Main lessons of the NBB's 2014 conference

"Total factor productivity: measurement, determinants and effects"

E. Dhyne
C. Fuss

Introduction

As stated by Paul Krugman, winner of the Nobel prize for economics in 2008, "Productivity isn't everything, but in the long run it's almost everything". Indeed, while the contribution of an increase in total factor productivity (TFP) to economic growth in the short term may seem relatively small, the cumulative effects of changes in TFP are the sole sustainable source of long-term growth. That is sufficient in itself to justify the interest that it attracts from economists, analysts, researchers and decision-makers.

For some years now, TFP growth has been slowing down at macroeconomic level in all developed countries, and particularly in Europe. That deceleration is naturally a source of major concern, because it affects not only the current situation of our economies but also their future growth potential.

The slackening of TFP growth was particularly apparent from the early 2000s. The economic and financial crisis therefore cannot be held responsible, although it has aggravated the situation. Both the poor prospects for demand and the possible financial constraints confronting businesses have delayed the productive, innovative investment which could help restore TFP growth and potential output to their historical levels. That situation is damaging the sustainability of our public finances and social protection systems. This modest TFP growth accompanied by weak domestic demand and flagging growth of external demand could amplify the risk that the European economies might be entering what some economists call a secular stagnation phase.

In view of the potential consequences of the TFP slowdown for long-term growth, it is vital – as stated by the Governor Luc Coene in his opening address to the conference – to have adequate tools for measuring TFP, for understanding the sources of growth, and for establishing the necessary incentives and stimuli.

To achieve an accurate analysis and take appropriate decisions it is essential to obtain the most precise and reliable measurement. That objective requires a special effort, knowing that TFP is measured as the residual figure in the estimation of production functions. TFP can in fact be defined as the efficiency with which goods and services are produced, using a given technology and taking account of the quantity of available inputs. This is obviously a concept that has no directly observable equivalent, but which is nonetheless quantifiable. That is a reminder of the importance of having access to data that are as accurate, complete and reliable as possible, and of using the most appropriate econometric techniques.

Given the crucial importance of this variable, the Bank devoted its eighth biennial conference to this topic. The conference on "Total Factor Productivity: measurement, determinants and effects" took place in Brussels on 16 and 17 October 2014. At this event, six original contributions

analysing the trend in TFP in Belgium and in Europe were presented. Three internationally renowned speakers tackled this subject from a broader perspective. This article aims to summarise the lessons of those contributions and the ensuing discussions. Since the subject is by nature extremely broad, the article will only address some of the questions relating to TFP. It begins by presenting a general observation on the trend in TFP in the advanced economies, possible reasons for the decline in recent years, and the diverging developments between sectors. Next, it aims to assess the scale of the challenges associated with major external changes such as population ageing. It also inquires into the sources of TFP growth, and in particular the factors that corporate decisions may influence. It then examines the impact on business performance of the increased competition resulting from the expansion of imported products. Finally, it looks at the potential role of economic structures and policies.

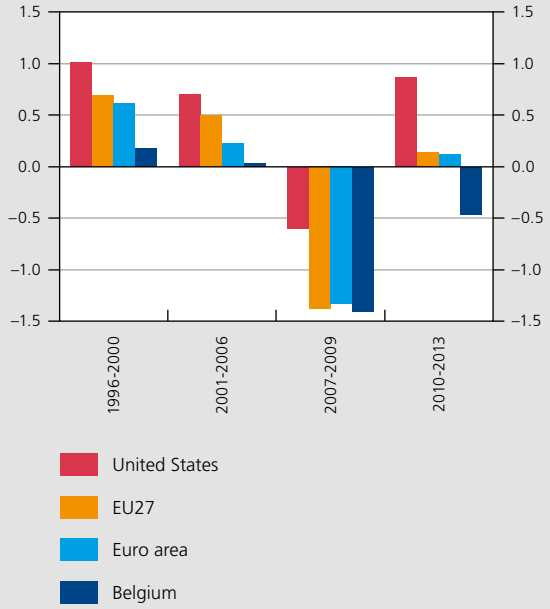
1. General observation and issues

As Bart van Ark said at the conference, TFP growth has clearly stagnated in developed economies over the past decade. TFP, which can be linked to productive efficiency and/or technological progress, plays a central role in long-term economic growth. In the short term, year-on-year TFP growth only represents part of the increase in GDP, but since its effects are cumulative, it is the only source of long-term sustainable growth in per capita GDP. These developments are therefore justifiably a focus of attention.

If we consider the average annual growth of TFP in the United States, Europe and the euro area over the periods 1996-2000, 2001-2006, 2007-2009 and 2010-2013, at least three important lessons emerge. First, the TFP slowdown was more abrupt in Europe than in the United States. Second, the economic and financial crisis exacerbated the slowdown, as TFP growth was negative in the euro area during 2007-2009. Third, while TFP growth has returned to its pre-crisis level in the United States since 2010, the recovery is yet to come in Europe.

Belgium was no exception to these phenomena: its TFP growth rates are particularly low, and have actually been negative for several years. Moreover, as demonstrated by the study by Verschelde *et al.* (2014), there have been divergences between Belgian industrial sectors. Despite a steady rise in some sectors such as that comprising rubber and plastic products, TFP declined in other sectors such as textiles, the manufacture of other non-metallic minerals, and metallurgy. Moreover, the economic and financial crisis led to a substantial fall in TFP in several sectors.

CHART 1 AVERAGE ANNUAL GROWTH OF TOTAL FACTOR PRODUCTIVITY PER REGION AND PER PERIOD



Source: Conference Board – Total Economy Database.

Although economists differ on the outlook for technological progress and future growth at global level, it must be said that the weakening of TFP growth, especially since the crisis, has led to a downward revision of the trend in potential output. Thus, the European Commission's DG-ECFIN cut its estimate of the trend in potential output in the euro area from 1.9 % before the crisis to just 0.6 % for 2009-2014 and 1.4 % from 2014 onwards. As a corollary, the growth of our economies is currently close to potential output growth, and the problem is not so much that we are in a cyclical trough, it is more a matter of being faced with the conditions for weak long-term growth.

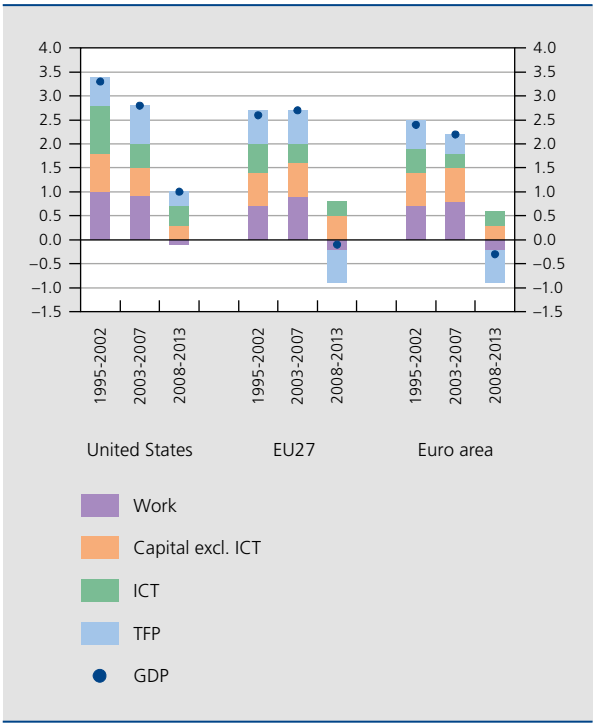
In view of that outlook, it is essential to understand both the sources of TFP growth and the factors impeding it. Comparing the experiences of various countries or economic sectors reveals a number of factors. First, the shift towards the services sectors in our economies automatically reduces TFP growth because that growth is generally weaker in services than in industry. For example, according to the EU-KLEMS data, in the period 1996-2006, TFP in Belgium increased by 9.7 % in the manufacturing sector and declined by 3.2 % in the market services sector. At the same time, the share of manufacturing industry in total value added declined from 23.6 % in 1996 to 18 % in 2010, while the contribution of market services rose

from 47.8 % to 51.8 %, according to the NAI's ESA 2010 statistics.

Furthermore, the comparison between Europe and the United States suggests that European economies are suffering from a shortage of investment in innovations, and a lack of efficiency in their use in general, and in information and communication technologies (ICT) in particular. The gains generated by the ICT revolution come from three sources: (1) the innovations of firms producing ICT, (2) the benefits in terms of productive efficiency gained by firms investing in ICT and incorporating those technologies in their production processes, and (3) the positive externalities associated with network effects. Bart van Ark (2014) illustrates the annual contribution of each of these factors to TFP growth in the eight European economies for which those data are available[1]. That contribution was assessed at 0.28, 0.44 and 0.25 % respectively for the period 2001-2007, and at 0.16, 0.21 and −0.24 % for the period 2008-2011. ICT thus accounted for almost 1 percentage point of annual GDP growth before the crisis, or around a third of GDP growth over that period. According to Bart van Ark, there is still massive potential for ICT growth via the adoption of ICT by firms and network effects.

CHART 2 CONTRIBUTIONS TO GDP GROWTH

(in %)



Source: van Ark (2014).

The comparison between European countries and the United States reveals not just a lack of investment in physical capital (ICT or non-ICT), but also a shortage of investment in intangible assets. A study by Corrado *et al.* (2013) in fact shows that, over the period 1995-2009, spending on intangible assets[2] represented 6.6 % of GDP in the EU15 compared to 10.6 % in the United States. Moreover, the proportion of intangible assets increased more strongly in the United States (+33 % over the period 1995-2007) than in the EU15 (+21 % over the same period). Finally, the authors highlight the existence, at macroeconomic level, of a positive link between investment in intangible assets and TFP growth, suggesting that there are spillover effects for this type of assets.

The low level of investment in intangible assets in Europe, and especially in Belgium, is particularly striking in the case of expenditure on R&D, rights and patents, and digital information (which covers both software and expenditures associated with the purchase, development and management of databases). In addition, the EU15 tends to invest little in organisational capital. This last point applies less to Belgium, which instead lags behind significantly in expenditure on training.

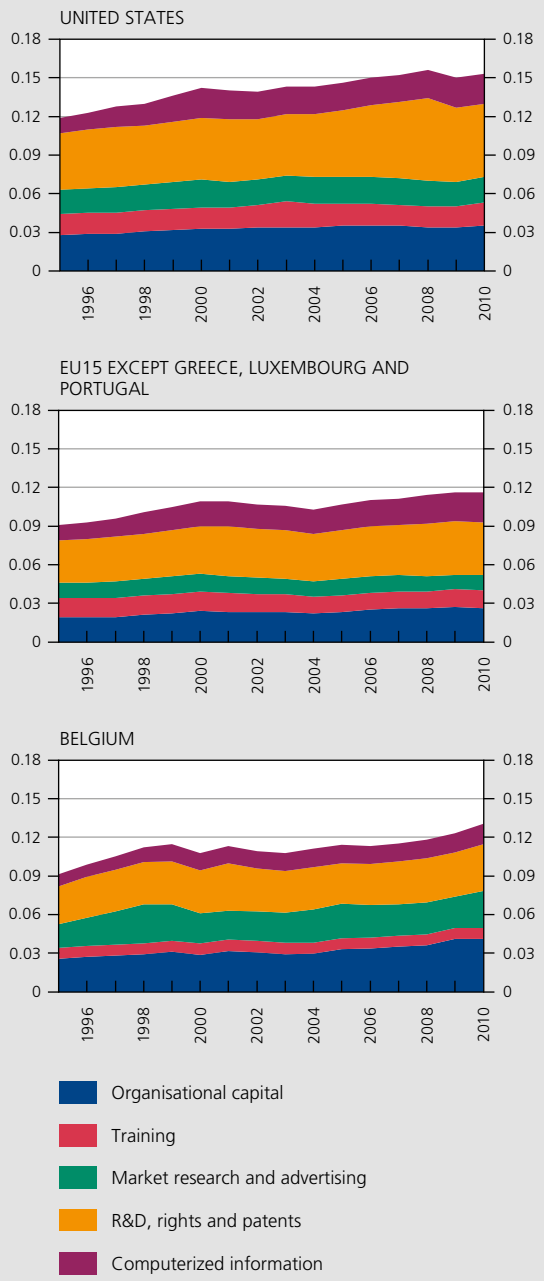
On the basis of this first set of results, we find that the advanced economies, and the European economies in particular, need to implement policies which can stimulate TFP in order to return to sustainable long-term growth. The need to promote TFP is justified not only in view of the slowdown in TFP growth over the past decade but also on account of the many issues that will confront these economies in the future.

At the Bank's conference, one contribution dealt more specifically with one of those challenges, namely population ageing. While this question has mainly been discussed in terms of the sustainability of public finances and social protection systems, the study by Ariu and Vandenberghe (2014) sheds new light on the subject by focusing on the consequences of ageing for the dynamism of TFP. The authors assess the impact of the changing age structure of the labour force on TFP growth at the level of Belgian firms in the market sectors, excluding agriculture. Their estimations indicate that the TFP growth of firms is lower the higher the proportion of older workers employed, regardless of gender or status (manual or non-manual workers). That effect seems more pronounced in industry, construction and trade taken as a whole than in other market services (excluding trade).

(1) Germany, Austria, Spain, Finland, France, Italy, Netherlands and United Kingdom.

(2) The authors take intangible assets to mean digital information, R&D, other forms of innovative property, market research and advertising, training and organisational capital.

CHART 3 INVESTMENT IN INTANGIBLE ASSETS
(in % of GDP)



Source : Intangible investment database – www.intan-invest.net.

This study also permits a simulation of the impact of labour force ageing on aggregate TFP, even though the estimated figures need to be treated with caution. According to Ariu and Vandenberghe (2014), labour force ageing accounts for a decline in aggregate TFP of 4.5 percentage points since 1991. In view of the demographic projections, population ageing will continue until the mid-2020s. If structures and policies remain unchanged, the reduction in TFP due to labour force ageing is therefore set to continue. If Belgium were to achieve the European target of an employment rate of 75 %, with workers aged between 55 and 64 years accounting for 25 % of employment in 2023, the cumulative loss of TFP would be even greater. These factors present numerous challenges calling for the development of measures to stimulate the productivity and employability of older workers.

2. Sources of TFP growth

TFP represents the efficiency with which output is produced from a given quantity of inputs. A rise in TFP therefore raises the level of output based on a given quantity of inputs. Innovations are an obvious example of the factors that lead to TFP growth. The reallocation of resources from the least productive to the most productive firms can also have a significant impact on aggregate TFP. Finally, for a given quantity of inputs, their quality will also be a factor increasing output.

2.1 The effect of innovations on TFP

The role of innovations in economic growth in general, and in TFP growth in particular, was established and analysed long ago. At the conference, Bronwyn Hall (2011) presented a summary of the lessons that can be drawn from the empirical studies devoted to the link between innovation and productivity.

Most of the studies have focused on R&D expenditure, as those data are the most widely available. However, the expected effects of innovations on TFP are greater than those measured by microeconomic analyses of the link between R&D expenditure and TFP. First, other types of innovations (organisation, management, marketing, and expenditure related to the creation, management and operation of databases, etc.) have to be considered. Next, if existing firms develop or adopt innovations in order to improve their productive efficiency, the R&D is not necessarily carried out by the firm itself but may be created by a third party. It is therefore necessary to distinguish between firms that innovate and firms that adopt innovations developed by others. The firm's ability to absorb innovations or to adapt to them, be it in terms of organisation or the skills and adaptability of the labour force, plays a decisive role in that respect. Third, it is necessary to bear in mind that expenditure that firms commit to innovation is not confined to R&D spending alone, and that new technologies may also be adopted via investment in physical capital. By way of illustration, Hall (2011) states that the results of the Community Innovation Survey conducted

in the United Kingdom in 1998-2006 reveal that barely a third of expenditure on innovations by manufacturing firms concerns R&D; 40 % of that expenditure covers the acquisition of machines or IT resources; the balance relates to expenditure on marketing, design and training. Fourth, it is necessary to take account of the spillover effects of innovations in one firm on other firms; those effects have been demonstrated by other studies.

Subject to these restrictions, Hall (2011) presents an overview of all the available results, and particularly the estimates of TFP elasticity in relation to the proportion of sales generated by innovations. The results indicate that elasticity is positive, as one would expect. It is higher in capital-intensive sectors or those specialising in advanced technology, sectors where technological innovations in products or production processes may prove particularly fruitful.

In some cases, the survey data make it possible to distinguish between process innovations and product innovations. The effect of process innovations on TFP is hard to measure, owing to the complexity of measuring quality; in the present case, that refers to the quality of the capital stock, but it may also extend to the other production factors. In parallel with process innovations, innovations in management or organisation also tend to improve productive efficiency and reduce production costs. However, it is not easy to conduct an empirical assessment of that effect, notably because it is difficult to measure these types of more intangible innovations.

Another issue associated with estimating the impact of innovations on TFP lies in the fact that, in many cases, econometricians cannot distinguish between actual productive efficiency and the firm's pricing policy. As innovations in processes or organisation tend to reduce production costs, ultimately lowering the prices of firms' products and hence their income, these innovations will also tend to have a negative impact on the traditional measures of TFP (known as TFP-R or TFP in revenues), even if they have a real, positive, direct effect on productive efficiency.

The contribution by Braguinsky *et al.* (2014), presented by Chad Syverson, illustrates in particular how the adoption of a more efficient way of managing both production and demand can enhance firms' performance. This paper gives a very detailed account of a period of industrial restructuring featuring many mergers and acquisitions. Even though it concerns a particular phenomenon – the study analyses the cotton-spinning sector in Japan in the 19th century – it illustrates very clearly the effects on TFP of the adoption of organisational innovations. It shows how the performance of the firms taken over improved once they had adopted the buyer firms' methods of organising production and managing demand. The profitability of the acquired firms increased once they came under the control of the acquiring firms, partly by more intensive use of their production capacity and partly by better demand management.

The role that organisational innovations can play in the use and adoption of innovations was also demonstrated by Bloom *et al.* (2012). Their study indicates that, within firms operating in the United Kingdom, the productivity of American multinationals is higher than that of similar non-American firms, essentially owing to more effective use of ICT. Furthermore, their results show that a takeover by an American firm increases the productivity of those firms. The authors attribute that finding to forms of organisation that make more efficient use of the new technologies.

TABLE 1 LINK BETWEEN INNOVATION AND TFP: RESULTS OF VARIOUS ECONOMETRIC ESTIMATES

(elasticity of TFP in relation to the proportion of firms' sales generated by innovations)

	Elasticity	Estimation period
France	0.07	1986-1990
Finland	0.09	1994-1996
Norway	0.26	1995-1997
Sweden	0.15	1994-1996
Sweden	0.12	1996-1998
Netherlands	0.13	1994-1996
France		
High-tech manufacturing sectors	0.23	1998-2000
Low-tech manufacturing sectors	0.05	1998-2000
Sweden		
Capital-intensive manufacturing sectors	0.29	1998-2000
Services sectors	0.09	1996-1998
Germany		
Capital-intensive manufacturing sectors	0.27	1998-2000

Source: Hall (2011).

2.2 Reallocation effects

It has been shown that the reallocation of the means of production from the least productive to the most productive firms can generate a significant proportion of

aggregate TFP growth. That factor may prove particularly relevant in a situation where economic conditions have deteriorated.

Technological progress may also be linked to the creation of new businesses, the expansion of innovative companies and the closure of less productive firms, what Schumpeter calls "creative destruction". That is the case where there is increasing pressure of competition from firms whose efficiency has improved, driving down the prices and/or market shares of less productive firms below the profitability threshold.

These reallocation effects concern the closure of some businesses and the creation of new ones as well as, more generally, a change in companies' market shares or adjustment of their product portfolio. In all cases, this process implies the reallocation of both human and financial resources. It requires an adaptable labour force, particularly in terms of skills, but also the efficient allocation of financial resources and establishment of conditions that favour business start-ups.

2.3 The quality of the production factors

Apart from innovations and reallocation effects, input quality can also be regarded as an essential factor in the dynamism of TFP. For example, in regard to physical capital, the contribution by Braguinsky *et al.* (2014) demonstrates that in the specific case studied the productivity of the firms depended essentially on the age of the capital stock. That case illustrates the positive effect of the absorption of technological innovations via investment in physical capital, the newest capital being associated with more efficient technology.

In regard to the quality of the factor labour, the skills of the labour force naturally play a crucial role. They influence not only the efficiency of production, but also the capacity to absorb and adapt to new technologies. In this connection, the study by Verschelde *et al.* (2014) notes that technological progress may be accompanied by a change in the intensity of the use of certain production factors. More generally, some technological developments lead to the "replacement of men by machines", while others modify the type of skills that employers seek. For example, the development of ICT has transformed the duties of workers, amplifying demand for workers whose skills match the jobs associated with these new technologies and, conversely, reducing demand for other categories of labour less suited to the job or workers who can be directly replaced by these new technologies. The study by Verschelde *et al.* (2014) aims to assess more generally whether technological progress has brought a change in demand for the various inputs. Their estimations for firms in the Belgian manufacturing sector over fifteen years indicate that technological progress has been accompanied by a reduction in the proportion of manual workers in many sectors. In the great majority of cases, that has not been offset by a rise in demand for non-manual staff. In some sectors, technological progress tends to imply a greater intensity in physical capital. Other sectors make more use of intermediate products, reflecting the increasing fragmentation of production. That results in more outsourcing to other Belgian firms, but also higher imports of intermediate products.

3. Market structure, industrial policy and TFP growth

Apart from the various TFP growth drivers highlighted in the preceding section, some structural reforms may also improve the long-term dynamism of TFP growth, notably via measures aimed at making product and labour markets operate more efficiently. Similarly, industrial policy measures can influence productivity.

3.1 Competition from foreign products and TFP growth

Numerous studies, both theoretical (Aghion and Howit, 1996) and empirical (Holmes and Schmitz, 2010), have revealed the potentially beneficial effect on productive efficiency of reforms aimed at boosting competition on the product market. In the face of tougher competitive pressure, a firm – be it at the cutting edge of technical capability or lagging behind in its technology – will have a greater incentive to invest in the various forms of innovation mentioned above, either to stay in the lead or to catch up.

During the conference, three articles (De Loecker *et al.*, 2014, Dhyne *et al.*, 2014, Dobbelaere and Vancauteren, 2014) addressed from various angles some of the questions relating to the complex link between competition and productive efficiency. The first two articles examined this issue by considering how competition from imports influences domestic producers of similar products.

By way of illustration, according to the international trade data recorded at the NBB, 42 243 Belgian firms imported goods (including intermediate products) in 2012, 37 % of them importing from Chinese companies. It should be noted that the beneficial effect of access to better quality or cheaper inputs is not limited to importers.

TABLE 2 IMPACT OF AN INCREASE IN THE DEGREE OF FOREIGN COMPETITION ON PRODUCTIVE EFFICIENCY

	$log(TFP-Q_t)$ at the level of the firm		$log(TFP-Q_t)$ at the level of firm × product	
	(1)	(2)	(3)	(4)
Degree of foreign competition$_{t-4}$	0.082***	0.024***	0.012	0.079*
Degree of foreign competition × $Rank2_{t-4}$	–	–	–	–0.103***
Degree of foreign competition × $Rank3_{t-4}$	–	–	–	–0.131***
$Log(TFP-Q_{t-4})$	–	0.656***	0.896***	0.872***
# observations	46 090	33 169	19 402	19 402

Source: Dhyne *et al.* (2014)

Notes: Dhyne *et al.* (2014) use various measures of the degree of foreign competition. The results presented are based on the share of imports net of re-exports in total domestic output and net imports, assessed at product level (PRODCOM 8-digit nomenclature). The authors use either a measure of competition at firm level obtained as the weighted average of the degrees of competition observed for each product in the firm's range, or measures at product level. The first measure is compared with a measure of $TFP-Q$ at firm level (overall productive efficiency). The second is compared with a measure of $TFP-Q$ at the level of the firm × product combination (productive efficiency for each product in the range). *Rank2* and *Rank3* are indicative variables showing that the product ranks either second or third in importance in the firm's product range. This analysis only considers the three main products.

Since the degree of competition variable is a percentage, the coefficients shown represent elasticities.

*, ** and *** mean significant at 10, 5 and 1 % respectively.

The index t denotes the quarter.

Some of the latter are trade intermediaries that also give non-importing firms access to these imported inputs. On the basis of the data from the 2012 VAT returns, we can consider that, on average, eight non-importing firms buy from an importer (that figure rises to 22 if firms buying in China are taken into account). Access to imported inputs therefore has potentially significant spillover effects for Belgian firms.

Although imports, when considered as a means of access to a broader product range and better quality or cheaper intermediate inputs, can directly improve the productive efficiency of the importing firms, they also increase the pressure of competition confronting domestic producers of those goods.

In their article, Dhyne *et al.* (2014) analyse the question of the link between competition from imports and productive efficiency (TFP-Q or TFP in quantities) on the basis of various measures of TFP assessed at the level of firms in the manufacturing sector. The authors calculated both the overall productive efficiency of the firms and their productive efficiency per product. More than 50 % of firms active in the various branches of manufacturing industry make more than one type of good. In measuring the productive efficiency per product, the authors can thus determine how a firm responds to imported competition according to its product range.

For that purpose, they base their analysis on extremely detailed data on firms' production, obtained in particular from the survey of industrial output conducted monthly by the NSI on Belgian manufacturing firms, and the international trade data recorded at the NBB. By combining these various sources, the authors construct precise measures of the degree of foreign competition confronting a Belgian producer, taking account of the producer's product range and the fact that Belgium is a port of entry to the Single Market. In practice, not all the imports entering Belgium, e.g. via the port of Antwerp, are necessarily destined for the Belgian market[1].

Dhyne *et al.* (2014) conclude their analysis by showing that firms facing greater foreign competition on the Belgian market tend to step up their productive efficiency. However, that positive effect appears to apply only to each firm's main product, in which firms already have an advantage in terms of TFP[2]. Indeed, the authors demonstrate that if the relative importance of each product in the firm's range is taken into account, when the degree of foreign competition increases for products other than the main one, the effect on productive efficiency associated with those goods tends to be negative.

This therefore suggests that, faced with increased foreign competition, a firm will tend to improve its production system if the increased competition concerns its main

(1) Duprez (2014) assesses the overall level of these re-exports at 30 % of total Belgian exports in 2010.

(2) The results obtained by Dhyne *et al.* (2014) show that, within its product range, a firm is on average more efficient in the production of its main product, and that the more marginal a product in its range, the less efficient the firm is at producing it.

product. Conversely, if it concerns a second – or third – rank product, the firm will tend to stop investing in production of that product and will therefore become less efficient at producing it. According to the authors, this disinvestment in the production of more exposed minor goods may then lead either to increased specialisation in the production of the main product, or to the development of other, less exposed products.

In their study, De Loecker *et al.* (2014) also tackle the question of firms' response to increased pressure of foreign competition. However, their analysis is not confined to identifying only the impact of foreign competition on TFP, but also encompasses a range of variables, such as the level of firms' prices, their marginal cost, their margins and their productive efficiency. In addition, foreign competition comes in two forms.

On the one hand, competition is introduced by the import of products, possibly intermediate inputs, from countries with low production costs. In that connection, their study focuses more particularly on competition from products imported from China, whose share of Belgium's imports grew from 1.2 % in 1995 to 3.8 % in 2013.

The authors also consider the effect of competition from firms based in the three neighbouring countries (France, Germany and the Netherlands). They measure the degree of competition by the labour cost differential between Belgium and those countries.

The results indicate that, in the face of increased imports from China, Belgian firms in manufacturing industry branches have, on average, cut their marginal costs, probably by using imported intermediate products. However, that reduction in marginal costs does not seem to have been fully reflected in lower prices.

Where productive efficiency is concerned, the increased competition from Chinese products does not seem to have had the same influence on all Belgian producers. According to the authors, it is mainly technologically backward firms, i.e. those with a relatively low level of TFP, which have had to respond to the increased competition by becoming more efficient.

As regards competition from neighbouring countries, the findings – though they are still preliminary – suggest that the relative decline in labour costs in France and the Netherlands compared to Belgium has led to a reduction in the margins and productive efficiency of Belgian firms, whereas the relative movement in labour costs in Germany seems to have had no significant effect. However, on the basis of a specific study of the food industry, the authors show that firms based close to the German border, and therefore potentially more exposed to competition from German firms, responded to the relative fall in labour costs in Germany by significantly increasing their productivity and reducing their costs and their prices.

3.2 Market structures and TFP growth

The article by Dobbelaere and Vancauteren (2014) examines the link between the degree of competition on the

TABLE 3 IMPACT OF INCREASED COMPETITION FROM CHINESE IMPORTS ON PRODUCTIVE EFFICIENCY (TFP_Q), MARGINAL COST (CM) AND PRICES (P)

	$log(TFP\_Q_t)$		$log(MC\_Q_t)$		$log(P_t)$	
	(1)	(2)	(3)	(4)	(5)	(6)
Degree of Chinese competition $_t$	–0.166	–	–0.684**	–	–0.722***	–
Degree of Chinese competition × Low_t	–	3.507***	–	–1.042***	–	–4.339***
Degree of Chinese competition × $Medium_t$	–	–0.078	–	–0.730**	–	–0.942**
Degree of Chinese competition × $High_t$	–	–3.158**	–	–0.331	–	2.445**
# observations	48 664	48 664	48 664	48 664	48 664	48 664

Source: De Loecker *et al.* (2014).

Notes: De Loecker et al. (2014) use a sectoral measure of the degree of competition from Chinese imports: the proportion of imports from China in the total of domestic output and Chinese imports, assessed at the CPA 2-digit level, taking account of re-exports. The variables *Low*, *Medium* and *High* are indicative variables showing that the level of TFP_Q in a firm during the first year of observation is respectively in the 1st quartile, between the 1st and 3rd quartile, and in the last quartile of the distribution of TFP_Q for the sector.

Since the variable indicating the degree of competition from Chinese imports is a percentage, the coefficients presented represent elasticities.

*, ** and *** mean significant at 10, 5 and 1 % respectively.

The index t denotes the year.

product market and TFP growth. On the basis of individual data on firms operating in Belgium and the Netherlands, and the methodology developed by Dobbelaere and Mairesse (2013), the authors estimate productive efficiency in conjunction with certain parameters characterising the degree of imperfection observed on the product and labour markets, before analysing the link between TFP growth and imperfections on those markets.

According to their results, the dominant competition model on the product market is the imperfect competition model, which concerns 90 % of branches in the Belgian economy (defined at the NACE Rev. 2 2-digit level) and 89 % of firms[1]. Next, the authors examine the link between the degree of imperfection on the product market (measured by the mark-up) and the parameters of the distribution of the TFP growth rates. In general, they show that, while the degree of competition appears to exhibit a positive correlation with the average TFP growth rate (the mark-up exhibits a negative correlation), that correlation is not significant. Similarly, the other parameters of the distribution of the TFP growth rates (variance, skewness, kurtosis) do not appear to be significantly affected by an increase in competition on the product market.

As stated above, Dobbelaere and Vancauteren (2014) are not only interested in the impact on TFP of the degree of competition on the product market. They also measure the degree of imperfection on the labour market. On

(1) Slightly higher rates are observed in the Netherlands (93 % of branches and 96 % of firms).

TABLE 4 COMPETITION REGIMES ON THE PRODUCT AND LABOUR MARKETS AND CHARACTERISTICS OF THE DISTRIBUTION OF TFP GROWTH RATES IN BELGIUM

			Product market	
			Perfect competition	Monopolistic competition
			% branches: 10.0 % firms: 11.4	% branches: 90.0 % firms: 88.6
Labour market	Perfect competition or right-to-manage	% branches: 13.3 % firms: 27.0	% branches: 3.3 % firms: 8.6 TFP (average): n. TFP (standard deviation): n.	% branches: 10.0 % firms: 18.4 TFP (average): 0.012 TFP (standard deviation):0.754
	Efficient bargaining	% branches: 53.3 % firms: 50.7	% branches: 0.0 % firms: 0.0 TFP (average): n. TFP (standard deviation): n.	% branches: 53.3 % firms: 50.7 TFP (average): 0.011 TFP (standard deviation): 0.161
	Monopsony	% branches: 33.4 % firms: 22.3	% branches: 6.7 % firms: 2.8 TFP (average): n. TFP (standard deviation): n.	% branches: 26.7 % firms: 19.5 TFP (average): 0.014 TFP (standard deviation): 0.170

Source: Dobbelaere and Vancauteren (2014).

the basis of their estimates, they classify the branches of activity (and hence firms) into three different regimes on the labour market: the perfect competition or right-to-manage regime in which wages are equal to the marginal productivity of labour, the efficient bargaining regime in which the level of wages exceeds marginal productivity, and finally the monopsony regime in which wages are lower than marginal productivity. According to their calculations, 53.3 % of branches in the Belgian economy (51 % of firms) come under the efficient bargaining regime, 33.3 % (22 % of firms) come under the monopsony regime, while perfect competition on the labour market, or the right-to-manage regime concerns only the remaining 13.3 % (27 % of firms)[1].

By comparing the degree of imperfection on the labour market with the TFP distribution parameters, the authors show that this factor does affect the distribution of TFP growth rates. In fact, branches operating under perfect competition on the labour market seem, on average, to have higher TFP growth rates than those observed in branches where an efficient bargaining regime prevails. However, that higher average TFP growth seems to be accompanied by greater divergences in corporate performance.

3.3 Industrial policy and TFP growth

A final contribution presented at the conference concerned the effects of state aid on corporate performance, particularly since the crisis. Although industrial policy is not the main way of stimulating TFP growth, it can still play a role in the short run. In their study, Van Cayseele *et al.* (2014) analyse how the various forms of state aid authorised by the European Commission affect the TFP of a sample of European firms during 2003-2011. In principle, state aid is prohibited in the EU, but there are some exceptions enabling Member States to set up government aid on a temporary basis, targeting a particular sector or a limited number of firms. For instance, state aid may be granted if it can help to boost growth and encourage innovation, primarily in cases where the recipient firms are faced with shortcomings in the market, such as financing constraints.

The authors show that Member States made widespread use of this economic policy tool from 2007 onwards, as a short-term response to the funding problems that the recent crisis had caused for businesses. They also show that, over the recent period, the granting of state aid has had a positive effect on the TFP growth of firms suffering from a technology gap, but without hitting firms at the cutting edge of technical efficiency. That positive effect of state aid seems to have been particularly significant for firms experiencing problems in raising finance.

The research by Aghion *et al.* (2012) likewise confirms the positive short-term effects of certain industrial policy measures, so long as they benefit an economic sector as a whole rather than just particular firms. However, these policies must be considered as short-term support policies and cannot on their own constitute the response of European countries to the challenges of secular stagnation and those resulting from the current crisis. In fact, while such measures may make it easier for some firms to finance investment in R&D to make good a technology gap, they may also slow the essential reallocation of resources between sectors and firms.

(1) For the Netherlands, the breakdown of branches by type of imperfection on the labour market is 56.7 % for the efficient bargaining regime, 16.7 % for monopsony and 26.7 % for perfect competition or the right-to-manage regime.

TABLE 5 EFFECTS OF STATE AID ON TFP, ACCORDING TO THE TECHNOLOGY GAP

	2003-2011	2003-2006	2007-2011	2003-2011	2003-2006	2007-2011
	(1)	(2)	(3)	(4)	(5)	(6)
State aid recipient	0.008	–0.002	0.025*	0.007*	0.002	0.018***
Technology gap	–	–	–	0.338***	0.475***	0.214***
Technology gap × State aid recipient	–	–	–	0.105*	0.110	0.161***

Source: Van Cayseele *et al.* (2014).
Notes: The technology gap variable takes a value between 0 and 1. The firm with the biggest technology gap has a value of 1.
*, ** and *** mean significant at 10, 5 and 1 % respectively.

4. Conclusions – How to avoid secular stagnation ?

On the basis of the findings presented above, many speakers at the conference drew attention to the various policies to be conducted in Europe, and more specifically in Belgium, to restore TFP growth and thus avoid what Summers (2014) calls secular stagnation.

It is not only a question of identifying policies that favour TFP growth, but also of striking a balance between various policies, objectives and horizons. On the one hand, the long-term aims are to restore the growth of TFP and potential output in order to ensure sustainable growth. On the other hand, against the backdrop of the consolidation of public finances, it will be necessary to make difficult choices in order to implement economic policies conducive to growth. Moreover, some measures and reforms will only have an effect in the medium or long run, while implying immediate adjustments and costs. Policies supporting these measures and reforms and stimulation in the short term could prove to be a key complement.

The main economic policies to be pursued were the subject of the conference's closing discussion panel, which comprised four international experts : Nick Johnstone, from the OECD, Servaas Deroose, from the European Commission, Henri Bogaert, honorary Plan Commissioner, and Leo Sleuwaegen, from the Vlerick School of Economics, and was chaired by Jan Smets, Director of the NBB. These four experts were able to present the range of actions to be taken at the level of the European Union, Belgium and firms.

The OECD representative, Nick Johnstone, began by stressing the need to improve the ability of the advanced economies to absorb the technological changes brought about by the ICT revolution. That greater adaptability includes reforms aimed at boosting the flexibility of the labour market in order to permit a better reallocation of the available resources from declining or stagnating sectors and firms to expanding sectors and firms.

In that respect, he considers that the European labour markets need structural reforms, but those reforms must be accompanied by new policies on lifelong training, particularly in the context of a longer working life. This increased labour market flexibility must be understood in the broadest sense as an increase in the ability to adapt to change. For example, efficient reallocation of the production factors from one firm or sector to another requires adjustment to a new environment, and may entail supplementary skills or the development of new skills. Moreover, the ability of firms to absorb technological changes also depends on the flexibility of the workers, who have to get used to new tools and new methods of organisation and production. In that context, responsibility for the policies to be pursued does not rest solely with governments. Firms also have a role to play here, by stepping up their investment in training, particularly in Belgium.

In regard to stimulating TFP growth, Nick Johnstone also stressed the importance of measures aimed at facilitating business start-ups, and policies designed to improve entrepreneurship in Europe and reduce the administrative or regulatory barriers to the creation or expansion of businesses. Bart van Ark mentioned in particular the need to create a Single Market for services in Europe.

Turning to the question of the policies to be implemented at European level, Servaas Deroose first pointed out that the European institutions have revised downwards their long-term growth assumptions for the EU's potential output, as their economic forecasts in fact incorporate a permanent slowdown in TFP growth. The European Commission therefore considers it essential to implement structural reforms in order to restore the long-term growth prospects. Those reforms must not be delayed or postponed.

This downward revision of growth potential also concerns Belgium, as stated by Henri Bogaert. He therefore likewise advocated structural reforms, but he also mentioned other routes to TFP growth, stressing that some investments are necessary to maintain or reinforce the growth potential of the Belgian economy. In his presentation, Bart van Ark in fact pinpointed the worrying lack of investment, be it in Belgium or in other European economies such as Germany. This dearth of investment is extremely troubling if it takes the form of low investment in R&D or in information and communication technologies, as research has demonstrated the long-term multiplier effects of such investment on TFP growth. The restoration of business confidence is one of the factors involved in revitalising investment in Europe.

Henri Bogaert emphasised the need for public investment in transport infrastructure, to alleviate the congestion problems around large cities, investment in the network industries, particularly the energy sector, and finally, investment in R&D.

On the effects of investment in R&D, he mentioned that the repercussions of R&D are not confined to the firms funding the research, but that this type of investment generates very significant spillover effects for the whole economy. In that context, it is also said to favour measures

that preserve or enhance the attractiveness of the Belgian economy for foreign investors, the latter being a powerful vehicle for the spread of technical or organisational innovations. In particular, he advocated improvements in the efficiency of administrative structures in Belgium and drew attention to the importance of the predictability of the institutional framework in which private operators have to function, notably in regard to investment in the energy sector.

Last, Leo Sleuwaegen highlighted the problems of production factor reallocation as one of the main weaknesses of the Belgian economy, and called on the government to reduce the burden of regulation in order to foster that reallocation. In addition to the points made by the other three speakers, he commented that, in his opinion, our firms need creative workers and they must therefore adapt in order to encourage the creativity of their staff. This change in firms' methods of organisation and production also entails a transformation of the education system in order to enhance the development of individual creativity. More creative workers should also increase the momentum of business start-ups.

Jan Smets closed the conference and summed up its main lessons by observing that, in order to avoid the spectre of secular stagnation in Europe, and particularly in Belgium, we need a whole range of policies, measures and reforms. We need to promote a stable economic environment favourable to investment, both corporate investment, particularly in innovation, and public investment programmes. We also need to introduce structural reforms that favour both the development of new technologies and the ability to absorb innovations, and encourage the creation (and financing) of businesses or the efficient reallocation of the production factors. Finally, we need to conduct support policies aimed at facilitating the transition of our economy and the process of reallocating resources from the least productive to the most productive firms.

These policies, whether or not they target certain sectors, require the involvement of all players at all levels of power – European, federal and regional. Finally, firms also have a role to play, both in investing in new sources of TFP growth and in working with the social partners to develop the means to boost workers' productivity and employability.

Bibliography

Aghion Ph., M. Dewatripont, L. Du, A. Harrison and P. Legros (2012), *Industrial Policy and Competition*.

Aghion Ph. and P. Howit (1996), *Endogeneous Growth Theory*. Cambridge, MA : MIT Press.

Ariu A. and V. Vandenberghe (2014), *Assessing the Role of Ageing, Feminising and Better-Educated Workforces on TFP Growth*, NBB Working Paper, 265-32.

Bloom N., R. Sadun and J. Van Reenen (2012), "Americans Do It Better : US Multinationals and the Productivity Miracle", *The American Economic Review*, 102(1), 167-201.

Braguinsky S., A. Ohyama, T. Okazaki and C. Syverson (2014), *Acquisitions, Productivity, and Profitability : Evidence from the Japanese Cotton-Spinning Industry*, NBB Working Paper, 270-72.

Corrado C., J. Haskel, C. Jona-Lasinio and M. Iommi (2013), "Innovation and Intangible Investment in Europe, Japan, and the United States", Oxford Review of Economic Policy, 29(2), 261-86.

De Loecker J., C. Fuss and J. Van Biesebroek (2014), *International Competition and Firm Performance : Evidence from Belgium*, NBB Working Paper, 269-45.

Dhyne E., V. Smeets, A. Petrin and F. Warzynski (2014), *Import Competition, Productivity and Multi-Product Firms*, NBB Working Paper, 268-34.

Dobbelaere S. and J. Mairesse (2013), "Panel Data Estimates of the Production Function and Product and Labor Market Imperfections", *Journal of Applied Econometrics*, 28(1), 1-46.

Dobbelaere S. and M. Vancauteren (2014), *Market Imperfections, Skills and Total Factor Productivity : Firm-Level Evidence on Belgium and the Netherlands*, NBB Working Paper, 267-78.

Duprez C. (2014), "Value creation in exports – A diagnosis for Belgium", NBB, *Economic Review*, September, 27-42.

Hall B. H. (2011), "Innovation and Productivity", *Nordic Economic Policy Review*, 2, 167-203.

Holmes Th. J. and J. A. Schmitz (2010), "Competition and Productivity : A Review of Evidence", Annual Review of Economics, 2(1), 619-42.

Summers L. H. (2014), "U.S. Economic Prospects : Secular Stagnation, Hysteresis, and the Zero Lower Bound", *Business Economics*, 49(2), 65-73.

van Ark B. (2014), *Total Factor Productivity : Lessons from the Past and Directions for the Future*, NBB Working Paper, 271-26.

Van Cayseele P., J. Konings and I. Sergant (2014), *The Effects of State Aid on Total Factor Productivity Growth*, NBB Working Paper, 264-32.

Verschelde M., M. Dumont, B. Merlevede and G. Rayp (2014), *A Constrained Nonparametric Regression Analysis of Factor-Biased Technical Change and TFP Growth at the Firm Level*, NBB Working Paper, 266-46.

National Bank of Belgium
Limited liability company
RLP Brussels – Company number: 0203.201.340
Registered office: boulevard de Berlaimont 14 – BE-1000 Brussels
www.nbb.be

Publisher

Jan Smets
Director

National Bank of Belgium
Boulevard de Berlaimont 14 – BE-1000 Brussels

Contact for the Review

Luc Dufresne
Secretary-General

Tel. +32 2 221 24 96 – Fax +32 2 221 30 91
luc.dufresne@nbb.be

Cover and layout: NBB AG – Prepress & Image

Published in January 2015