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IS MIDDLE-INCOME TRAP IN POLAND INEVITABLE?

bakalářská práce

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Prohlašuji na svou čest, že jsem diplomovou práci vypracovala samostatně a s použitím uvedené literatury.

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Abstract

The term middle-income trap refers to the phenomenon when country get stuck at certain level of income per capita, and surpassing to higher level seems difficult or is even impossible. Economy does not have advantage of poor economies - lower wages, neither the advantages of rich economies – best technologies. The theme of the middle-income trap attracted lot of attention in recent years, especially after publishing the paper of Eichengreen, Shin, and Park When Fast Growing Economies Slow Down (2011). Eichengreen et al. conclude that there is more than only depletion of total factor productivity behind the middle-income trap. Human capital, production of high-technology intensive goods and share of Hi-Tech goods in the export play its role. This thesis, using regression model and data analysis, discuss the case of Poland and concludes that Poland is still an efficiency-driven economy and therefore the danger of falling into middle-income trap is still present. Main weakness of the economy is lack of human capital and innovation.

Termín "middle-income trap" (případně uvíznutí ve středním příjmu) se vztahuje k situaci kdy se země zasekne na určité výši HDP na obyvatele a nedaří se jí najít z této situace východisko. Ekonomika nemá ani výhody nízko-příjmových zemí (nízké mzdy), ani výhody zemí bohatých (technologie). Téma "middle-income trap" přilákala hodně pozornosti v posledních letech, zejména po publikování práce Eichengreena, Parka a Shina v roce 2011. Eichengreen a spol. dochází k závěru, že za sníženou úrovní růstu HDP je nejen vyčerpání produktivity výrobních faktorů, ale roli hraje i lidský kapitál, výroba technologicky náročných produktů a jejich podíl v exportu. Práce analyzuje současnou situaci Polska, a pomocí regresního modelu a analýzy dat dochází k závěru, že Polská ekonomika stále nedospěla do stadia, kdy jsou její hlavní konkurenční výhodou a zdrojem růstu inovace - a tím pádem je hrozba zaseknutí se v "middle-income trap" stále přítomna. Hlavním nedostatkem ekonomiky je absence lidského kapitálu a inovací.

JEL classification: E01, E02, E19, F63

Key words: middle-income trap, human capital, innovation, product specialization

Contents

1. Introduction

In recent years, the problem of "middle income trap" has attached lot of attention especially after publishing the paper of Eichengreen, Shin, and Park *When Fast Growing Economies Slow Down* in 2011. However, the precise definition of the term itself is missing in the incipient literature. In general, the term "middle-income trap" refers to the phenomenon where country has reached certain level of income per capita, and its growth slows down or even ceases. Surpassing to higher level seems difficult, since the economy does not have access to the best technologies (unlike rich economies), and it doesn´t have the advantage of lower wages either (reserved to poor economies).

To identify a growth slowdown, Eichengreen et al. require the rate of GDP to meet three conditions: the seven-year average growth rate is at least 3.5 percent prior to the slowdown; at least 2 percentage points decline in the seven-year average growth rate; and for country to be involved its GDP per capita must be greater than $10,000 in 2005 constant prices. First condition serve to identify earlier fast growth, whilst the second one is assure that the slowdown was not negligible. Third condition rules out "growth crises in not yet successfully developed economies" – and because of this condition that most of middle European countries weren´t taken into account (Poland as well as Argentina, Brazil, and Malaysia, which are normally considered paradigmatic examples of the middle-income trap). Eichengreen et al. come to conclusion that middle-income trap has more causes than only depletion of the advantages of catching-up process. Human capital, production of high-technology intensive goods and share of Hi-Tech goods in the export play role as well.

In this thesis we use regression model to analyze impact of factors found important by Eichengreen et al. on high-income economies (as defined by World Bank). Focus is put on Poland, one of the largest economies of Central and Eastern Europe (CEE). Since 1992, Poland´s economy is growing continuously. In 2013 Poland has achieved "levels of income, quality of life, and well-being never experienced before" and "quality of life enjoyed by an average Pole is even higher than what the level of GDP per capita alone would suggest" (Piatkowski, 2013). If we look at average GDP per capita growth, Poland´s economy has grown faster than all large countries at similar level of development, and the growth continued despite global financial crisis in 2008-09 –

Poland was the only EU country that did not sag into a recession. Piatkowski describes the last 20 years economic development as “the best 20 years in more than one thousand years of its history”.

Using the regression analysis we examine the factors found important in previous research, and identify those that are important in order to maintain long-term economic growth. We run the regression for all the high-income economies, and neglect the condition of GDP per capita greater than $10,000 in 2005 constant prices. Actual World Bank data are used to analyze the current state Poland, and to decide whether Poland in the danger of falling into middle-income trap.

The paper is organized as follows: (i) first part presents the main concept of the middle-income trap, work of Eichengreen, Park, and Shin, and the (ii) factors that play role in avoiding the middle-income trap. Second part (iii) proposes an analysis of actual Poland´s data. Third section (iv) describes the regression model and (v) fourth part concludes.

2. Middle-income Trap in General

2.1. Definition of middle-income trap

The principle of economic convergence is based on the presumption that less developed countries tend to grow faster, because they can follow the path that their forerunners broke before them. Countries import the know-how from abroad, allowing the latecomers to skip some steps and narrow the gap with the rich ones.

In reality this principle of narrowing the gap does not always reign. In general two situations may occur: a poor country fails to get going, or, it makes a quick progress and then lose its way. The first situation describes a victim of a "poverty trap", while the second refers to "middle income trap" (Gill and Kharas, 2007). The economy faces different challenges when passing from low- to middle-income and from middle- to high-income economy. In the first case the growth is driven by low-skilled labor, a shift of workers from low-productivity sector (agriculture) to higher-productivity sector (manufacturing), whilst foreign technology is imitated. In case of transition to high-income economy more investment into infrastructure and innovation is needed. The imitation and use of foreign technologies is not sufficient anymore. Kharas and Kohli (2011) conclude that the major difference between the growth strategies of low- and middle-income countries is that the latter focus more on demand. More factors that could be decisive for economic growth of middle-income country are going to be discussed later.

2.2. Economic Development and Main Cause of the Middle-Income Trap

Economic development can be referred as transition from factor-driven to efficiency-driven and further innovation-driven economy. Factor-driven economy is defined by low-skilled labor and unprocessed natural resources, which is the main competitive advantage (Chen and Tian, 2014). This advantage does not last forever. Eichengreen, Park, and Shin (2011) argue that the growth deceleration is mainly the result of the slowdown of productivity growth. Low income countries are competitive in international markets because they are able to produce low-cost, labor-intensive goods, using imported technologies. Reallocation of labor force from low-productivity to high-

productivity sectors occurs in order to maximize the gain. At some point, it is no longer possible to shift workers from agriculture to industry and thus boost productivity. Pool of underemployed rural workers drains out and wages begin to rise. Gains from imported knowhow and foreign technology diminish and TFP growth falls to zero (Eichengreen et al., 2011 and Agénor et al., 2012). The economy loses its competitiveness – it has no longer the lowest wages, neither best technologies and must struggle "to compete with countries above and below" it. It is at this point when the danger of middle-income trap occurs (for the first time) (Gill and Kharas, 2007).

In efficiency-driven economy the growth is based on efficient production process and improved product quality. To stay competitive, more factors are important - higher education and training, efficient goods markets, well-functioning labor markets, developed financial markets, the ability to harness the benefits of existing technologies, and a large domestic or foreign market.

Third, most developed stage, is innovation-driven economy. The economy is characterized by high share of services, and ability to produce innovative products, which is the main source of competitive advantage (The World Economic Forum, 2012).

Another point of view on the economic development is offered by Kharas and Kohli (2011). They distinguish three critical transitions: first from diversification to specialization in production, second from physical accumulation of factors to productivity-led growth, and third from centralized to decentralized economic management.

The country is considered to be in middle-income trap when it gets stuck at some level of income and it seems difficult to surpass this stage of development. For a successful transmission from middle-income to high income economy it is necessary to explore the nature of the middle income trap. It is formed by a combination of factors, that are somehow correlated and we need to understand their inherent logic in order to be able to identify whether the economy is in danger of the middle-income trap or not. Through this big picture the nature of the middle-income trap can be explored, understood and the trap can be eventually avoided.

According to Eichengreen´s, Park´s and Shin´s (2013) findings the slowdown occurs in neighborhood of $10,000 - $11,000 and $15,000 - $16,000 in 2005 constant U.S. dollars in purchasing parity. The slowdown does not occur at a single point of time, but rather in steps. This implies that the slowdown might start even before reaching the level of income mentioned above.

Aéngor and Canuto offer a different theory of falling into middle-income trap. In their paper *Middle-Income Growth Traps* address to United States of America as a reference group and come to conclusion that countries that got stuck at middle-income trap had income per capita between 5% and 45% of the USA between 1960 and 2009. Typical for those middle-income countries was low level of human capital, low level of infrastructure development and their institutions, which were not well adequately designed nor were they based on good governance practices (Agénor and Canuto, 2012 and Pruchnik and Toborowicz, 2014).

Eichengreen, Park, and Shin conclude that several factors have to do with the occurrence of slowdown. First, probability of slowdown is greater the higher pre-slowdown growth. Second, human capital matters: countries with higher the share of population with at least secondary education, are less likely to experience the slowdown. This factor is especially important for middle-income countries that are trying to move up at production of more technologically sophisticated goods and thus stay competitive. Larger the share of high-tech products in the export, lower the probability of slowdown. Third, slowdowns are more likely in economies with high old age dependency ratios. Financial crisis and "positive" regime changes (for example from autocracy to democracy) raise the likelihood of slowdown (more precisely "political change overall (both positive and negative) has no significant association with the probability of a slowdown. But when we distinguish positive and negative changes, positive changes significantly increase the likelihood of a slowdown in one of our two specifications," (Eichengreen et al., 2013)). Factors found important by Eichengreen et al. (2013) are going to be discussed more precisely in the next part.

2.3. Other Causes

2.3.1. Institutional transition dilemma

As said above, country is considered to be in the middle-income trap when it encounters the bottleneck, and transition from factor-driven to efficiency-driven is difficult. Hand in hand with economic development goes a change of role of government and institutions. In the former stage many institutional arrangements could have efficiently address and handle the challenges at the time, but they are inefficient when moving from factor-driven to efficiency-driven and further innovation-driven economy. Transformation from extractive institutions to inclusive institutions is necessary. Extractive and ineffective institutions are not able to effectively promote the transition of economic development and economic structure" (Chen and Tian, 2014)[1]. According to Kunzets (1971) economic development is a complex process that involves transfer of labor and capital from activities of low productivity to higher-productive activities, as well as changes in social institutions and beliefs.

Developed economies appear to follow a similar path of structural change - falling production and employment shares of the agricultural sector, initially rising but eventually falling shares of the industry sector, and rising shares of the service sector. Innovation can be a drive of economic growth whether it is in middle-income or high-income economy. However, structural change plays even greater role in case of middle-income economy (Yiping, Qin, and Xun, 2013).

Institutional transition dilemma consists in the government handling badly its role in governance. It fails to provide necessary and sufficient public goods and services (needed when the economy and the society develop into a new stage) and therefore under-plays its part or the opposite – it excessively participates and/or interferes in economic activities. If the government overplays its role it will lead to low efficiency or even to inefficiency and failure of resource allocation because of information and incentive problems. The government is a "devisable and controllable variable with strong positive and negative externalities that plays a vital role", that can "become the impetus for economic development, […] and achieve balanced and sustainable economic growth" (Chen and Tian, 2014).

[1] If economic development comes to an impasse, the core of development mode is reduced to economic structural transformation and upgrade (Chen and Tian, 2014).

Indeed, government plays important role in country´s economy and its decisions could be decisive for economic growth. Because of its mandatory role, there should be a clear definition of boundary between government and market as well as between government and society. Being a player and the referee in the same time, clear procedures and regulations on government are fundamental. However, this boundary is impossible to define clearly and in one step. Basic functions and role of government should be generalized as "maintenance" and "service", which will ensure social order and stability, providing public goods and services. When evaluating the performance of government, it is not sufficient to rely only on GDP indicator, but also pay attention to the wealth flow to the people to maximize social welfare (Chen and Tian are referring to this as shift from "competition for economic growth" to "competition for services of public interest").

Then, laws of market economy should be respected in order to establish an endogenous mechanism which would drive the economy from efficiency- to innovation-driven. Yiping, Qin, and Xun (2013) found that democracy, law and order contribute positively to economic growth. Market competition is the most effective mechanism through which, it is possible to achieve efficient resource allocation. It is the result of the transition from centralized to dispersed economic management – which is one of the critic transition according to Karas and Kohli (2011).

> "Centralization of economic policy making militates against required speedy decision making. Decentralization enables policy makers to acquire and absorb large amounts of information and to react timeously to issues of opportunity and distribution" (Roux, 2013, p. 2).

In the market competition monopoly profits are a strong motivation to ameliorate and invent new products, and thus it encourages innovation. Strong motivation of private sector to gain those profits will have for consequence more innovation, which has become main drive for economic development in major developed market economies today.

Social forces play an important role in transition and development. With transition also come the differentiation of social structure and the reorganization of interest groups, and in the open environment a social anomie may occur.

> "…traditional informal institutional system of a society, including value and belief, customs, cultural traditions, ideology, morality and ethics, tend to weaken or fade away under strong external shocks. …the uncertainties in institutional environment and the transaction costs of socio-economic activities will increase while the efficiency and benefits of socio-economic development thus decrease" (Chen and Tian, 2014, p.7).

An important factor to achieve social stability is the middle-income group, which usually owns certain properties and demands protection of private property rights. Thus it forms the base for construction of a democratic, law-governed society.

2.3.1.1. Labor market rigidities

When considering government intervention into the market, the labor market rigidities should be mentioned. Some labor marked restrictions, such as firing costs, they may discourage hiring. This might be a problem especially in innovation and design activities, where it is difficult to observe the productivity of worker ex ante. If a college degree does not serve as sufficient prove of ability to perform well, it might lead to insufficient motivation to achieve higher education and therefore lack of innovation in the economy (Agénor and Canuto, 2014).

Also Eichengreen´s et al.´s conclusion that "positive" political change may be at the origin of slowdown has to do with labor market. In case of this "positive" shift to democracy "successful efforts by authoritarian governments to suppress labor demands come to an end," and "movements in the direction of democracy are [therefore associated with] increases in labor action and production costs", which might increase the likelihood for middle-income trap (Eichengreen et al., 2013).

2.3.2. Education and Human Capital

One of the driving forces for economic development is accumulation of physical and human capital. When passing from middle-income to high-income economy, especially the later is important. Human capital is the essence for innovation and research and development activities, and crucial for long-run sustained growth. Therefore it is also a

key factor for surpassing to higher economic level (this will be explained more precisely in later). Transiting countries often face the prelevance of human capital demand, which slows down advanced sectors and thus the economic growth (Saner et al., 2014).

In less developed economy the key contribution of education is facilitation and diffusion of technology, which will have for consequence a catch up with the developed ones. Education helps to increase the capacity of workers to learn new ideas and adapt more quickly to new technologies and therefore increase the flexibility of the labor force (Nelson and Phelps, 1966). Also, education is the basic assumption for forming of a group of workers dedicated to research and development and other innovation activities. "…an important role of education is to increase an individual´s capacity, first, to innovate (i.e. to create new products and new technologies) and, second, to adapt to new technologies, thereby accelerating technological diffusion in the economy" (Koh et al., 2003).

Nelson and Phelps argue that even if the technology is stationary, the marginal productivity of education can remain positive forever. Moreover, "the rate of return to education is greater the more technologically progressive is the economy" (1966). Koh (2003) refers to this argument as a virtuous circle, where "the higher the overall level of educational investment and attainment, the higher the level of technology that could potentially be achieved, thus reinforcing the benefits to education". In reality it is not possible to accumulate the human capital forever. Specialized skills can be acquired by devoting a certain amount of time to education in early adulthood (Agénor and Cantuo, 2012), and it is thus considered as an investment. Since education is needed in order to become a skilled-worker that is capable to work in innovation sector, the individual takes into account the wage in this sector when deciding whether to invest into education. If the productivity in innovation sector is high, wages in this sector will be high as well, and enough high-ability individuals will invest in education. The pool of knowledge in the society will get bigger.

However, as Saner et al. (2014) argue in their paper, emerging economies that have achieved rapid improvement in overall education attainment might lack specific kinds of skilled workers. If the lack of investment persists, and training of skilled labour is missing, the gaps between supply and demand of human capital will not disappear.

Support of the government is often needed to promote human capital accumulation and thus improve national competitiveness and develop a more advanced economy.

2.3.3. Lack of Innovation

As explained in the beginning, in early stages of development the country copies and adapts available technologies, which allows it to catch up with already developed countries. Source of growth are relatively low-skill workers, specialized in basic technical skills. At higher economy level, the firms will stop using labor-intensive technologies and encounter more capital-intensive, technologically sophisticated sectors. Those have stronger learning effect which might have for consequence spillovers to the rest of the economy and strengthen it to grow further. For some period of time knowledge may grow because of imitation of foreign product, but it will have decreasing returns. If there is lack of highly educated workers (e.g. lack of human capital), the externalities associated with knowledge network might be exploited. The economy finds itself in the "imitation trap", where productivity and wages in the design sector are low and because of low wages this sector will not attire educated, high-ability individuals. Thus, there is a two-way causality between education and innovation (Agénor and Canuto, 2012).

2.3.4. Insufficient Investment in Public infrastructure

Middle-income trap can be defined as a stable, low-growth equilibrium that is associated with talent misallocation and innovation stagnation (Agénor and Cantuo, 2012). Public policies can be decisive for avoidance this *equilibrium*. Productivity growth is affected by three determinants: individual decisions to acquire skills, access to different types of public infrastructure, and *knowledge network externalities* (which refers to the possibility that higher share of workers with advanced skills has a positive impact on others performance). Agénor and Canuto distinguish two types of labor – basic and advanced. Regardless the skills of individuals, both types of workers can work in the production of final goods, while only advanced workers (e.g. workers with acquired skills, can be also referred as human capital) can work in the innovation sector (design activities). Therefore advanced workers are perfect substitute for workers in

basic group. Since labor is more productive in innovation (design) sector, more skills-acquired workers in design sector will enhance the growth of the economy. As mentioned above, the individual must invest in order to get advanced skills, and this will only happen if wages in design sector are high enough, compared to manufacturing. If there are enough of individuals in the design sector, the economy is able to benefit from existing ideas and innovations.

Another important factor is infrastructure. Similarly to two types of labor, Agénor and Canuto (2012) differentiate two types of infrastructure – basic and advanced. Basic infrastructure is necessary to promote final products, and include road, electricity and basic telecommunication. Advanced infrastructure inhere advanced information and communication technologies (ICTs) in general, and high speed communications network in particular. It is fundamental when promoting design.

Productivity in design sector will be low if the access to advanced infrastructure is limited. Because of low productivity the wages will be low, and therefore only few high-ability individuals will choose to invest (in education) and work in design sector. Thus, the middle-income trap can be also characterized by a misallocation of talent. On the opposite site, good access to advanced infrastructure boosts productivity and wages in the design sector, attracts high-ability individuals, and therefore helps to benefit from existing ideas. To extent this argument, easy access to information (for example high-speed internet) may reduce total amount of time needed to complete higher education, which will induce even more high-ability individuals to invest in education. Put briefly, with sufficient investment in advanced infrastructure it is possible to avoid the middle-income trap (or the lower-growth equilibrium, as Agénor and Canuto refer to this phenomenon).

2.3.5. Enforcement of Property rights

Innovation and design activities require often a costly investment (capital and/or time) at the beginning where the gain is uncertain. Once the product or information is introduced to the market it is very easy to copy the idea or, in case of information, to spread it at low cost (whilst the acquirement might have been costly). This would reduce the motivation to innovate; therefore a functioning system to administrate

patents and protect property rights is needed. Inefficiencies in protection of property rights imply that the innovation (design) producers receive only a fraction of the *real* price of product (e.g. only a part of the cost invested in the product), which would lead to lower wages in the design sector and lower the motivation to invest into education. On the opposite side, efficient protection of property rights will lead to higher wages and thus attract more high-ability workers (Agénor and Canuto, 2012).

Based on this theoretical framework we can conclude that beside the economic cause we can find other factors that might be at the origin of the middle-income trap. Institutions and public infrastructure form a framework that may support (or be in the way of) acquirement of human capital. Human capital is indispensable in innovation, which is the main factor that drives long-term economic growth. One of the crucial factors is education – only through sacrifice certain amount of time it is possible to acquire the knowledge that can be applied in innovation. Inefficient protection of property rights might lead to lack of innovation effort. In next part case of Poland is going to be discussed. The accent will be put on factors discussed above.

3. Case of Poland

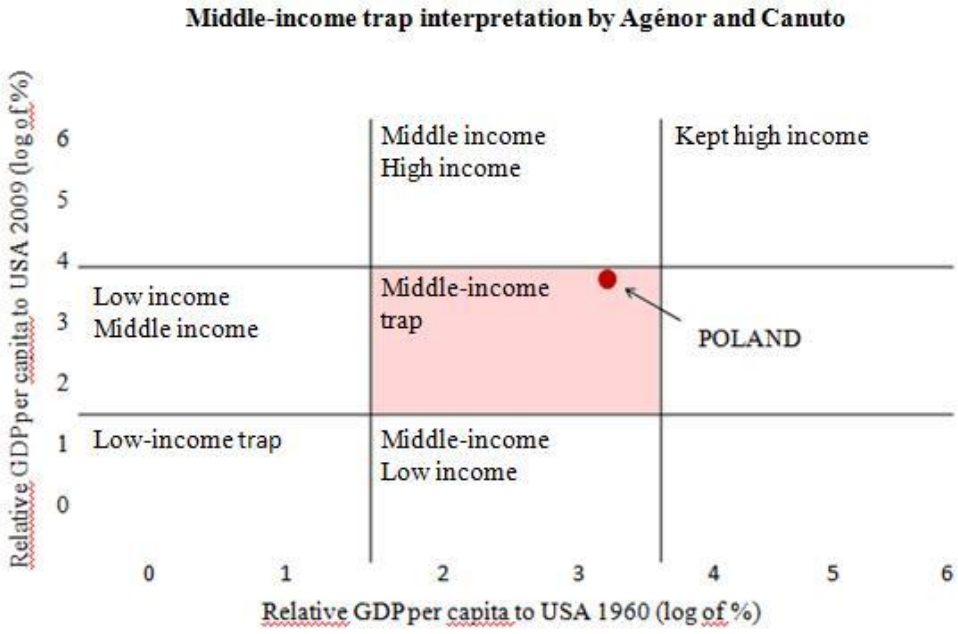
Over the past two decades Poland´s economy has grown quickly, outpacing the most dynamic countries in Europe. Its GDP per capita more than doubled and it is now "well integrated upper income country and increasingly strong member in the EU and the global stage" (Radwan, 2014). With Gross National Income per capita $13,080 (Data Bank 2013, Atlas method[2]) and population of about 38.2 million it is the largest economy in central Europe.

Marcin Piatkowski, a senior economist in the World Bank office is talking about Poland´s New Golden Age (Piatkowski, 2013). According to him Poland just had probably best 20 years in its economic history, and the convergence with Western Europe will continue for at least next 15 years, reaching around 80 percent of westerner´s level of income. What is behind this "economic miracle"? According to Piatkowski it is a combination of factors: Poland has adopted Western institution, rules and social norms (e.g. the rule of law, independent monetary policy, robust competition, free press, and democracy), good quality of education as well as its quantity, and ability to benefit from funds of European Union, which helped to connect Poland with Western Europe by highways.

The World Bank defines middle income countries as those with a GNI per capita of more than $1,045 but less than $12,746 in 2013 prices. Lower-middle-income and upper-middle-income economies are separated at a GNI per capita of $4,125. By the World Bank's definition of middle income country Poland does no longer belong into this group, and with GNI $13,240 is classified as high income economy (Data Bank, 2013, Atlas method). "Poland seems to have already avoided the "middle income trap" [and is] considered a "high-income" country by the OECD and the World Bank", Piatkowski argues (2014, p.27). Indeed, Poland is considered as high income country and it has already passed the income level $16,000 (2005 PPP dollars), where the probability of slowdown peaks (Eichengreen et al. 2011). But does this fact mean that Poland has already escaped the trap and will grow continuously, narrow the gap

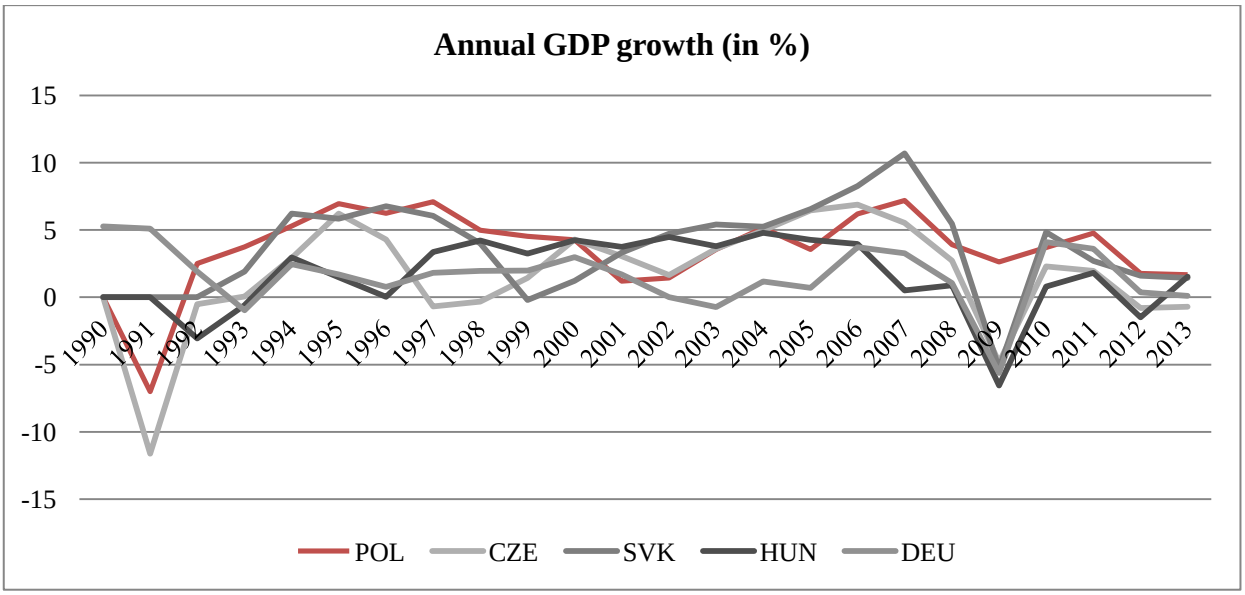
[2] In calculating gross national income in U.S. dollars for certain operational and analytical purposes, the World Bank uses the Atlas conversion factor instead of simple exchange rates. The purpose of the Atlas conversion factor is to reduce the impact of exchange rate fluctuations in the cross-country comparison of national incomes. The Atlas conversion factor for any year is the average of a country's exchange rate for that year and its exchange rates for the two preceding years, adjusted for the difference between the rate of inflation in the country and international inflation; the objective of the adjustment is to reduce any changes to the exchange rate caused by inflation. For precise method see https://datahelpdesk.worldbank.org/knowledgebase/articles/378832-what-is-the-world-bank-atlas-method.

between “rich westerners” and developing countries? Considering the concept of middle-income trap from point of view of Agénor´s and Canuto´s work (2012), Poland is still facing the challenge of transition from middle-income to high-income economy.



Graph 1: Middle-income trap as defined by Agénor and Canuto (2014). Source: Pruchnik and Toborowicz, 2014

Since the transition recession in 1990 and 1991, Poland´s economy continues to grow. Even during the global crisis in 2008, Poland was the only economy in the European Union to register positive growth (Karasinka-Fender, 2010). According to Poland´s Ministry of Treasury will reach the highest average growth rate among all big EU economies until 2050, and its average annual growth will likely reach at least 2.7%. This decrease in annual growth (current growth rate is 3.3%) rate results from the fact that Poland is catching-up with advanced economies and maintaining the same growth rate will be a bigger challenge (Ministry of Treasury, 2015).



Graph 2: Poland´s economic growth in % (Author´s own calculations. Data source: The World Bank, 2015)

Projections of Poland´s economic growth are positive in the short-term period. However, in the long run the growth Poland may lose the path. Country Report Poland published by European Commission (2015) forecast "robust GDP growth" in next term, but large share of employment in labour-intensive sector limits productivity growth which will restrain the growth in the long term. In the following part of the work the factors important for the long run economic growth are going to be discussed.

3.1. Factors important in long run economic growth

In the past 25 years Poland has been benefiting from the catching-up process (European Commission, 2015). With economic development efficiency gains become more and more difficult to achieve and if the country exploits growth reserves based on cost efficiency gains and fails to promote factors that support Total Factor Productivity growth in the long run, it will find itself stuck at achieved income level (Bogumil and Wieladek, 2014). Based on the previous research we can conclude that the most important factors are quality of human capital, the amount of intensity of innovation, and research and development and elements that facilitate factor mobility (Eichengreen et al., 2013 and Bogumil and Wieladek, 2014). In the following part mentioned factors will be analyzed using actual data for Poland.

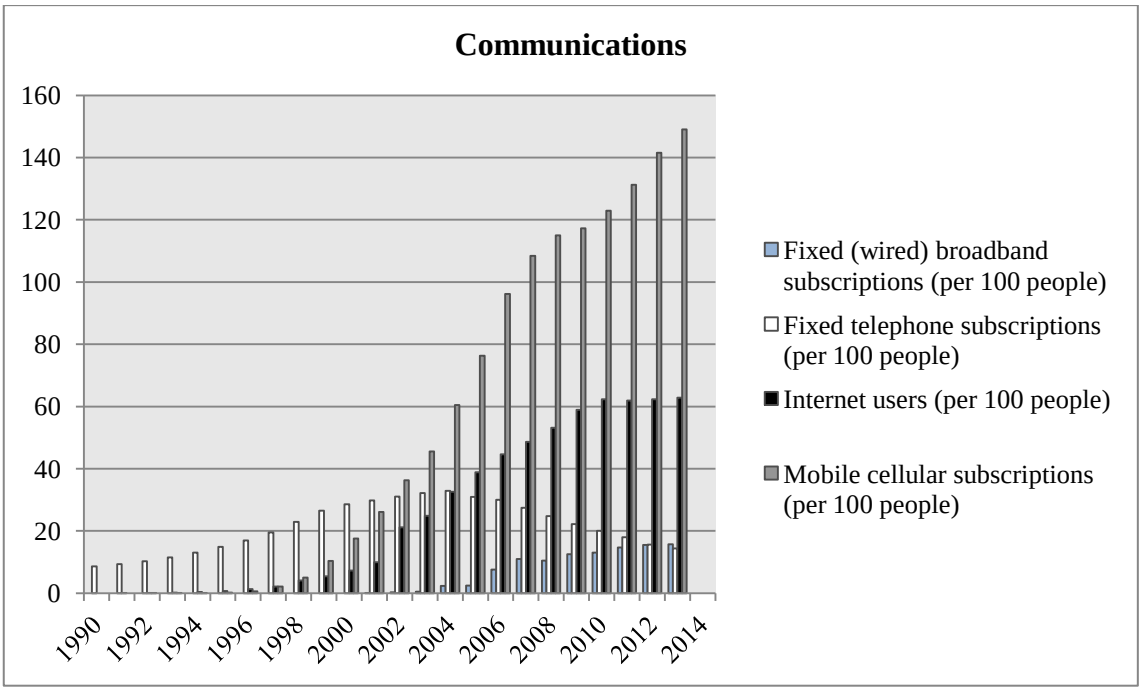
3.1.1. Infrastructure and Communication

Poland serves as a major route between western and eastern European countries, because of its location. Especially in recent years, a significant number of tracks that have become major carriers of goods, cross the country, carrying goods from France, Netherlands, Germany and other EU members, through Poland to Belarus, Lithuania, and Ukraine. Between 2007 and 2012, Poland was one of the European Union leaders in terms of the number of road investment projects - investment into infrastructure was over $9.33 billion US dollars in 2011 and, with a help of EU funds, the expenses on transport infrastructure has been steadily growing (since 2006 had more than quadrupled). Poland spent over $3 billion US dollars on infrastructure maintenance, which is the highest amount in Europe (apart Italy and United Kingdom) (OECD data, 2015). According to PwC[3] research (2014) the motorway network density ratio per 100 km2 of land increased by over 106% and highway density by 230% between 2007 and 2012. Despite the increased in number of kilometers of motorways built, Poland is still far away from the average figure of European Union – density of 2,73km per km^2, while in Poland the number is only 0,44km per km^2 (estimates based on Eurostat data).

What concerns telecommunications, Poland is on the same level as western high-income economies. Since 2000 the number of fixed telephone subscriptions (per 100 people) has been falling, however the number of mobile cellular subscriptions is over four times higher. Number of internet users has been constantly growing, from 17 per hundred people in 1990, to over 149 per hundred in 2013. In 2014 Poland had more than 16,000 secure internet servers, which is twice as much as in 2010[4].

Share of locations beyond the range of any networks has decreased, and even though "totally white spots" still exist - they make approximately 8% of locations, mainly those below 100 habitants. However, with cooperation of European Commission´s Digital Agenda for Europe (DAE) Poland's national broadband plan foresees that "100 % of households and companies should have access to internet connectivity of at least 30 Mbps until 2020 and 50 % of households and companies have access to internet connectivity of 100 Mbps until 2020" (European Commission, 2015).

[3] PricewaterhouseCoopers (trading as PwC) is a multinational professional services network. Together with Deloitte, EY and KPMG forms the Big Four auditors.
[4] To compare with Germany, which has over 114,000 secured internet servers, or Czech Republic with 7,269 servers in 2014 (The World Bank Data, 2015)



Graph 3: Communications in poland (per 100 people). (Author´s own calculations. Data source: World Bank Data 2015)

Numbers show that Poland is on the right path to acquire high quality transport infrastructure, but there is still an effort needed. Quality, as well as number of kilometers of road and reliability of connections must be further improved. As for quality of telecommunications, Poland has been catching up very quickly and it is comparable with western high-income economies.

3.1.2. Education

3.1.2.1. Quality of education

As for quality of education, according to OECD Poland has made a big progress in the quality of its secondary education. In early 1990 Poland had one of the lowest participation rates in full secondary education and in higher education. But since then Poland has have produced a large overall improvement in educational performance. Its ongoing educational reforms started in 1999, and its main goal is to improve the overall level of education in society, increase educational opportunities for citizens, and improve quality and equity of the education system. Measured by results on the OECD

Program for International Student Assessment (PISA) test, Poland ranked among the top 15 OECD countries in 2009[5] (OECD, 2011).

The pupil-teacher ratio is used to compare the quality of schooling across countries. It is the number of pupils enrolled in school (primary or secondary) divided by the number of school teachers. Even though it is often weakly related to student learning and quality of education, it is used quite often because of the presumption that the student will receive more attention from the teacher with lower number of students in class and thus better quality education. In Poland the ratio in secondary schools is decreasing since 2000 – from 13.2 to 8.7 in 2007. In primary school the ratio balance around 10 - this is lower than ratio in Germany, France, United Kingdom, Belgium, Czech Republic, or Slovakia. Fall of this number from 13.5 in 2000 is due to the reform mentioned above, which contained a change of the basic education system from two-pronged (primary – eight years and secondary – three, four, or five years, according the choice of the student) to three-pronged system: a comprehensive primary school cycle of 6 years, a comprehensive lower secondary school cycle of 3 years, and a two-track upper secondary school cycle that could last either 3 or 4 years, depending on the choice of stream. Another consequence of this reform was decline of the number of primary education teachers (and thus growing pupil-teacher ratio in primary education) and a slight growth of number of secondary education teachers (The World Bank Data, 2015 and OECD, 2011).

Universities in Poland rank behind western universities[6] in different university and college rankings (Center for world university rankings, QS World University Rankings, The World University Rankings). In Center for world university rankings (CWUR)[7] Poland´s University of Warsaw occupies 419th place, Jagiellonian University is among first 500 best universities as well. Another seven universities are among 1000 best around the world. Poland occupies relatively good place considering quality of education indicator is (measured by number of a university's alumni who have won major international awards, prizes, and medals relative to the university's size) - University of Warsaw 115th place, other Poland universities´ ranks among 300 best

[5] Poland´s PISA scores rose from 470 points in 2000, to 490 in 2003, and again to 495 in 2006. Poland's reading score improved in a similar manner - from 479 in 2000, to 490 in 2003, to 508 in 2006 (The World Bank, 2013).
[6] Top places are mostly occupied by universities in United States, United Kingdom, Scandinavian countries.
[7] CWUR is a global university ranking that measures the quality of education and training of students as well as the prestige of the faculty members and the quality of their research without relying on surveys and university data submissions. Ranking of CWUR consists of eight indicators that measure quality of education, alumni employment, quality of faculty, publications, influence, citations, broad impact, and patents.

universities worldwide. Overall score of Warsaw university is 45.5 (of 100) points, other eight universities[8] that entered the ranking have score of 44 points approximately.

Poland´s universities score the best in natural sciences, then life sciences and medicine. Engineering and technology field is scores lower, whilst Warsaw University of Technology is the leader among polish universities (Center for World University Rankings, 2015).

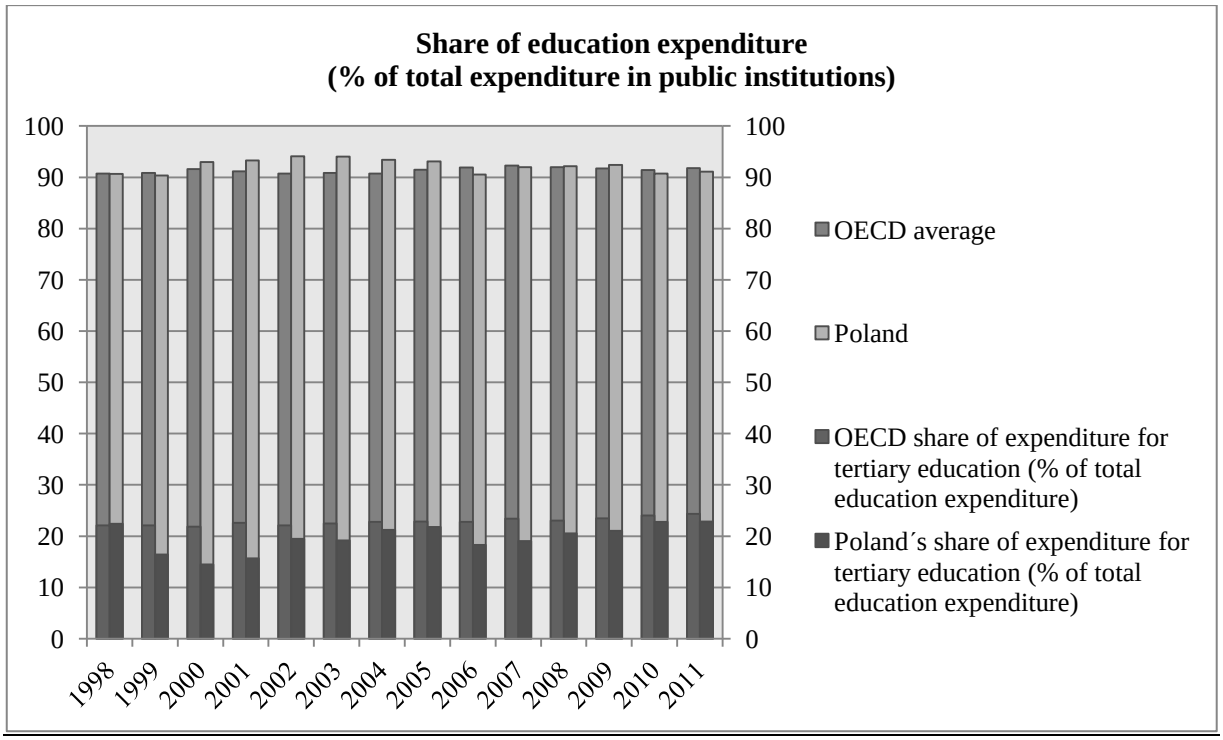
3.1.2.2. Expenditures on education

The impressive placement in PISA ranking is despite Poland´s low spending on education. Government expenditures on education as percentage of GDP (4.9%) are slightly above the world´s average (4,8%), but below the average of high-income countries (5,2% of GDP). If we compare expenditure on education as percentage of government expenditure, Poland comes out worse – only 11,4% comparing to world average 13,5% in 2011 and high-income country average 12,7%. Middle-income countries spend on average 15,9% of government expenditure[9].

Government expenditure per student (as percentage of GDP per capita) in tertiary level of education is below world´s average (29.6%), as well as below high-income countries average (25.9%; compared to Poland´s 20,9%). Only in case of primary level of education Poland is standing above average of world and high-income countries (26.7%, 18.3%, 21.40% respectively). With around US$40,000 spent on educating each of its school students is less than half of what richer countries like the United States and Norway spend (OECD data, 2013).

[8] Polish universities in CWUR ranking: University of Warsaw, Jagiellonian University, AGH University of Science and Technology, Warsaw University of Technology, Adam Mickiewicz University in Poznań, University of Wrocław, Nicolaus Copernicus University in Toruń, Wrocław University of Technology, University of Silesia (listed in order of the position in CWUR ranking).

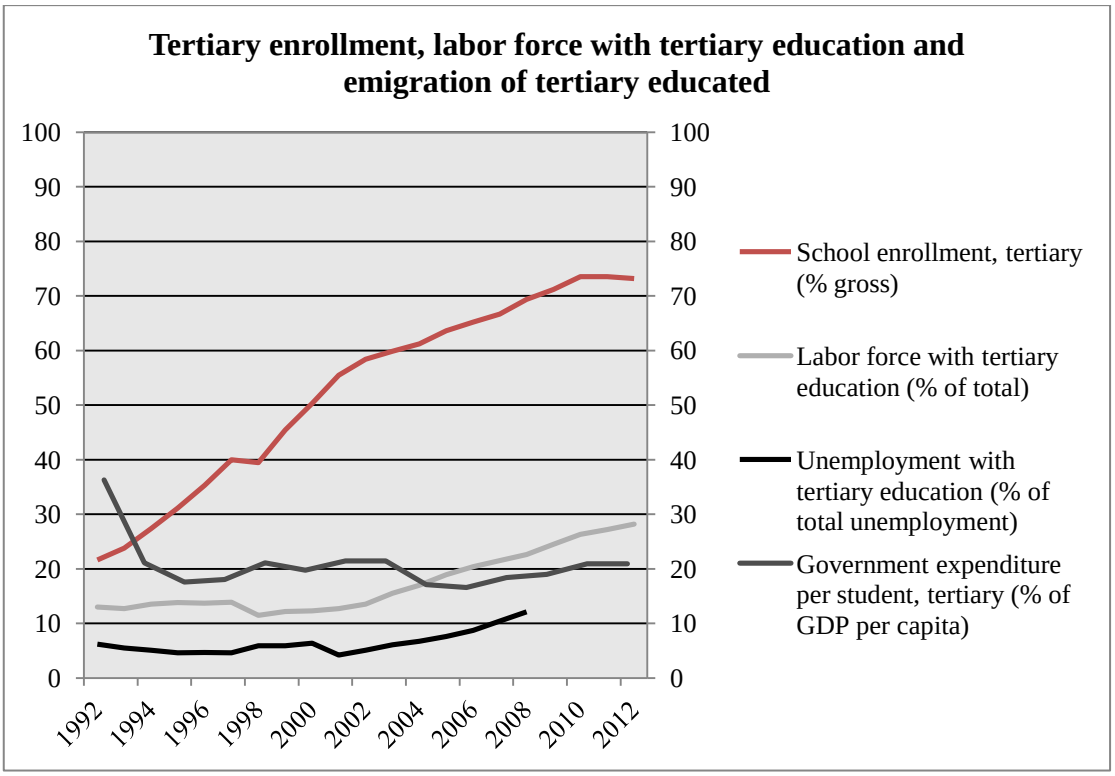
[9] According to Koh (2003) et al. low- and middle-income countries´ education expenditures in general are much lower than expenditures of high income countries, and more emphasis is put on physical capital. Koh et al. explain this preference of investment in government´s myopia: physical capital investment brings more immediate and certain returns.



Graph 4: Share of education expenditure as % of total expenditure in public institutions (Author´s own calculations. Data source: The World Bank Data 2015)

As for tertiary education, share of education expenditure as a percentage of public institutions is slightly above average of OECD countries. However, percentage of expenditure on tertiary education is constantly lower than most of OECD countries, and when measuring per student in tertiary education (as percentage of GDP per capita), one can observe 15.4 percentage points decrease since 1992 (see Graph xy).

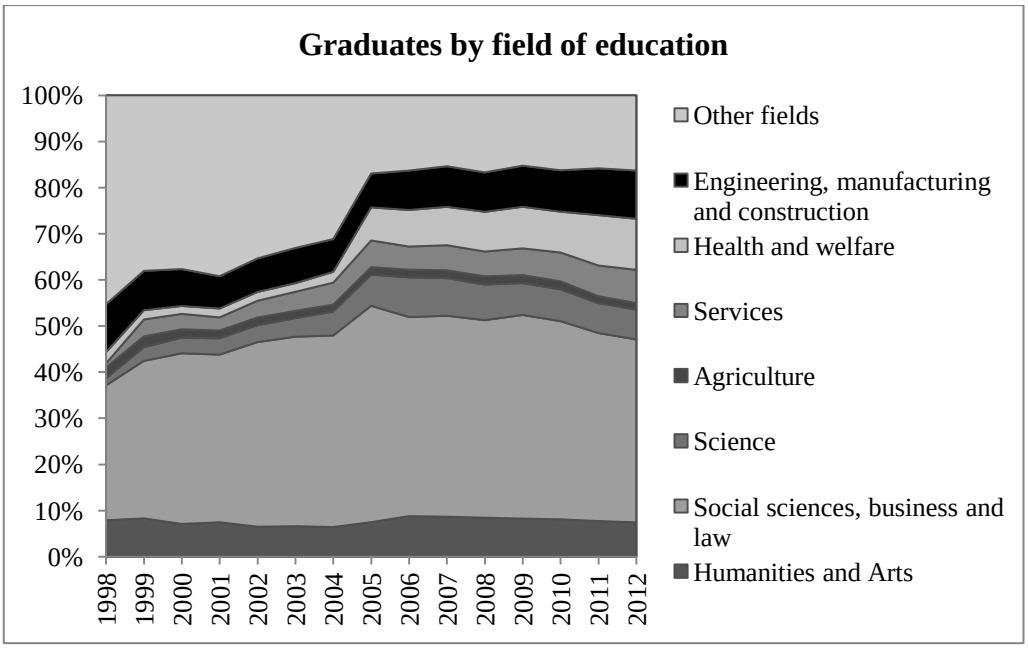
School enrolment in tertiary education has been continually growing (percentage ratio of gross of total enrollment), and since 1990 has more than tripled (20.8 in 1998 to 73.2 in 2012). Increase of share of labor force with tertiary education (as percentage of total labor force) – 13% to 28% between 1992 and 2012 is impressive as well. However, unemployment with tertiary education (as percentage of total unemployment) is following a similar path as tertiary educated labor force – increase from 6.2% in 1992 to 12.1 in 2008.



Graph 5: Tertiary enrollment, labor force with tertiary education, emigration of tertiary educated and government expenditures per student in tertiary education (Author´s own calculations. Data source: OECD, 2015)

As for number of new graduates, Poland is in front of Czech Republic, Hungary, Sweden, France, and it is following a similar path as United Kingdom. From 1998 number of graduates had rise in health and services and engineering field. Since 2005 number of graduates in manufacturing and construction is following a similar path as numbers of Germany or United Kingdom. However, unlike in Germany, the number of graduates in engineering and engineering trades is decreasing and number of graduates in manufacturing and processing is more than five times higher than in Germany (over 16,000 and over 3000 graduates respectively)[10] (OECD data, 2015).

[10] To comparison United Kingdom, Austria, France, Norway, Belgium, Finland, Czech Republic do not cross the line of 5,000 graduates in manufacturing and processing (OECD Data, 2015).



Graph 6: Graduates by field of education in %. (Author´s own calculations. Data source: OECD, 2015)

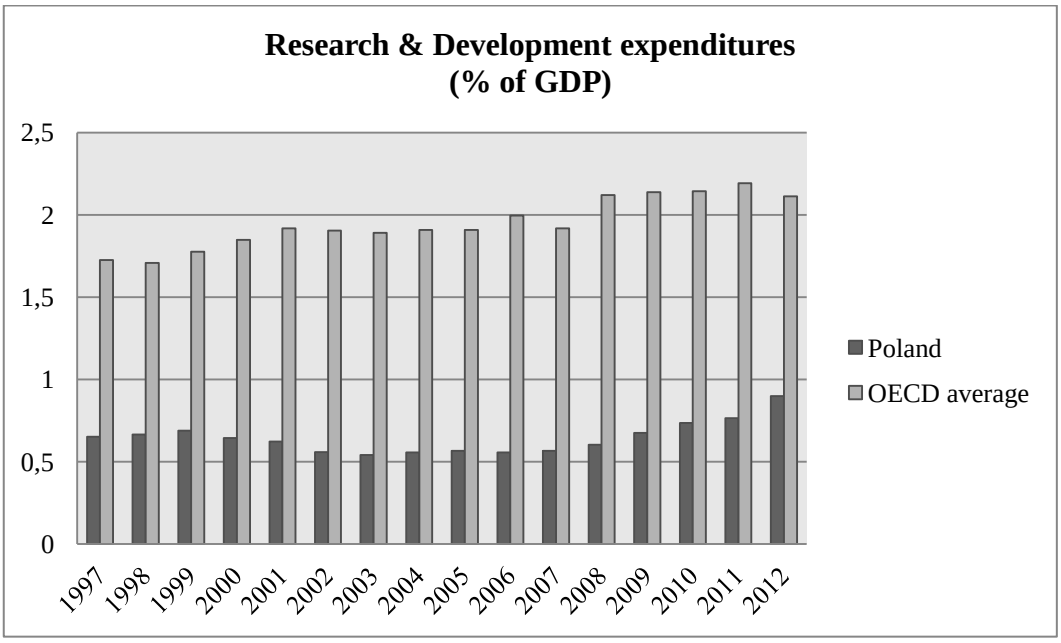
As the data above shows, despite lower expenditures on education than average OECD country, Poland´s primary and secondary education is in a good shape after the reform begun in 1999. Considering the growing number of new graduates, one might say that pool of accumulated human capital is growing – a factor necessary for economic growth (Koh, 2003). However, as Saner and Yiu (2014) argue, even the rapid improvement in education attainment does not guarantee economic growth, and economy might suffer from shortage of specifically-skilled workers. Poland has more and more graduates in manufacturing and processing, which may be a consequence of focus of Poland´s economy and dominance of low and medium-low technology industry (this will be discussed more precisely in chapter about product specialization).

3.1.3. Research & Development and Innovativeness

Innovative capacity of Poland has been lagging behind European Union average. Its research and development intensity experienced an average annual growth of 9.7 % between 2007 and 2012, reaching 0.9 % of GDP in 2012, but it is still below the average of 2.1% of GDP in EU.

Poland also lags behind what concerns the number of researchers and technicians in research and development sector. There are around 1750 researchers and 420

technicians (per million people) – a number lower than in most high- and middle-income OECD countries. (For example Germany has around 4000 researchers and over 1600 technicians (per million people) working in research and development field. In Czech Republic the numbers are 3100 and 1700 (per million people) respectively) (The World Bank Data, 2015).



Graph 7: Research and Development expenditures as percentage of GDP (Author´s own calculations. Data source: World Bank Data, 2015)

Since 2007, Poland has increased its investment in research and development, but there is still long way to go. According to Research and Innovation Performance review (published by European Union, 2014) the main weakness is an underinvestment into research and innovation in private sector (0.33% of GDP). Also Bogumil and Wieladek (2014) see the weakness of the economy on the output side. According to their paper Poland is facing a risk-averse innovation support, which has for consequence lack of endogenous innovation. Innovation support comes mostly from publicly-funded grants, business expenditures are about half of public expenditures. In 2012, private businesses performed only 37.2 % of total research and development, compared to the significantly higher EU average of 63 % (Research and Innovation Performance in the EU, 2014).

In 2013 Poland adopted a document Strategy for Innovation and Effectiveness of the Economy 2020 (SIEG), which is focused on stimulating innovativeness and addressing

key challenges in the research and development (and innovation) sector. Its objective is strengthening regulatory and financial environments to address the needs of an innovative and effective economy; stimulating innovativeness through the increase in effectiveness of knowledge and work; improving the efficient use of natural resources and raw materials; and increasing the internationalization of the Polish economy. Those should be achieved through policies such as increase of expenditures on development and innovations, increase of capital availability for innovative enterprises, and support of pro-innovation culture (National Development Strategy 2020, 2012).

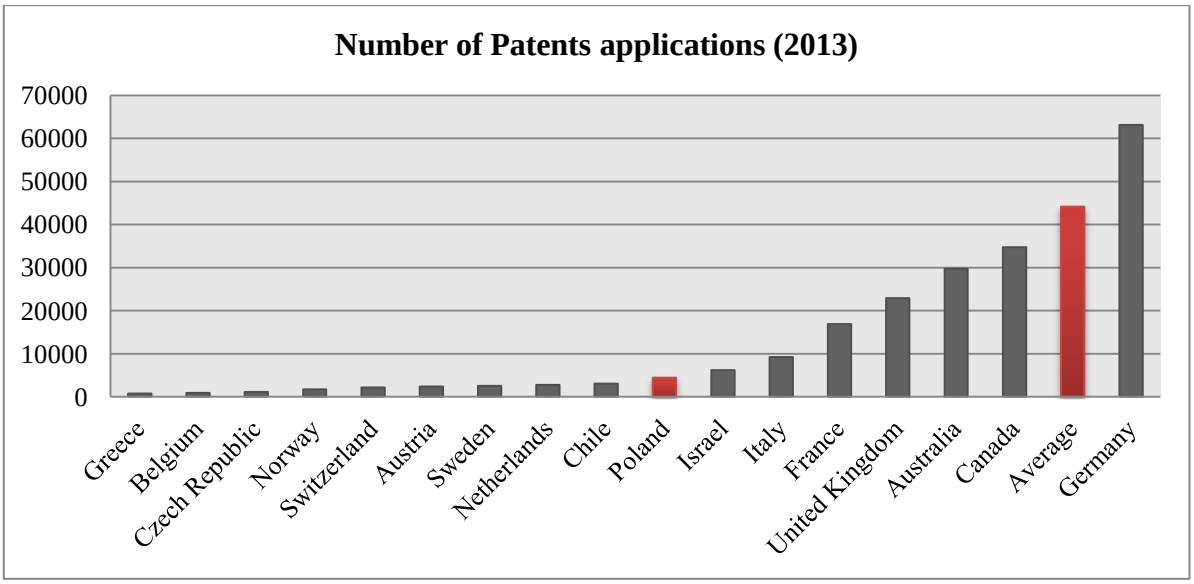
However, the indicators mentioned above do not reflect efforts recently undertaken to increase public R&D spending and trigger private-sector investment in R&D. Tax incentives for research and development are used only by a limited number of companies, and public funding together with structural funds is still the main source of funding research and development activities (Research and Innovation Performance in the EU, 2014).

3.1.3.1. Research and Innovation output

Scientific publications. The number of scientific publications is very low. "Only around 4 %of Polish scientific publications qualify for the top 10 % of most-cited scientific publications worldwide" according to Research and Innovation Performance review (2014, p. 220), which is "the third lowest ranking among EU countries". Number of public-private co-publication is very low in general, which is the consequence of lack of cooperation culture between industry and science.

New products on the market. Most of the innovation activities (business research and development intensity, patent applications) are financed from abroad. A sharp decline in innovation activities can be seen among small and medium enterprises, which are already lagging behind the rest of Europe in introducing new products on the market. Share of SME introducing a new product to the market is significantly falling as well.

Patents. Number of patent applications is among the lowest in OECD high- and middle-income countries (4,411 comparing to OECD average of 44,134).



Graph 8: Number of patent applications in 2013 (Author´s own calculations. Data source: World Bank Data, 2015)

3.1.3.2. Innovation index ranking

Innovation Union Scoreboard is a comparative assessment of the research and innovation performance of the EU Member States. Poland consistently ranks on low in the index. It currently occupies the last rank among *moderate innovators* and only Bulgaria, Latvia and Romania lag behind Poland (those are considered *modest innovators*). Poland´s performance only marginally improved between 2006 and 2013 and its relative performance to the EU members has been declining from 54% in 2007 to about 50% in 2013, due to a more rapidly increasing performance for the EU (Innovation Union Scoreboard, 2015).

Global Innovation Index. The indicator ranks 143 economies from all over the world, in terms of their enabling environment to innovation and their innovation outputs. Among European countries Poland occupies relatively low rank - 45th place (behind for example Czech Republic, Italy, Hungary, Slovakia or Lithuania). The index is built on five pillars that enable innovation activities (innovation input) - institutions, human capital and research, infrastructure, market sophistication, and business sophistication; and two output pillars that capture actual evidence of innovation outputs - knowledge and technology outputs and creative outputs. Among those five categories, Poland has the lowest score for Knowledge and technology outputs (it includes knowledge creation, impact, and diffusion) – only 31.2 points out of 100. In the category of creative outputs Poland´s rating is 36.7 points (out of 100) (Global Innovation Index, 2015).

Bloomberg Innovation Index. Countries´ overall index is an average of six indicators: research and development, manufacturing (measured by gross value added), number of hi-tech companies, education level of a country´s workforce, number of professional workers in research and innovation and number of patents. Poland occupies 25th rank (of 50 most innovative countries), and reaches the best results in categories hi-tech companies and number of patents (Bloomberg Innovation Index, 2015).

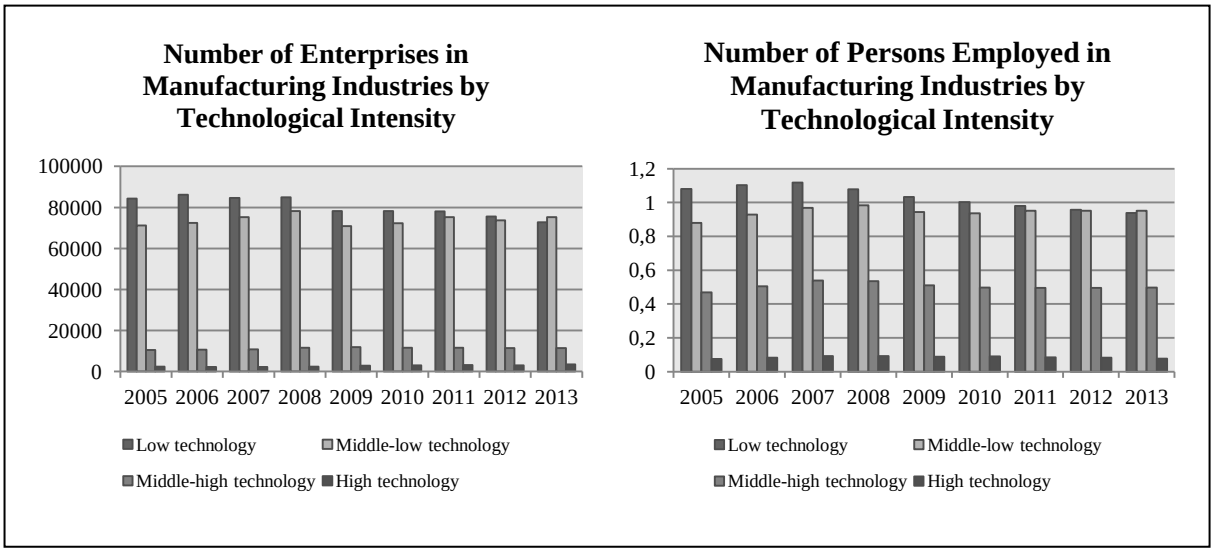
Union Scoreboards Index. Relative to the performance of the EU countries, Poland is below average of most indicators. Firm´s investment into non-research and development expenditures is above average – but the opposite is true for research and development expenditures. Also share of the population with completed tertiary and upper secondary level education is bigger than in average European country. Relative weaknesses are in new doctorate graduates, patent applications, and patent revenues from abroad (Union Scoreboards Index, 2014).

Poland has been able to maintain remarkable economic growth despite low investment into research and development. Most of the innovation is funded by public sector, and the incentives for innovation are still missing. As a consequence Poland lags behind advanced economies in output of innovation and lower value added in innovation sector.

3.1.4. Product specialization and revealed comparative advantage

Product specialization has been relatively static with little progress towards a higher share of medium- or high-technology sector. As shown on the graphs below, most enterprises produce low or medium low technology products[11], and number of enterprises specializing in high or medium-high technology intensive goods is rather small. Whilst number of middle-high technology intensive enterprises has been slightly rising, number of high technology intensive enterprises has not changed. Same trend can be seen in the number of employees in manufacturing industries.

[11] We use Classification of Manufacturing Industries by Technological Intensity, as defined by the OECD and accepted by the UN and the EU. Available online at http://www.cbs.gov.il/publications12/economic_activities11/pdf/intensity_e.pdf

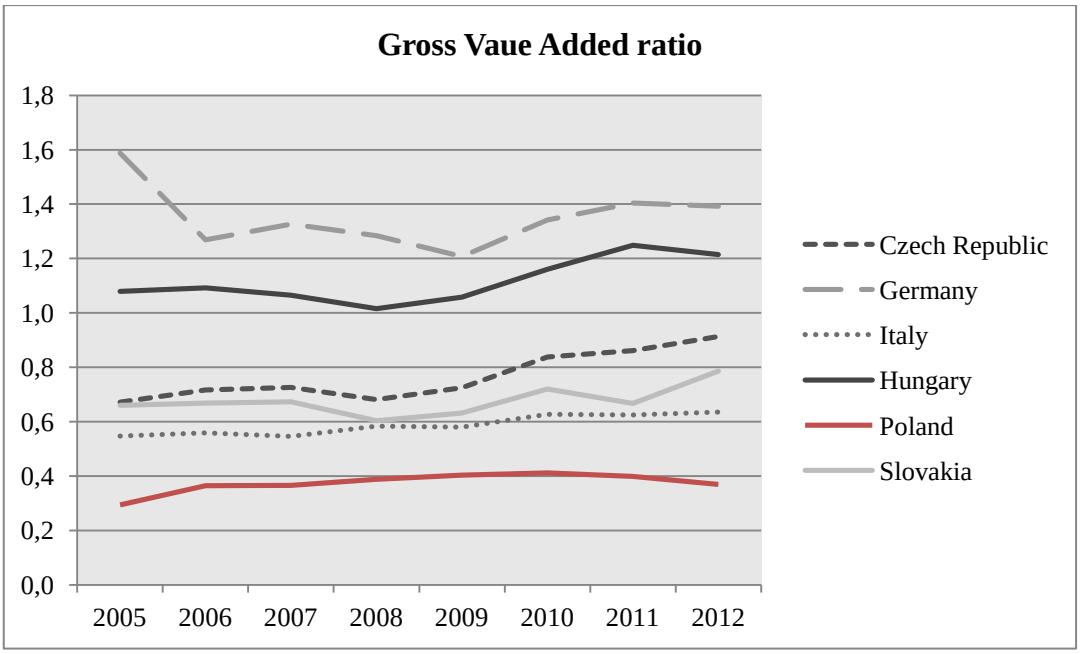


Graph 9: Number of enterprises in manufacturing industries by technological intensity. (Author´s own calculations. Data source: Eurostat, 2015)

Graph 10: Number of persons employed in manufacturing industries by technological intensity, in millions (Author´s own calculations. Data source: Eurostat, 2015)

As for value added by individual industries, the highest value was produced in medium-low technology intensive sector, which has been sharply growing (comparing to other three manufacturing industries) since 2009. Low and medium-high intensive sectors have been lightly declining in recent years, but overall increase since 2005 can be observed. High technology industries are experiencing slight decrease since 2010, and only a little change in value added can be seen.

We use ratio of Gross Value Added produced in high technology and medium-high technology industries to medium-low technology and low technology industries to compare Poland´s product specialization with different countries. Apart Germany, highest ratio among chosen countries has Hungary, where the main driving force was increase in production of pharmaceutical products. Czech Republic, despite similar low-ratio start, outpaced Slovakia. This performance was due to expansion in production of motor vehicles and transport equipment industry. Poland´s ratio is the lowest among chosen economies and since 2010 has been declining. According Bogumil and Wieladek (2014) it was the increase in the medium-low technology sectors, like manufacturing of rubber, plastic and other non-metallic mineral products, which noticeably dragged Poland´s performance down.



Graph 11: Gross value added ratio. (Author´s own calculations. Data source: Eurostat, 2015)

Bogumil and Wieladek (2014) quantify Poland´s growth potential via shift-share analysis. They project what would Poland´s economic growth would have been if the country had the economic structure of Germany, Hungary, Italy or Czech Republic (in terms of sectoral composition of GDP), and come to conclusion that Poland´s real economic growth (real gross value added) would have been significantly higher with sectoral composition of any of the countries mentioned above.

Data show that Poland has revealed comparative advantage in low- and medium-low technology intensive goods. Revealed comparative advantage index is higher for low and medium-low technology and relatively low for high and medium-high technology. Most high-technology industries (pharmaceuticals, office equipment, aircraft equipment, scientific and professional equipment; exception is telecommunications equipment) have particularly low revealed comparative advantage. As for medium-high-technology goods, only some product groups have a comparative advantage (dyeing materials, cosmetics, fertilizers, power generating machinery, road vehicles and railway equipment) (Trade Map, 2015).

Comparison of aggregated revealed comparative advantage index in Poland

	Poland		Hungary		Germany		Czech Republic		European Union	
	2000	2013	2000	2013	2000	2013	2000	2013	2000	2013
High technology	0.28	0.68	1.54	1.52	0.86	1.08	0.33	1.10	1.12	1.26
Medium-high technology	0.78	0.88	0.91	1.09	1.18	1.18	1.11	1.09	0.99	1.19
Medium-low technology	1.93	1.45	0.75	0.88	1.06	0.88	1.97	0.68	1.10	1.13
Low technology	1.57	1.46	0.88	0.80	0.70	0.77	0.80	0.80	0.87	0.87

Table 1: Comparison of aggregated revealed comparative advantage index (Source: UN Comtrade, 2015)

A consequence of relatively low value added in high technology industries and decreasing value added in medium-high industries are lower wages in those sectors (OECD data, 2015). As discussed in the first part of this paper, because of lower wages fewer individuals are willing to invest into education that would prepare them to work in this industry, and misallocation of talent might occur. We have seen in the chapter about education that number of graduates engineering and engineering trades is decreasing, which might be a sign of lower motivation of individuals to work in this field and thus lower value added in the particular sector.

Poland´s economy is still relying on labour-intensive technologies. So far, the main drives of have been low- and middle-low technology intensive goods, such as furniture, vehicles or copper products. However, in the long run Poland needs to manage the transition from efficiency-driven to innovation-driven economy – which also means the transition from a low-cost, low-skilled labour force and labour-intensive manufacturing processes to a high-skilled labour and endogenous innovation.

3.1.4.1. Export

Since 1995 Poland export has been growing in average 9% p.a. and in past 4 years on average 4,65% p.a. In 2013, the value of merchandise exports of Poland increased substantially by 11.2 percent to reach 199.7 billion US$, while its merchandise imports increased moderately by 5.4 percent to reach 201.8 billion US dollars.

Poland´s main trading partner is Germany, where Poland´s exports form almost 25% of all Germany´s imports. Other important trading partners are United Kingdom, France, Czech Republic, and Russian Federation, where Poland exports 5 to 10 percent of goods and services.

Main exported goods (considering the exported value in 2013) are machinery; electrical and electronic equipment; vehicles (other than railway and tramway); furniture, lighting, signs, prefabricated buildings[12]. As for trade balance, prevailing are furniture and lighting, vehicles and copper articles. Highest share of world exports among Polish goods have tobacco and manufactured tobacco substitutes, furniture, lighting, ships, boats and other floating structures, meat and edible meat offal, soaps, lubricants, waxes, candles, modeling pastes, cocoa and cocoa preparations (International Trade Centre, 2015).

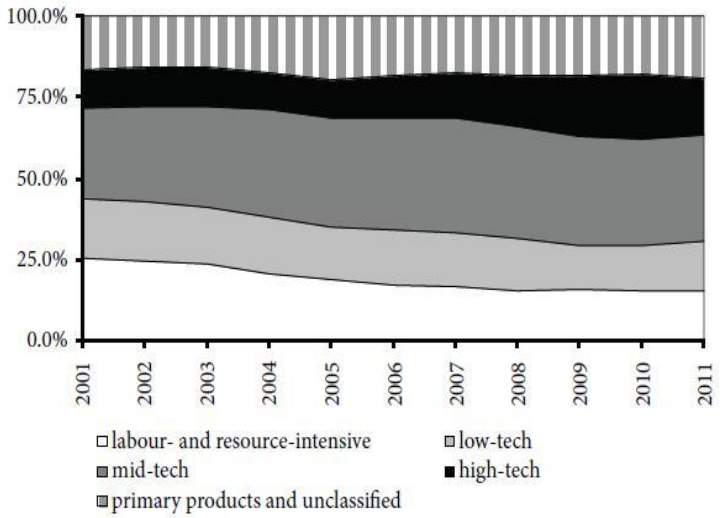
Applying commonly-used OECD classification that groups individual manufacturing sectors by their technological intensity: high- technology, medium-high technology, medium-low technology, and low technology, most of those products are in category *low technology*[13].

Among the sectors with highest annual growth in value between 2009 and 2013 was aircraft, spacecraft manufacturing, and miscellaneous chemical products, which are categorizes as high and medium-high technology intensive (respectively), but between 2012 and 2013 the highest growth of value added was made mostly by sectors with low technological intensity (oil seed, grain, seed, fruit, furskins and artificial fur, arms and ammunition, nickel and articles thereof).

[12] We are considering the International Trade Centre categories: Machinery, nuclear reactors, boilers, etc (category number 84), electrical and electronic equipment (85); vehicles other than railway, tramway (87); furniture, lighting, signs, prefabricated buildings (94), tobacco and manufactured tobacco substitutes (24), meat and edible meat offal (02), soaps, lubricants, waxes, candles, modeling pastes (34), cocoa and cocoa preparations (18), aircraft, spacecraft manufacturing and parts thereof (88), miscellaneous chemical products (38), oil seed, oleagic fruits, grain, seed, fruit, etc (12), furskins and artificial fur, manufactures thereof (43), arms and ammunition, parts and accessories thereof (93), nickel and articles thereof (75) (International Trade Centre, 2015).

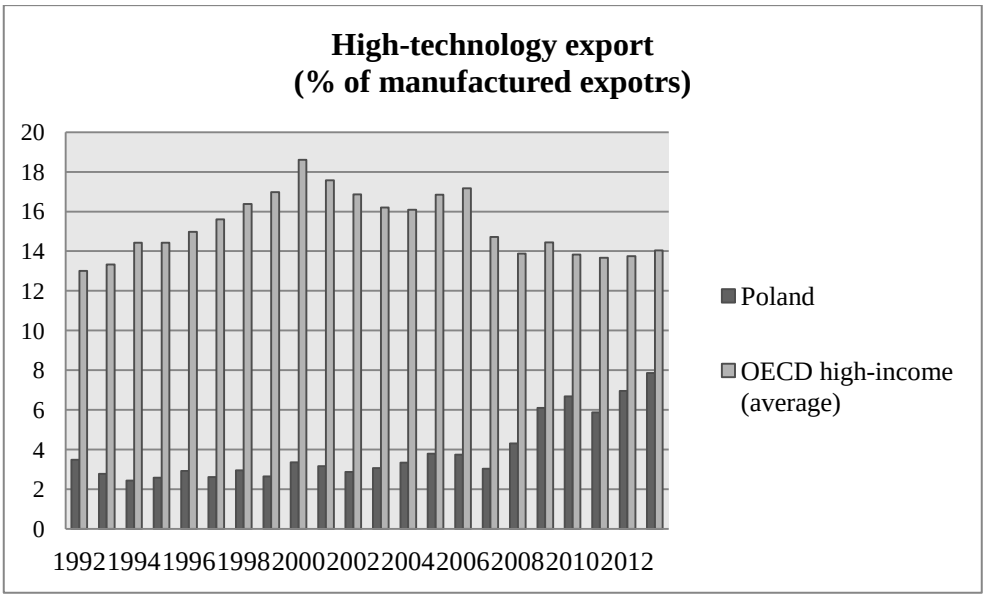
[13] Manufacture of tobacco products – low; furniture, lighting, signs, prefabricated buildings – low; ships, boats and other floating structures – medium low; meat and edible meat offal – low; soaps, lubricants, waxes, candles, modeling pastes – medium low, cocoa and cocoa preparations - low.

Technological Intensity of Polish Exports
(2001 and 2011)



Graph 12: Technological intensity of Polish Export between 2001 and 2011 (Source: Michalski, 2014)

Poland´s mid-tech and high-tech exports are dependent on the activity of foreign companies operating in Poland (Michalski, 2014). According to Michalski Poland is highly dependent on the inflow of FDI's and imports of advanced technological knowledge. This can be observed on the increased export share of high-tech goods since 2005, when Poland joined the European Union. Amelioration of the infrastructure and easy access to the European marked caused the increase of the export from 70.3 billion USD in 2005 to 216.4 billion in 2014. One may observe decreasing shares of labour- and resource-intensive goods - by 10 percentage points, to the level of 15.1% in 2011 as well as low-tech intensive products – decrease of 3 percentage points since 2001 (reaching 15.4% in 2009).



Graph 13: High technology export as percentage of manufactured exports (Author´s own calculations. Data source: World Bank Data, 2015)

3.1.5. Institutions

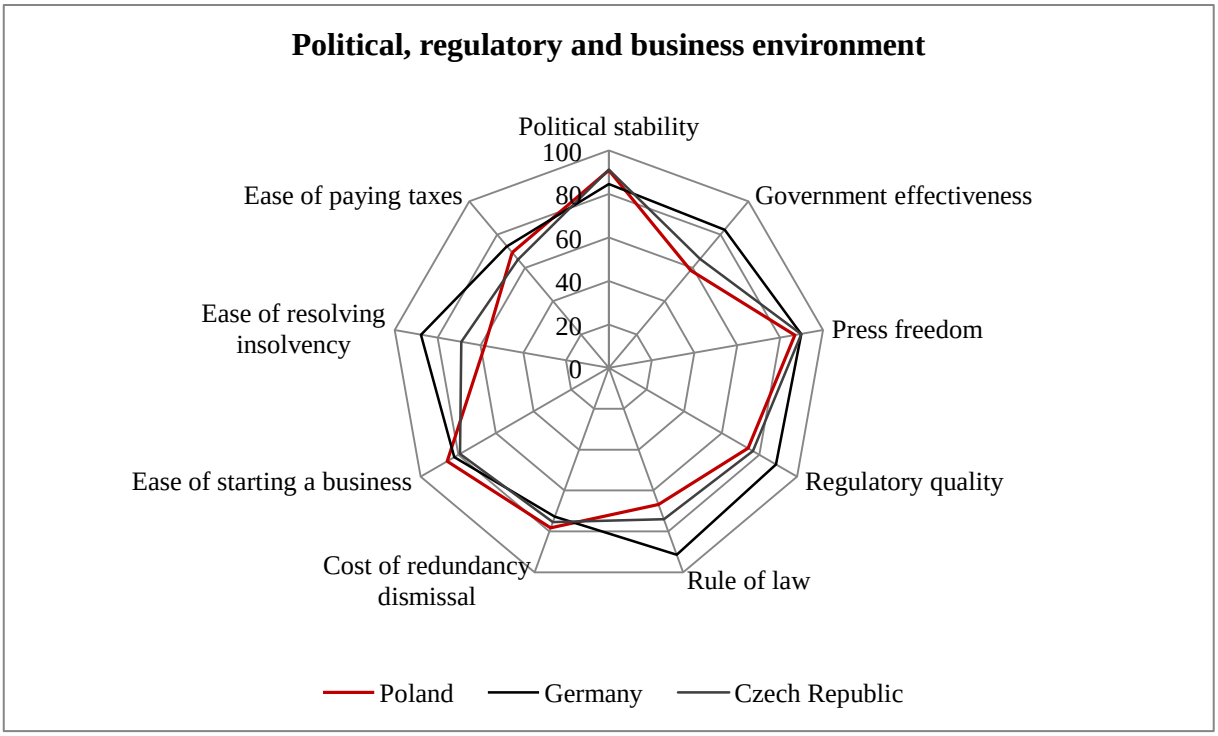
As for institutional framework, we will use Global Innovation Index scores (more precisely the institutions category) to assess its quality. Institutions form one of the five main pillars that Global Innovation Index considers when ranking the countries.

Institutional framework is divided into three parts: political environment, regulatory environment, and business environment. Considering quality of institutions overall, Poland ranks as 35th of 189 economies, reaching the score 74.4 points. However, with a closer look to individual sub-indexes, one may see several weak points.

As for the political environment overall, Poland is doing relatively well - 27th rank, comparing 189 countries. A weakness can be seen in government effectiveness, where Poland does worse than most of European countries. The index captures public and civil services and the degree of their independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.

What concerns regulatory environment, Poland ranks 42nd of 189 countries, however doing worse than most of the Europe – it places 25th out of 39 countries. Weak point can be seen in ability of the government to formulate and implement sound policies and regulations that permit and promote private-sector development. Poland scores lower than European average in rule of law index, which captures quality of contract

enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. Costs of enforcing contracts are lower than OECD average, but it takes more time and more procedures are needed.



Graph 14: Political, regulatory and business environment. (Author´s own calculations. Data source: Global Innovation Index, 2015)

Poland scores very well in ease business index – it ranks 32nd of 189 economies worldwide. However, the entrepreneurs have to face different obstacles when start doing a business. According to Doing Business Index data, published by World Bank, it takes around thirty days to start a business comparing to nine days in average OECD country. Costs of starting a business are more than four time higher than OECD average. Another barrier may be obtaining a construction permit and getting the electricity, which takes more twice as long as in average OECD country and require more procedures to obtain the permit needed. As for ease of paying taxes, higher number of payments is required and entrepreneurs spent more time paying taxes on average 236 hours per year, comparing to Europe average of 175 hours a year. Costs of resolving insolvency are higher and take more time than in OECD in average, and recovery rate is lower.

To sum up, Poland´s institutional framework is hardly at the same level as high-income OECD countries. Main weakness is time-consuming enforcement of contracts and relatively poor business environment, suffering from a number of entry and exit barriers, that discourage new entrepreneurs and hampers competition.

3.2. Conclusion

Poland is still a typical efficiency-driven economy, profiting from effects of catching-up with advanced economies. In recent 25 years Poland has been able to maintain high growth mainly because of productivity gains and capital accumulation, but this will become more and more difficult over time. Poland is using rather labour-intensive technology and shows revealed comparative advantage in low and middle-low technology intensive goods, with lower value added. However, share of labour-force with tertiary education is growing - which is a good sign of accumulating the human capital necessary for economic growth. In upcoming years Poland´s major challenge is to improve effectiveness of research and development policy and strengthen endogenous innovation.

4. Model

We will use an ordinary least square regression model to further analyze each of the factors discussed in the first part and found important. Those are institutions, infrastructure, education, R&D, innovation and property rights. Based on previous research one can suspect a correlation between individual factors. Let´s start with the education – it is considered as an investment, since the individual has to sacrifice certain amount of time in early adulthood in order to be able to work in the innovation sector, where his wage will be higher (because of higher value created by this sector). Higher the number of individuals that decide to invest into education, larger will be the share of labor with tertiary education (e.g. accumulated human capital), and thus more people will be skilled enough to work in research and development sector. We assume that with more people working in R&D sector will have for consequence more ideas and thus it will be more fruitful. The value added by this sector will be higher, therefore wages will be high and more individuals will be willing to invest into education – since the benefits of this investment will be high. Because of more innovation, also the share of high-technology export will be bigger. Good quality infrastructure and effective enforcement of property rights will even enhance this *vicious* circle.

Correlation would reduce the quality of the model; therefore we selected only five exogenous variables, independent of each other: expenditure on education, labor force with tertiary education, expenditures on research and development, export of goods and services and share of high tech exports. Using same variables, we have constructed two models: one for 35 high-income economies as defined by World Bank, and one for Poland. For the analysis we used World Bank data in the range between year 1995 and 2013.

4.1. Variables

We have employed the logarithm of GDP per capita growth as endogenous variable (in 2005 constant U. S. dollars). For our analysis we use

Expenditures on education are expressed as a percentage of direct expenditure in public educational institutions of the specified level of education. It includes staff

compensation, teaching materials, ancillary services and administration. (Financial aid to students and other transfers are excluded from this number.) Education is considered as an investment in human capital, thus we expect positive relationship between growth and expenditures on education – higher the percentage of capital invested, higher the GDP growth.

Another factor considered in the model is labor force with tertiary education, as a share of the total labor force that attained or completed tertiary education as the highest level of education (employed, unemployed but seeking work, and first-time job-seekers are included). This variable provides insights into skill level of labor force. Since at higher economy level, the quality of work force cannot be neglected, this variable shows accumulated human capital among workers. Advanced workers can work in innovation (design) sector where the productivity is higher and thus a positive relationship between GDP per capita growth and share of labor force with tertiary education is expected.

In order to obtain competitive advantage in science and technology, investment into research and development is necessary. This includes current and capital expenditures (both public and private) on creative work undertaken systematically to increase knowledge, including knowledge of humanity, culture, and society, and the use of knowledge for new applications. Research and development expenditure variable is defined as percentage of GDP determined for basic research, applied search, and experimental development. Higher the share of this kind of expenditures, more means invested, higher the economic growth should be.

The variable net export is the value of all goods and other market services provided to the rest of the world minus the value of all goods and other market services received from the rest of the world. Again, we expect positive coefficient, since it is one of the main components of GDP. The variable include value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. Data are in constant 2005 U.S. dollars.

Last variable in our model is the variable share of high-technology exports, expressed as a percentage of manufactured export. Eichengreen et al. found statistically significant relationship between exports of high-technology and occurrence of slowdown - bigger

the share of high-technology products in the exported goods, higher the value added by the economy. Thus, we expect positive correlation. We use data from World Bank, where high-technology exports are products with high R&D intensity such as aerospace, computers, pharmaceuticals, scientific instruments, and electrical machinery.

4.2. Results

4.2.1. Model 1: High-income economies

After running the regression we have found all the variables statistically significant. As expected, all the coefficients are positive and we can conclude that they influence the GDP growth in positive way. The most significant are labor force with tertiary education, expenditures on research and development and share of high technology export. One percentage point increase in share of the labor force with tertiary education will have for consequence 0.01 % growth in GDP per capita. As expected, accumulated human capital has positive influence on economic growth. Also the expenditures in research and development have positive impact – increase of one percentage point is followed by average GDP growth of 0.26%. Increase of one percentage point in share of high-technology products in export has for consequence 0.02% GDP growth.

Selected variables are responsible for 53% of changes in GDP growth. Based on this result we can conclude that investment into research and development, human capital, and innovation are among the main driving forces in high-income economies.

4.2.2. Model 2: Poland

Statistically significant variables turn out to be education expenditures, labor force with tertiary education, and net export. But most of the constant have only negligible value comparing to Model 1. Unlike in case of high-income countries, research and development expenditures have not proved to be important and have only small impact on GDP growth. Education expenditures effect is about the same as in high income economies. As for labor force with tertiary education, have greater impact – increase of

one percentage point will result in 0.03% growth of GDP per capita, and among chosen variables will have the greatest positive effect.

Small coefficients suggest that Poland is driven by different factors than those chosen in our model. However, those factors have been proved relatively important and influencing the GDP growth in the model for high-income economies. Those finding support our data analysis: Poland is still not the efficiency driven economy, and contribution of human capital to the economic growth is relatively unimportant.

5. Conclusion

Middle-income trap can be referred as an impasse from efficiency-driven to innovation-driven economy. It can be found that more factors plays a role when transiting from one stage to another – but the endogenous innovation is the one that is the most important. Latter is a result of accumulated human capital, which is the main competitive advantage of high-income economies. Government often needs to promote human capital accumulation in order to enhance national competitiveness and more advanced economy – but its role should be only mandatory, whilst providing business- and innovation-friendly environment. It can be achieved through quality infrastructure, effective enforcement of property rights, and support of research and innovation.

Poland achieved a remarkable economic progress since 1990. According to Eichengreen´s et al.´s definition of the middle-income trap Poland already passed the danger of falling into it. But following the middle-income trap definition of Agénor and Canuto, Poland is still facing the challenge of transition. Its rapid growth was due mainly to cheaper factors of production, unleashed local demand and improved factor productivity. However, the main driver of growth - total factor productivity is slowing down. Poland is still taking advantage of the growth impulse from the catching-up process, but it is not sustainable in the long run.

So far, Poland´s success is relying mostly on price competitiveness and its product specialization, which is biased towards low- and medium-low-technology products, using cheap and comparatively low-skilled labour. In order to stay competitive and maintain long-term growth, Poland needs to manage the transition towards sectors with higher technological content and higher value added. Main challenge is to create more innovative- and business-friendly environment.

Poland has already made couple of steps towards more sustainable growth – school reform, which has reflected in high score of the youngest on standardized tests, such as PISA; ameliorating motorway and highway density (using European Union funds), which create a supporting infrastructure for innovation, and business environment. Even though the steps towards more advanced economy has been made, Poland is still an efficiency-driven economy – and it is still long way to go to become an economy driven by innovation. The main challenge is the transition from a low-cost, low-skilled, labour-

intensive economy towards a more high-skilled labour, innovation-based economy. A human capital-focused development strategy is the right way to go, since the main key to sustainable growth is innovation and human capital is the source of it.

List of Graphs and Tables

References

ANÉGOR, Pierre-Richard – CANUTO, Otaviano: Middle-income Growth Traps, Policy Research Working Paper 6210, The World Bank, 2012

BOGUMIL, P. – WIELADEK, R.: Securing Poland´s economic success, ECFIN Country Focus, Vol. 11, No. 9, 2014. ISSN 1725-8375

CHEN, Xudong – TIAN, Guoqiang: On the Nature of Avoidance of "Middle Income Trap", IAR Working Paper Series, No.E 2014001, 2014

EICHENGREEN, Barry – PERK, Donghyun – SHIN, Kwanho: When Fast Economies Slow Down: International Evidence and Implication for China, National Bureau of Economic Research, Working Paper 16919, 2011

EICHENGREEN, Barry – PERK, Donghyun – SHIN, Kwanho: Growth Slowdowns Redux: New Evidence of the Middle-income trap, National Bureau of Economic Research, Working Paper 18673, 2013

European Commission: Poland, Research Policy Goals, Erawatch, 2013. Available online http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/pl/country?section=ResearchPolicy&subsection=RecentPol

European Commission: Research and Innovation Performance in the EU, 2014, p. 217 – 226. Available online https://ec.europa.eu/research/innovation-union/pdf/iu_progress_2014_flipbook/files/assets/seo/page219.html

GILL, Indermit S. – KHARAS, Homi: An East Asian Renaissance, The International Bank for Reconstruction and Development, The World Bank, 2007, ISBN-10: 0-8213-6748-X (electronic)

HIDALGO, César, A. – HAUSMANN, Ricardo: The building blocks of economic complexity, PNAS, Vol. 106 No. 26, 10570–10575, doi: 10.1073/pnas.0900943106, 2009

KARSINKA-FENDER, M.: Poland survives crisis relatively unscathed, EU 27 Watch, No. 9, 2010, p. 3

KHARAS, Himi – KOHLI, Harinder: What Is the Middle Income Trap, Why do Countries Fall into It, and How Can It Be Avoided? Global Journal of Emerging Market Economies, vol. 3 no. 3, 2011, p. 281-289

KOH, Winston T. H. – LEUNG, Hing-Man: Education, Technological Progress and Economic Growth, SMU Economics and Statistics Working Paper Series, Paper No. 1-2003, 2003

Kuznets, S. 1971. Economic Growth of Nations: Total Output and Production Structure. Cambridge: Belknap Press of Harvard University Press

MICHALSKI, Bartosz: Competitiveness of Polish mid-tech and high-tech exports to the European Union (EU-27) in the first decade of the 21st century, Poynań University of Economics Review, Vol. 14, Number 4, 2014

National Development Strategy 2020, Attachment to Resolution No 157 of the Council of Ministers of 25 September 2012, 2012

NELSON, Richard L. - PHELPS, Edmunt S.: Investment in Humans, Technological Diffusion, and Economic Growth, The American Economic Review, Vol. 56, No. 1/2., 1966, pp. 69-75.

OECD (2011), "The Impact of the 1999 Education Reform in Poland", OECD Education Working Papers, No. 49, OECD Publishing. Available online http://dx.doi.org/10.1787/5kmbjgkm1m9x-en

PIATKOWSKI, M.: Poland´s New Golden Age, Policy Research Working Paper no. 6639, 2013

PRUCHNIK, Kamil – TOBOROWICZ, Jerzy: Low Level of Innovativeness and the Middle Income Trap – Polish Case Study, Social Science Research Network, 2015, available at SSRN http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2578676

RADWAN, I.: Avoiding the Middle Income Trap in Poland, The World Bank. 2014

ROUX, André: Stuck in the middle of an income trap, Strategy Insights, Vol. 21 No. 01, 2013

SANER, Raymond – YIU, Lichia – GOPINATHAN S.: Policy Debate | Learning to Grow Beyond the Middle-Income Trap - Singapore as an Export Model? Revue Internationale de Politique de Développement, 2014, available online http://poldev.revues.org/1803#tocto1n1

WORLD ECONOMIC FORUM: The Global Competitiveness Report 2012–20013: Full Data Edition, 2012, ISBN-13: 978-92-95044-35-7

YPING, Huang – QIN, Gou – XUN, Wang: Institutions and the Middle-income Trap: Implications of cross-country experiences for China, National School of Development, 2013. Available online https://www.hhs.se/contentassets/c9558a10642a49d9815e5b09f189b9dc/institutions-and-the-middle-income-trap.pdf

Internet sources

European Commission: Commission Staff Working Document: Country Report Poland 2015, COM (2015) 85 final, 2015. Available online http://ec.europa.eu/europe2020/pdf/csr2015/cr2015_poland_en.pdf

European Commission: Digital Agenda for Europe – Country Information – Poland, 2015, cited 5/5/2015. Available at https://ec.europa.eu/digital-agenda/en/country-information-poland

Ministerstvo Skarbu Państva (Ministry of Treasury): Macroeconomic Analysis of Polish Economy, 2015, cited 5/5/2015. Available at http://www.msp.gov.pl/en/polish-economy/macroeconomic-analysis/5975,Macroeconomic-Analysis-of-Polish-Economy.html

PWC: Road Building in Poland. The facts and the myths, experience and perspectives, report 2015. Available online http://pzpb.com.pl/newpzpb/wp-content/uploads/Road-building-in-Poland_ver_ang.pdf

Data sources:

Eurostat, cited May 2015, available at http://ec.europa.eu/eurostat/data/database

International Trade Centre: Trade Map data, cited May 2015, available at http://www.trademap.org/stDataAvailability.aspx

OECD, cited May 2015, available at http://stats.oecd.org/Index.aspx?DatasetCode=RGRADSTY#

The World Bank, cited May 2015, available at http://databank.worldbank.org/data/views/variableSelection/selectvariables.aspx?source=world-development-indicators

United Nations Comtrade, cited 2015, available at http://comtrade.un.org/data/

Indexes and Scoreboards:

Center for world university rankings 2015, cited May 2015, available at http://cwur.org/

European Commission: Innovation Union Scoreboard, 2015. Available online http://ec.europa.eu/enterprise/policies/innovation/policy/innovation-scoreboard/index_en.htm

Global Innovation Index 2014, cited May 2015, available online at https://www.globalinnovationindex.org/content.aspx?page=data-analysis

QS World University Rankings 2015, cited May 2015, available at http://www.topuniversities.com/university-rankings/world-university-rankings/2014#sorting=rank+region=+country=+faculty=+stars=false+search=

REUTERS: The World Universities rankings 2015, cited May 2015, available at http://www.timeshighereducation.co.uk/world-university-rankings/2014-15/world-ranking

The Bloomberg Innovation Index 2015, cited May 2015, available online http://www.bloomberg.com/graphics/2015-innovative-countries/

World Bank Group: Doing business Index 2014, cited May 2015, available online at http://www.doingbusiness.org/rankings

Appendix

Model: Impact of education expenditures, labor force with tertiary education, research and development expenditures, net export, and share of hi-tech goods in export

	Growth GDP per capita	
	[1]	[2]
Education expenditures	0.0158603**	0.0160541**
	[0.007]	[0.006]
Labor force with tertiary education	0.0159016***	0.0329777***
	[0.003]	[0.002]
Research and Development expenditures	0.265256***	0.000755583
	[0.033]	[0.153]
Net export	7.51922e-013*	-3.12668e-012**
	[4.310e-013]	[1.291e-012]
share of hi-tech goods in export	0.0185668***	-0.00525708
	[0.003]	[0.013]
Observations	320	14

Source: Author´s own calculations