other hand she carries a sickle-shaped knife to cut herbs to be put in the cauldron. The circle acts as a boundary to forces coming from outside; in the picture, these are negative forces such as doom and death. The border of the circle also shows how much manoeuvring room she has and reveals the scope of her influence. Standing in the centre of the circle and making use of the cauldron for the right recipe to deal with the world around her, she is a woman aware of the impact she has on her immediate environment (the circle)—and her task to protect this environment by providing the right ingredients (the cauldron).

**The magic circle**

This part of the study dwells on the "magic circle" of policy. The circle defines the scope of policymakers. In an integrated world in which more responsibilities are being transferred to Brussels, the circle of influence for a small open economy like the Netherlands seems to be

[1] *The Magic Circle* can be seen in Tate Britain in London or at http://www.johnwilliamwaterhouse.com/.

narrowing. This is not to say that Dutch policy has diminished in importance. On the contrary, the cauldron represents the recipe for action in a world characterised by ever-increasing unpredictability and sudden changes, implying that good and bad choices will have a larger effect on the economy than ever before. It is a matter of seizing opportunities or wasting resources—and a matter of trading off different options when government intervention is warranted.

Nowhere is the importance of these choices more evident than in labour-market policies. The process of globalisation, technological change and the rise of cities have since the 1980s led to a fall in the demand for unskilled labour relative to skilled labour in Western economies. Accordingly, a major challenge of labour-market policies has been to support the living standards of the unskilled without reducing their work incentives. At the same time, the knowledge economy has done its utmost to motivate people to obtain higher levels of education and to stimulate innovation in order to increase the productivity of skilled workers. Beyond the labour market, also the physical infrastructure, and the business environment, has been on the radar of Dutch policymakers. Policies have therefore aimed at making it more attractive for multinational firms to do business in the Netherlands, and at developing a sound physical infrastructure to serve as the main port to Europe.

This picture of the world is changing, and the trade-offs that policymakers will be facing will also change. As shown in the previous two parts of the study, a widespread and fundamental change is taking place in the organisation of production and work, leading to a geographic decomposition of value chains—an increasing flexibility, heterogeneity, and versatility of work. These developments lead to new, more complex patterns of winners and losers, calling for a new policy response. At the same time, cities are becoming the centres of economic activity, with economic activity either spreading across many relatively small agglomerations or concentrating in a few large cities.

This calls into question the radius of national policies—and could have the effect of decentralising more tasks to the city level or centralising them to the EU- or global level. Policy has to deal with these developments. Finally, as a result of globalisation the world is becoming more integrated, which implies that policy in a small open economy has to adapt to developments in the world economy. This does not mean that there will be fewer options from which to choose than before, but that choices should be made with an open mind towards the world outside—and not in isolation. Good choices raise returns more than they did before, but bad choices will be punished more harshly in an integrated world. A credible but also flexible government is crucial for making choices and communicating these choices to its citizens.

This study has thus far stalwartly kept its focus mainly on the production side of the economy—and this will continue to be the case here. Basically, the goal is to optimise the production function of the Dutch economy. This involves the Netherlands as a place of business (Chapter 9), the Dutch knowledge economy as a catalyst for productivity (Chapter 10), and the future of the labour market as a source of vitality and flexibility (Chapter 11). Finally, Chapter 12 presents a general view on strategic policymaking in *The Netherlands of 2040*.

# 9 Place of business

*'Here is a pleasant situation, and yet nothing pleasant to be seen. Here is a harbour without ships, a port without trade, a fishery without nets, a people without business; and, that which is worse than all, they do not seem to desire business, much less do they understand it.'*
Daniel Defoe, *A Tour Thro' the Whole Island of Great Britain,* Letter 12.

The Netherlands is an attractive place of business—but will it also be successful in the future? This question is too broad to answer, as the determinants of an attractive business environment are numerous and complex. We focus here on two issues, and leave other questions for future policy analysis.[1] First, in a globalised world in which production may become footloose, or where face-to-face interactions may become more important, or where access to the worldwide knowledge stock improves economic outcomes, workers and firms need to be connected in one way or another. With regard to the place of business, this is true both within and between cities. Infrastructure plays a crucial role in establishing these connections. How should future connections be developed in the different scenarios, and what are no-regret investments? Second, market transactions require regulation (for example, property rights and coordination of transactions by international rules) to ease the flow of people, goods and services and knowledge across the world. However, regulation is also needed to safeguard workers' rights or to improve environmental outcomes. This latter type of regulation may frustrate international flows. So, both sides of regulation may either support or hamper economic activity. The question can then be expressed as follows: who should prepare regulation, and at what level—and who should supervise its fair execution?

The scenarios have several important implications for the place of business, which are summarised in the first part of Table 9.1. First and foremost, cities are increasingly important, but the size of the representative city differs in the various scenarios, from just over 100,000 in *Talent Towns* (TT) to many millions in *Metropolitan Markets* (MM). The density of these cities depends on both size and specialisation. Large cities drive up the value of land and stimulate high-rise buildings (see, for example, the evidence presented in Figure 4.6 for Brabant, and the development of Boston throughout history described by Glaeser (2005b)). Specialisation benefits from frequent face-to-face interactions, which are optimised in dense urban areas. Together, size and specialisation suggest that urban density is highest in *Cosmopolitan Centres* (CC) (large and specialised) and lowest in *Egalitarian Ecologies* (EE) (small and not specialised).

Cities are parts of larger networks, which is especially important in the case of specialisation. The reason is that interactions between different types of cities are needed to

[1] For example, the location decisions of firms depend on the location of other firms. These agglomeration externalities, discussed in Chapter 6, may call for all kinds of government intervention—such as the development of a business district, the creation of knowledge institutions and a well-functioning labour market. Some of these issues are discussed in the next two policy chapters; others are left for future policy analysis.

coordinate the production process. If all cities together produce a car, but the many parts are produced all over the world, coordination is crucial to maintain quality. Toyota's recent problems in delivering a high-quality car show how delicate this coordination process may be. These networks often exceed national borders (in TT), and even may turn out to have a global character (in CC). This requires a level playing field in terms of regulation, because differences in regulation are likely to be exploited by firms and workers. Both the size of the cities and their networks determine the exchange of goods and services, people and ideas within and between cities. In the move towards smaller and specialised cities in TT, the exchange of knowledge and intermediate goods between cities becomes more important. Networks are less important for relatively autonomous cities. In EE, networks are mainly needed for trade in intermediate inputs and consumption goods. MM cities function quite autonomously, and rely on the exchange of knowledge and intermediate products mainly within the city.

**Table 9.1 Outcome and policy orientation**

| | Talent Towns | Cosmopolitan Centres | Egalitarian Ecologies | Metropolitan Markets |
|---|---|---|---|---|
| **Outcome** | | | | |
| City – size | 100k - 200k | 2m - 8m | 100k - 500k | > 10m |
| City – part of a larger network | Continental | Intercontinental | National | Autonomous |
| Urban density | + | ++ | 0 | + |
| Exchange within cities | 0 | ++ | + | +++ |
| Exchange between cities | ++ | + | + | 0 |
| **Policy orientation** | | | | |
| Infrastructure within cities | 0 | ++ | + | +++ |
| Public infrastructure between cities | Europe | Europe | National | 0 |
| Extent of regulation, at city level | + | ++ | + | +++ |
| Regulation, between cities | national | continental | national | global |

What is a promising direction for government intervention aimed at creating an attractive place of business? First, the size of cities as well as the degree to which economic activity is specialised has important implications for what the cities look like in 2040. Large cities in MM and CC benefit from high density. Neither the development of multiple centres nor an orientation towards diversified construction is efficient in these scenarios. These cities act as magnets in attracting economic activity. Specialised cities in CC and TT benefit from the exchange of ideas between specialised workers. A higher degree of specialisation implies that higher values are attached to interactions (Combes, 2000).

Public infrastructure should accommodate the exchange of goods, people and ideas, the flows of which are quite specific for each scenario. A sound urban structure is important in MM, because of its enormous size. Intercity networks are important in TT. Both a sound urban structure and high-quality networks of goods and services are important in CC and EE. Of course, part of this infrastructure can be developed privately, but the government will remain involved through investments in subways, roads, railways, harbours, airports and telecom

networks. The main reason is that infrastructure is a public good (at least to some extent), which comes along with high fixed costs. Individual private parties are unwilling to pay for these fixed costs, given that the return to the investment in infrastructure accrues to the society.

A complicated element for infrastructure networks is their cross-border orientation in CC and TT. The EU has a role to play in terms of the coordination of international investment projects, such as high-speed trains—but also in terms of the regulation of virtual connections and transactions. CC cities, in particular, also need intercontinental connections, which can be operated privately.

Cities become increasingly important, so regulation may be reoriented towards the city level. While this holds true for all scenarios, it is particularly the case for the large-scale and autonomous scenarios. The orientation of regulation at the city level may differ substantially. For example, MM city size is extremely high, and some cities will tend to be oversized (as individual citizens or firms have limited opportunities outside the city). Spreading activities across several cities is efficient, but requires coordination mechanisms to work appropriately. In this context, restrictive regulation might be welcomed once a substantial city size has been reached. In contrast, the CC cities tend to be too small: individual firms and workers base their location decisions on private costs and benefits, but tend to ignore the benefits for other citizens of concentration in specialised areas. Specialists do not take into account the positive knowledge spillovers they will encounter when clustering in a city. This suggests that regulation at the city level in CC needs to support additional city growth to reach a minimum efficient scale to develop new technologies.

Finally, environmental regulation, trade negotiations and other types of cross-city regulation require some sort of coordination. The stronger the interrelations between cities, the more important this coordination tends to be. It needs a continental or global scope in the CC scenario, in which the EU might play an important role. The EU will be less relevant in MM, where either regulation at the city level or global coordination is the appropriate level of regulation. Finally, nation states continue to be the first-best unit of coordination in TT and EE. Nation states are able to bundle the interests of these types of cities to reach a minimum efficient scale. The role of provinces diminishes in all scenarios—either because the size of cities exceeds provincial borders, or because coordination at the national or European level is first best.

## 9.1 Mobile factors and attractors

To determine the scope for government intervention it is crucial to identify the factors that attract economic activity and to distinguish the mobile production factors in each of the four scenarios. Mobile factors demand connections, whereas attractors warrant local support.

The easiest way to understand the distinction between attractors and mobile factors is to ask whether the presence of this factor is crucial (or very important) in the development and existence of the city, or could it easily be demanded from abroad? In answering the question,

we focus on reasons why business activity eventually clusters in each of the scenarios, with firms benefiting from proximity to workers, access to a pool of ideas and the availability of demand. Other determinants of attractive cities, such as culture, entertainment and shopping centres, are not considered to be of immediate relevance for investigating the production side of the economy. The mobile production factors and attractors of each scenario are summarised in Table 9.2.

Table 9.2 **Attractors (A) and mobile production factors (M) in each scenario**

| | Talent Towns | Cosmopolitan Centres | Egalitarian Ecologies | Metropolitan Markets |
|---|---|---|---|---|
| Workers | M | A | M | A |
| Ideas | M | A | M | A |
| Demand | M | M | A | A |

### Workers

Large cities attract workers. The CC scenario features clusters of specialised workers who benefit from day-to-day interactions. The outside options for these specialists are poor, as they have to move and retrain simultaneously. The outside options for MM workers are worse, as the hinterland is quite poor and other big cities tend to be relatively far away and may be overcrowded. This suggests that MM and CC citizens alike are tied to the place of business and stay in large cities.

The outside options for TT and EE workers are much better: there are many cities around offering good job opportunities and affordable homes. Workers are likely to move between cities as economic circumstances change.

### Ideas

Large cities contribute to economic efficiency by producing goods and services, but also to the efficient production of knowledge. There are two mechanisms by which knowledge is produced. First, the concentration of firms in the same industry stimulates knowledge transfers between workers and firms with the same specialisation, and facilitates innovation and growth. Employees from different firms in an industry exchange ideas about new products and new ways to produce goods: a higher concentration of specialised employees in a given location allows more opportunities for exchanging ideas that may lead to productive innovations. This effect is important in CC. Second, knowledge spillovers also occur among heterogeneous workers and industries. A diverse urban environment encourages innovation because it encompasses people with varied backgrounds and interests, thereby facilitating the exchange of ideas among individuals with different perspectives. This exchange is likely to lead to the development of new ideas, products and processes. This effect is important in MM. Both types of spillovers are strengthened by the fact that new GPTs will arrive in these scenarios (see Chapter 7).

In the small-scale TT and EE cities, the exchange of ideas (and intermediate inputs) occurs between, rather than within, cities. Direct knowledge spillovers are of less importance because the level of technological change is lower, with no new GPT arriving.

#### Demand

Demand for output determines the location of firms. A wide range of tasks is performed locally in MM, which implies that consumers will be served primarily by incumbent firms. This makes the city more attractive for both workers (as consumers) and firms. In CC, a fraction of all tasks is performed locally, though on a large scale. Basically, a set of specific tasks is monopolised by the centre. This implies that many intermediate goods and services will be traded. In terms of consumer service, market location hardly matters. A similar distinction holds between TT and EE, where in the latter case significantly more goods and services are produced locally.

## 9.2 Infrastructure

The exchange of goods, people and ideas depends on connections. The effectiveness of connections, in turn, depends on the quality of the infrastructure, defined as the system of public works in a city or country. Infrastructure encompasses both local roads and highways, both trams and intercity trains—and also includes harbours, airports and fibre optic cables.

### 9.2.1 Scope for government intervention

Public provision of infrastructure can be motivated on several grounds. First, much of the infrastructure has features of a public good. Roads and bridges are often publicly available, which means that users cannot be excluded but are able to ‘free ride’. To some extent, the use by one driver does not necessarily limit the use by another driver. In principle, road pricing can privatise this public good, but this demands not only a kind of toll system, but also sound information about users’ willingness to pay—and often the presence of monopolies in order to be able to profitably exploit the infrastructure. Secondly, cities exist because workers and firms benefit from clustering. The analysis in Chapter 6 shows that the size of cities depends on the balance between the gains of clustering (agglomeration economies, such as knowledge spillovers) and the costs (scattering forces, such as congestion). Connections within and between cities affect both gains and costs. The trade-off between gains and costs of sitting together in one place plays an important role in the development of cities and in the optimal distribution of production across space. Thirdly, infrastructure often involves externalities, of which network externalities are the most relevant. By improving the connection between two cities, one may affect the value of the connections with third cities; private parties do not take this effect into account. Finally, infrastructure exhibits high investment costs, which are both sunk and fixed. Were infrastructure to be provided privately, this fixed-cost nature would give substantial market power to the investor. This final reason for government intervention has to strike a balance between commitment and flexibility: commitment to deal with the complex

externality of collecting information and providing public goods, and flexibility to seize upon new developments and trends.

### 9.2.2 Trade-off in infrastructure policy: commitment versus flexibility

The main trade-off for public investment in infrastructure is between long-term commitment and flexibility. Large and sunk investments might be necessary for credibly improving the business climate and attracting private investors. Both private and public investments are long-lasting and benefit from commitment. The future has yet to unfold, however, and is inherently fraught with uncertainty for both private investors and policymakers. Currently, sound decisions about infrastructure might be subject to change. Huge investments with high sunk costs limit the flexibility to adjust to changing economic conditions. Yet, the span of time between decision-making and delivery necessitates that the relevant decisions be made today.

Baldwin (2009) argues that it becomes harder to predict the winners and losers of global competition. Integration of our economies together with advances in ICT has flattened the world in the sense that we are trading tasks, not final goods. It implies that production is often part of a larger chain, which is beyond the control of firms and policymakers. Small changes and differences in prices may lead to radical changes in this global supply chain. Related to this are sudden shocks. Activities that are incontestable today become contestable tomorrow and may leave the country the day after. This uncertainty and suddenness calls for policymakers to exhibit a kind of flexibility that comes at the expense of their credibility and commitment.

### 9.2.3 Two types of connections

In considering matters of infrastructure in the four scenarios, it is useful to distinguish between infrastructure within and between cities. The first type of infrastructure benefits local production processes and facilitates transport within cities. It aims to improve local production facilities and to overcome local congestion. Key examples are industrial estates and the underground. The second type of infrastructure improves the connections between cities and facilitates the exchange of goods, people and ideas at a distance. Key examples are the development of airports, high-speed train lines, harbours and fibre-optic cables.

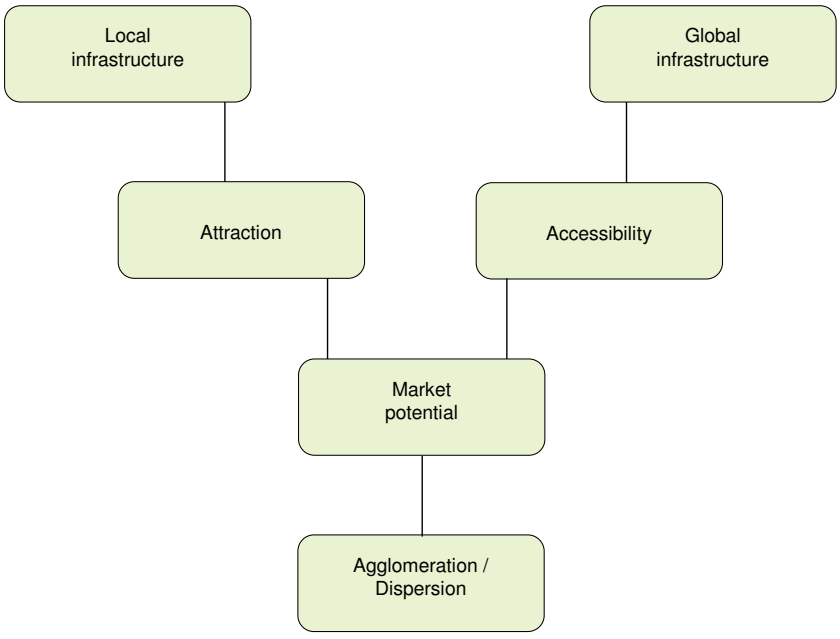
The distinction between attraction and mobility, as summarised in Table 9.2, guides our analysis. Attractors demand local investment and mobile production factors benefit from connections. So, cities should invest locally in their attractors. These investments draw business activity and workers, attract knowledge and stimulate innovation, and solve bottlenecks in local mobility and in the availability of facilities. Moreover, the returns to these investment projects will, to a large extent, accrue locally and can be taxed locally.

The economy as a whole benefits from mobility, both internationally and between cities. Bottlenecks in the exchange of goods, people and ideas hinder economic development. Infrastructure projects in support of the mobile production factors are therefore conducive to growth—conditional, of course, on being cost-effective. This is an example of a positive externality from public infrastructure, leading to more competition between producers located

in different regions and to thicker labour markets. This economy-wide effect cannot be captured by a private investor, but warrants public intervention. However, a warning should be made at this point, as the benefits of better access may be very unevenly distributed. Connecting two cities may benefit both—but may just as well lead to the growth of one at the expense of the other. For example, the Portuguese government has invested heavily in road networks, increasing the motorway network from 234 to 1,393 kilometres between 1985 and 1998. Although the investments were meant to stimulate economic activity in the remote Portuguese regions, Lisbon benefited primarily from the fall in transport costs.

The argument that connecting two cities may benefit both or only one was nicely summarised by Ottaviano (2008). Figure 9.1 shows that local infrastructure benefits attraction and global infrastructure stimulates accessibility. Both improve the market potential of cities or regions. Market potential measures the potential demand for products and services in a market. It depends on the proximity of both consumers and competitors, and is determined by the size of the home market and the proximity to other markets. Market potential improves—but whether this leads to agglomeration or dispersion is an open question. In the case of Portugal, it led to agglomeration of economic activity in the Lisbon area, where about a third of the Portuguese population resides.

**Figure 9.1 Attraction and accessibility**




Source: Ottaviano (2008).

### 9.2.4 Connections in the scenarios

The connections for workers, ideas and trade in final goods and services are specific to each of the four scenarios. Table 9.3 summarises what types of connections fit best in each scenario.[1]

**Table 9.3 Connections for workers, ideas and final goods**

| | Talent Towns | Cosmopolitan Centres | Egalitarian Ecologies | Metropolitan Markets |
|---|---|---|---|---|
| Workers | Continental | Local and global | National | Local |
| Ideas | Global | Local and global | Global | Local |
| Final goods | Global | Global | Continental | Limited |

#### Talent Towns

In Talent Towns, connections are essential to facilitate the exchange of information, the trade in intermediate and final products and to a smaller extent to facilitate the mobility of people. Especially virtual connections to support specialised teams from all over the world are beneficial for attracting economic activity. Local investments might be needed to support specific local production processes, but in this very dynamic scenario, it is highly questionable whether these local investments will pay off or contribute to a city's value added. Connections, in contrast, do pay off. If TT materialises, the Netherlands needs to be a network of small-scale cities operating in a worldwide network of similar cities.

#### Cosmopolitan Centres

Connections between cities are important for the development of Cosmopolitan Centres. International support for the mobility of goods, people and ideas between cities improves the functioning of the whole economy. It facilitates the development of large cities and allows the economy to grasp economies of scale. However, it is unclear which city will benefit, as some may attract specialised workers and prosper, while others are unable to do so and decline. Individual cities lack the incentive to improve intercity connections for people. In this scenario, local infrastructure supports or facilitates local economies of scale by investing in local facilities. If CC becomes reality, the Netherlands has to develop a limited number of highly specialised cities. Improving the networks between these cities will be important because specialised cities cannot operate in isolation and are part of larger global supply chains.

Connections not only require infrastructure, but also depend on international regulation. Open borders for high-skilled immigrants complementing the existing expertise are crucial. The EU should arrange a level playing field for this—both internally and with other (groups of) countries. Currently, even with the EU in place, it is hard to transfer pension rights and to obtain working permits when more than two countries are involved. This frustrates migration of specialists and high-skilled workers.

[1] The summary follows from Table 9.2's discussion of attractors and mobile production factors and the several exchanges within and between cities in Table 9.1.

### Egalitarian Ecologies

Local infrastructure supporting the liveability and local mobility of workers benefits local people and stimulates the local economy. Crucial for the functioning of the economy is the ability to have access to the global knowledge stock to produce local varieties of goods with state-of-the-art technologies, which demands high-standard telecommunication networks. Production in EE depends on the international trade of intermediate inputs for local production, which requires not only harbours and airports, but also reliable international relations. In this scenario, large cities are under pressure. Investment policies should be diversified, with the risk of being incoherent.

### Metropolitan Markets

In this scenario, investments in infrastructure benefit the city, which is the attractor of a wide range of productive activity. Local investments in any kind of infrastructure, aimed at the mobility of goods, people or knowledge, are important. But even linkages between the city and the surrounding region encourage firms to cluster, produce jointly and serve distant markets from the central city. In fact, it is very hard for the government to stimulate the economy of peripheral cities because MM acts like a black hole absorbing all economic activity and all workers from the periphery. Its development seems to be consistent with the Portuguese example of Lisbon described above. Intercity investments enforce competition on the peripheral markets, which can be served more easily from the central city. And even local infrastructure in the peripheral regions hardly stimulates the local economy, as firms are unwilling to leave the central city. Economies of scale in the mega city dominate the location decisions of firms and workers.

In Metropolitan Markets, the Netherlands should develop the Randstad into an integrated city able to compete with large European cities, in the first place, but also with similar cities in other parts of the world. Public investment can primarily be targeted at improving the local network in the Randstad. Linkages with the other regions in the Netherlands and even with foreign MMs are of secondary importance.

## 9.2.5 No-regret: invest in urban quality

In all of the discussion about connections, one might forget the public investment that must occur in local infrastructure, buildings, sewage systems, theatres and so forth. Given the growing role of cities in the future of the Dutch economy, the quality of cities might be decisive in the international competition for headquarters, research departments and other high-skilled commercial activities. Of course, the way to improve the quality of the infrastructure will differ from city to city and from scenario to scenario, and deserves further consideration.

## 9.3 Regulation

Regulation is an important determinant for the location of economic activity. On the one hand, business activity depends on the regulation of contracts, financial transfers, property rights, patents and so forth, without which economic transactions become too expensive because of exorbitantly high contracting costs. On the other hand, regulation may restrict business activity—often because other socially desirable goals are pursued, such as the protection of workers or reduction of greenhouse gas emissions. We briefly consider both sides of the coin and discuss the implications in each of the four scenarios.

According to Nobel Prize laureate Douglas North (1994), institutions are pivotal. Defined as the "rules of the game", institutions provide the rules under which not only governments, businesses and employees, but also social organisations (such as trade unions, schools, churches, mosques or synagogues) operate. In addition to the rules, the players (or "organisations" in North's terminology) are also important. Businesses face great uncertainty if property rights are poorly protected, if contracts are difficult to enforce, if governments are corrupt or if they can arbitrarily jack up taxes on profits. In short, uncertainty can be reduced with well-designed and efficiently run institutions. The reduction of uncertainty helps to improve the investment climate and can thus promote economic growth.

Employment protection legislation (EPL) supports long-term relationships between firms and workers. This has pros and cons for both parties. For example, EPL stimulates firm-specific investments in human capital, which benefits both firms and workers. While it limits the flexibility of firms to fire workers, it also prevents firms from adjusting well to changes in labour-market conditions. EPL protects insiders (those with a job) from being fired, but reduces the hiring rate and labour-market options for outsiders. Consider a firm that dislikes EPL and prefers flexibility. This firm is willing and able to move its activities if EPL differs across TT and EE cities, which implies that EPL must be instigated at a national or even supranational level. In contrast, firms in MM and CC cities will hardly respond to stricter EPL, which reduces the need for coordination at a higher level of decision-making.

Environmental protection is (presumably) in the interest of society at large, but is not necessarily in the interest of individual workers and firms. As a consequence, individual firms and workers have an incentive to avoid strict environmental regulation and relocate to cities or countries with permissive rules. Again, in scenarios featuring mobility of either firms (TT and EE) or workers (CC), strict environmental regulation may depress economic activity. In these scenarios, (international) coordination is needed to protect the environment.

Policy has to strike a balance between the conflicting aims of regulation. A crucial question is at what level: locally, nationally or even internationally. This principle of subsidiarity guides us in this issue.

### 9.3.1 Subsidiarity

Subsidiarity is about the appropriate level of decision-making, which involves a careful assessment of the optimal level at which decisions should be taken (see Gelauff et al., 2008 for an overview and a number of applications). The local level is appropriate for many decisions in the absence of externalities and economies of scale in the decision-making process. Examples are decisions on local infrastructure, local taxes and facilities. Given the trend towards urbanisation, where economic activity prospers in local concert, more and more autonomy might be handed over to cities.

However, in the context of externalities and economies of scale, decision-making at a more central level might be more efficient. This applies to investments in infrastructure between cities and between countries; it applies to the coordination of tax and regulation policy in the scattered scenarios (TT and EE); it applies to education policy, where uniformity in certificates may improve the mobility of high-skilled workers; it applies to welfare states, where risk-sharing between workers in different cities is more efficient, and so forth.

### 9.3.2 Subsidiarity in four scenarios

If coordination is needed, what is the appropriate level? Table 9.4 summarises the level of coordination that is most efficient in each of the scenarios.

**Table 9.4 Subsidiarity: what governance level should regulate economic behaviour?**

| | Talent Towns | Cosmopolitan Centres | Egalitarian Ecologies | Metropolitan Markets |
|---|---|---|---|---|
| City | x | x | x | x |
| Province | | | | |
| Country | | | x | |
| European Union | x | | | |
| Global institutions | x | x | | |

#### Talent Towns

Next to the city, the EU and global institutions such as the WTO will become important in Talent Towns. In this scenario, the world is flat, and nearly everything is footloose. Firms easily move from one city to another—not only within the Netherlands but also internationally. Moreover, firms attract their ideas and intermediate inputs from all over the world. Supranational rules are important in creating and sustaining a level playing field. The EU level or the federal level in the US suffices for many types of regulation, such as employment protection and the regulation of business services. Countries in TT will search for bridges to strike trade deals with others. International trade and financial markets, in particular, may be regulated globally.

### Cosmopolitan Centres

Next to coordination at the city level, global coordination is essential in Cosmopolitan Centres. Cities are big enough to perform many public tasks locally, but the large and specialised cities strongly interfere at the global level. They demand each other's input and compete against each other. Only global coordination via organisations like the WTO and the IMF can sustain a level playing field. These organisations become more powerful. Nation states should transfer responsibility to make efficient trade possible. It is also important that more countries join these organisations—to construct a worldwide level-playing field for all kinds of transactions.

### Egalitarian Ecologies

Next to the city, the nation state seems to be the most appropriate level of coordination in Egalitarian Ecologies. The nation state may levy taxes, and provide regulation and investment in infrastructure without bothering too much about the international context. International spillovers are limited and economies of scale exceptional. Global coordination likely fails because too many parties have competing interests and none of them can credibly take the lead. For international trade it is important that the current international institutions remain in place, despite the fact that countries will have a tendency to produce more on their own.

### Metropolitan Markets

In Metropolitan Markets cities rule the world—their own world first and foremost. The independence of cities is very large; they may regulate many issues locally. Global coordination plays a supplementary role in this scenario. Global cities communicate with each other; they are the G20s of the future. Just like the G20, this coordination occurs on demand, infrequently and with the full commitment of all parties. Small-sized cities have limited influence in this scenario, and have to accept the rules set by the biggest players.

## 9.3.3 No-regret policies

In all scenarios, cities become increasingly important, so regulation may be reoriented towards the city level. While this holds true for all scenarios, it is particularly true for the large-scale and autonomous scenarios (MM). Of course, regulation across cities will always be needed, especially in the scenarios with specialised and small-sized cities (TT ). The stronger the interrelations between cities, the more important coordination will be. Nation states, the EU and international organisations may organise this coordination, but the role of provinces diminishes in all scenarios—either because the size of cities exceeds provincial borders, or because coordination at the national- or European level is first best.

# 10 Knowledge economy

*'Knowledge will forever govern ignorance; and a people who mean to be their own governors must arm themselves with the power which knowledge gives.'*
James Madison, third president of the United States.

The history, facts and trends set forth in Part I underscore one of its main conclusions: knowledge has mattered, continues to matter and will matter even more in the future. Knowledge is crucial for development because it leads to better production technology and new products. Better production technology improves outcomes; new products satisfy consumer demand. The inputs in creating knowledge are education, science and innovation. Knowledge creation comes with knowledge spillovers to outside firms or rent spillovers to consumers, which could limit the incentives for private parties to engage in knowledge production. In addition, asymmetric information in the form of signalling and coordination problems could lead to finance restrictions, when financiers have insufficient insight into risks (adverse selection), or to insufficient cooperation in the market.[1] These market failures constitute the main motives for policy intervention in the knowledge economy. Yet, often the government struggles with the same problems as private parties do. For instance, information asymmetries exist not only among private parties, but also between policymakers and private parties. Hence, policymakers often have to deal with trade-offs. A major trade-off concerns the issue of whether policymakers should or should not act: policy may seize upon opportunities to resolve market failures, but it has to avoid wasting resources when private parties take advantage of policy by exploiting information asymmetries.

Knowledge features prominently in all scenarios, but it develops in different ways, as shown in the first part of Table 10.1. The arrival of a new general-purpose technology (GPT) distinguishes the CC and MM scenarios from the TT and EE scenarios. The GPT makes innovation more fundamental and research based—either through partnerships between universities and firms in CC, or through extensive research facilities within firms in MM. In contrast, applied innovation processes characterise TT and EE, building on a further expansion of ICT, which is the current GPT (see also Chapter 7). The division of labour and the associated spatial patterns distinguish the TT and CC scenarios from the EE and MM scenarios. The high degree of specialisation in TT and CC demands specialised workers. Because workers with a particular specialisation work and live together, these scenarios benefit from knowledge spillovers among similar workers. In contrast, in the generalised EE and MM scenarios, knowledge flows primarily between different types of workers.

[1] Another market failure in this area is market power. Market power can lead to exorbitant entry costs and too-low incentives for incumbent firms to innovate. We abstract from market power in the present study because its effect is rather limited, relative to the importance of spillovers and information problems.

**Table 10.1 The knowledge economy: outcome and policy orientation**

| | Talent Towns | Cosmopolitan Centres | Egalitarian Ecologies | Metropolitan Markets |
|---|---|---|---|---|
| **Outcome** | | | | |
| GPT | 0 | Research oriented | 0 | Application oriented |
| Knowledge | Specific | Specific | General | General |
| Knowledge spillovers among | Similar workers | Similar workers | Different workers | Different workers |
| Innovation | Direct applications, strong competition | Radical, firm-university linkages | Applied and incremental | Fundamental and applied, within firms |
| **Policy orientation** | | | | |
| Education | Specialised | Specialised | Broad | Broad |
| Science | Utilisation | GPT | Utilisation | GPT |
| Universities | Specialised | Specialised | Broad | Broad |
| Public-private cooperation | 0 | + | 0 | 0 |
| Innovation subsidy | + / specific | ++ / specific | + / generic | 0 |
| Innovation credit | + | 0 | + | 0 |

The structure of the knowledge economy in the scenarios has implications for the orientation of policy in the fields of education, science and innovation. Workers need a broad education if generalisation rules the world (EE and MM scenarios), whereas with specialisation (TT and CC) they need highly focussed education in which excellence pays off in their fields of specialisation. In tertiary education, this specialisation in TT and CC is in line with the scientific specialisation of universities. Utilisation-oriented scientific research at universities supports the applied innovation processes in TT and EE. Development of the new GPT demands high-quality fundamental science, particularly in CC, where strong public-private interaction between scientific research and innovation by firms moves the GPT forward.

Innovation policy has two main orientations: subsidies that encourage firms to invest in innovation and public credits that solve credit constraints in financing innovation. In the TT scenario, firms innovate close to the market in a highly competitive environment. Policymakers may to some extent support innovation with specific subsidies targeted at the specialisation of a particular talent town, taking into account the risk that subsidies leak abroad. That risk is much smaller in the larger and more autonomous CC scenario, where considerable knowledge spillovers warrant extensive specific subsidies. In contrast, generic subsidies, such as tax deductions for wages of researchers, support firms in the generalised EE scenario. Moreover, the predominantly small- and medium-sized firms in TT and EE may find it difficult to obtain funds to finance innovation. That calls for public support—for instance, through seed capital that fits in the elaborate venture capital market in TT, or through public innovation credits that complement the bank-oriented capital market in EE. Finally, MM cities needn't worry about developing any special innovation policy, as MM firms generate most knowledge inside their research facilities. The limited knowledge spillovers enable them to appropriate most of the returns. Moreover, firms finance innovation from retained earnings and have excellent access to the capital market.

Before discussing the scope for government intervention and policy options for each of the pillars of the knowledge economy (education, science and innovation), we first briefly present the structure of the knowledge economy.[1] This structure reveals that education, science and innovation are strongly related and complementary. Policies addressing education should also take into account the consequences of these interrelations for the design of science and innovation policies.

## 10.1 Ideas and people

Ideas and people are the two major ingredients for the knowledge economy. Firms use ideas to improve upon their production process and to design new products—or even new product varieties. Of course, it is people who develop ideas into new technologies and implement these in the production process, and who think up new ideas. In that sense, ideas seem to be directly linked to people. Still, it is necessary to closely distinguish both inputs in production and innovation, since ideas may move between people in various ways. Indeed, flows of ideas constitute one of the main channels of knowledge formation—and thus of technological and organisational progress.

The functioning of the knowledge economy and the motives for public policy depend upon the degree to which ideas are linked to people or to firms. In their most abstract form, ideas closely resemble information. Ideas exist independently from people; they can be fully *codified* in some information carrier (a computer file, for instance). Examples include blueprints for a machine or a scientific article. The central characteristics of these codified ideas are that they are non-rival and non-excludable (i.e. these ideas are public goods). Non-rival means that in contrast to most products, an idea does not depreciate when it is used again and again. Romer (2010) describes non-rivalry of ideas as follows: "If you can explain it on the phone, present it in a lecture, describe it on paper, or send it over the Internet, it is non-rival. The formula for a new pharmaceutical is a non-rival good." Excludability is defined as the degree to which the owner of the good can charge a fee for its use. For example, laws allow for patents that make the formula for a new AIDS drug partially excludable. So, for a limited period of time some usage of the formula to manufacture the drug is not permitted without the permission of the owner. Permission can be granted by licensing, for example.

The codified character of ideas implies that they are globally available for anyone with access to information carriers. However, putting ideas into practice often requires that people add a considerable amount of *tacit* knowledge. In contrast to codified ideas, tacit knowledge resides in the minds of people. Someone may easily distribute a blueprint or a scientific article over the Internet, but the ability to understand its contents is something completely different. Such understanding often requires a lengthy education or training before people have built up sufficient tacit knowledge to be able to absorb and apply ideas. In particular, at the forefront of

[1] CPB (2002) provides a detailed background report about the economics of the knowledge economy and the many trade-offs involved for policymakers. Here we focus on the most pressing ones from the perspective of the scenarios.

science and innovation, picking up ideas from the global stock of ideas often only succeeds if people are engaged in that kind of research themselves, so they can understand the jargon and put the ideas in perspective.

An economy that operates in high-end manufacturing and service production needs outstanding knowledge inputs. It needs high-skilled researchers, who are able to create new and valuable ideas both in science and in innovation. It also needs access to the global stock of ideas, and experts who manage to transform these ideas into new or better products, more efficient production processes or organisational improvements.

This perspective explains why education, science and innovation constitute the pillars of a country's knowledge economy and why they are interrelated. The purpose of education and training is to equip people with such a degree of tacit knowledge that they have the potential to create new ideas or absorb a part of the exiting knowledge base and apply ideas from the outside. Using the tacit knowledge of researchers and the scientific knowledge base, science generates fundamentally new ideas that often require considerable evolution to be practically relevant. Innovation mainly concerns the combination of scientific, practical and organisational ideas with tacit knowledge that resides both in the minds of workers and in the culture of a company to devise new products or new production processes.

## 10.2 Education policy

Education involves an investment decision. Society and young people invest money, effort and time now to obtain higher wages in the future. Education policies concern not only the quantity of money spent on education, but also the timing of that spending and the quality of education provided. Timing matters, because education is a cumulative process: skills obtained early in life increase the ability to acquire other skills in the future. High-quality education raises the return on educational investment. Before turning to education policy in the scenarios, we briefly discuss the motives for government involvement with education. Next, based on the outcomes of the scenarios, we single out the most important trade-offs that policymakers face when they consider educational policy in the future. That leads to scenario-dependent policy options. We finish with some no-regret policies that look favourable in all scenarios.

### 10.2.1 Scope for government intervention

Why should governments finance education? Basically, education is a private good because it is excludable (admission can be refused) and rival (a teacher can spend his time only once). However, individuals do not take into account the full benefits of their investments on society at large; this leads to educational investments that are too low. These social benefits are twofold. First, a higher-educated workforce is better able to explore ideas, adopt new technologies, benefit from the world's knowledge frontier and cope with social problems, such as crime. This constitutes an efficiency argument for the intervention of policymakers. Individuals also face uncertainty about the outcomes of their educational choices, which can lead to suboptimal

levels of investment, as well. Credit constraints and incomplete markets for student loans are reflections of these uncertainties. Second, prevention of social deprivation is an important target, from an equity point of view. Education lowers income differentials, improves people's health and strengthens social cohesion. Many educational policies use the equity argument for government intervention.

### 10.2.2 The trade-off in education policy: generalisation vs. specialisation

The basic trade-off is between general- and specific education at primary, secondary and tertiary education. General education is important in the EE and MM scenarios; tailor-made education is important in TT and CC. Table 10.2 summarises the trade-offs for education.

**Table 10.2 Trade-offs in education**

| | Specialisation (Talent Towns and Cosmopolitan Centres) | Generalisation (Egalitarian Ecologies and Metropolitan Markets) |
|---|---|---|
| Primary education | Early selection | Accessibility |
| Secondary education | Vocational schools | High schools |
| Tertiary education | Excellence | Accessibility |

#### Primary education

At the primary-school level, the choice between specialisation and generalisation implies acknowledging heterogeneity or stimulating homogeneity in the education of pupils.

Acknowledging heterogeneity in Talent Towns and Cosmopolitan Centres implies early selection to create different levels of classes. Based on early-age test scores, schools place high-ability pupils together in a class. The pace of teaching then approaches the pace at which average-ability pupils learn instead of the pace of the lowest-ability pupils. This speeds up the learning of the high-ability children, who do not have to wait for new instructions but can go on. Working together is also very important when specialisation is important. The emphasis should be on performing tasks in teams rather than solving problems individually. The costs of early selection are that low-ability children benefit, in general, from the presence of high-ability children—so that selection lowers their performance. Specialisation emphasises within-cohort inequality in schools. As a consequence, elite groups might appear—which could lead to social tension.

Stimulating homogeneity in Egalitarian Ecologies and Metropolitan Markets calls for accessibility in the form of mixed-ability classes. Low-ability children perform better because they are not denied access to the positive influence of high-ability children. Consequently, they also perform better in the generalist teams that inhabit the EE and MM worlds. In addition, a system based on mixed-ability classes benefits from a government policy that defines a general learning target for everybody and provides means to reach that target. Such a system creates the

possibility for a broad range of children to obtain a basic level of education and qualify for advanced schooling.

The trade-off between early selection and accessibility falls within the basic trade-off between equity and efficiency. Accessibility promotes equal opportunity for all, whereas selection enhances education according to ability. Ultimately, the choice for efficiency or equity is a political one, but the choice for equity in the TT and CC scenarios leads to relatively high underperformance of high-ability pupils and fewer prospects for firms to compete successfully with high-quality specialised teams.

### Secondary education

At the secondary-school level, the basic trade-off means early selection, specialisation on future tasks and on-the-job learning by apprenticeships versus a broad and homogenous high-school system followed by modest specialisation on the job.

Early selection increases specialisation in TT and CC, in terms of both levels (inflow from primary school) and types of education. The education system needs to be decentralised in order for local communities to determine their own educational needs. Because of early specialisation, students might regret choices and face switching costs. Schools should have incentives to prevent dropouts by penalising dropping out and by rewarding excellent academic performance. Together with mandatory publication of student achievements and assistance in their initial career steps, this intervention increases the transparency and durability , respectively, of performance across schools, which is likely to foster educational quality. Towards the end of the curriculum it is important to combine work and school via apprenticeships. This stimulates students to gain experience in working in specialised teams and to deepen their type of specialisation. The high-ability students move on to university instead of doing apprenticeships.

A broad and homogenous high-school system, such as is presently in place in the US, is effective in EE and MM scenarios. Schools are homogenous and the central government plays a major role in setting standards for education and school inputs. Towards the end of the curriculum, internships might help students to select a job. Secondary education will be broad, and students who would like to go to university opt for a more theoretical curriculum, whereas students focusing on obtaining jobs pursue a more practical curriculum.

### Tertiary education

At the tertiary level of education, specialisation in TT and CC focuses on the creation of excellence. Incentives and competition are maximised and universities select the best students. In particular, competition on a European scale, in line with the European Research Area in science (see Section 10.3.4), boosts excellence. The best universities are likely to charge the highest tuition fees, and students pay for their own education. After a bachelor education, the focus is on PhD trajectories or advanced master programmes aimed at further specialisation. The PhD trajectory is theoretical and comprises a considerable amount of high-level scientific

education, while the master programmes prepare students for private-sector jobs by providing targeted and specialised training. Master programmes are specialised, and not all universities offer the same programmes.

Accessibility is important in EE and MM. Universities have to set minimum standards and are controlled by the government, both in terms of their budgets and the quality of education. In these worlds, universities charge the same tuition fees and there is no selection of students. All universities supply a similar package of master programmes.

### 10.2.3 No-regret policies

In all scenarios the level of human capital is increasing around the world, and emerging economies are narrowing the gap in world income distribution, which implies that competition is on the rise (see also facts 7, 8, 9 and 10 in Chapter 3). It becomes increasingly expensive to repair the lags in development of countries that fall behind, and top-class education increasingly becomes an asset for countries specialising in high-end manufacturing and services. In a global world, the room for redistribution through progressive taxes becomes smaller—and the benefits of policies to prevent people from falling behind rise. In terms of educational policies, we observe three areas for which new investments are efficient, regardless of the scenarios: investment in the very young, investment in English language training and investment in good teachers.

#### Investing in the very young

The increasing importance of human capital and the higher costs of repairing knowledge deficiencies make it increasingly essential to invest in the very young. The rate of return to a dollar of investment made while a child is young is higher than the rate of return to the same dollar made at a later age (Cunha et al., 2006). Especially preschool investments in human capital have a high rate of return (Heckman, 2007). This implies that children from families with a weak social background, who run a large risk of falling behind, should be targeted in particular for participation in specially designed preschool programs. It is often difficult to reach these families, however, and to encourage parents to have their children join a program. Should this prove a real hindrance, then lowering the compulsory education age to three would be an effective way to reach the entire target group. This offers the additional advantage that the quality of compulsory education may exceed that of day-care, provided that the introduction of compulsory education coincides with investment in highly qualified teachers and methods suited to the very young (Datta Gupta and Simonsen, 2010). In that case, all children would benefit from playing in a rich and stimulating learning environment with qualified teachers who monitor their cognitive and social development. For this policy to pay off to society, the benefits of reaching the target group and a providing higher quality education should exceed the costs of the necessary investments. The high returns to preschool investments contribute to a positive outcome of this social cost-benefit assessment.

The reasons for the high returns to early preschool investments are twofold. Firstly, early investments are harvested over a longer horizon than those made later in the life cycle. This was shown by Becker (1962) and later in a dynamic version by Ben-Porath (1967). Secondly, and more importantly, because early investments raise the productivity of later investments, human capital is a cumulative process. Learning begets learning, because skills acquired early on facilitate later learning—and this is true not only for formal schooling, but also for the effectiveness of on-the-job learning and training. The cumulative effect is boosted by the fact that young children are more malleable with regard to cognition and behaviour than are adolescents or adults (see also Heckman and Jacobs, 2010). Thus, inadequate investments early on have a level effect on the future accumulation of human capital and a continuing effect over the life cycle. In order to compensate for early deficits later on, huge investments will need to be made at great costs—in terms of both loss of income during reparation and the cumulative loss up to the point of remediation.

The benefits of early interventions manifest themselves not only in higher wages or economic success, but also in terms of behaviour. Ample evidence suggests that foregone investments at early age limit social and emotional competencies that make learning at later ages less efficient—and therefore harder and less likely to continue (Borghans et al., 2008). Differences between children become apparent already in the first eight months of enhanced pre-school education (Fryer and Levitt, 2006). Next to genetic differences at the time of birth, differences in nurture and environment at young ages also have a strong and long-lasting impact on social outcomes. These findings have been confirmed by research in psychology and neurobiology that show that early experiences are crucial for the development of the brain and child behaviour (Nelson, 2000 and Knudsen et al., 2006). The first four years are characterised by rapid development of fundamental capabilities on which children build their future human capital. Next to enormous developments in language and cognitive skills, children develop emotional, social and normative capabilities during this period. Productive early environments therefore lead to fewer social problems (such as crime) and behavioural problems (such as misconduct in school, smoking, drug use and alcohol abuse) (Segal, 2008 and Urzua, 2008).

### Investing in English language training

Knowledge stocks and flows are becoming increasingly international. The ability to contribute to the knowledge economy—in terms of both ideas and skills—implies that communication in English is crucial. While it's not unthinkable that Chinese language training will become necessary, most of the Chinese contributions to the worldwide knowledge stock are presently in English. And, with the development of India, the South-Asian economies and South-America, it seems likely that English will remain the dominant international language. In all of our scenarios, people are contributing to and making use of the worldwide knowledge stock for production and development. This applies not only to high-educated workers, but also to blue-collar manual workers, who have to be able to read manuals for operating machines and communicate with colleagues and headquarters all over the world. Only local service workers

are likely to be unaffected by the globalisation of knowledge. However, also from a societal point of view, people will benefit from having a good working knowledge of the English language. The Internet is dominated by English web pages, and anyone who wants to remain connected will find it essential to be able to read and understand what is going on.

Children at early ages are sensitive to developing language skills. This means that their education in different languages should already start in primary schools. In this malleable period of brain development, language can be incorporated in the curriculum in several ways. Incorporation of English in the current curriculum can be established without additional investments in specific English language teachers. English can be included in the ordinary curriculum by teaching some courses (partly) in English and by exposing children to teaching materials in English, such as accessible educational television programmes or games. As such, this change would not necessarily involve specialised training of primary school teachers.

### Improving the quality of teachers

Many measures have been taken to raise the quality of education. Hanushek and Kimko (2000) demonstrate that quality differences in schools have a dramatic impact on productivity and national growth rates. To assess the effects of these measures, a great deal of attention has been directed at inputs—particularly those perceived to be relevant for policy (such as school resources or characteristics of teachers). The available evidence is mixed (see Hanushek, 2003, for a review of 90 studies, and Hanushek and Rivkin, 2010, for an update), and the conclusion of much of the research is that not many measures improve outcomes.

What has been established is the following. Despite the many difficulties in measuring teacher quality and educational outcomes (which has resulted, by the way, in a strong debate in the economic literature about the validity of measures), teacher quality noticeably matters for educational outcomes. In the Netherlands, the level of education of teachers has been falling over time, and the uproar in the news some time ago in reaction to the dismal performance of future teachers with regard to math and languages suggests that teacher quality in primary and secondary education may be falling. Research indicates that teacher performance may be improved by providing incentives for good performance, such as performance-related pay for individual teachers or for teams. Performance pay for school managers also seems to improve school quality.

## 10.3 Science policy

Science creates fundamental knowledge. Although this is codified in scientific publications available all over the world, it is hard to comprehend without the tacit knowledge obtained by a scientific education and experience in scientific research. Analogously to Section 10.2, this section reviews science policy in the scenarios in four steps: the motives for government science policy; an important trade-off in science policy; scenario-dependent policy options; and a no-regret policy option.

### 10.3.1 Scope for government intervention

All over the world, governments finance a substantial part of scientific research. Two main answers exist to the question 'Why?' First of all, for a considerable part of scientific research a market does not exist. Few firms are willing to pay for fundamental research in archaeology, astronomy, fundamental physics, etc. Societies, however, assign intrinsic value to science, independent of commercial application, which makes funding of these fields of science pre-eminently a public issue.

Secondly, knowledge spillovers limit private incentives to invest in science and at the same time raise their social value. Arrow (1962) and Nelson (1959) show that there is private underinvestment in scientific research. The reason is the inability to capture the entire stream of economic returns from investments in new knowledge. Knowledge that escapes from exploitation by the originator and is taken up by others for profitable use increases social welfare. The originator goes unrewarded, however, because these spillovers do not generate private revenues. This market failure is exacerbated in science, because practically applicable basic scientific knowledge usually has the potential to expand in many directions and be applied in many instances. Hence, creating opportunities for outside parties to benefit from scientific knowledge at low cost is socially very valuable.

Institutions in fundamental science solve this dilemma by turning the incentives upside down. Public finance links up with strong incentives to publish outcomes of scientific research (publish or perish). Universities, which are often government institutions, pay researchers to send out new ideas and publish or codify these new ideas in peer-reviewed outlets. A scientist does not benefit from private exploitation of his knowledge, but on the contrary from public dissemination. A long list of publications yields prestige, reputation, promotion and ultimately tenure. In this way knowledge is disseminated widely to benefit society at large.

### 10.3.2 Trade-off in science policy: performance vs. utilisation

No matter how useful it may be to link public finance with publication incentives to encourage dissemination of knowledge, for relatively applied scientific fields these incentives may hamper application-oriented research that benefits society. The reason is that publication incentives affect the research agenda. "Publish or perish" implies that researchers take up research topics that most likely will result in publications in esteemed peer-reviewed journals. Those do not necessarily have to be topics where science can contribute to solving problems that exist in society. For instance, a researcher may find it more rewarding (from a publication perspective) to expand a theoretical model instead of investing heavily in data gathering and applying existing methodology to solve some concrete practical problem. Therefore, in relatively applied fields researchers face not only publication incentives, but also utilisation incentives (such as research financed by private parties, revenues from patenting and opportunities to create a private firm as a spin-off (science parks)).

These considerations would lead to a trade-off for academic research between performance and utilisation. A strong focus on performance creates the best quality of scientific output, while

a focus on utilisation creates the best application of ideas to socially relevant questions, such as climate change or combating diseases. However, evidence on this trade-off is mixed. Top scientists often excel both in basic and in applied research. Furthermore, scientists do not operate in a vacuum. Social needs and practical questions also guide the scientific research agenda— particularly in applied fields (such as health research) scientists are strongly motivated to solve real-world problems.

Moreover, several authors have argued that for European universities it seems that the trade-off is not yet binding, since both performance and utilisation lag behind the United States. Studies focusing on the sources of the relatively low European research quality (compared to the US) emphasise the relevance of incentives (both at individual and department levels) and the need to promote profound institutional reforms in most European countries (e.g., Jacobs and Van der Ploeg, 2006; Drèze and Estevan, 2006). Aghion et al. (2009) find in an analysis of university performance in the period 1947-2005 that university autonomy and competition for funding to a large extent explain university performance. Universities that have experienced more freedom in dedicating resources to fundamental research and that have been forced to compete for funding have fared better. European countries have invested less in their university systems compared to the United States. On average, EU25 members spend 1.3 percent of GDP on higher education, versus 3.3 percent in the United States. At the same time, European universities have been less autonomous, particularly with regard to budgets—but also in hiring, remuneration, curriculum design and student selection, especially at the master's level.

### 10.3.3 Scenario-dependent policy

When the trade-off is partly absent or non-binding, both performance and utilisation incentives may be strengthened in European science. Still, the emphasis on performance or utilisation also depends on the outcomes of the scenarios (see Table 10.3).

**Table 10.3 Orientation of science policy**

| | Talent Towns | Cosmopolitan Centres | Egalitarian Ecologies | Metropolitan Markets |
|---|---|---|---|---|
| Performance or utilisation | Utilisation | Performance | Utilisation | Performance |
| Specialised or broad universities | Specialised | Specialised | Broad | Broad |

Utilisation of knowledge matters in a scattered world. In Talent Towns, it is important that specialised knowledge is created that can be used by local workers to innovate and compete worldwide. In Egalitarian Ecologies, utilisation is important to serve local demand. The global knowledge stock needs to be translated into products for the local market. This also implies that EE universities need to be broad. Relative to the current landscape in the Netherlands and Europe, the TT scenario fosters the specialisation of universities towards the specialisation of local production, whereas Egalitarian Ecologies will leave the landscape relatively unchanged.

EE universities resemble the current Dutch universities, which serve a large part of the market and have expertise in many different fields. They are also scattered across the country.

Performance is crucial in Cosmopolitan Centres and Metropolitan Markets. The arrival of the new GPT requires outstanding researchers from all over the world to cluster and work on developing the new technology. Scale is also important for developing the new GPT because knowledge spillovers among researchers are crucial. The research carried out in the CC scenario is specialised, depending on the type of specialisation the centres attract. Close collaboration with companies is important for developing the GPT further. This can lead to spin-offs by innovative and specialised groups of researchers. In MM, the GPT is developed to larger extent inside companies in large laboratories that benefit from general spillovers between different fields of research and collaborate with universities. Multidisciplinary teams of researchers are important to explore new fields.

### 10.3.4 No-regret policy

With regard to science, further internationalisation and collaboration provide a clear indication of two fields where policy works out favourably in all scenarios.

#### European research area

The European Research Area (ERA) was established in 2000 with the aim of creating a unified research area across all of Europe. The most important advantage of the ERA would be an increase in market size, so as to ensure that university potential will be better utilised in Europe, due to less dispersion of resources and activities ("stepping on toes" instead of "standing on giant shoulders"; Jones, 2002). In addition, reform of country-specific funding, regulation and rigidities may enhance incentives for performance. The ERA increases the market for students and researchers by creating a single market for scientific research. This increases competition for funding and talent. Competition for funding and peer-review of research proposals on a larger scale increases the quality of research.

Scale is a second issue that is important for fundamental research. Many European universities lack critical mass because they have been operating within national boundaries and national institutions that limit incentives for performance. This has led to the scattering of research activities and underutilisation of complementarities in research and the building of infrastructure. While the average quality of European university research is good (see Fact 7 in Chapter 3), it is not up to the leading world standards. Concentration of resources and specialisation in niches helps to create excellence in Cosmopolitan Centres and Talent Towns. In addition, the ERA yields a network of universities and public research organisations across the EU. This is of importance for Talent Towns and Egalitarian Ecologies, because they are unable to host large universities and thus have to specialise (TT) and focus on utilisation of knowledge (EE).

The ERA offers several advantages for universities in EE and MM scenarios: autonomy to position themselves (MM), opportunities to cooperate and compete at European and

international levels (EE), and ways to better link their research activities to the needs of industry and society (EE). Positioning and autonomy are crucial in MM and CC because these cities in these scenarios have to attract researchers. Professionalism in the management of research, and adherence to more transparent standards of quality, with which comparisons can be made across universities and cities, are important for assessing the quality of the research. Within the ERA, the European Research Council (ERC) plays an important role in the competition for grants to fund academic research at the European level—comparable to the role of the National Science Foundation (NSF) and the National Institutes of Health (NIH) in the United States.

The ERA also stimulates virtual centres of excellence in the form of strong and durable partnerships between universities. This is the purpose of the networks of excellence in the research Framework Programme. In particular, Talent Towns and Egalitarian Ecologies benefit from virtual centres of excellence. Other instruments, such as large-scale research facilities shared by several institutions to pool research-management capabilities (including knowledge transfer, fund-raising and other key functions), could help to create virtual centres of excellence. For some of these networks scale is important, which offers opportunities for MM and CC universities to host these facilities.

All in all, in line with the ongoing internationalisation of knowledge, ERA benefits science in all scenarios—albeit in different ways. In Talent Towns and Cosmopolitan Centres, ERA primarily induces competition, which leads to excellence and specialisation. In Egalitarian Ecologies and Metropolitan Markets, the emphasis of ERA is on networks and links with the international science base.

### Collaboration in science

Scientific advances and the level of scientific knowledge is increasing around the world. It takes a considerable amount of education before people have gathered sufficient tacit knowledge to be able to participate in scientific research (see Section 1.1). Because the total stock of scientific knowledge increases strongly over time, new researchers face an ever-increasing ‘burden’ of knowledge that they need to master (Wuchty et al., 2007 and Jones, 2010). They respond by extending their period of education and / or by narrowing their expertise. The latter effect, together with the tendency towards multidisciplinary research, implies that increasingly teams, as opposed to individuals, generate scientific contributions. The teams differ in orientation over the scenarios. In TT and CC scenarios, researchers join specialized teams with colleagues of comparable quality. In the worlds of EE and MM, they participate in generalized teams that consist of a single top-level researcher working with several less-qualified colleagues. Still—in all scenarios—teamwork will increase in science.

To adjust scientific policy accordingly, team rewards and team evaluation can be used effectively in all scenarios to stimulate research collaboration. Current institutions mainly focus on individual rewards. Team rewards can help to set appropriate incentives for individuals to invest in collaborative effort. Appropriate team evaluation is a necessary condition, because only teams show sufficient quality and scope to be able to judge a collaborative effort. Team

evaluation may take place when the time comes to decide whether or not to finance a research project, publish a scientific research, grant a patent or promote someone to a tenured position. An example of such an approach is some version of the English Research Assessment Exercise in which teams obtain finance based on their scientific contributions of a previous period.

## 10.4 Innovation policy

Technological progress results for the most part from innovation activities of private firms. However, the incentives for innovation that firms get on the market differ at times from incentives that would be optimal from a social perspective. That is where innovation policy steps in. This section reviews innovation policy using the same structure as the previous two sections.

### 10.4.1 Scope for government intervention

Private incentives for innovation may differ from socially desired incentives, for two main reasons. The first reason is similar to the main motive for public science policy: knowledge spillovers that private parties cannot fully appropriate. Nelson helps to identify these by establishing a benchmark where underperformance would not be expected to occur, “To the extent that the results of applied research are predictable and related only to a specific invention desired by a firm, and to the extent that the firm can collect through the market the full value of the invention to society, opportunities for private profit through applied research will just match social benefits of applied research, and the optimum quantity of a society’s resources will tend to be thus directed. ” (Nelson, 1959, p. 300). Departure from these conditions is likely to create a divergence between private incentives and the socially desired production of knowledge. For example, society would like to have the best AIDS drug developed, not necessarily the most profitable one. The size of this divergence represents an opportunity cost of relying solely on market mechanisms, which should then be weighed against the costs that might arise from intervention. Policy instruments to reduce the divergence are innovation subsidies that increase incentives for innovation or intellectual property rights that enable firms to appropriate the returns on innovation.

The second reason explaining the differences in incentives concerns asymmetric information, which may exist between a firm and a party that contemplates financing the firm’s innovation project or between two firms that consider joining hands in co-innovation. The fundamental problem is that the outcomes of investment in innovative projects are uncertain; have potentially high returns but also encompass high risks. This implies that it is hard for a person with a promising idea to obtain funding for exploring the idea. In addition, two firms that cooperate in a highly uncertain innovation project face difficulties to decide ex-ante upon the division of efforts and revenues. When one of the firms has more information about the project, the other firm may become reluctant to participate in order to avoid the risk of getting too little out of the project. In this case, asymmetric information could lead to a lack of

productive cooperation. Policy instruments in this area are public innovation credit, creation of a venture capital market, platforms for information exchange or obligations for parties to make information available.

### 10.4.2 The trade-off in innovation policy: seizing opportunities or wasting resources

Knowledge spillovers and asymmetric information merit government intervention. R&D subsidies or creating or extending intellectual property rights (IPR) are examples of ways to deal with spillovers. Venture capital and information provision are examples of coping with information and coordination issues. These measures increase the private returns to knowledge creation and the incentives to engage in R&D.

However, seizing opportunities by government intervention is hard, which gives rise to a difficult trade-off. Policymakers suffer from the same information problems as private firms do, and the size of spillovers is often hard to capture when designing government programmes to stimulate innovation. Hence, innovation policymakers face an intricate trade-off: seizing opportunities to encourage innovation or wasting resources when policy is not effective, due to information asymmetries between policymakers and private firms.

Governments face at least four information problems:

- Policymakers often do not know whether public investments crowd out private initiatives. It is possible that without the subsidies the investment would still have taken place.
- It is hard for policymakers to judge whether firms indeed spend public money on innovation.
- It is often unknown to what extent appropriation problems can be solved by the market; consultants or industry associations, for instance, may also tackle information problems.
- The design of government intervention is not costless. In 2010, total public investment in innovation in the Netherlands amounts to 1.8 billion Euros. The costs incurred for executing the different programmes amount to 75 million Euros (or about 4 percent of the total public spending on innovation).

Taking account of these possible problems is important because at present every euro spent on innovation in the Netherlands is matched by about 27 cents of public investment.[2] In terms of scenarios, the following picture emerges:

[2] Total private innovation investments are about 5.8 billion Euros; Pubic investments 1.8 billion Euros.

| Table 10.4 Seizing opportunities or wasting resources | |
|---|---|
| Scenario | Outcome |
| Talent Towns | There is a high probability of wasting resources because knowledge flows away easily once created. The world is very dynamic and specialised, making the probability that governments bet on the wrong horse relatively large. |
| Cosmopolitan Centres | It is important to seize the opportunities that arise from the arrival of a new GPT by stimulating public-private cooperation in developing new technologies. |
| Egalitarian Ecologies | Seizing opportunities is possible by granting subsidies to stimulate innovation for local applications. There is some scope for public finance, but funding can to a considerable extent be arranged through the market, because cities operate on a relatively small and autarkic scale, making trust an important asset to coordinate market transactions. |
| Metropolitan Markets | The arrival of a GPT merits large integrated firms. Innovation policies are less effective because of limited additionality (the probability is high that large firms crowd out the public innovation budget); information problems, moreover, can be solved by the firms themselves and large firms face scale economies in R&D. |

### 10.4.3 Scenario-dependent policies

This section discusses four types of scenario-specific orientations for innovation policy. Table 10.5 summarises the outcomes. The line 'Scope' in the table summarises the trade-off (from Table 10.4) between seizing opportunities and wasting resources.

#### Specific or generic

Specific innovation policies only work if the government has low search costs and is able to discriminate between successful and less successful investments. When there are relatively large differences in knowledge spillovers between sectors or industries, and when they can be measured, specific policies can help to internalise these spillovers. Specific innovation policies also work if new technologies are promising, but have failed to offer a private return that attracts private investors. This might be the case because of technological lock-in. Rules that prohibit the use of old technologies or subsidies for the development of the new technology may be efficient. Finally, when search costs are low, specifically targeting policies is efficient. In the generalised EE and MM scenarios, government search costs are high, which limits the ability of the government to target policy. Hence, if anything, generic policies work better. In the TT and CC scenarios, the government can target policies (i.e. subsidies) to support the specialisation of the city. However, these polices are only feasible when the specialisation of a city has materialised to some degree. Backing (early) winners is an effective policy in these cases, but innovation policy is unable to create the specialisation of a CC or TT from scratch. In addition, CC governments can foster public-private cooperation between large, specialised universities and private companies. This may result in specialised campuses.

**Table 10.5 Innovation policies**

| | Talent Towns | Cosmopolitan Centres | Egalitarian Ecologies | Metropolitan Markets |
|---|---|---|---|---|
| Scope | Limited | High | Limited | Hardly |
| Specific or generic | Specific | Specific | Generic | Generic |
| Public-private cooperation | 0 | + | 0 | 0 |
| Small or large companies | Small | Large | Small | Large |
| Entrants or incumbent firms | Entrants | Both | Incumbents | Incumbents |
| Intellectual property rights | + | ++ | + | + |
| Innovation subsidy | + | ++ | + | 0 |
| Innovation credit | + | 0 | + | 0 |

### Small or large companies

The academic literature is not clear about the effectiveness of subsidising large or small companies. Exorbitantly high fixed costs could prevent small companies from entering the "innovation market". For example, small companies might have difficulties in getting access to the global stock of ideas, which limits the effectiveness of their research effort. Or, differences in scale could lead to diminished utilisation of knowledge, because small firms have only a limited and temporary capacity for research. When the capital market does not function well, small companies might have a disadvantage because they are likely to face stronger credit constraints. Large companies have scale advantages in knowledge production. They are able to install permanent research capacity, which streamlines the innovation effort. On the other hand, there might be strongly decreasing returns to scale, which limits the effectiveness of large companies in innovation.

Innovation in CC and MM scenarios takes place in large companies. Firms in the former specialise in the early stages of technology development and benefit from knowledge spillovers between similar workers. Governments can stimulate company-university exchange programmes to develop new technologies. In MM, firms deal with innovation internally. They are not easily budget-constrained, and benefit from scale economies in developing new technologies. There is hardly any scope for government policies—saving a well-developed system of intellectual property rights. At the other side of the spectrum, the smaller scale of TT and EE worlds offers opportunities for small- and medium-sized companies to innovate. Stimulating these firms to connect to the worldwide knowledge base and invest in R&D helps them to pursue innovative projects.

### Entrants or incumbent firms

Fostering entry is efficient when entrants create relatively high knowledge spillovers or when policy aimed at entrants is more effective. Looking at the numbers, most innovation effort is undertaken by incumbent firms. However, entrants allocate a larger share of their resources to innovation, and an extra euro of subsidy to an entrant generates more R&D than spending that euro on an incumbent firm (the additionality of the subsidy is higher). This makes subsidising

the marginal effort worthwhile. In addition, entrants have to build up their reputation, and face credit constraints because venture capitalists are less willing to invest in firms without some sort of reputation. This is particularly the case in Talent Towns, with small- and credit-constrained firms. Another feature of this scenario is that local trust is not very high because workers participate in rather loose global production teams. This makes venture capitalists reluctant to invest. Public seed capital or innovation credits aimed at bringing prototypes to the market could foster innovation. In addition, intellectual property rights (IPR) help to appropriate the rents from these innovations.

In the other scenarios, incumbents are more important for innovation. Established firms, either serving the global market or producing locally, could be stimulated to engage in R&D by taking away credit constraints. This is more important in Egalitarian Ecologies than in Cosmopolitan Centres or Metropolitan Markets. In CC, spin-offs could arise from university-company interactions. These spin-offs could be stimulated by sound IPR and subsidies.

#### Subsidies and innovation credit

Subsidies target the internalisation of knowledge spillovers; innovation credits are meant to solve credit constraints. Subsidies are particularly effective in Cosmopolitan Centres, which thrive on knowledge spillovers in developing new technology. Specific subsidies can also support the specialisation of Talent Towns—although only to a limited extent because policymakers have to take into account the risk that subsidies leak abroad. Egalitarian Ecologies can benefit from generic innovation subsidies, such as wage subsidies for engineers, when developing new technologies. Both TT and EE benefit from innovation credits because the predominantly small- and medium-sized firms face credit constraints. Finally, in Metropolitan Markets there is no room for public innovation subsidies or credits. Large firms are able to internalize knowledge spillovers, scale economies and information asymmetries.

### 10.4.4 No-regret policy: European patent

Patents grant appropriation of inventions for a certain period, which creates incentives to innovate. Patent applications in the EU have been lagging behind Japan, the US and recently even behind China. Since the late 1990s, Japanese patent applications have stabilised around 400,000 patent applications each year. The US has experienced a sharp increase in the number of patent applications—from 200,000 in 1996 to about 450,000 in 2008. China's filings increased from 50,000 applications in 2000 to almost 300,000 applications in 2008. In contrast, European patent applications have only grown from 150,000 in 2000 to almost 220,000 in 2008.

An important reason for the lacklustre patent growth in Europe has been the cost of patenting. Nearly 50 years of attempts to create the EU patent have led to failure thus far, due to lingering unresolved issues regarding language and the design of a centralised patent litigation court. Three main problems might be easily resolved. First, language has been a major obstacle. Although almost 80 percent of all filings have been in English, the French and Germans file mainly in their own languages. All other nations file in English only (even China). Stipulating

that filing may be done only in English could save significant translation costs. Second, patents are expensive and the European system is complex. National patent offices face costs and grant patents, as does the European Patent Office. Integration and/or abolishment of national offices could make the system more efficient. Finally, governance fails because national patent offices have diverging views on control, and fear the loss of control when Europe takes over. Streamlining the system could thus save costs.

# 11 Labour market

*'We have shown that most of the adjustment of states to shocks is through movements of labor, rather than through job creation or job migration. Cities and states affected by an adverse shock may find this adjustment unappealing. However, if firms' and workers' private costs and benefits of moving reflect social costs and benefits, the adjustment is efficient.'*
Olivier J. Blanchard and Lawrence F. Katz, 1992, *Regional Evolutions*, p. 54.

The labour market in the Netherlands of 2040 may be scattered or highly clustered; it may be highly specialised or employ workers with general skills. Chapter 10 discussed among other things the consequences for the education of workers, which is their preparation for the labour market. We now turn to workers on the labour market, focusing on labour-market risk, the risk of losing jobs. We address the opportunities for workers to cope with job uncertainty and show how governments may intervene, support workers and solve labour-market imperfections. In their interventions, governments have to choose between flexibility and security, between the ability to benefit from opportunities and insurance against negative shocks.

The scenarios have important implications for workers, which are summarised in Table 11.1. First, workers earn higher wages, because they have a high return to their human capital in large cities and when they carry out specialised tasks. In large cities, workers benefit from learning, spillovers, thick labour markets and widely available facilities. Specialised workers get a high payoff, as they are able to excel in their limited task and do not have to spread their work effort over a range of many tasks.

The generalised cities of Metropolitan Markets and Egalitarian Ecologies are well able to cope with negative shocks—in particular, with idiosyncratic shocks affecting only part of the production process. Some workers and firms become unemployed or bankrupt, respectively, but other segments of the market flourish simultaneously. This means that there are many options to find another job; also the opportunities for starting a new business are quite good.

The downside for specialised workers is the riskiness and specificity of their jobs. They cannot easily switch, once a negative shock occurs. Even the specialisation of complete cities might be at risk in Talent Towns and Cosmopolitan Centres. This implies that the negative shocks for workers accumulate: they lose their jobs, the value of their houses collapses and vacancies will be insufficient. So, specialisation-specific shocks do not affect some workers within each city (as would be the case in MM and EE scenarios), but all workers within some cities—and if cities are very large (in CC), the consequences may well be interminable. An example of such a city is Detroit. Specialisation in the car industry brought wealth to Detroit, but as competitiveness is lost, the city is in decline.

**Table 11.1 Outcome and policy**

| | Talent Towns | Cosmopolitan Centres | Egalitarian Ecologies | Metropolitan Markets |
|---|---|---|---|---|
| **Outcome** | | | | |
| Return to human capital | + | ++ | 0 | + |
| Income inequality | + | ++ | 0 | + |
| Specificity of human capital | + | + | 0 | 0 |
| Riskiness to city's output | + | ++ | 0 | 0 |
| **Policy orientation** | | | | |
| Redistribution | national | continental | national | city |
| Optimal social security pool | national | continental | national | city |
| Rental market for houses | + | ++ | 0 | 0 |

Workers are confronted with uncertainty about their jobs. They are sometimes hit personally, but in other cases their whole specialisation or industry collapses. This uncertainty will expand over time, given the ongoing development of the knowledge economy, the unbundling of production processes and the enhanced competition from all over the world. Labour-market institutions have to support workers in changing jobs or tasks. Flexibility on the housing market might support this change, particularly if job-to-job mobility involves moving between cities.

Western governments have dealt with risk and inequality on the labour market by building welfare states. It is not our aim here to question this public solution, but to discuss its scope. Our conclusion is that welfare states are under pressure in the scenarios in which risk and inequality are very large, whereas they remain feasible in scenarios with relatively low risk and moderate inequality. Consider the scenario of Cosmopolitan Centres, with sizable inequality and risk. Countries of the size of the Netherlands host only one or a few specialised cities. If one of these cities would be confronted with a serious negative shock, the country as a whole is affected. Insurance at the country level is very difficult, both publicly and privately; this means that supranational organisations such as the EU have to step in. At the other extreme, welfare states can be easily organised nationally in Egalitarian Ecologies, but in this scenario risk and inequality are quite moderate. This lowers the demand for a large welfare state.

Regulation of the housing market may require serious revision relative to the current situation (see Donders et al., 2010). In particular, in Talent Towns and Cosmopolitan Centres, where labour- and housing-market risks are highly correlated, workers who own their houses are hit twice by negative shocks. Workers who rent houses are only confronted with the unemployment risk, with the housing-price risk left to the homeowners. So, the private solution for workers to avoid the accumulation of risk is to leave the housing-market risk to private companies. These companies are able to spread the risk, even in TT and CC, by owning houses in several cities or even countries. Public institutions, such as regulation and taxation of the housing market, should accommodate this. This might require a revision of the currently strict regulation on rental prices, of taxes on housing transfers and of the mortgage tax deduction.

This chapter first discusses the private response to labour-market uncertainty. Public policy should accommodate this private response, both in the public provision of insurance and in the regulation of the housing market. The main implications for redistribution wrap up the chapter.

## 11.1 Workers' response to labour-market shocks

Consider a worker with a job at risk. This risk may stem from preferences changing away from products, or from technological changes making products obsolete. Job uncertainty may also stem from competition by other workers, like older workers who have to compete with younger colleagues, or workers who are challenged by cheaper labour abroad. These shocks occur in all scenarios, but the implications for workers and the way that they are likely to respond differ. We limit attention to permanent shocks and abstract from temporary labour-market uncertainty, which we assume to be beyond the control of the workers (it is thus the result of an exogenous shock, not due to moral hazard on the side of the worker).

### 11.1.1 Private response

Shocks occur in all scenarios. Sometimes all shocks occur simultaneously, but most are idiosyncratic. This distinction is crucial for generalist workers, who can quite easily cope with idiosyncratic shocks, but are severely hit by economy-wide shocks. These economy-wide shocks may have a huge impact in terms of job maintenance and outside options. For the specialised workers, this distinction matters less for their job maintenance, but does of course affect the opportunity of finding a new task or job.

The basic response to uncertainty is diversification. This response is common on the capital market, where investors diversify their portfolios, but is more difficult on the labour market. Most workers have a single job within a single firm and are able to perform a limited number of tasks. Even in the US diversification is very limited, with about 5 – 10 percent of the workers having two or more jobs. Within their jobs, some workers have a more diversified package of tasks than others, and have better outside options. Among other things, the outside options for workers depend on their degree of specialisation. The super-specialist excelling in a single task likely faces a substantial drop in income if he is fired. The outside options for a generalist might be as good as his current income, but he faces the disadvantage that he doesn't excel in his current job.

Diversification only helps in advance of a shock, and may facilitate the response once it actually occurs. Still, some shocks may be too big for even the most diversified worker. Consider those that permanently affect a worker's job opportunities. For both worker and firm it is clear that the current job, with unchanged conditions, is no longer feasible. This deterioration might be attributed to either a reduction in the demand for a workers' output or intensified competition from other workers or firms. How do workers respond if they are confronted with these supply shocks, which are too big to ignore? They may choose one (or a combination) of

the following alternatives: job mobility, retraining, moving house, accepting a wage adjustment or becoming unemployed (which although not really a choice, might result, after all).

- Job mobility: Workers may change jobs. Job mobility, in its purest form, implies that the worker will perform the same task, or the same set of tasks, in another firm. Adjustment is costly because a worker has to adapt to the rules and habits of the new firm.
- Retraining: Workers may change tasks, for which they have to retrain. This retraining may either be on the job or at school; it may either be on the boss's time or in their own time. In its purest form, these tasks are performed within the same firm. Adjustment is costly because retraining requires time and money.
- Moving: Workers may change places and move to another city, either within the Netherlands or abroad. In its purest form, this solution implies that the worker performs the same tasks within the same firm, but in another place. The expenses incurred by moving, which depend among other things on the cost of moving houses, are a clear barrier to this type of adjustment.
- Wage adjustment: Workers may accept a lower wage and continue in their current job. This response fits in a situation where the gain of moving to the other task is very limited. Of course, wage adjustment may be part of a package in which a worker resigns his position and starts performing a new task in a new firm.
- Unemployment: If all else fails, or if workers are unable to or unwilling to choose one of the other four alternatives, they will become permanently unemployed and receive social assistance.

Note that in all options we emphasize the disadvantages, which is natural in discussing the responses to negative shocks. In any case, the most important gain is that the alternatives are even worse. For example, a worker is willing to accept a wage cut if retraining is very expensive, if family ties prevent removing and if other jobs are hard to find. Of course, we do not exclude that improved job opportunities may be a positive side effect of changing to a better-paid job or task.

In addition to labour-market shocks and responses, workers may also be confronted with a shock in their wealth (in the value of their house, for example). This wealth risk becomes problematic if it is positively correlated with labour-market risk. This is likely to be the case for housing markets in the specialised scenarios of Talent Towns and Cosmopolitan Centres, where specialist workers of the same city are hit simultaneously. They sell their houses massively, causing a huge drop in prices. The optimal response to this correlated risk is to diversify. One option is to rent a house instead of owning it. Alternatively, one might insure oneself against a drop in housing value, as was proposed by Shiller and Weiss (1999) in their article on home-equity insurance.

### 11.1.2 Scenarios

The most likely and most beneficial response to labour-market uncertainty differs between scenarios. In the high-concentration scenarios (CC and MM), shocks will occur with low probability but may have huge impact. In the scenarios with scattered cities (TT and EE), shocks may occur more frequently, but with smaller impact. The following table summarises the most promising responses to permanent shocks, indicated with a plus or a double plus. Less-promising options are left blank.

**Table 11.2 Promising responses to permanent labour-market shocks**

| | Talent Towns | Cosmopolitan Centres | Egalitarian Ecologies | Metropolitan Markets |
|---|---|---|---|---|
| Job mobility | | + | + | ++ |
| Retraining | ++ | ++ | | |
| Moving | + | + | | |
| Wage adjustment | + | | + | |

#### Talent Towns

The job opportunities for TT workers depend primarily on their specialisation in combination with excellent communication abilities; location is of second order. Two options are promising when these workers lose their job when their specialisation is taken over. First, they may retrain and specialise in a new task. Workers specialised in today's software programs will have to 'keep up with the Joneses' and learn new languages or new applications. Moving to another city might be part of this job switch. If retraining and moving is too expensive, and the drop in income is limited, the specialised workers might accept a wage cut rather than retrain. The alternative of job mobility is very unattractive. Searching for a new job on the local labour market is very difficult, as the local labour market is very thin, with an extremely limited number of vacancies. Moving without retraining is hardly a good option, either, because job opportunities for the worker's specialisation won't be much better in another city.

#### Cosmopolitan Centres

The specialist workers in the CC scenario are operating on a large local labour market with a robust demand for their skills but also fierce competition for the vacancies. It is important to distinguish between moderate shocks that may affect only an individual firm, and huge shocks that impact an entire profession. In the first situation, the fired workers will search for a job on the thick local labour market. This option is unavailable, however, if the profession—and with it the specialised city—is severely hit. In response, many workers will have to retrain, and eventually the whole city collapses or has to change profession. Moving is a promising alternative if a competing city with the same profession proves to be more competitive and more successful. In the end, workers will be most productive in proximate interaction with other specialists, and do not have to be close to the consumer market.

### Egalitarian Ecologies

The labour market is quite thin in the small EE cities. Nevertheless, neither retraining nor moving to another place is a promising response to a negative shock. Retraining is unlikely to pay off, as general skills are the decisive determinant of a worker's productivity. Neither is moving a good alternative, as it neither creates new demand nor improves a worker's production network. Therefore, the EE worker faced with a negative shock will probably either change jobs or accept a wage cut.

### Metropolitan Markets

The labour market in MM is very thick, with abundant job opportunities inside, but very few vacancies outside, the big city. A fired worker will therefore search for a job on the large local labour market. Since the MM worker is trained in general skills, retraining will only play a very limited role in his response to negative shocks. Moving will only be a matter of last resort, in situations where the entire city loses its position in the global competition: just as Antwerp overtook Bruges in the sixteenth century, Amsterdam may be challenged by London, New York or Shanghai in the MM scenario. These disastrous events are unlikely to occur; unemployed MM workers will thus set their sights on another job in the sizable local labour market.

## 11.2 Risk sharing and government intervention

Workers will be confronted with negative shocks, to which they may respond by moving to another firm, to another sector or specialisation or to another place. Alternatively, the labour-market shock may permanently reduce their income. The feasibility of these responses differs between scenarios, from retraining in the specialisation scenarios (TT and CC) to wage adjustment in the scattering scenarios (EE and TT). What role may governments play in sharing these risks on the labour market and accommodating worker responses? Taking for granted the fact that workers are risk averse, spreading the risk reduces their uncertainty and raises welfare. The key policy question is then how public provision of insurance affects private behaviour.[1]

Insurance improves welfare by smoothing consumption between employed- and non-employed periods or between employed- and non-employed persons. Most people are risk averse; only in lotteries are people happy to give up 15 Euros for a small probability of winning more. They prefer a certain amount of income to an uncertain income flow with the same expected return. Workers generally prefer a job with a permanent contract to a flexible contract.

One alternative to insurance is to smooth consumption by borrowing and lending on the capital market. However, unemployed people, in particular, face liquidity constraints and have to save in advance to guarantee consumption in periods without income. Moreover, consumption smoothing is only possible in response to temporary changes in income, but does

[1] De Mooij (2006) provides an extensive discussion of the future of the welfare state.

not mitigate permanent reductions in income. In both cases, workers may pool the income risk, rather than engaging in precautionary saving individually.

The key disadvantage of risk sharing is moral hazard, which may occur if risks can be influenced by the claimant. Once insured, people change their behaviour and affect the probability of occurrence or the size of the claim. Insurance is not likely to affect the flow in and out of unemployment, as neither the risk of unemployment nor the probability of finding a new job is completely exogenous. Turning the argument around, insurance is hardly feasible if the behavioural responses of the insured are very big. Only if the behaviour of the insured can be perfectly monitored, an efficient insurance contract would be feasible. Perfect monitoring is generally not feasible, and would be very expensive. So, the optimal insurance contract strikes a balance between the gains from insurance and the costs from moral hazard.

### 11.2.1 Publicly provided insurance and protection

The government has several instruments (including unemployment benefits and employment protection) that it can use to allocate labour-market risk or income uncertainty between workers. Each instrument has to strike a balance between the gains of spreading risk and the disincentives of moral hazard. The gains are quite uniform across the scenarios, but the efficiency loss depends on the mobility of the worker (i.e. on the way he likely responds to changes in his job opportunities). Table 11.2 has shown that these responses are scenario-specific. This implies that that the public insurance device will be scenario-specific as well. The applicability of the instruments in each scenario is summarised in Table 11.3.

**Table 11.3 Government policy to reduce labour-market uncertainty**

| | Talent<br>Towns | Cosmopolitan<br>Centres | Egalitarian<br>Ecologies | Metropolitan<br>Markets |
|---|---|---|---|---|
| Unemployment benefits | Facilitate retraining | Facilitate retraining | Facilitate job-job mobility | Limited |
| | Publicly provided at the EU level | Private savings account | Private savings account | Private savings account |
| Social assistance | Last resort | Limited | Last resort | Limited |
| Labour tax | Flat and low | Progressive | Flat | Progressive |
| Employment protection legislation | Desirable, but unfeasible | Feasible | Less desirable | Less desirable |
| Active labour-market policy | Stimulate mobility | Stimulate mobility | Low return | Low return |

The main publicly-provided sharing devices against unemployment risk in the Netherlands are unemployment benefits and social assistance. Unemployment benefits are meant to insure against temporary unemployment. The provision may improve matching on the labour market, as workers do not have to accept the first (poor) job offer, but may be more patient and wait for another offer that better matches their abilities and preferences. In other words, insurance may facilitate the movements workers need to make in response to labour-market shocks (see Table 11.2). These benefits should be temporary—supplemented, perhaps, by an active labour-market

policy and sanctions to guarantee successful labour-market transitions. Unemployment benefits are most welcome in scenarios in which transitions are important, but costly (if workers have to retrain) or difficult (if the labour market is thin).

Social assistance is, among other things, an insurance against long-term labour-market risk. It acts as a last resort for workers who become permanently unemployed, which will occur relatively frequently in the TT and EE scenarios, where wage adjustments are inevitable responses to negative labour-market shocks. The downside of social assistance is moral hazard, where workers with a sufficient earning capacity choose to quit the labour market and accept the income transfer.

The government may provide public insurance against idiosyncratic income uncertainty by implementing a progressive tax system in which households with higher income realisations pay higher average tax rates. This makes after-tax labour income less risky than pre-tax income. The key advantage of this instrument is that it effectively reduces long-term income uncertainty: you pay a large tax rate if you do permanently well, and a lower tax rate if your career is on a less-prosperous path. The gains from insurance should be weighted against the disincentive effects of progressive income taxes on labour supply (e.g., Krueger and Perri, 2009). The case in favour of progressive taxes is stronger for large life-cycle income differences and weak labour-supply disincentives. Income differences are pronounced in TT and CC, but the high mobility of workers prevents progressivity in the first scenario. Income differences are less pronounced in EE and MM, but the limited mobility of workers between cities or countries allows for progressive taxes in the MM scenario.

Next, we turn to policies that keep workers from losing jobs or support them in finding a new job. Employment protection legislation (EPL) shifts part of the labour-market uncertainty from employees to employers. These laws stimulate workers to accept more productive but riskier jobs, thereby possibly bolstering aggregate productivity. A second gain of EPL is the internalisation of externalities, by letting firms paying part of the societal costs of unemployment (which include public transfers and lower tax revenues). The downside of EPL is limited job-to-job mobility, which aggravates mismatches on the labour market. The case for EPL is strongest in the CC scenario, with costly retraining for workers and limited mobility of firms. The potential gains for EPL are also large in TT, but firms in this scenario are too mobile to be seriously regulated by EPL.

Active labour-market policy comes in many forms. Here we focus on instruments that may facilitate the switch to another specialisation. First, governments may have better information about job opportunities and offer job search assistance via government-operated labour-market exchange and placement services. This instrument is among the most cost-effective active labour-market policies (De Mooij, 2006). Second, governments may provide compulsory training schemes for unemployed workers, in situations where groups of ‘similar’ workers become unemployed, but are hesitate to retrain. These training schemes should be applied sparingly, as they are often expensive and turn out to be quite ineffective empirically. Only in

scenarios with a highly specialised labour force may active labour-market policy successfully support job-to-job mobility and retraining.

### 11.2.2 Public versus private provision

It holds true for all instruments that the public provision of insurance should be carefully weighed against private insurance schemes. Moreover, public insurance may crowd out private insurance—and in the end workers may even be worse off rather than better protected against income uncertainty. The extreme case may in particular hold for public instruments with compulsory collective insurance.

Consider again unemployment benefits. Shocks can be cushioned by spreading income over the life cycle—either by individuals privately or by the public provision of unemployment benefits. Bovenberg et al. (2006) show that for the Danish unemployment benefits, about half of the transfers are between people; the rest is over the life cycle. This sharing device is most relevant with temporary unemployment, or temporary reductions in wage income. From the perspective of an individual's lifetime income, these shocks are relatively small. A small sacrifice in annual income during periods of employment will suffice to guarantee income in unemployment.

Two main obstacles prevent this risk sharing over the life cycle. First, workers may act myopically, be short sighted and prove themselves unable to use the opportunity of life cycle spreading. Second, credit constraints prevent workers from borrowing against future income. Jongen and Van Vuren (2008) show that the gains from a public provision of saving accounts may improve welfare if credit constraints are sizable. Unfortunately, the empirical literature on the size of today's credit constraints is thin. One of the reasons might be that the public support for unemployed workers is sufficiently generous, and workers simply don't have to apply for loans. This implies that credit constraints will become more important in Talent Towns, a fragmented world with limited public insurance. In other scenarios, the case for public provision of unemployment benefits is much weaker, either because job-to-job mobility is very easy and short term in thick labour markets, or because credit constraints are less binding (in Egalitarian Ecologies).

The case for public provision of insurance on the labour market is strongest in a scenario in which labour mobility frequently crosses national borders (Talent Towns), which hampers its implementation or maintenance.

### 11.2.3 Scenarios and no-regret policies

This section discusses Table 11.3 from the perspective of each scenario. Retraining and wage flexibility are the preferable means to cope with labour-market uncertainty in Talent Towns. The government may support these responses by active labour-market policy and unemployment benefits with limited duration. Both may be offered collectively, as many shocks are idiosyncratic and the gains from pooling are large. The challenge in this scenario is to provide collective support for self-employed workers (in Dutch: ZZP; zelfstandigen zonder

personeel). Moral hazard is not a serious problem, as the world is highly dynamic; workers have to cope with many challenges, which makes a laid-back attitude disastrous. Progressive taxes are highly distortionary, as workers are mobile and able to work in whatever country they like.

National governments have limited means with which to insure the risk that an entire profession (or task) loses market share in Cosmopolitan Centres. These shocks are simply too big, and resemble the difficulties Iceland faces in dealing with the collapse of its financial centre. With this limitation in mind, retraining and moving to another place (probably in another country) are the preferable means for workers to cope with labour-market uncertainty. The government may support retraining by active labour-market policy, but runs the risk of retraining workers for other countries, as workers are highly mobile. Any impediments against international and intercity mobility should be minimised. Moving to another place shouldn't be made more expensive than necessary, so any institutions at the housing market or in the transferability of pensions that limit the mobility of workers are very expensive. Finally, EPL may improve risk sharing between employees and employers, as the latter are not easily distracted by restrictive regulation.

Job mobility and wage adjustment are the preferable means to cope with labour-market uncertainty in Egalitarian Ecologies. Both can be supported by social assistance. Job-to-job mobility can be supported by social assistance with a high replacement rate and limited duration.

Job mobility is the main adjustment device in Metropolitan Markets, which may be supported with social insurance. Policies such as EPL that limit job mobility do not fit in this scenario, which lacks already sufficient dynamics. Moreover, MM cities already run the risk of being monopolistic, which should not be aggravated with protectionist devices. Only in the exceptional case that the entire city shrinks and loses the race against bigger cities (such as London), will workers have to move. In this latter situation, the government will have neither the means (very low tax revenues) nor the scope (limited to national borders) to support workers in migrating.

The conclusion from this discussion is that there is a discrepancy between demand for public insurance and its feasibility. Jobs are highly uncertain in Talent Towns, but policy is very limited in supporting them. Policy is quite feasible in Metropolitan Markets, but hardly needed in the thick labour market. In terms of the trade-off between incentives and insurance: incentives are huge in the TT scenario, but collective insurance hardly feasible: successful workers are able to evade public insurance by moving to another country. Insurance is feasible in the MM world, but incentives are quite weak. This outcome points to a limited role for the welfare state in all scenarios. In the balance of gains and costs of public insurance, either the gains are limited or the costs (in terms of moral hazard or adverse selection) are substantial.

## 11.3 Redistribution

Next, we briefly discuss redistribution, the second key function of the welfare state. With respect to insurance, we have seen that the need for and feasibility of social insurance move in opposite directions. With regard to redistribution, a similar conclusion follows if we confront income inequality and the scope for national regulation and taxation in each scenario. Table 11.4 distinguishes income inequality in three dimensions. The income inequality within cities is more pronounced in bigger and specialised cities. Specialisation helps to get the best return out of the quality in which a worker excels, whereas generalised workers have to perform several tasks reasonably well. Moreover, larger cities host a greater variety of people, living from suburbs to residential areas, which creates more inequality. Income inequality between cities depends mostly on a given city's degree of specialisation. Some specialised cities will be very successful—at least for some time (such as the glass blowers of Venice), whereas other cities are specialised in tasks with a low return (such as currently the Detroit car industry). Finally, in scenarios where agglomeration economies are very important, such as MM and CC, there will be a huge income gap between city and hinterland. Income inequality is therefore most uneven in CC, followed by MM and TT. As its name already indicates, EE is the most equitable scenario.

**Table 11.4 Income inequality and the governance of the welfare state**

| | Talent Towns | Cosmopolitan Centres | Egalitarian Ecologies | Metropolitan Markets |
|---|---|---|---|---|
| **Income inequality** | | | | |
| * Within city | + | + | 0 | + |
| * Between cities | + | + | 0 | 0 |
| * City - hinterland | 0 | + | 0 | + |
| **Redistribution** | Continental | City or global | National | City |

Egalitarian Ecologies, however, is also the scenario in which the national government has the strongest influence, as has been argued in Section 9.3. MM cities have very limited incentives to deal with the income lag of the hinterland. TT and CC cities have an incentive to set up a redistribution scheme, as a means of insurance against negative shocks, but this scheme should exceed the national level. It might therefore be hard to implement. So once again, redistribution via national welfare states is very difficult in scenarios where it is most urgent.

## 11.4 Housing market

We have pointed to the role of housing markets in either supporting or hampering workers in responding to changing circumstances. In particular, in Cosmopolitan Centres and Talent Towns, where flexibility of workers is needed, institutional reform in favour of the rental market should be seriously considered.

Donders et al. (2010) investigate reforms for the Dutch housing market. They argue that there are two counteracting reasons for public support of homeownership. On the one hand, homeowners might take better care of their property, which benefits the neighbourhood. On the other hand, ownership limits mobility on the labour market and hampers workers' response to distant job opportunities. The study argues that the balance between both effects is likely to be negligible, which implies that, even today, public support cannot be motivated on economic grounds. In scenarios demanding more flexibility from workers, the balance might very well turn negative, meaning that changing houses should be supported rather than discouraged. This has also implications for the transfer (or conveyance) tax, which taxes housing transactions. This tax is harmful in all scenarios and should even be turned into a subsidy in scenarios demanding more flexibility from workers (particularly CC)

An additional argument against private property is the accumulation of negative shocks. If the specialisation of cities in TT or CC scenarios is negatively hit, many workers become unemployed and firms shut down their vacancies. Workers will thus have to move to another city to find a job. During this downturn, many workers are going to sell their house, which severely reduces the value. In this case—which is not unlikely in the specialisation scenarios—homeowners are hit twice. Workers who rent their house are better off; they simply terminate the tenancy.

In fact, the risk is shared between the worker bearing the labour-market risk and the proprietor bearing the house value risk. The proprietor is able to diversify the risk by owning houses in several cities or by holding a diversified asset portfolio in general. This argument shows that the government should reconsider subsidies on homeownership in a scenario like Cosmopolitan Centres.

# 12 Strategic policymaking

*'I am convinced that changes in technology and globalization will only make cities more vital. Why do I think that the face-to-face interactions that are enabled by cities are actually complementary with new technologies rather thank taking the more standard view that face-to-face interactions and electronic interactions are substitutes? New technologies increase the returns to being smart and face-to-face interactions are a crucial element in becoming smart. New technologies enabled the growth of world trade, but that trade is centered in cities which enable people from different countries to connect.'*
Edward L. Glaeser, 2010, *The Paradox of Urban Triumph*, 2010 CPB Lecture.

How can this study, with four distinct scenarios, be used for strategic thinking about the future? What is the use for policymakers? The relatively broad scope of the study—using developments in cities, human capital and the world economy at large—has the advantage that it can be used as background information and input for many different subjects that require a long-term perspective. It also means that to analyse other policy areas of interest, a further elaboration of the framework will be needed.

Before exploring how scenarios can support strategic policymaking it is useful to remember what the main characteristics of scenarios are (see also Chapter 1 and De Mooij and Tang, 2003). Scenarios are consistent, plausible and challenging stories of possible futures. They do not predict the future—in principle, an infinite number of scenarios exist, which makes each individual scenario useless as a prediction. The aim of scenarios is to span the future in the same way as a number of vectors span a mathematical space. To reach that aim, the scenarios together they should cover such a degree of variation that they confront the policy issues at hand with the most relevant uncertainties. This means that scenarios serve as a fixed background for strategic policymaking. The policymaker can neither select the most attractive scenario nor adjust a scenario to have it fit more closely his policy objectives. All in all, scenarios do not answer the question 'what will happen that may affect a policy?' but they provide policymakers with a tool to answer questions such as, 'what will be the effect of a policy measure if … ?'

## 12.1 Scenarios: A way to effectively deal with uncertainty

The critical message of the present study is that any decisions taken about long-term investments or other policy actions should take into account uncertainty about future developments—and not be based on a single scenario. The first lesson we drew in Chapter 1 is that current events have the tendency to be considered as generic—watersheds between past and present. This turned out disastrously for *Echo and Narcissus,* and most certainly will also be the wrong course of action today. Therefore, it is impossible to point to a single scenario as being the most probable, as all scenarios have an equal probability of being "true" or "false". The

future is fundamentally uncertain in almost all respects, and the only 'benefit' to be had of picking one particular scenario would be to create a false sense of certainty.

Yet, in the policy arena choices have to be made. They cannot be made conditional on future events, but have to be made today, based on current knowledge. For policies that can be changed fairly rapidly, it is feasible to take action immediately and adjust the policy when it turns out wrong. More difficult are policies with a great lead-time and/or investments that involve large sunk costs. In such circumstances, the policymaker has to trade off the benefits of waiting and learning about future developments against the costs of delay. The trends in Chapter 4 and the scenario framework in Chapter 7 may help to monitor developments and learn about the world that is materialising.

Keeping all options open until there is less uncertainty about future developments is often impossible. At some point, decisions have to be made. Present decisions should not be looked upon as ultimate wisdom, but as inevitable choices made while facing a fundamentally uncertain future. In that sense, policymakers could be seen as entrepreneurs making an investment decision that could yield positive returns but may also result into failure. The uncertainty should be used to build in measures to operate as flexibly as possible with respect to changing circumstances or in case future developments turn out to be different than those assumed initially. Hence, policymakers must in some way take into account uncertainty about future developments. This is where the four scenarios come into play.

Basically, the government should implement policies for which the social benefits exceed the costs. Both costs and benefits may differ across scenarios. For example, Chapter 10 shows that in one scenario public-private cooperation between private firms and universities is beneficial (Cosmopolitan Centres), while in the other scenarios this benefits the development of a strong knowledge economy to a much less extent. As for infrastructure, Chapter 9 argues that local connections (such as the underground or a ring road) are crucial in the large-city scenarios (CC and MM), but are not likely to pay off in smaller cities. For each scenario one can subtract the costs from the benefits. The outcome may be positive in some scenarios and negative in others. Of course, as Chapters 9 to 11 clearly indicate, in various cases a full cost-benefit calculation is not feasible. Yet, it often proves possible to obtain a qualitative impression about the expected sign of the cost-benefit balance, in order to assess whether a given policy appears promising in a certain scenario context or not.

These exercises are very useful for thinking about strategic choices, because they force policymakers to confront various possible decisions with various potential futures using their power of imagination (which is the final lesson in Chapter 1). The best choice then differs from project to project. In general, the outcome of a project might fall into one of four cases. The simplest case, first of all, is when the social cost benefit analysis yields a positive outcome in all scenarios. In that case, the associated policy turns out to be a no-regret policy; it is indifferent to the uncertainty about the future represented in the scenarios. Often these policies respond to the facts and trends presented in Part I of this study—such as the switch from sectors to tasks following the ongoing development of ICT, and the growing importance of cities relative to

countries. Secondly, when a policy looks favourable in three out of four scenarios it is robust to future uncertainty. Implementation looks reasonably promising. Thirdly, when a positive result occurs only in one or two scenarios, uncertainty is large. If a decision has to be taken, then a viable option is to just count on uncertainty and weight the benefits and costs in each scenario with a one-fourth probability. This approach may also help to identify the fourth case: the low probability - high impact event. If circumstances in a certain scenario entail a risk of very large and costly consequences—or even a disaster—then a project that minimises the probability of these consequences frequently pays off. This holds true for the danger of flooding, but may also apply to job uncertainty. In the former case, the government decides to invest in strong dikes, whereas in the latter one might opt for a generous welfare state.

## 12.2 The magic circle of strategic policymaking

The influence circle of national governments shrinks, but the impact of their actions increases. This conclusion, illustrated with *The Magic Circle* in the introduction to Part III, follows from the previous policy chapters. First and ultimately for all scenarios, technology drives the scenarios: global developments such as the advance of ICT or a new general-purpose technology (GPT) coming along, strongly influence the future of the Dutch economy. Technology progresses largely autonomously; policy may to some extent affect science and innovation within a scenario (see Chapter 10), but is unable to steer technology towards a new GPT. Secondly, as globalisation continues, international communication becomes increasingly important and the government is more or less obliged to support English language training in public schools. Would it decide differently, the consequences for the Dutch position in trade and business services (to mention a few) would be detrimental. Or to take another example, globalisation and the surge of international connections limits the scope for welfare states, which are generally organised nationally. The Netherlands might become very unattractive, were the government to expand the welfare state considerably and raise taxes.

The influence circle implies that governments have to move with the tide of all-encompassing trends such as technological change—and that deviations from the dominant developments are costly. More countries are using knowledge as the dominant input into the production process. Producing more advanced products makes an economy less vulnerable to adverse shocks. In recessions, industries producing the least advanced products are being hit strongest (see Di Govianni and Levchenko, 2009, for an analysis of the current economic crisis). Emerging knowledge economies urge developed economies to sustain high-quality education, science and innovation. More importantly, knowledge is relatively fluid and mobile, as it is embodied in people and blueprints. Codified knowledge is produced in many different locations and can be accessed and applied independent of place. Talented and productive people are attracted by an attractive place of business, a flexible labour market and good educational and research facilities. Hence, in all these fields governments cannot diverge from keeping policy up to standard.

Despite their being less vulnerable to shocks compared to basic industries, knowledge-intensive industries and tradable services may also experience rapid change. Due to the integration of the world economy and the upgrading of various countries to higher quality products and services, the suddenness and size of changes is likely to rise for Western economies (and the Netherlands, in particular, as a very open service economy). The recent crisis, for example, has revealed the vulnerability of the financial sector. Moreover, several parts of the services production chain (such as software development) have been outsourced to India. Also for industrial production, competitive positions are uncertain. The partial collapse of the car industry in the United States in the last ten years is a good example of a sector losing its competitive edge. These processes will continue. They call for a policy strategy to deal with the uncertainty surrounding this suddenness. The circle of influence is too narrow to offset the downturn of particular industries. But the role of governments might be decisive in designing institutions for change—such as flexible labour markets, capital markets, property markets and innovation systems.

The right policy response is to closely monitor the competitiveness of the place of business, the quality of the knowledge economy and the flexibility of the Dutch labour market. Chapter 9 stresses the importance of a sound infrastructure and regulation. Chapter 10 points to the benefits to be had from a highly educated labour force, with workers being able to excel in current activities and change to other jobs. Chapter 11 shows that workers occasionally have to move or to retrain for a new job. They might be more flexible, willing and able to move, if they rent rather than own their house. So institutions contributing towards flexibility of the labour- and housing market should be seriously considered, particularly in Cosmopolitan Centres, where unemployment and a drop in housing value likely coincide.

## 12.3 Other applications

There is one world, hundreds of countries, thousands of cities, billions of workers, uncountable policy options—and yet only four scenarios. So we have had to make choices, by focussing on only three policy applications. We have focused on policies concerning the place of business, the knowledge economy and the labour market. And even within these areas we have only touched upon a selection of policy issues.

Of course, it would be possible to extend the analysis to other policy areas. For example, the movement of goods and people has important implications for environmental policy. The transition from sectors to tasks has far-reaching implications for industrial policy, regulation, and education, which go far beyond the analysis in Chapters 9 to 11—and this list is far from complete. The challenge for policymakers is to take the scenarios, consider the examples in the previous chapters and investigate the future of their own policy area.

The framework developed in Part II is a general economic framework. It sketches a broad picture of the role of tasks, cities and knowledge in the world economy, and subsequently zooms in on the Netherlands. This framework can be applied to other modern economies as

well, or to a set of countries, such as the European Union. Other countries in the developed world can also benefit from an analysis of how smart cities and clever people shape the future.

Finally, in line with the scenario tradition at CPB, this study will have a successor. This qualitative approach will be followed by a quantitative assessment. The gauntlet will be taken up by the team producing the WLO (*Welvaart en Leefomgeving*) study, which will be used for a variety of applications in Dutch policymaking.

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