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DIPLOMOVÁ PRÁCE

**Three essays on Joseph Stiglitz and information
asymmetry**

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Prohlášení

Prohlašuji, že jsem diplomovou práci vypracoval samostatně a použil pouze uvedené prameny a literaturu

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Abstract

This thesis contains three essays related to the work of economist Joseph Stiglitz. The first essay describes the contribution of Stiglitz to economic theory by analysing problems of information asymmetry, new Keynesian and institutional economics, rationality, and market theories. Shortcomings of neoclassical economics are described and possible solutions are outlined. The last part of this is essay summarizes the main critique to Stiglitz.

The second essay applies the topic of information asymmetry by discussing whether the current level of economic development leads to convergence or divergence in the technology and information levels. The conclusion is that even though globalisation affects the level of technology and information, we do not see convergence as predicted by several theoretical models and information asymmetry remains an important element in the economy.

The last essay links the Stiglitz-Greenwald theory of credit rationing using recent Czech data from years 2008 and 2009. Data confirm that credit rationing increases, information asymmetry increases, and the transmission mechanism does not function well during economic decline. I conclude that Czech banks increase their screening of clients and consequently credit rationing in the times uncertainty leading to ambiguous development of interest rates. Recent Czech data confirm Stiglitz-Greenwald monetary theory.

Abstrakt

Tato práce obsahuje tři eseje vztahující se k dílu ekonoma Josepha Stiglitze. První esej popisuje Stiglitzův přínos k ekonomické teorii s důrazem na problémy spojené s informačními asymetrií, novou Keynesovskou a institucionální ekonomii, racionalitou a teorií trhů. Jsou popsány nedostatky neoklasické ekonomie a navrhnutá možná řešení. Závěrečná část shrnuje nejčastější kritiku Stiglitze.

Druhá esej aplikuje téma informačních asymetrií na diskusi, jestli současný stupeň ekonomického vývoje vede ke konvergenci nebo divergenci technologických a informačních úrovní. Závěr je, že ačkoliv globalizace ovlivňuje technologii i informace, nedochází ke konvergenci, kterou předvídají některé teoretické modely, a informační asymetrie zůstává významným faktorem v ekonomice.

Poslední esej propojuje teorii Stiglitze a Greenwalda o přidělování kreditu s novými českými daty z let 2008-2009. Data potvrzují, že dochází ke zvýšenému omezení úvěrů (credit rationing), zvyšují se informační asymetrie a transmisní mechanismus nefunguje dobře během hospodářského poklesu. Docházím k závěru, že české banky zpřísňují prověřování klientů a přidělování kreditu, což vede k nejednoznačnému vývoji úrokové míry. Současná česká data potvrzují Stiglitz-Greenwaldovu měnovou teorii.

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To all my teachers and classmates¹

1 Specifically, I would like to thank professor Milan Sojka who passed away only a few months before this thesis was submitted. The author regrets that he could not work with professor Sojka on a doctoral dissertation. Professor Sojka was the most capable Czech in any area of Keynesian economics and history of economic thought in general

1. General Introduction

My starting point is that we live in an inherently imperfect world. The concept of perfect competition, perfect information is almost useless, the equilibrium concept is very much limited and the information asymmetry causes significant limitations for classical economic theory. The fact that human beings are not rationally calculating machines assessing all available information is important to understand. It has become obvious that not only consumers of economics but economists as well have become dissatisfied with the recent state of the science².

In the work, I will assess the contribution of Joseph Stiglitz to the economic theory. Stiglitz won the Nobel Prize for Economics in 2001, together with George A. Akerlof and A. Michael Spence, for his research on information asymmetry. Besides his academic research, he was involved in the President Bill Clinton administration as a member and later Chairman of the Council of Economic Advisors (CEA)³. However, he is critical to the results of 1990s; even though he appreciates economic successes of the Clinton administration such as reduction of the US budget deficit, robust non-inflationary economic growth, low unemployment, strong investment, or economic stability, he grades the administration harshly⁴. I am interested in his work mainly because he tries to develop an economic theory that is closer to reality⁵. Over time, it has become clear that neoclassical theory of market must be supplemented or even substituted with some more

2 However, I am persuaded that economics is not science in the Karl Popper's sense. I believe that economics is a social science and as such, it should be focused primarily on society and individuals rather than on attempts to create mathematically coherent but unrealistic modelling.

3 The Council of Economic Advisers (CEA) is a group of economists set up to advise the President of the United States. It is a part of the Executive Office of the President of the United States, and provides much of the economic policy of the White House. The Council's three members are nominated by the President and approved by the Senate (<http://www.whitehouse.gov/cea/>, downloaded 7th July 2007).

4 The critique comes especially due to the "deregulation mantra" – as he calls administration attempts to reduce the role of the state in certain economic areas.

5 To mark Stiglitz's 60th birthday in 2003 a group of his teachers, students and co-authors wrote essays in his honour. The outcome was named "Joseph Stiglitz and the economics for an imperfect world". Indeed, Stiglitz knows that the world is not perfect, neither are human beings. .

realistic theory. The key assumption is that market is not perfect; everything else is included, Stiglitz says.

Studying economics is to a certain extent unsatisfactory. Mainstream economics accepts value judgments, the so-called Paretian⁶ judgment. Many economists believe they are scientists like mathematicians or physicians. However, one definition of science says that science is supposed to be objective. It is then difficult to be scientific when the subject matter, the individual decision-maker, lacks objectivity. Karl Popper believed in the unity of methods⁷, he believed that the study of natural phenomena also apply to the study of social events⁸. Economics is not like physics, even though many mathematical economists would like it to be so. Still prevailing paradigm⁹ (that market at least in the longer run tends towards equilibrium) cannot explain many economic problems¹⁰. Moreover, most of economic models are to a large extent simplified and most of modern economics is prepared for developed economies only. Even though authors usually mention this simplification at the beginning of their work, later they neglect it. Economics have become applied mathematics: derivations, integrations, optimisation, utility maximisation, rationally behaving consumer form the core of modern economics. Human being has often been forgotten.

I am aware of the limitation of perfect competition and I believe that most of economists are aware of these limitations as well. This work however, puts emphasis on one the strongest microeconomic assumptions: symmetry of information. There are factors in the system we will never be able to understand, some information is inherently private, some information is purely subjective¹¹. Information asymmetry is what economists call market imperfections. The model of asymmetric information has far-reaching

6 Named after economist Vifredo Pareto

7 Popper (157, p.130)

8 Soros (1994, p.11)

9 Namely in the financial economics

10 The author is persuaded that the recent financial crisis, which started in 2007, can not be explained using standard economic thinking based on equilibrium.

11 The God's presence, for example. The existence of God cannot be proofed nor neglected. That means that the existence of God is subjective information.

consequences not only for the financial market but for the real economy as well¹². Economic theories do matter. Policies, politics, and decision-makers are guided by economic theories, especially when there is a lack of evidence.

1.1. Structure of the work

The thesis is constructed as follows. It contains three essays related to the work of economist Joseph Stiglitz. The first essay describes the contribution of Stiglitz to economic theory by analysing problems of information asymmetry, new Keynesian and institutional economics, rationality, and market theories. Shortcomings of neoclassical economics are described and possible solutions are outlined. The last part of this is essay summarizes the main critique to Stiglitz.

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¹² The simple example is the recent crisis. Starting as purely financial crisis, the development starkly hit the real economy very soon.

2. Life and Work of Joseph Stiglitz

2.1. Joseph Stiglitz

Joseph Stiglitz is a well-known economist, author of several books and papers concerning economic policy¹³. Among the most important is a book on public finance “Economics of the Public Sector”, in which he clarifies the principles of the functioning of a correctly managed and cautious state¹⁴. Stiglitz is aware of the importance of markets in the economy, he says that “[t]he market has been an enormous success. It has brought prosperity beyond the wildest dreams. It has put the middle class at the centre of our societies. But it has not, as some claim, ended redistributive politics.”¹⁵ To put it simple, Stiglitz opposes neoliberal economic policies of fast unregulated privatisation, or unfettered deregulation.

His critiques – mostly laissez-faire economist – disagree with him mostly because Stiglitz emphasizes the role of government in society. Stiglitz opposes social engineering but he argues that leaving certain decisions upon individual decision-makers would lead to a kind of society that would be unacceptable to most of population¹⁶. Stiglitz criticizes conservative policies of low taxes and the attempts to decrease the welfare state¹⁷. As a result, he says¹⁸, the US and others following its example are becoming rich countries with poor people. Stiglitz have always preferred he Scandinavian socio-economic model to the US model. He notes:¹⁹

[o]f course, government, like the private sector, must strive for efficiency. But investment in education and research, together with a strong safety net, can lead to a more productive and competitive economy, with more security and higher living standards for

¹³ At the date of submission of the thesis (June 2009), Stiglitz was the highest ranked economist in the world in RePEc. See <http://ideas.repec.org/top/top.person.all.html>

¹⁴ Martincova (2003, p.24)

¹⁵ Stiglitz (2003, p.317)

¹⁶ See 3 Pareto assumptions

¹⁷ Welfare state

¹⁸ Stiglitz (2006a, p.1)

¹⁹ Stiglitz (2006a, p. 2)

all. A strong safety net and economy, close to full employment provides a conducive environment for all stakeholders – workers, investors, and entrepreneurs – to engage the risk-taking that new investments require.

Stiglitz's views are grounded in his personal experience. He came of age in the 1960s and he strongly believes in civil rights and equal opportunity – and that government can be the solution rather than the cause of social and economic problems²⁰. Stiglitz studied at Amherst College, and then he went to the Massachusetts Institute of Technology (MIT), where he studied for his PhD from 1966-1967. Between 1969 and 1970 he was a Fulbright research fellow at the University of Cambridge. Later he held professorship at Yale, Stanford, Oxford, and Princeton. Stiglitz is from 2001 a Professor at Columbia University. Stiglitz's academic life has been fulfilled with outstanding economists. During his studies in Amherst, MIT, and Cambridge, Stiglitz was taught by outstanding lecturers, including at least four winners of the Nobel Prize: Paul Samuelson, Robert Solow, Franco Modigliani, and Kenneth Arrow – Stiglitz's teacher at MIT who "opened him, in many ways, the field of information economics"²¹. Later on, Stiglitz was influenced by Nicholas Kaldor, Joan Robinson, and Frank Hahn. Even after leaving the MIT he was long known as the best critical reviewer of Paul Samuelson's articles.²²

2.2. Stiglitz's contribution to the economic theory

Stiglitz influenced the whole bundle of economic disciples. It is impossible to cover all areas of Stiglitz's interest. Apart from information asymmetry – for which he was awarded the Nobel Prize – we can mention (international) macroeconomics, public finance, development economics – including several works about the transition Eastern Europe. Arguably, Stiglitz's most important contribution to economic theory is his research on information asymmetry. He focuses on screening, a technique used by one economic agent to extract otherwise private information from another. His critique of neoclassical economics opposes the assumption of perfectly efficient markets, rational and fully informed consumer, and immediate market-clearing process. With Bruce Greenwald they showed that "whenever markets are incomplete and/or information is imperfect (which is

²⁰ Eichengreen (2004, p.3). Barry Eichenreen is a professor at the University of California, Berkeley.

²¹ Stiglitz (2003, p.xxxiv)

²² Martincova (2003, p.24)

virtually in all economies), even competitive market allocation is not constrained Pareto efficient.”²³

For microeconomics, there are important topics of adverse selection, signalisation, and screening. If we accept the assumption of asymmetric information, several questions arise. One of the issues is the role of price in the economy. The assumption of perfect competition says that the price reflects all information on the market. If we start to implement the concept of information asymmetry, the price does not have to play this role anymore and it is difficult to work with the price in economic models. So far, information asymmetry was applied to problems that include labour markets, credit problems, understanding business cycles, and monetary economics among other issues.

For Stiglitz, the problem lies on finding an appropriate balance between markets and government²⁴. Stiglitz as a collectivist economist emphasises the collective action. For example, he argues that the international community, through institutions like the World Bank²⁵, has a collective responsibility for the creation of one global public good – knowledge for development. Hage (2000) notes²⁶ that in Stiglitz’s book *Whither Socialism* (1996), Stiglitz mathematically and formally demonstrates the potential efficiency-enhancing properties of the state based on the Greenwald-Stiglitz theorems (by establishing) the constrained Pareto efficiency of market economies with imperfect information and incomplete markets. Stiglitz hopes to²⁷, and works to find solutions which would be guided by this new set of mathematical theorems, which replace the old

²³ Greenwald and Stiglitz (1986)

²⁴ See Stiglitz (1996, p.267)

²⁵ However, he is critical to these institutions. His critique of globalisation, or international institutions such as the World Bank or the IMF can be found for example in his book *Globalisation and Its Discontents*

²⁶ Hage (2000)

²⁷ Joseph Stiglitz has criticized the Lange-Lerner theorem for replicating many of the alleged errors of neoclassical economics. He suggests that because of economic problems resulting from costs of information and missing markets, market economies solve problems in a manner different from that described by the neoclassical analysis. Therefore, according to Stiglitz, the Lange-Lerner Model is a poor description of how the price mechanism will work in a socialist economy to the same extent that neoclassical economics is a poor description of market capitalism

theorems of Arrow²⁸-Debreu²⁹ and Lange³⁰-Lerner³¹. Together with Karl Shells, he pointed to the fact that in the future, still growing markets will generally be exposed to an unstable dynamics. Stiglitz argues that markets are efficient and stable only under very strict conditions. He even writes that:

[O]ne of the great intellectual achievements of the mid-twentieth century (by Gerard Debreu of the University of California at Berkeley and Kenneth Arrow of Stanford, both of whom received Nobel Prizes for this achievement) was to establish the conditions under which Adam Smith's "invisible hand" worked. These included a large number of unrealistic conditions, such as that information was either perfect, or at least not affected by anything going on in the economy, and that whatever information anybody had, others had the same information; that competition; and that anyone could buy insurance against any possible risk.³²

2.3. Rationality and markets

„Successful capitalist institutions are well based in the developed countries and there is the temptation to take them for granted even when thinking about transition of developing countries where those institutions are missing. The policy of liberalisation, stabilisation, and privatisation, that is not supported with sufficient institutional framework does not have to be successful “

G. Roland

²⁸ Kenneth Arrow won the Nobel Memorial Prize in Economics with John Hicks in 1972. He contributed to the neo-classical economic theory. His most significant works are his contributions to social choice theory, notably "Arrow's impossibility theorem", and his work on general equilibrium analysis. He has also provided foundational work in many other areas of economics, including endogenous growth theory and the economics of information.

²⁹ Gérard Debreu was a French-born economist and mathematician, a professor of economics at the University of California, Berkeley, where he began work in 1962, he won the 1983 Nobel Memorial Prize in Economics. In 1954, he published a breakthrough paper titled *Existence of an Equilibrium for a Competitive Economy* (together with Kenneth Arrow), in which they provided a definitive mathematical proof of the existence of general equilibrium, using topological rather than calculus methods.

³⁰ Oskar Lange was a Polish economist and diplomat. Despite being an ardent socialist, Lange deplored the Marxian labour theory of value, being very much a believer in the Neoclassical theory of price. In the history of economics, he is probably best known for his work *On the Economic Theory of Socialism* published in 1936, where he famously put Marxian and Neoclassical economics together.

³¹ Abba Lerner contributed to the Lange Model. While living in the US, he was an intellectual opponent of Milton Friedman

³² Stiglitz (2003, p.13). In the book, Stiglitz does not criticize Adam Smith himself but rather neoliberals who simplified Smith's work into the blind belief in unfettered markets. Smith himself was much more aware of the limitations of the market.

The problem of rationality is not a subject of this thesis³³, however it is closely linked with Stiglitzian economics. It is because sometimes we do not behave rationally³⁴ which has an effect on the economy as a whole.

Market is an institution. This is a crucial point because institutions form society and influence the overall economic and societal performance. Institutions matter and what also matters is that they are different. A market as an institution in the Czech Republic is clearly different from the market in the UK not only because there are different types of players but mostly because these players follow different rules, both formal and informal. And even if we could apply all formal rules, legislation, legal enforcement we would not get the same result of market players' behaviour. Informal institutions and rules explain this. They are not written in any Codex or Act; however, people follow them in tradition. In fact, this is the core concept of modern social sciences – path dependency. Any studies of business and economic behaviour must take this into account. However, neoclassical price theory does not. Snehota³⁵ writes:

More recently, research on business strategy has focused on various aspects of market behaviour and generated a number of observations that are difficult to link to the economist's conception of market as a price mechanism.

Behavioural economists like Khaneman and Tuerski (1980) argue that people are intelligent but they are not rational. The approach towards individual behaviour can be of different types. The first type is cost-benefit analysis (CBA) where players maximise the following equation

$$(1) \quad V_i = \theta R_i - C_i,$$

³³ My colleague at the Charles University in Prague Vit Horak wrote a nice master thesis: *Rationality of Human Action and Preferences: A Criticism of Subjectivist-Teleological Tenets of Economics and an Outline of a Remedy*. He clears up the notion of rationality, shows the possibilities of its meaning, and points out at the radicalism of any assumed causality it may encompass. Horak uses the critical conclusions to outline a preference framework that would not repeat the identified mistakes, which would, however, set out from the subjectivist-teleological perspective as well.

³⁴ As an example might serve Coca-Cola. Everyone buys it but it is not because it would taste better than other soft drinks but because it is supposed to taste better.

³⁵ Snehota (1990, p.20)

where V_i is net benefit of a decision, θ is probability of success, R_i is gross benefits and C_i is cost.

Another approach to the individual decision-making process is the opportunity cost concept. If we want to go to a cinema, not only we pay for the ticket, but we also implicitly lose 2 hours of our time. Third approach is called “mental accounting” and is based on the principle that an individual evaluates gains and losses separately. Moreover, losses have a greater impact. For marketing purposes, firms try to integrate consumer’s losses and segregate their gains³⁶. Fourth approach to individual decision-making is the concept of anchoring. An individual usually starts doing mental accounting from a fixed point (‘anchor’) which is usually the status quo. People also value the fairness of companies. Finally, there is one important notion that comes from the game theory and is no so simple to understand. There are many situations in which individual rationality can lead to undesirable outcomes for the group (society)³⁷. The conclusion is that we cannot count on an outcome being optimal given the decentralised decisions of self-interested individuals³⁸. Stiglitz understands that and based on this he is in favour of a bigger role of the government in the society.

2.4. Institutional economics³⁹

Stiglitz’s economic views stand between institutional and new Keynesian economics. Therefore, it is justified to describe both economic schools in more detail. The World Bank (2002) defines institutions as the rules of the economic game. These include both formal rules and informal norms. As institutions “place restrictions on undesired kinds of individual behaviour” (Roland 2001a, pp. 37), they will reduce uncertainty.

³⁶ Many people tend to prefer more small gains than one big gain.

³⁷ See for example R. Gibbons: *Game Theory for Applied Economists*, Princeton University Press, 1992.

³⁸ On the other hand, this conclusion lies on the ground that we have the right definition of rationality.

³⁹ The term “institutional economics” was announced by Walton Hamilton at a meeting of the American Economic Association in 1918 (Hamilton, 1919). He claimed that institutional economics alone could unify economic science by showing how parts of the economic system related to the whole (Hamilton, 1919, pp.309-11). Old institutionalism started off as a reaction against the lack of realism and awareness of historical evolutionary processes in neoclassical economics. It was therefore sharply opposed to neoclassical thought.

Institutions might be solutions to asymmetric information problems as they secure property rights through legal and judicial systems, competition policy, financial systems and political institutions (Matos, 2005). Institutions determine transaction costs, and those subsequently explain economic performance. Adaptively efficient institutions, which “encourage trial and eliminate errors”, enhance economic performance (North, 1997b, p. 4).

Institutionalism is based on the premise that institutions play a vital and relatively independent role in the forming of political, social, or economic behaviour. However, institutional economists do not have a good reputation when trying to reach a consensus about the basic pillars of institutional economics. Miloch (2005, p. 7) even argues that institutionalism lacks a standard textbook. Institutionalism criticizes neoclassical economics for the following reasons:

- static
- abstract-deductive
- without respect to historical time and institutions
- formal, mathematical
- perfect competition
- economic man

For Hamilton (1919, pp. 309-311) the ‘most important’ omission of neoclassic theory was its neglect of ‘the influence exercised over conduct by the scheme of institutions under which one lives’. The original institutional approach understood institutions as a special type of social structure with the potential to change agents, including changes to their preferences. Geoffrey Hodgson (2000, p.318) uses following five propositions of institutional economics, which are based on Hamilton’s approach to institutionalism:

1. Although institutional economists are keen to give their theories practical relevance, institutionalism itself is not defined in terms of any policy proposals.
2. Institutionalism makes extensive use of ideas and data from other disciplines such as psychology, sociology, and anthropology in order to develop a richer analysis of institutions and of human behaviour.
3. Institutions are the key elements of any economy, and thus a major task for economists is to study institutions and the processes of institutional conservation, innovation and change.
4. The economy is an open and evolving system, situated in a natural environment, effected by technological changes, and embedded in a broader set of social, cultural, political, and power relationships.
5. The notion of individual agents as utility-maximising is regarded as inadequate or

erroneous. Institutionalism does not take the individual as given. Individuals are affected by their institutional and cultural situations. Hence, individuals do not simply (intentionally or unintentionally) create institutions.

There is an important disagreement between the old and new school of institutional economics. Both types of institutionalism keep a distance from the assumptions of perfect rationality, perfect foresight and zero transaction costs. However, old institutionalists even dismiss several assumptions that are important for the new institutional economics – those that are common with neoclassical economics. On one hand, new institutional economics emphasises the need for “formalization, institutions created by individuals, spontaneous process, and limited role of the government.” On the other hand, the old institutional economics emphasised “informal techniques, institutions that predetermine individuals, habits and social norms, collective decision-making, and much bigger role of the government in the society.”⁴⁰.

The essential feature of the ‘old’ institutional economics (OIE) is the recognition that, for the purposes of economic analysis, individual purposes and preferences are to some degree socially formed (Hodgson, 2004, p.257). The single most important defining characteristic of the old institutionalism is proposition (5). Among other schools, the new is distinguished from the old institutional economics principally in these terms. Other criteria do not demarcate the old institutionalism so readily (Hodgson, 2000, p. 318). The main feature of OIE is rejection of the ontological and methodological presumptions of classical liberalism; individual is no longer taken as given. OIE proponents argue that mostly one person’s rights are another person’s obligations, i.e. an unavoidable trade-off of rights and duties for different groups or individuals exists. ‘Old institutionalists criticize the performance of markets for the inequities they create in the distribution of income, wealth, and economic opportunity; the exercise of monopoly and other types of economic power; financial manipulation and productive inefficiencies; macroeconomic instability and unemployment; the blocking of technological and instrumental advance; and various forms of “waste” such as competitive salesmanship’⁴¹.

⁴⁰ Rutherford (1996, p.174)

⁴¹ Schmoller (1996, p.130)

The ancestor of OIE - Thorstein Veblen – criticized the concept of ‘rational economic man’ and paying too much attention to the question of equilibrium in "static state". Instead, he puts stress on the processes of economic evolution and technological transformation. Veblen thought individuals act as being influenced by relations of an institutional nature. He emphasized inertia and habit instead of calculating agent of neoclassical theory. Institutions by Veblen⁴² are ‘settled habits of thought common to the generality of men’.⁴³

The significant difference between neoclassical and institutional economics is efficiency. Neoclassical economics is based on allocation efficiency. However, for a long-term growth the adaptive efficiency – the field of institutional economics – is more important (North, 1990, p. 80-81). The core of today’s world economy is to create value for shareholders, for customers, for people. It is the value that matters, not the allocation.

Inefficient allocation of resources due to irrational administrative system largely contributed to the collapse of the centrally planned economy. North (1994, p. 367) argues, “Adaptive efficiency is the result of long-lasting evolution. We do not know how to create adaptive efficiency in a short-run.” North emphasizes adaptive– rather than allocation– efficiency. Efficiency is not a clearly defined concept as it includes the trade-off between rights and responsibilities of various groups and individuals (Peukert, 2001, p. 110-111).

2.4.1. The Washington Consensus

How do institutions matter for the development of the economy? We describe one set of policies that underestimated the role of institutions in the economy. Washington consensus is the set of policies for promoting economic growth that was first prepared for Latin America. Nonetheless, it affected the transition paradigms of the Czech economy. In this particular case, neoclassical theory, associated with Washington consensus faced a theoretical crisis. These paradigms were not suitable for the former command economies, as they did not take into account different historic and institutional differences in transition countries. John Williamson known for his liberal approach to economics firstly presented

⁴² Veblen (1909, p.239)

⁴³http://uk.geocities.com/balihar_sanghera/oniekatynewandoldinstitutional.html (downloaded 03/01/2005)

the Washington Consensus. He admits that the consensus has not brought expected results and argues that “second generation reforms” were needed, involving the strengthening of institutions to allow full advantage to be taken of the first-generation reforms (Williamson, 2002).

It is interesting to note Joseph Stiglitz who was the main critic of Mr. Williamson, sees the biggest problem of the transition in institutional factors too. Stiglitz argues that an underestimation of the institutional framework, especially the capital market, was one of the biggest problems of the transition especially in the Czech Republic and in Russia (Stiglitz, 2002). Stiglitz criticized the assumption that privatisation creates the demand for the market infrastructure on its own (Stiglitz, 2002, pp.163-4).

Washington Consensus did not succeed because it did not involve institutions. “If institutional change is slow, the time horizons for structural adjustment programs need to reflect this. Adjustment that would sustainably improve development prospects simply cannot happen over three or five years — the typical duration of these programs.” (Rodrik and Subramanian, 2003, pp. 34).

2.5. New Keynesian economics

„On of the biggest tricks of neoclassical economics is ... that it takes labour as any other production factor.“⁴⁴

Apart from being an institutionalist, Stiglitz is also considered to be a new Keynesian economist. New Keynesian economics is the school of modern macroeconomics that evolved from the ideas of John Maynard Keynes. New Keynesians responded to the new classical critique of original Keynesianism, which took place in the 1970s. The primary disagreement between new classical and new Keynesian economics is over how quickly wages and prices adjust. New Keynesians believe that market-clearing models cannot explain short-run economic fluctuations, and so advocate models with “sticky” wages and prices⁴⁵. However, new Keynesian economics is a heterogeneous school and its adherents do not necessarily share a single view on economic policy. Some

⁴⁴ Stiglitz (2002)

⁴⁵ Mankiw (2007)

prefer monetary policy (like for example Gregory N.Mankiw⁴⁶), others prefer fiscal policy (Stiglitz). Generally, new Keynesians suggests that recession does not represent the efficient functioning of the market. Key elements of this economic school are sticky prices, menu costs, coordination failures, and efficiency wages, which provide a rationale for governmental intervention⁴⁷. Stiglitz disagrees with laissez faire approach and says that “[b]y and large, the Keynesian medicine has worked; downturns are shorter and shallower, upturns are longer.”⁴⁸ Over last years however, Stiglitz consistently criticizes inflation targeting which is the core of modern new Keynesian economics. He argues:

Inflation in many countries is, for the most part, imported. Raising interest rates won't have much impact on the international price of grains or fuel. So long as developing countries remain integrated into the global economy [...] domestic prices of rice and other grains are bound to rise markedly when international prices do.

*Most importantly, both developing and developed countries need to abandon inflation targeting. The struggle to meet rising food and energy prices is hard enough. The weaker economy and higher unemployment that inflation targeting brings won't have much impact on inflation; it will only make the task of surviving in these conditions more difficult.*⁴⁹

The role of the US Central bank – Federal Reserve is to take into account both the unemployment and the inflation. However, modern central-banking laws give the central bank rather one single target – and that is a stable price level⁵⁰. Because Stiglitz perceives unemployment as a bigger problem than inflation⁵¹, he is not happy with the current development. In the article “Employment, social justice and societal well-being”⁵², he shows that the economic policy based on the neoclassical labour market necessarily leads to the worsening of the position of employees because of long-lasting market failures.

⁴⁶ Gregory N.Mankiw (1958) is American economist who studied the theory of menu costs, rigid prices. Not only for economics students, his blog is very informative: <http://gregmankiw.blogspot.com/>

⁴⁷ *Ibid* (2007)

⁴⁸ Stiglitz (2003, p.198)

⁴⁹ Stiglitz, *The Failure of Inflation Targeting*, Project Syndicate. Available at <http://www.project-syndicate.org/commentary/stiglitz99>

⁵⁰ The exception is the European Central Bank that inherited its two-pillar structure after the German Bundesbank

⁵¹ As many other Keynesians

⁵² *International Labour Review*, Vol. 141 (2002), No 1-2

Stiglitz's vocabulary contains words such as full employment, better working conditions⁵³, stakeholders⁵⁴ rather than only shareholders

2.6. Critique of Joseph Stiglitz

*Joe, as an academic, you are a towering genius. Like your fellow Nobel Prize winner, John Nash, you have a "beautiful mind." As a policymaker, however, you were just a bit less impressive.*⁵⁵

Kenneth Rogoff

Economists in general can be divided according to their view on the role of state in the economy. On one hand, there are scholars who see the market solving almost all economic problems and limit the role of the state to the minimal activities, such as defence, safety, basic schooling (for example Walter E. Williams). On the other hands there are economists who believe in a bigger role of the state.

George Stigler belongs to the first groups of economists. He does not share Stiglitz's approach to the role of the state in the economy. In particular, he criticizes the concept of information asymmetry. Even though Stigler understood the importance of information, he argued that if we take into account the real costs linked with information, the standard assumptions of economics will still hold⁵⁶. For a Czech reader it is interesting to read a critique of Stiglitz by Vaclav Klaus⁵⁷ who follows Stigler's views:

"Professor Stiglitz – as a theoretician – came up with a concept of "asymmetric information" with a new argumentation showing imperfect efficiency of markets. This inefficiency arises from the fact that asymmetric – and therefore imperfect – information affect the market. Therefore, we all (I would say us serious economists) have put this into our standard economic argumentation. I clearly say yes to this. However, something very different is the question whether this automatically means the need for the state intervention. The fact that markets are often inefficient does not automatically lead to a conclusion that it is – as itself – a reason to a greater extension of state intervention. It is also the state (government, bureaucrats) who faces asymmetric – therefore imperfect –

⁵³ Stiglitz

⁵⁴ Not only owners but also employees, suppliers, creditors etc.

⁵⁵ Rogoff (2002)

⁵⁶ Stigler (1961)

⁵⁷ Klaus (2002)

information. This was the critique of socialism and of the central planned economy was for decades based on the principle that the market is the best “information” system.

Economics reveals various market imperfections for centuries. The concept of information asymmetry is one of these and I would not say that it is the most important one. When Stiglitz says that “the basic information framework must be regulated by the state”, it is more or less funny as we have already lived in such a world already. When he wrongly arguments against the theory of information – which is in economics closely linked with another Nobel Prize holder George Stigler of Chicago – Stiglitz does not, according to me, understand some part of Stigler’s theory. When he says that it is impossible “for the firms to collect all possible information”, then he does not understand market. Nobody ever has or can have all information because information is costly. That is why all economic subject must compare costs and benefits of information and find his own equilibrium. And this equilibrium is not at the all-information point but in the “optimal-amount-of-information point. Stigler knows it, Stiglitz doesn’t. And it is silly to think that the state should provide the subject with “overoptimal” information. And partly sad.”

Stiglitz follows John Maynard Keynes, saying that the aim of economic policy is to maintain full employment, he is a Keynesian economist. However, for his expansive fiscal solutions of economic problems, he is often criticized even by his former colleagues. For example Kenneth Rogoff (2002) writes:

Let's look at Stiglitzian prescriptions for helping a distressed emerging market debtor, the ideas you put forth as superior to existing practice. Governments typically come to the IMF for financial assistance when they are having trouble finding buyers for their debt and when the value of their money is falling. The Stiglitzian prescription is to raise the profile of fiscal deficits, that is, to issue more debt and to print more money. You seem to believe that if a distressed government issues more currency, its citizens will suddenly think it more valuable. You seem to believe that when investors are no longer willing to hold a government's debt, all that needs to be done is to increase the supply and it will sell like hot cakes. We at the IMF—no, make that we on the Planet Earth—have considerable experience suggesting otherwise. We earthlings have found that when a country in fiscal distress tries to escape by printing more money, inflation rises, often uncontrollably. Uncontrolled inflation strangles growth, hurting the entire populace but, especially the indigent. The laws of economics may be different in your part of the gamma quadrant, but around here we find that when an almost bankrupt government fails to credibly constrain the time profile of its fiscal deficits, things generally get worse instead of better.

Rogoff (2002) links interestingly Stiglitz with Laffer:

No, instead of Keynes, I would cloak your theories in the mantle of Arthur Laffer and other extreme expositors of 1980s Reagan-style supply-side economics. Laffer believed that if the government would only cut tax rates, people would work harder, and total government revenues would rise. The Stiglitz-Laffer theory of crisis management holds that countries need not worry about expanding deficits, as in so doing, they will increase their debt service capacity more than proportionately.

In his bestseller *The Roaring Nineties* Stiglitz offers a coherent critique of the policies of financial liberalisation pursued by Ronald Reagan, George H.W. Bush and Bill Clinton. He argues that the Clinton administration placed too much faith in the markets. Of course Stiglitz's perspective contrasts with many members of the Clinton administration. One of them is Robert Rubin⁵⁸. Rubin as the Secretary of the Treasury made tremendous influence on the economic policy in the 1990s. It was Rubin who insisted on deficit reduction and, according to Stiglitz, convinced the President to place his faith in the hands of markets. However, as Eichengreen⁵⁹ notes, Rubin's own memoirs, *In an Uncertain World*, reveal a deep and abiding scepticism of the efficiency of financial markets. Anyway Stiglitz writes⁶⁰:

During the 1990s, with America's economy seeing triumphant, others were tempted to follow its lead. [...]. The U.S. Treasury said, for instance, that others should follow America's lead in corporate governance and accounting. They were correct in advocating good corporate governance and accounting; they were not correct in thinking we have found the right model

Stiglitz's work in the Clinton administration was as well focused on environmental issues, which included serving on the Intergovernmental Panel on Climate Change. He was involved in some legislation work as well.⁶¹ Even though Stiglitz says that he is enormously proud of what President Clinton and his administration accomplished⁶², he remains to be a stark critique of used economic policy. In the preface of *The Roaring Nineties*, Stiglitz writes:

[I]f I seem to grade the administration harshly, it is partly because if the high hopes that we had as we entered early in 1993⁶³.

⁵⁸ Robert Edward Rubin (born August 29, 1938) is an American banker who served as the 70th United States Secretary of the Treasury during both the first and second Clinton Administrations. From January 20, 1993, to January 10, 1995, Robert Rubin served in the White House as Assistant to the President for Economic Policy. In that capacity, he directed the National Economic Council, which Bill Clinton created after winning the presidency. Rubin served as Treasury Secretary from January 10, 1995 to July 2, 1999, succeeding Lloyd Bentsen. Under Rubin's tenure, national deficits turned into surpluses (policy sometimes referred as Rubinomics).

⁵⁹ Eichengreen (2004, p.3)

⁶⁰ Stiglitz (2003, p.xiv)

⁶¹ A law for toxic wastes at which Stiglitz cooperated, was never passed.

⁶² Stiglitz (2003, p.xxix)

⁶³ Stiglitz (2003, p.xxix)

Paul Krugman, a liberal economist, calls 1990s as the success of Robert Rubin and argues that “by decade’s end ‘Rubinomics’ was triumphant,” and that “at the beginning of the new millennium, then, it seemed that the United States was blessed with mature, skilful economic leaders,”⁶⁴. Economic expansion in the 1990s was amazing. It was not only its strength, but mainly the stable, non-inflationary development.

The right question is whom Bill Clinton preferred; Joseph Stiglitz or his “opponents” like Robert Rubin, Lawrence Summers⁶⁵. Obviously in terms of economic policy, the US Treasury has by nature more influence than the Council of Economic Advisors, which serves only as an advisory institution. However, this does not say anything about personal views of President Bill Clinton. On the other hand, in Clinton’s own memoirs⁶⁶, the name Robert Rubin is mentioned on 21 pages, Lawrence Summers on 13 pages, while Joseph Stiglitz is mentioned only once, even though Bill Clinton calls him familiarly “Joe”.

2.7. Concluding remarks

In general, Stiglitz is an institutional economist, he stresses out the role of institutions in modern world. Stiglitz understands that neither countries, nor institutions are the same in contrast to the neoclassical theory. Stiglitz opposes social engineering but he is right in claiming that the policies we adopt today do shape our society. Leaving certain activities absolutely on individuals would lead to a form of society, which is unacceptable for most of people. Stiglitz is right when he emphasizes the need for a collective action in certain issues, the necessary support of the non-governmental sector and other institutions in the broader sense, institutions that do not follow the simple profit-maximisation process⁶⁷. Even though I disagree with some Stiglitz’s statements⁶⁸, I largely value his

⁶⁴ Krugman, 2003, *The Great Unravelling*, pp. xxi-xxii in Pollin 2004, p.3.

⁶⁵ Lawrence "Larry" Summers is an American economist and academic. He is the 1993 recipient of the John Bates Clark Medal for his work in macroeconomics, was Secretary of the Treasury for the last year and a half of the Clinton administration, and served as the 27th President of Harvard University from 2001 to 2006. Stiglitz have always had poor relationship with Summers. In 2000, Summers successfully petitioned for Stiglitz’s removal from the World Bank Chief Economist chair (Mallaby, 2006, p.266)

⁶⁶ Clinton (2005)

⁶⁷ He often cites Herbert Simon of Carnegie Mellon University who was awarded the Nobel Prize for important contributions to the theory of organisational behaviour

contribution to the economic theory. What I consider important, is the stressing of economics as a science about people and their needs. Economics is not only a simple utility-maximisation function subject to a budget constraint.

Joseph Stiglitz simply wants to be heard. However, his arguments are sometimes controversial⁶⁹. He supports Chinese economic system⁷⁰, disagrees with the IMF policy, criticizes the Clinton; this all makes Stiglitz a controversial but influential thinker in today's world. His views on globalisation have many supporters in the anti-globalisation movement. He is critical of both the Clinton administration and the World Bank, both institutions where Stiglitz served and could have changed or at least could have influenced its policymaking.

To a Czech reader, this ambiguity of an economist first responsible for a policy making in 1990s and later becoming a critique of this economic policy, Stiglitz might remind of Tomas Jezek. Jezek was a co-founder of the voucher privatisation, Minister of Privatisation, and later the Chairman of the Fund of National Property. Jezek⁷¹ stood at the roots of Czech privatisation. However, today he criticizes that time political representation and insufficient regulation of the whole privatisation process.⁷²⁷³. Jezek too criticizes insufficient regulation and the economic policy of the Klaus' government in the 1990s. Jezek points at problems linked with Czech voucher privatisation: bad regulation of investment funds, lacking legislation. This is very interesting as both economists come

68 For example, the author does not fully agree with Stiglitz evaluation of Czech privatisation process and with Stiglitz's positive approach to Chinese socio-economic system. Moreover, Stiglitz overly criticizes otherwise relatively successful President Clinton's economic policy

69 For example his critique that the budget reduction went too far while still in 1997 he praised this economic policy.

70 See for example China's New Economic Model (2007). There Stiglitz argues: "The old [Chinese] economic model has been resounding success, producing almost 10% annual growth for 30 years and lifting hundreds of millions of Chinese out of poverty (p.1)

71 We might add that Jezek does not agree with Stiglitz on most of the issues. Speaking about Czech privatization, Jezek even thinks that Stiglitz is "an alien" (personal interview with doc. Jezek). Jezek probably thinks that Stiglitz does not understand problems linked with transformation of formerly command economies as Stiglitz has lived all his life in the US

72 Jezek (2004)

73 With a little irony, we can one more thing that Jezek and Stiglitz have in common. Professor Klaus strongly disagrees with both. For example, Jezek's book Zrození ze zkumavky (2007) – one of the most important books written about the Czech transformation process – was strongly opposed by Klaus

from the opposite part of economic thought. Stiglitz is a Keynesian; on the other hand, Tomas Jezek is a convinced liberal. Stiglitz strongly opposes neoliberal policies, policies of the IMF or the Washington consensus.

Stiglitz speaks about important issues that might not get so much attention without him. For Stiglitz as well as for many others, it is hard to share the conservative view that “poverty is an inherent part of a human fate”⁷⁴. Stiglitz’s views on the fiscal policy are clear. As a Keynesian, he proposes fiscal expansion in economic downturn. “I believe strongly in the importance of investment, especially in new technology, for long term growth,” he says and adds “in the short run, deficits may be absolutely essential for the recovery.”⁷⁵ Interestingly 28 pages later in the same book he writes that “[o]ur growth today should not be at the expense of the well-being of future generations.” This is quite inconsistent, debts have to be repaid and using budget deficit is in fact living at the expense of future generations.

However, new Keynesian economy today has evolved into fiscally conservative policy. While in the US, the Republicans – a conservative party – have shifted towards deficit financing policies and they abandoned the responsibility for maintaining the budget deficit low. In fact, the U.S. under conservative government have today one of the largest deficits ever, and the trend set by the Clinton administration, i.e. balanced or near-balanced budget has been reversed. To put it simple, Democrats are today much more fiscally responsible than the Republicans. Joseph Stiglitz raises important issues; without Stiglitz’s awareness, some of them would not get attention they deserve. Stiglitz is right in promoting collective action, supporting NGOs, cooperative activity, he points at other goals of a firm that simple profit maximisation⁷⁶ and he uses the word stakeholders⁷⁷ rather than shareholders. These are all things that neoclassical economics omits because they do not fit in its framework. Joseph Stiglitz remains to be a controversial and nonconformist thinker. He is worth reading.

⁷⁴ Loužek 2007, p. 8.

⁷⁵ Stiglitz, 2003, p.270

⁷⁶ In this respect, he often cites Herbert Simon of Carnegie Mellon University, who received his Nobel Prize for important contributions to understanding how organisations behave.

⁷⁷ Not only owners, but employees, suppliers, lenders etc. as well

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3. Information asymmetry

3.1. Classical economics

Neoclassical economics is based on certain assumption including well-defined property rights and stable economic environment. Mainstream microeconomics has the following properties (Pareto⁷⁸ judgments)⁷⁹:

1. Each individual is the best judge of his own welfare or utility
2. Society is perceived unorganically, i.e. as a sum of individuals. Therefore the society is formed by individuals only⁸⁰
3. If there is a possibility to reallocate resources leading to the increase of utility of one individual without a decrease of somebody else's utility, it leads to the increase of welfare in the whole society.

For economics for a long time, one of the postulates on which the theory was based was perfect knowledge⁸¹. However, this neoclassical economic analysis cannot explain institutional change. Transition of a centrally planned economy during the transition period full of new deregulation, regulation, new legislation, and cultural change; this is a good example of institutional change where the neoclassical economics does not hold. Post-communist countries have gone through simultaneous, extreme and systemic uncertainty. Such process cannot be compared to anything that the democratic states have undergone in the past. Therefore, standard recipes that worked in developed countries will not work in the transition country. The American economist Armen Alchian⁸² argues that

⁷⁸ Vilfredo Pareto (1848-1923) was an Italian economist, philosopher, and sociologist. He was focused among other things on the analysis of individual decision-making and income distribution

⁷⁹ Following Cullis and Jones (1998, p. 2). The author was lucky enough to be taught by Professor Jones one year at the University of Bath, UK.

⁸⁰ We speak about economic objectivism that allows for the summing up of utilities and costs of various individuals. On the other side stands economic subjectivism that dismisses the option of summing up individual utilities. Most libertarians, Austrian economic school scholars, such as Murray N. Rothbard. He (1979) argues that "the sole concept of social costs and utilities is wrong." Contrary to Rothbard, Jan Sokol (in Fukuyama 2004, p. 124) says: "We can see another weakness of recent social thinking, this simplified perception of a man and the society. Individualistic model of society as a sum of otherwise selfish individuals who behave rationally in their materialistic interest does not by far describe the true human behaviour in the society"

⁸¹ Soros (2008, p.5)

⁸² Armen Alchian (1914) is an American economist who focuses on the property rights theory, transactional costs and he is the founder of new institutional economics

people are not able to solve the economic problem of utility maximisation when they face uncertainty (Alchian, 1965). Douglass North (1994, p. 359)⁸³ starkly criticizes neoclassical economic theory that is focused only on „the fundamental assumption of scarcity, competition, and analytical tools of neoclassical microeconomics“.

3.2.Theories of market

Any object or phenomenon can be observed and approached from different angles, and the different perspectives result in different pictures of the landscape⁸⁴

Using the idea of the preceding quotation we realize why economics is such an unclear science. Wearing different “glasses”, we see different things. Sometimes economists use oversimplifications, sometimes economic models are too much sophisticated. Stiglitz always wanted to bring the theory back to the reality. He tried most of his life to build an economic paradigm that would describe how people actually behave and not how people should behave to achieve perfect market efficiency. Therefore, it is crucial to understand that using different perspectives we yield different conclusions, some features are brought to the forefront, some features are omitted for simplification. Moreover, any model is only a model. It is supposed to be a simplification. The model is not supposed to explain everything; it should help to understand a certain process of behaviour. When engineers are fine-tuning the aerodynamics of a car, they do not need a car that actually works. What they need is a model of a car with approximately the same characteristics as the real, working car. The same is with economic models. The question is not whether the assumptions we make are too simplified but whether we still see, what we want to see and whether the model is suited for the purpose at hand and what guidance it offers. The perspective affects explanation in that it points to features and phenomena that need to be explained. It matters especially when we face complex phenomena (Hayek, 1978).

What is a market? Such a question should be asked by everybody interested in economics, business, marketing, or in general any social science focused on behaviour of

⁸³ Douglas North was awarded together with Robert William Fogel the Nobel Prize in 1993. North focuses on institutional economics and economic history.

⁸⁴ Snehota (1990)

human beings. People using the word market in every day language do not seem to care much about the notion of the market. Market can be approached from different perspectives. As we commonly use the notion market, we should understand what it means.

As Snehota (1990, p. 16) puts it, even though economics is generally credited for the most consistent and complete conception and theory of markets, it is not easy to find a summary statement of the market conception in economics. Douglass North (1977, p.710) observed, “it is a peculiar fact that the literature of economics and economic history contains so little discussion of the central institution that underlies neo-classical economics.” A critique of neoclassical theory says that the theory does not have a proper market theory but rather a theory of price. It is because neoclassical theory sees market as a tool for optimization of individual’s scarce resources, limited budget. Neoclassics proved that the market is the price determination mechanism. Neoclassical perspective of the market sees the product as the parameter of the market while price is a variable. Each product has a different market. Neoclassical microeconomics allows for the testing of the influence of substitutes and complements on the product but does not go much further. Moreover, neoclassical economics emphasizes the price as a tool for revealing information. It is generally accepted among neoclassical economist that price carries the most of (may be all available) information. Therefore, the relationship between buyer and seller is strongly limited to carrying exchange transactions and price signalling (Snehota, 1990, p.17). The principle of screening and signalling is a part of Stiglitz’s contribution to the economic theory. Following the neoclassical assumption of perfectly rational individuals, price – if not distorted by market imperfections – allows the market to clear and reach equilibrium⁸⁵. In general, the relationship between buyer and seller is in

⁸⁵ We speak about Walrasian equilibrium. Together with the Nash equilibrium used in the game theory, they form the two most important equilibriums in modern economics. The equilibrium issue is also controversial. Many economists argue that we have to assume equilibrium; otherwise, we would not be able to predict much in economics. If we relax the perfect competition assumption, than we leave the Walras equilibrium and we have to use the game theory to reach the Nash equilibrium if possible. However, with game theory we are ale to predict much less than in the situation with perfect markets.

neoclassical economics vastly underestimated. These buyer-supplier relationships are crucially important especially for small and medium enterprises⁸⁶.

Neoclassical theory assumes that individuals are rational, perfectly informed, and have rational expectations. Modern microeconomics argues “it does not matter that some individuals are not rational, it is important that significant part of people are rational”. The neoclassical price theory is coherent and strong but the neoclassical market theory is weak. Neoclassical market theory is not supported by empirical observation. This simplified neoclassical perspective has been challenged and criticized many times. Individuals are simply not rationally calculating machines.

Economist Chamberlain⁸⁷ (1933) was one of the first scholars allowing the product to be a variable rather than a parameter of a market. Later on, institutionalists emphasized the importance of rules both formal and informal during a transaction. Game theory allowed for deeper understanding of the difference between one-shot and repetitive (finite and infinite) games (i.e. transactions). It has been observed that many transactions are repeated and additional information apart from price play important role in the relationship between buyer and seller. The real economy is based on networking. People make large transactions with people they predominantly know or about whom they have some reference. It is straightforward that such a relationship reduces costs (transactional) and creates an opportunity for higher flexibility⁸⁸.

Over time, economists (Richardson 1972, Coase 1988, Linderberg and Frey 1993) understood that continuous interactions between market players are the key supplement to price mechanism. Others like Joseph Schumpeter⁸⁹ (1934), Douglass North (1990), or Langois and Robertson (1995) challenged the view that markets are stable or that changes

86 For example, the author of this thesis was doing a research for a possible market entrant – a big supplier of automotive components. During many interviews with distributors of automotive components (garages) on the market, the main reason for not changing a supplier was the garage-supplier relationship. In conclusion, on the market where the quality of good is very important, the players value this relationship much more than price. However, neoclassical economics cannot fully incorporate the value of buyer-supplier relationship in its framework.

*87 Chamberlain, E. H. (1933). *The Theory of Monopolistic Competition*. Cambridge, Mass: Harvard University Press.*

88 For example flexible contract, longer repayment period, liquidity support.

89 The concept of creative destruction is being raised many times during the ongoing financial crisis.

of the market come from the external environment (changes in the production function, changes in preferences) only. In contrast, they argue that changes can come and usually come from inside of the market – so that changes in preferences and changes of production function and technologies emanate mostly within markets not outside them.

3.3.Economics of information

Motto: “[s]ubstantial portions of economic theory would not survive if economic agents could not be assumed to have transitive preferences.”⁹⁰

For understanding Stiglitz’s work it is important to define the basic assumptions of mainstream microeconomics that is being challenged by Stiglitz and to which Stiglitz tries to find an alternative. Stiglitz says:

These standard models made economics a part of technical sciences and all individuals in the economy became engineers. Each individual maximizes utility (firms maximize profit) subject to several assumptions (subject to budget constraint in the environment of perfect information. Modern microeconomics textbooks take into account information asymmetry however, the extent is not sufficient⁹¹.

The following part therefore, shows how modern microeconomics deals with information asymmetry and how it is implemented in the microeconomic general equilibrium. For more than a century economics was focused on models in which the core assumption was the perfect information. The basic hypothesis of modern microeconomics is that individual decision-maker is rational. Rationality in economics has the following properties⁹²:

1. Individual decision-maker is aware of all possible alternatives and does not take into account any alternative that is not for him available⁹³

⁹⁰ Mas-Collel, Whinston, Green (1995, p.7)

⁹¹ See for example Mas-Collel, Whinston, Green 1995, p.709, Chapter 19.F Incomplete Markets. Authors describe not only uncertainty but also asymmetric information without leaving strongly mathematic microeconomics. The description of this approach follows.

⁹² Based on ing. Ivo Koubek’s text

⁹³ Advanced microeconomics, especially game theory is extending this rationality, which might contradict this assumption. For example the Rubinstein’s model in game theory yields the conclusion that: “Changing behaviour that would happen in contingencies that in fact will never arise can change behaviour in contingencies that do happen. Because it changes people’s behaviour in a way that make sure such contingencies never do arise

2. The decision-maker takes into account all information that is available or is worth searching for to estimate the consequences of his decision in each available alternatives
3. Following 1. and 2. the decision-maker ranks the alternatives according to her preference while this rank has certain assumptions (complete, transitive, continuous)
4. The decision-maker chooses the alternative which is the highest in his rank (therefore he prefers this alternative to all other alternatives and their consequences)

The key assumption is however the following⁹⁴:

There is also the so-called apparent irrationality. The costs linked with searching for such information are much higher than expected benefits from possessing such information. Therefore, customary behaviour can be the behaviour how to rationalize time and resources. However, the fact that some decision-makers are behaving irrationally, it is no big obstacle for accepting our hypothesis if in general there is a sufficient number of decision-makers behave rationally.

Information asymmetry, imperfect information and its consequences was the core of Stiglitz's research for more than twenty-five years. The simple outcome of this work can be summarized – as Stiglitz did in his lecture on receiving the Nobel Prize ⁹⁵ – such that information is a public commodity. Therefore, it is improbable that a private market will secure effective allocation of resources when information is an endogenous factor.

Information asymmetry is such a wide topic that it is impossible to cover it in one thesis. Information asymmetries influence our daily life. Appointment at a general physician, reading a newspaper, having a lunch in a restaurant, or investing on the financial markets; these are actions influenced by information asymmetry. Stiglitz (2001, p. 472) believes that information economics represents a fundamental change of economic paradigm.⁹⁶ Economics is nowadays more than ever focused on the seeking the optimal balance between government and market and information plays an important role in this process.

⁹⁴ Based on Koubek (2007)

⁹⁵ Stiglitz (2001b)

⁹⁶ The author of this thesis worked for a global management consulting company. These companies largely benefit from the fact that management of companies does have neither perfect nor complete information about the market. Information is costly and the internet has not changed much on this.

Imperfection stands in stark contrast with perfection. The assumption of perfection is what makes mainstream economics hard to accept by the public. Assumption of perfect markets, perfect information, and full rationality are very far from reality. The key assumption of Stiglitz's economics is that markets are not perfect and everything else follows. Information asymmetries are market imperfections and they lead to market failures. Stiglitz even confronts Adam Smith and his most famous thesis, that free markets lead to effective allocation, as if by invisible hand⁹⁷. Stiglitz says that this thinking leads to a minimalist role of state in society. Professor Mlcoch however, argues that this understanding of Smith⁹⁸ is emanating from the misunderstanding of Smith's work.

Mathematically we can define rationality as follows:

Definition: The preference relation \succsim ⁹⁹ is rational if it possesses the following two properties:

- (i) Completeness: for all $x, y \in X$, we have that $x \succsim y$ or $y \succsim x$ (or both).
- (ii) Transitivity: For all $x, y \in X$, if $x \succsim y$ and $y \succsim z$, then $x \succsim z$.

Therefore, rationality simply assumes that the individual has a well defined preference relation between any two possible alternatives. Stiglitz argues that microeconomics pretends that vast majority of people in general fulfil the above-mentioned assumptions of rationality.

Symmetric information means that all decision-makers possess the same information¹⁰⁰. When we allow for asymmetric information, conceptual problems arise.¹⁰¹ Let us suppose that we have I consumers¹⁰². With given probabilities $\pi_{si} = (\pi_{1i}, \dots, \pi_{Si})$, the

⁹⁷ Smith 1976

⁹⁸ Both of free-marketers and their critiques

⁹⁹ The preference relation \succsim is a binary relation on the set of alternatives X , allowing the comparison of pairs of alternatives $x, y \in X$. We read $x \succsim y$ as "x is at least as good as y".

¹⁰⁰ Another term that modern economics uses to simplify the reality. The substitution of "all" with "all concerned", modern economics avoids the critique of unrealistic assumption of all possessing the same information.

¹⁰¹ Mass-Collell, Whinston, Green 1995, p.716

¹⁰² Each consumer is different and we expect to have positive number of consumers, i.e. $i = 1, \dots, I$.

state $s = 1, \dots, S$ occurs. As soon as the state s occurs, we have one spot market. On this market, the first commodity (good or service) is traded against the second commodity (money – this commodity can be for simplicity normalised to 1). Consumption is a vector $x_i = (x_{1s}, \dots, x_{si}) \in R^{2S}$ and is optimised by the consumer also according to the extended Neumann-Morgenstern utility function:

$$U_i(x_i) = \sum_s \pi_{si} u_{si}(x_{si})^{103}$$

The consumer has got the initial endowment, which is state dependent (dependent on $s = 1, \dots, S$) $\omega_i = (\omega_{1i}, \dots, \omega_{Si}) \in R^{2S}$. Moreover, we assume that the signalisation function $\sigma_i(\cdot)$ associates the real number $\sigma_i(s) \in R$ to each of the states $s \in S$. Let's suppose now that the state s occurs at the beginning of the period. That means that we also suppose that as soon as the state s occurs, the consumer is given the endowment ω_{si} and the signal $\sigma_i(s) \in R$. This in fact means that the consumer is able to distinguish between the two states $s, s' \in R$ only if $\sigma_i(s) \neq \sigma_i(s')$ ¹⁰⁴. After the consumers receive the signal, the spot market opens. In the end of each period, the state of the world is being revealed and consumption takes place.

3.4. Information asymmetry

For the work with the previous assumption under the assumption of perfect information, please see Mass-Collell, Whinston, Green (1995), Chapter 19H. We are more interested in the case where the information is not symmetric. Asymmetric information would mean that the signalisation function $\sigma_i(\cdot)$ is private and are not necessarily the same among the consumers. If the state s occurs, each consumer receives $\sigma_i(s)$ and uses his signalisation function $\sigma_i(\cdot)$ to refresh the probabilities and utility functions. This

¹⁰³ $u_{si}(\cdot)$ represents consumer's Bernoulli utility function i in a state s

¹⁰⁴ Purely mathematically, it is necessary that the endowment vector $\omega_i = (\omega_{1i}, \dots, \omega_{Si}) \in R^{2S}$ is measurable to the signalisation function. That means $\omega_{si} = \omega_{s'i}$ anytime $\sigma_i(s) = \sigma_i(s')$. We can therefore write ω_{si} as $\omega_{\sigma_i(s)i}$. Therefore, the consumer's endowment i does not reveal other information about the state of the world which were not revealed by the signal

defines the spot economy where we can find out the market-clearing spot price¹⁰⁵ for as $p(\sigma_1(s), \dots, \sigma_I(s))$.

We can see that $p(\sigma_1(s), \dots, \sigma_I(s))$ depends on each individual's signal¹⁰⁶. The price function $p(s) = p(\sigma_1(s), \dots, \sigma_I(s))$ does not have to be measurable to individual signalisation functions $\sigma_i(s)$. Hence, two states $s, s' \in R$ are not able to be distinguished by the consumer (i.e. $\sigma_i(s) = \sigma_i(s')$). These two states are – however – able to be distinguished by the market (i.e. $p(\sigma_1(s), \dots, \sigma_I(s)) \neq p(\sigma_1(s'), \dots, \sigma_I(s'))$). Mas-Colell, Whinston, Green (1995, p. 716) mathematically show, that it is rational for the consumers to take into account information revealed by the prices when consumers decide about their consumption on different spot markets¹⁰⁷. Therefore, we can perceive price as public signalisation function¹⁰⁸ and every consumer can combine it with her own private signalisation function. That means that when the state s occurs, the consumer also knows that the situation $E_{p(s), \sigma_i(s)} = \{s'; p(s') = p(s) \& \sigma_i(s') = \sigma_i(s)\}$ occurs. Consumer refreshes his estimates of probabilities of the state $s' \in E_{p(s), \sigma_i(s)}$ to

$$\pi_{s'i} \left| p(s), \sigma_i(s) = \frac{\pi_{s'i}}{\sum_{(s') : s' \in E_{p(s), \sigma_i(s)}} \pi_{s'i}} \right.$$

If the refreshed utility function $p(s)$ clears the market for all s , we say that the price function $p(\cdot)$ is the rational expectations equilibrium price function¹⁰⁹.

¹⁰⁵ Spot price (commodity or stock price) is a price that is quoted for an immediate deal. On the other hand, the forward price is set today, however the delivery occurs in the future.

¹⁰⁶ We say that the market aggregates information of the market participants.

¹⁰⁷ Spot markets

¹⁰⁸ Public signal function

¹⁰⁹ Rational expectations equilibrium price function. For accurate definition, see Mas-Colell, Whinston, Green (1995, p.

3.5.Applications of information asymmetry

Many believed that with the increasing internet penetration, globalised network, where everybody can get any information at any time, there would be a shift towards the assumptions of neoclassical economics. People would be fully informed, they will behave more rationally, they will be aware of all available alternatives. This shift has not happened.

The concept of information asymmetry is also very useful when we study markets. For example, it is interesting to apply the concept of information asymmetry in the centrally planned economy (CPE). In the CPE, the price does not carry about the information as in the market information; the opposite is true. In the CPE, the price is rigid, set by the planning centre and most of all, it does not represent the interaction of demand and supply

There are many other implications emanating as a result of information asymmetry: adverse selection¹¹⁰, signalling¹¹¹, moral hazard¹¹², or screening¹¹³. There is also the problem of information asymmetry after signing or agreeing a contract (the so-called post-contractual behaviour); this opens the principal-agent topic. Information asymmetry can also be the explanation of the so-called home bias arguing that investors prefer to invest in a country that they know (their home country) rather than in a country when the returns might be higher.

110 Adverse selection is the result of information asymmetry between the seller and the buyer. It is for example the bias to get less credible applicants for credit in the banking sector or the bias to get clients that are more vulnerable to indemnity in the insurance sector

111 Signalling is the notion that one side of the contract (agent) reveals meaningful information about himself to the other side of the contract (principal). On the labour market, it was for example economist Michael Spence (1943) who studied the theory signalling. Signalling assumes that the agent is active and reveals the information

112 Moral hazard is the situation when the insured person behaves in a different way than if he had not been insured and would have to pay for the damage/loss on his own

113 Screening is also the strategy how to avoid asymmetric information. The author of this concept is also Michael Spence. There is however the assumption that the less-informed (principal) is active (plays first in the game theory notation)

Information asymmetry forms the basis of Joseph Stiglitz's models. For example in his work *Dividend Taxation and Intertemporal Tax Arbitrage*,¹¹⁴ he – together with Anton Korinek – created a life-cycle theory of a firm which analyses the effects of dividend tax policy on aggregate investment. They prove that that new and young firms have bigger problem with finding capital and therefore they invest less with increasing dividend tax rate – this is intuitive and with a relation to the traditional view on dividend tax policy. However, they prove that for internally growing and matured is the dividend tax policy irrelevant. And because internally growing and matured firms dominate aggregate investments, the dividend tax policy or expected change of this tax rate do not gave significant influence on aggregate investment and output.

3.6. Markets and information asymmetry

Financial markets are the meeting point between the supply and demand for capital (in the form of debt and equity). Moreover, Merton and Bodie (2007) extend the definition and they distinguish 6 functions of financial markets:

- To supply and manage means of payments
- To collect savings for investment
- To transfer economic wealth through time and space
- To offer risk management instruments
- To produce/diffuse information
- To restrict the conflicts caused by asymmetric information

Schmukler (2004) argues:

One of the primary potential benefits of financial globalization is the development of the financial sector, enhancing the provision of funds for productive investment opportunities. Financial globalization helps improve the functioning of the financial system through two main channels: by increasing the availability of funds and by improving the financial infrastructure, which can reduce the problem of asymmetric

¹¹⁴ Korinek, Stiglit (2006). This model is however hardly applicable to the Czech economy. It assumes that the only source of capital for firms are capital markets. In the continental Europe – including Czech economy – it is mostly banking sector that provides firms with capital. The model also assumes that the firm maximises its value $V(M_0)$ which is in the model discounted flow of dividends D_t facing dividend tax rate τ :

$$V(M_0) = \max_{\{D_t, I_t, M_{t+1}\}_{t=0}^{\infty}} E \left\{ \sum_0^{\infty} \beta^t (1 - \tau) D_t \right\}, \text{ where } I_t \text{ is investment and } M_{t+1} \text{ is the money in the period } t+1$$

information. As a consequence, financial globalization decreases adverse selection and moral hazard, thus enhancing the availability of credit.

The neoclassical idea is that financial markets are self-correcting and tend towards equilibrium. However, Solow (2008, p.7) challenges this notion:

There is a two-way connection between the facts and opinions prevailing at any moment in time: on the one hand, participants seek to understand the situation (which includes both facts and opinions); on the other, they seek to influence the situation (which again includes both facts and opinions).

Successful market economies develop because a society created framework conducive for their development. Institutions are vital for a well-working economy¹¹⁵. Douglass North was an elegant exponent of this view; in his analysis of the development of market economies, he points out the importance of supporting institutions to the market. Successful market economies develop because a society created framework conducive for their development. On the contrary, where these supporting institutions are not created nor do function properly, market economy does not evolve.

Information plays a crucial role on the financial markets. When information is imperfect and markets are incomplete¹¹⁶ markets are not constraint to be Pareto-efficient. This is the contradiction to the fundamental theorem of welfare economics says that competitive equilibrium leads to efficient resource-allocation. The current economic crisis started as a microeconomic failure and transformed into a macroeconomic problem. The crisis was to a large extent caused by the information asymmetry. Mismatch between private rewards and social benefits is very much linked with market failures. Moreover, the fact that banks all around the world are unable or rather unwilling to lend money to their clients proves that information asymmetry plays large role in every day life.

Stiglitz (1989, p.197) notes that market failures may be ameliorated by non-market institutions. It is also obvious that capital markets have not functioned well over past few years. They basically did not fulfil their functions mentioned above. Financial markets

¹¹⁵ Douglass North was awarded the Nobel Prize in 1993 "for having renewed research in economic history by applying economic theory and quantitative methods in order to explain economic and institutional change" (source: http://nobelprize.org/nobel_prizes/economics/laureates/1993/index.html, downloaded December 10, 2008).

¹¹⁶ Which means always, as Stiglitz points out (for example during his speech at The Nobel Prize Laureate Meeting at Lindau in August, 2008).

were unable to diversify risk, they produced and diffused wrong information and they did not restrict the conflicts caused by asymmetric information, rather they created the conflicts¹¹⁷.

Soros¹¹⁸ comes with the concept of reflexivity. He argues that market participants can not base their decision on information (knowledge) alone. Participants' perceptions have ways of influencing not only market prices but also the fundamentals that those prices are supposed to reflect. He argues¹¹⁹ that the decision-maker's thinking plays a dual function. On the one hand, they seek to understand their situation (cognitive function). On the other hand, they try to change the situation (participating or manipulative function). The two functions work in opposite directions and, under certain circumstances, they can interfere with each other. This is called the reflexivity.

Another application of information asymmetry is mergers and acquisitions. There are very few successful companies in today's global economy that do not have to grow or change in order to maintain and strengthen their market position. There is an ever-increasing tendency to achieve this growth and change through acquisition. One of the greatest challenges to the acquisition process is the fact that the acquirer and the acquired do not really know enough about each other's business despite the determination to make the acquisition (see Figure 1). We call this information asymmetry and it is one of the reasons acquisitions fail¹²⁰.

117 Another application of the theory of asymmetric information is in Chapter 4.

118 Soros (1994 and 2008)

119 Soros (2008, p.viii)

120 <http://www.aegisgroep.nl/frameset1.htm?stratned.htm~Aegiscontent>

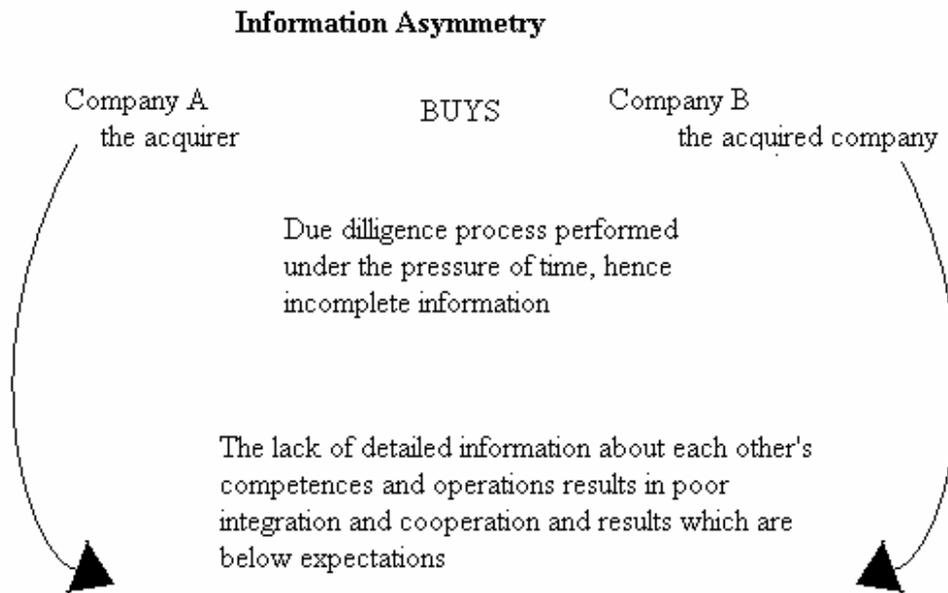


Figure 1: Information asymmetry in Mergers and Acquisitions. Even in specialised institutions such as investment banks, there is no guarantee that there is enough information about the acquired company. That is one of the reasons why many M&As fail. Source: www.aegisgroep.nl

3.7. Information asymmetry and technology¹²¹

In this part, I will try to assess the effects of globalization on the levels of technology and information in different parts of the globe. Current stage of globalisation allows for the transmission of knowledge at a pace never seen before. New technologies, communication channels like the Internet, or cheap travelling allow people and regions to share knowledge, information, and technology. This part asks whether this unprecedented level of development leads to a convergence or a divergence in the technology and information levels. I will emphasize the concept of information asymmetry with respect to disruptive innovation and reverse-engineering. In order to satisfy my research aims, I will firstly describe the current state of globalisation, the New economy, and the effect of increased trade on technology and information levels. Then, I will present some theoretical models: I will analyse the Solow growth model (which forms the basis of any international growth theory), largely used in macroeconomics. The central conclusion of the model is that long-run growth of output per worker depends only on technological and information progress. Therefore, the model links the convergence of the technology and information levels with wealth-creation. Then, I will present alternative views on technology growth including the total factor productivity. I discuss the endogenous growth theories, and the theory of free market. In the second half of this part, I will describe whether convergence in technology and information levels occurs and if it does not occur, then what are the reasons for the divergence. Moreover, I will try to find the link between information, technology, and the level of innovations. Finally, I will discuss the role of multinational companies and government in technology diffusion.

There is a significant role of the multinational companies in technology convergence. The role of government is more limited. We will discuss it as well. The conclusion of this part is that current level of globalisation is affecting the level of technology and information more then ever before. However, we do not see technology and information convergence as predicted by several theoretical models. On the other hand, countries with lower level of technology and information can benefit from the concepts of disruptive innovation or reverse-engineering.

¹²¹ A revised version of the paper submitted at the London School of Economics in January 2009

3.8. *Contemporary globalisation*

First, we should define the current state of the world that we call globalisation. During recent years, we are experiencing already the third wave of globalisation¹²². Hatzichronoglou¹²³ notes that before this period of globalisation there was a period of internationalisation during the 1950s and 1960s, however the complex stage of globalisation corresponds to changes that took off in the 1980s, including deregulation and liberalisation¹²⁴. Globalisation is the closer integration of the countries in the world because of lower transportation and communication costs. Globalisation makes everybody in the world interdependent. It means more than just the freer movement of goods, services, capital, and people but also the freer and faster movement of ideas. Today, in the era of the internet, we can immediately share new technology innovations; we can read scientific articles that lead to technology spill over around different regions.

The economy has changed since 1990. The technological innovation and especially the computer revolution, the Internet had become a part of the world's economy. The so-called New economy, that took place in the 1990s, represents among others just-in-time production, a shift of production of goods to the production of ideas, and technology innovation. In the US, manufacturing had shrunk to 14 percent of total output and even smaller proportion of total employment and there are now four-times less unskilled jobs than in 1950s. Since 1980s, new technologies came up, clustered around technology and new media, as well as around biotechnology and new materials¹²⁵. These new technologies have led to a series of product (computers, CD-ROMs) and process innovations (e.g. the use of information within organisations, Just-in-time production), as well as to the rise of entirely new companies and industries¹²⁶.

¹²² First wave of globalisation took place between 1850-1914. After the post-WWI retreat another wave of globalisation took place between 1945-1980

¹²³ Hatzichronoglou (1999, p.7)

¹²⁴ Apart from these changes that took off in 1980s, the World Bank (2007) mentions other: De-regulation and liberalisation in developed and developing countries, advances in information technology, fall in cost of communications, partial integration of world financial markets, changing relationship between investors and managers, focus on "shareholder value"

¹²⁵ For more, see Rob van Tulder and Gerd Junne, *European Multinationals and Core Technologies* (London, and Sons, 1988)

¹²⁶ Stubbs and Underhill (2000, pp.321-323)

Stiglitz (2003, p.1) argues that historically the whole process of globalisation has been marked by asymmetries. Globalisation is very much linked with increased capital flows. Intuition would say that capital inflow brings about technology inflow and therefore globalisation leads to technology convergence. Theories of “divergent” development, on the contrary, predict that the economy durably divides the world into winner and loser places, where some places would always be appreciably richer than others would

Has the new economy led to convergence or divergence in technology and information levels? Has it led to higher level of innovation? It is certain that the current development opens new ways for the developing countries to close the gap in technology and information levels. New technologies like Internet and cheap travelling and transport reduce boundaries in technology and knowledge spill over. In general, the Internet makes all players on the market more informed. Counter intuitively, it does not mean that it makes individuals better informed¹²⁷. The boom of high-technology industry in the 1990s which was linked with ongoing globalisation produced innovations that profoundly altered an economy’s mix of firms, industries, and jobs (as predicted by Luker, 1997)

3.9. Trade and developing countries

We can see globalisation of goods market, markets with services, and financial markets. In all these markets, players are more demanding, markets are more matured, saturated, more sophisticated. Do we see globalisation of technology and information? Today more than ever before, both the external and internal environment is evolving and therefore it affects the level of technology distribution around the world. That includes the evolution of technology parks, knowledge transmission, or innovation. The advances in information technology allow for easier communication. New technologies allow for better communication between regions, between companies, better expertise sharing¹²⁸. New technology makes it easier to send information across the world at negligible cost. With

¹²⁷ In game theory, we distinguish a perfect-information game (i.e. a game where all players move sequentially and all past actions are observable) and a complete information game (i.e. every player knows the payoffs and strategies available to other players)

¹²⁸ In the past, the problem was not that the company did not have knowledge in the company. The problem sometimes was that the company did not know that they had certain knowledge in the company. Recently employees start putting their knowledge online, they share their professional interests and they allow for information sharing.

the deregulation of the markets and better information technology developed over the last two decades, one would expect the technology and information levels to converge.

The issue of globalisation is very linked with some central questions of macroeconomic theory.¹²⁹ Therefore, we ask: How is the world's technology knowledge distributed around different regions? Trade in general should lead to convergence in technology and information. In 1990s, the age of outsourcing started; firms began to focus on their core competencies by outsourcing certain activities¹³⁰. This largely affected technology and information convergence. Both old and new trade theories¹³¹ conclude that trade improves economic performance. David Ricardo's famous theory of comparative advantage suggests that the bigger the trade the higher level of specialisation. This would suggest – contrary to the first notion – that globalisation would not lead to technology convergence, as regions would become much more specialised in what they produce.

Globalisation can promote technology and innovation. Free trade in general brings about transfer of technologies from one region to another, which leads to higher innovation. With increasing globalisation, the number of joint ventures (JVs) increased. JVs can be an effective type organisation for technology and information sharing¹³². The developing countries regularly ask whether they really benefit from the current way of globalisation, whether they have access to technologies that developed countries have, and if not whether they can succeed without this technology. The unfinished Doha Round of trade negotiation harms regions that could benefit from technology spillovers¹³³.

¹²⁹ Like for example: *Why are some countries poorer than others are? Why is there unemployment? What are the sources of economic growth?*

¹³⁰ See C.K. Prahalad and Garry Hamel, 'The Core Competence of the Corporation', *Harvard Business Review* (May-June 1990): 79-91

¹³¹ Old trade theory is based on the assumption of absolute and comparative advantages, first analysed by Adam Smith and David Ricardo in 18th and 19th centuries. New trade theory is the economic critique of international free trade from the perspective of increasing returns to scale and the network effect. It also takes into account changing technology and imperfect competition.

¹³² Some companies such as China and to some extent India require or required foreign companies to create JVs with domestic companies. One of the reasons was information and technology sharing

¹³³ As of 2008, talks have stalled over a divide on major issues, such as agriculture, industrial tariffs and non-tariff barriers, services, and trade remedies (Fergusson, 2008).

Most of the trade is taking place within regions (EU, US, Asia), and not between the regions. Developing countries even extend great effort to adopt existing technologies, often they have to face several measures from the developed countries or international organisations in terms of intellectual property rights (Trade related property rights, TRIPs). It is also true that many poor countries in the past succeeded to become technological centres of the world (India, South Korea, or regions in China). However, the spillover of technology is not only between countries and regions but also within countries. For example India's Silicon Valley: Bangalore has reached incredible level of technology, while the villages and remote places remain extremely poor and the level of technology there is nonexistent.

3.10. Theory of technology and information

The notion is that knowledge is a public good. That means that marginal costs of somebody else using the knowledge are zero. Ultimately, any restriction of the usage of knowledge (such as Intellectual property rights) introduces inefficiencies in the economy. The ultimate assumption of our theory is that the production of technology and information is very different from the production of normal goods. The technology is very much linked with the technology growth. Robert Solow in 1957¹³⁴ tried to decompose the technological growth and argued that most of economic growth was not related to increases of inputs (labour, capital) but to increases in productivity. This paper was the beginning of the discussion about the sources of economic growth itself. Later in 1962, Kenneth Arrow published a paper about *learning by doing*¹³⁵ simply stating an intuitive but for economics long omitted fact that during a production process one learns. One of the consequences is explicit expenditure to research. Externalities have impact on the technology growth.

Traditional economics has focused on the allocation of inputs amongst sectors, on the barriers of movement of capital, labour, or the distortions of the allocation of capital and labour across sectors and countries. Moreover, standard economics argues that in

¹³⁴ Technical Change and the Aggregate Production Function, Robert M. Solow. *The Review of Economics and Statistics*, Vol. 39, No. 3. (Aug., 1957), pp. 312-320

¹³⁵ Arrow, Kenneth J. (1962). "The Economic Implications of Learning by Doing". *Review of Economic Studies* 29: 155–73

optimum the economy produces on the production possibility frontier; however, this is not always true. Another set of ideas important to technology is linked with the work of Kenneth Arrow and Gerald Debreu proving the conditions under which the competitive equilibrium was Pareto efficient. One of the assumptions was that technology was fixed (i.e. not endogenous). However, the exogeneity of technology is only a theoretical concept. In reality, technology is endogenous which might result into market failures. The starkest conclusion is that when technology is endogenous – which is always the case – market outcomes are in general not efficient. The goal of economic policy is therefore to increase the ability of the economy to learn which would lead to economy that is more productive and it would increase the standard of living. Stiglitz even argues, “creating a learning society should be one of our major objective in economic policy.”¹³⁶

3.10.1. Definition of technology

First, we should define the term technology. According to Kemeny (2008, p.3) technologies are rules and ideas that direct the way goods are created. In the framework of endogenous technology change, technology has three major characteristics¹³⁷ :

1. Technology is non-rival in the sense that the marginal costs for an additional firm or individual to use the technology are negligible.
2. The return to investments towards new technology are partly private and partly public;
3. Technological change is the outcome of activities by private agents who intentionally devote resources towards the invention of new products and processes¹³⁸ .

Technology, information and the process that produces it, research and development (R&D), are typically characterized as homogeneous entities. In reality, the typical industrial technology is composed of three elements: a generic technology base,

¹³⁶ A part of his speech during *The inaugural Kenneth J. Arrow lecture at the Columbia University “Helping Infant Economies Grow: Promoting Innovation and Learning in Developing Countries”*. November, 12th 2008

¹³⁷ *The theory of endogenous technical change views technology as knowledge. It was proposed by Aghion and Howitt (1992), Grossman and Helpman (1991), Romer (1990), and Segerstrom, Anant, and Dinopoulos (1990).*

¹³⁸ Summarized in Keller (2001)

supporting infra-technologies, and proprietary market applications (innovations)¹³⁹. It is crucial for our analysis to define whether technology is a public good. Public goods have two distinct aspects: they are non-rivalrous (one's consumption does not affect consumption of the other) and non-excludable (costs of keeping non-payers from consuming the good is prohibitive). Tasse (2005, p.11) argues that a generic technology base and supporting infra-technologies have public good characteristics, while innovation does not. Stiglitz argues that knowledge is a classical example of public good¹⁴⁰. Thomas Jefferson used the example of a candle: When we take a candle we can light another candle, the first candle still continues to glow¹⁴¹. The light of a candle can thus be transmitted from one person to the next and not diminish and not diminish as it goes on. Romer (1990) emphasises that all types of knowledge share one essential feature: they are nonrival. That is, the use of an item of knowledge, whether it is the Pythagorean Theorem or the soft-drink recipe, in one application makes its use by someone else no more difficult¹⁴². An immediate implication of this fundamental property of knowledge is that production and allocation of knowledge cannot be completely governed by market forces (Romer, 1996, p.112). However, while knowledge might be nonexcludable, technology is excludable: There might be legal constraints (patents, TRIPs¹⁴³) that create significant legal constraints to the technology usage. Therefore, technology is not a pure public good.

There are also large externalities associated with technology and information¹⁴⁴. New technologies, new information create significant positive externalities to the while business and economy. Direct international learning about a new technology means that a blueprint is known not only to a firm in the country where the blueprint was first developed (or firms, if there are domestic spillovers), it also becomes known to firms in other countries. Such learning involves a positive externality—hence: spillover--if the

139 Tasse (2005, p.10)

140 For example Stiglitz (2003, p.3)

141 Stiglitz (2003, p.3)

142 On the other hand, conventional private economic goods are rival. If someone consumes it, he affects the consumption of somebody else.

143 Trade related property rights

144 Whenever there are externalities, or public good, market outcomes will not be efficient.

technological knowledge is obtained at less than the original cost to the inventor.¹⁴⁵ Therefore, Stiglitz (2003, p.7) believes that the government should support the creation and adoption of new technologies. As Kemeny (2008, p.4) orthodox economic models assume technology to be "universally and freely available" even though they are in reality not. Keller (2001, p.5) concludes that technology is partially private, partially public goods. That implies that while there is a force that might be strong enough to sustain the private incentive to innovate (the private return, which is often a temporary monopoly), technological investments may also create benefits to firms and individuals external to the inventor by adding to their knowledge base (the public return). These benefits are usually called knowledge spillovers.

3.10.2. The Solow model¹⁴⁶

In the 1950s and 1960s it was thought that it is capital that developing countries lack to catch up with developed countries. However, it is more recognised nowadays that what separates developed from less developed countries is also a gap both in knowledge and in technology.¹⁴⁷ Developing countries realised soon that it is not only capital that they lack to catch up with the developed world. In 1956, Prime Minister Jawaharlal Nehru addressed fellow citizens at the site of the first Indian Institute of Technology (IIT) by suggesting "...here...stands this fine monument of India, IIT, today representing India's urges, India's future in the making." (Kemeny, 2008, p.1). Therefore, what is needed in order to make less developed countries into more developed countries was to transfer technology¹⁴⁸.

The Solow growth is the starting point for almost all analyses of growth. The principal conclusion of the Solow model is that the accumulation of physical capital can not account for either the vast growth over time in output per person or the vast geographic

¹⁴⁵ Keller (2001, p.6)

¹⁴⁶ The Solow model is sometimes called the Solow-Swan model. It was developed by Robert Solow (1956) and T.W. Swan (1956). Mathematically is described in the annex.

¹⁴⁷ Stiglitz (2003, p.2)

¹⁴⁸ Stiglitz (2003, p.2)

differences in output per person¹⁴⁹. However, the Solow model treats potential sources of real incomes as exogenous and thus not explained by the model or absent altogether. Therefore neither technological progress nor externalities¹⁵⁰ (positive or negative) from innovation or from globalisation are captured by the Solow model.

The Solow growth model can help us to explain the differences in output per worker via the differences in the effectiveness of labour¹⁵¹. The overall conclusion of is that only differences in the effectiveness of labour (A) have any reasonable hope for accounting for the vast differences in wealth across time and space¹⁵². However for the Solow model, the effectiveness of labour (technology, A) is exogenous. Therefore to understand cross-country differences in real incomes, one would have to explain why firms in some countries have access to more knowledge than firms in other countries, and why greater knowledge is not rapidly transferred to poorer countries¹⁵³. The conclusion of the Solow model is in the long run the growth of output per worker depends only on technological progress¹⁵⁴. However, the Solow model assumes that new technology is instantaneously available to everyone (Kemeny, 2008, p.3). Developing countries lack capital and one unit of capital brings them higher growth than to developed countries and in the long run there is convergence of GDP growth per capita though this converge does not necessarily lead to the same GDP per capita in developed and developing countries.

The Solow model can conclude that the income differences can arise because some countries are not yet employing the best available technologies. Whether these differences

¹⁴⁹ Romer (1996)

¹⁵⁰ An externality is an effect of a purchase or use decision by one set of parties on others who did not have a choice and whose interests were not taken into account. An example of a negative externality from free trade: Countries that have preferential access to the European market (for example former colonies) might benefit from technology spillovers. When free trade is achieved, all countries have the same access and those countries are losing their advantage. Example of a positive externality: Silicon Valley. Knowledge spillovers lead to higher level of innovation.

¹⁵¹ Generally, the Solow model identifies two possible sources of variation – either over time or across the world – in output per worker: differences in capital per worker (K/L) and differences the effectiveness of labour (A).

¹⁵² Romer (1996, p.23)

¹⁵³ There are other interpretations of A: the education and skills of labour force, the strengths of property rights, the quality of infrastructure, and cultural attitudes towards entrepreneurship (Romer, 1996, p.25).

¹⁵⁴ However, short-run growth can result from either technological progress or capital accumulation (Romer, 1996, p.27).

shrink over time affects the convergence of output per worker. Empirics suggests that initial income is not so important and that the capital is not flowing rapidly from developed to developing countries as Lucas (1990) proves. However over past 20 years, there was significant decrease in the so called home bias (the fact that investors preferred to invest in their home country even though abroad they might achieve higher returns) and the flow of capital to developing countries has increased. Young (1994) uses detailed growth accounting to argue that the unusually rapid growth of Hong Kong, Singapore, South Korea, and Taiwan over the past three decades is almost entirely due to rising investment, increasing labour-force participation, and improving labour knowledge (education), and not to rapid technological progress and other forces affecting the Solow residual. On the other hand, South Korea has become a major producer in high-technology and electronics and its innovations come from there as well.

The Solow model cannot account for why some economies remain more productive than others do. Stiglitz (1989, p. 197) argued that the predictions of the standard neoclassical growth model, of a convergence of growth rates in per capita income, with permanent differences in per capita consumption being explained by differences in savings rate and reproduction rates, do not seem to have been borne out¹⁵⁵. Technology and information is important in income levels across regions. The accumulation of capital cannot explain all of the cross-regional income differences. Keller (2001, p.7) suggests that the higher is the relative importance of non-codified knowledge, the more are technology creation and diffusion geographically centralized. It is natural to extend the Solow model and to model the growth of technology (A) rather than to take it as given. Endogenous growth theorists propose general equilibrium models in which technological inputs, such as human capital and research and development (R&D) drive an economy's overall growth rate. The extent of this essay does not allow for full description of the model¹⁵⁶. They are called endogenous because they explain economic growth from within the model. Mankiw (1995) and Parente and Prescott (2000) think of technological

¹⁵⁵ However, I believe that the main difference of the divergence is the production function $F(K)$ of particular countries rather than only savings rate and population growth

¹⁵⁶ For full description of the R&D model see Romer (1996)

knowledge as a global pool of knowledge, available to firms and individuals in all countries.

The issue of technology convergence is also very important for the free trade talks. If technology convergence will not be achieved after the liberalisation of trade, then there will be significant winners and losers of trade liberalisation. The liberal perspective praise free market and the invisible hand ensuring efficiency and equitable distribution of goods. As Woods (2005, p.332) notes, the optimal role of governments and institutions is to provide the smooth and relatively unfettered operation of markets. In contrary to the liberal theory stands mercantilism. According to mercantilists, the world trade is about competition among states, which try to maximize their power and position in the global market; the welfare of the state is being maximized through self-sufficiency. Trade quotas, subsidies, and tariffs are the basis of mercantilist economic policies. Main assumption of neoclassic theory is that free trade benefits all. International economics theory (e.g., Krugman and Obstfeld 2003) often stresses that the ‘winners’ from trade liberalization outweigh the ‘losers’. Theoretically, freer technology usage could yield a lot for the poor in developing countries. A substantial liberalisation of technology diffusion can lead to:

- better allocation of resources,
- higher incomes
- increased purchasing power in developing countries and globally
- help developing countries escape poverty.

3.10.3. Total factor productivity

Total factor productivity (TFP) is a variable which accounts for effects in total output not caused by inputs. For example, a production with a certain type of technology or information might tend to have higher output, because workers are used to this type of technology. Variables like technology or local habits do not directly relate to unit inputs, so technology might be considered a total factor productivity variable. We do have indications that countries vary in their total factor productivity (TFP), and that these differences are related to economic growth (Prescott 1997). However, there is no agreed upon way of evaluating technology’s contribution to TFP (Prescott 1997). Kemeny (2008, p.8) argues that the total factor productivity remains exogenously determined black box. Most observers consider that accounts for some significant proportion of TFP, but we lack

an accepted method for decomposing TFP, or even an accepted theory of its constituents (Prescott 1997). Keller (2001, p.6) argues that if technological knowledge is global and countries differ in their resistance to adopt it, then total factor productivity is country-specific, and bilateral or spatial characteristics should play no role for the distribution of technological knowledge in the world. For information asymmetry these are important notions.

3.11. Contemporary evidence on convergence¹⁵⁷

Countries and regions differ in the level of innovation. The question is how to measure it. There are similar problems as when we wanted to measure technology. Kemeny (2008, p.3) argues that to measure only R&D expenditures is not accurate as we would miss innovative efforts when imitating and adapting products and services which in turn reduce the innovation effort in developed countries (Jovanovic 1995).

The most used variable that compares convergence between regions is GDP per capita (income per capita). The biggest problem of income per capita is that it does not and cannot capture all consequences. It is not able to capture environmental damages, unethical behaviour, usage of child labour, or bad working conditions. Moreover, it is not able to capture the level of technology and information used in the production process. Kemeny (2008, p.2) notes that as technology is latent in the economy, embodied in products and services, it is very hard to measure it and therefore it is very difficult to measure technology gaps or information asymmetry between regions. Kemeny argues (2008, p.3) that country's technology positions are relatively stable over time and that most countries did not leap from one level to another.

Moreover, it is no longer true that the most advanced technology is in the US and Western Europe. For example, South Korea, Japan, or Singapore have much more developed cell phones use. One of the central ideas that have emerged in the last 10 years has been that successful development requires not only closing the gap in resources

¹⁵⁷ In part, the current wave globalization can be compared to the Atlantic economy at the end of 19th century. About 85% of the factor price differences between many regions of Europe and the Americas were wiped out between 1870-1914 (Source: Professor Storper's lectures at the London School of Economics). However this model has different prediction about convergence. The econometric evidence shows that the majority (60%) of the convergence was due to labour migration, and a smaller proportion was due to trade (25%), and the rest due to residual factors,

between the developed and less developed countries but also closing the gap in technology, in knowledge¹⁵⁸. Strong diffusion of technology is a force towards convergence, because it equalizes differences in technology across countries. Conversely, the absence of international technology diffusion favours divergence¹⁵⁹. Developing countries spend relatively less on R&D. Therefore, they rely even more on foreign sources of productivity growth than developed countries.

The level of innovation is generally dependent on three factors: Technology competition, flexibility, and the public sector. In the 1990s, the technology competition involved technological innovation and led to the so called IT revolution. Moreover, the 1990s was a decade of smooth advances in technology as the large decrease in prices of microchips allowed the computers to become really personal. Flexibility involves technology competition on the goods and services market, flexible labour market, easy access to capital sources. As technology has the partially public/private good characteristics it affects innovation through the channel of externality. Keller (2001, p.5) uses an example that the design of a new product might speed up the invention of a competing product, because the second inventor can learn from the first by carefully studying the product, or even the production design.

The technology and information is unequally distributed across the globe in its use and its creation both affecting the global division of labour.¹⁶⁰ The unequal distribution of technology does not necessarily mean that the world is worse off. One of the advantages of the unequal technology and information levels is the concept of disruptive innovations. The developing countries are considered imitators of products and technologies from the developed world. They can find new ways of efficiency, cost-cutting, and innovation. Therefore, it is not true what Kemeny (2008) tries to suggest that it is only the developed countries that pursue innovations. It is not always necessary to possess the highest available technology to become successful. The concept of disruptive innovation stresses the importance of different technology and information levels. Countries with lower

158 Stiglitz (2003, p.2)

159 Keller (2001, p.2)

160 Professor Storper lecture notes (Storper, 2008)

technology and information levels want to reach the same standard of living. Therefore, they use the technology they have available and find new ways of efficiency, cost-cutting, and innovation¹⁶¹. It might also be possible to acquire the technological knowledge embodied in an intermediate good by taking it apart and reverse engineering it. This would require importing one unit of a particular good, but not a substantial quantity of them.¹⁶²

3.12. Multinational companies and the government in technology and information asymmetry

Many multinational companies seek to produce and market the same product in the same way all over the world. This has opened a heated debate on the role of multinational companies in the global market, and the possible consequence of exploiting countries' comparative advantage. Due to the ongoing internationalisation, multinational companies have tilted the balance of power among key players in the world market in their favour. As consequence, multinational companies have the power to close the gap in technology in the world. They can bring technologies. However, shall the government require investors to bring technologies and information, not only allow them to use the local cheap labour? Or shall it be the multinational developing banks? How easy is to transfer a technology from one region to another? Some technologies depend on local knowledge, and the network of human relations¹⁶³, or institutional organisation of technology-production routines. All these assets are difficult to transfer.

Storper and Venables (2004) describe the development of face to face communication in globalisation and argue that it is also important to stress out the importance of face to face communication in the high-technology industry. As Storper and Venables (2004, p.356) point out: "In parts of the financial services and high-technology industries, local networks intersect with long-distance contact systems. In almost anything related to business-government relations, networks have strongly national and regional cast". Eaton and Kortum (1999) and Keller (2001) show that the major sources of

¹⁶¹ Think for example of the Indian automaker Tata and its Tata Nano

¹⁶² A good example of reverse-engineering was the Cold war. Even though the technology spillover between the democratic world and the Soviet bloc was minimal, reverse engineering helped both blocks to catch up with the technology of the other bloc.

¹⁶³ Professor Storper, lecture notes GY409, 2008

technical change leading to productivity growth in OECD countries are not domestic; instead, they lie abroad. Keller (2001, p.5) defines two basic mechanisms for international economic activities to lead to technology diffusion:

1. Direct learning about foreign technological knowledge.
2. Employing specialized and advanced intermediate products that have been invented abroad.

Social returns of technology diffusion are high. Scholars offer strategies leading to better technology transfer.¹⁶⁴ Keller (2001) discusses the concept and empirical importance of international technology diffusion from the point of view of recent work on endogenous technological change. Sometimes the reason for productivity increases lies in purely domestic activities, such as the learning effects resulting from cumulative production for domestic demand. However, productivity also increases due to learning through the interaction between foreign and domestic firms¹⁶⁵.

Therefore, when we speak about technology diffusion we have take into account the importance of government. The government can support research, education and innovation. The government has been active their core competencies by outsourcing certain activities their core competencies by outsourcing certain activities. Stiglitz often uses the example of the first telegraph line in the US between Baltimore and Washington in 1840s and the example of the Internet, both owing its origin effectively to the government¹⁶⁶. Much of the technologies that increase the well-being of the countries are based in ideas that have been originally produced by government-supported research.

What should the government or international institutions do to achieve converge of technology level rather than divergence across regions? The government can and should support new technologies. However, how does the government know that are the new technologies? What technologies are to be supported and what are not to be supported? Should the government pick up winners on the market? Stiglitz even argues that all

¹⁶⁴ For six principal points linked with strategies that could lead to better technology policy are summarised in Stiglitz (2003a, pp. 9-11).

¹⁶⁵ Keller (2001, p.3)

¹⁶⁶ For example Stiglitz (2003b, p.7).

industrial policies are in fact technology policies¹⁶⁷. The reasons that are quoted by scholars who support government involvement in the technology development is: information asymmetry. Players do not possess all the information to create new technologies. The heated debate about whether it makes a difference for a country to microchips or potato chips did not reach a clear outcome: According to Professor Mike Baskin it does not make differences whether a country produces micro-chips or potato-chips, while Stiglitz argues that it matters what a country produces. On the other hand, Stiglitz argues that it matters and that the government should do a certain planning in industrial policies. There is common agreement that the government should support basic research. The consensus on the support of applied research is not so widespread. Stiglitz argues that government should support even applied R&D. TRIPS (Trade related intellectual property rights) give a monopolistic power over a certain idea. Any monopoly results in inefficiencies. Stiglitz¹⁶⁸ argues that:

“The reason we do it is that we believe there are trade-offs. There may be advantages by accepting the loss of static efficiency in order to have enhanced incentives for innovation. We recognize that there is a trade-off between short-run and long-run concerns. But we have to recognize that intellectual property rights do result in inefficiency in the economic system.”

3.13. Conclusion

In the past, it was thought it is capital that developing countries lack to catch up with developed countries. However, it is more recognised that what separates developed from less developed countries is also a gap both in information and in technology. From the perspective of partially-codified knowledge, it appears that not only passive spillovers (embodied technology in intermediate goods), but also active spillovers are linked to the patterns of international economic activity, instead of being uniformly distributed (or distributable) throughout the world¹⁶⁹. Overall, the speed of changes that we can see today will be affected by the current economic crisis, but neither globalisation nor the advances

¹⁶⁷ For example Stiglitz

¹⁶⁸ Stiglitz (2003, p.3)

¹⁶⁹ Keller (2001, p.7)

in new technologies will be stopped. It will still lead to more flexible and innovative technology.

The unequal distribution of technology does not necessarily mean that the world is worse off. One of the advantages of the unequal technology and information levels is the concept of disruptive innovations or reverse-engineering. Trade, technological innovations, information are increasingly important and are transforming the global economy. The international diffusion of technology and information is a major determinant of per capita income in the world. International economic activity is therefore important not only because of trade itself but also because of the transfer of technologies throughout the world. For developing countries, learning through this international economic activity leads to greater adoption of technology from abroad and consequently to higher income per capita. The conclusion is that current level of globalisation is affecting the level of technology more than ever before. However, in general we do not see technology and information convergence as predicted by several theoretical models. Therefore, information asymmetry remains an important factor in the economy. There is a significant role of the multinational companies in technology convergence. The role of government is more limited but there should be less regulation from the developed countries if the desire is to achieve technology and information convergence.

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3.15. Annex

3.15.1. The Solow growth model

The production function in the Solow model takes the form

$$Y(t) = F(K(t), A(t)L(t)), \quad (1)$$

where Y (output), capital (K), labour (L), knowledge/effectiveness of labour (A)¹⁷⁰, and t denotes time¹⁷¹.

Solow expects that labour and knowledge grow at constant rates

$$\dot{L}(t) = nL(t) \quad (2)$$

$$\dot{A}(t) = gA(t) \quad (3)$$

where n and g are exogenous parameters¹⁷².

3.15.2.R&D models

R&D models were developed by P. Romer (1990), Grossman and Helpman (1991) and Aghion and Howitt (1992). The production of new ideas in these models depends on the quantities of capital and labour engaged in research and on the level of technology:

$$\dot{A} = G(\alpha_K K(t), \alpha_L L(t), A(t)) \quad (5)$$

In our case we will assume Cobb-Douglass production function:

¹⁷⁰ For our purpose we will treat A(t) as knowledge as we try to explain the convergence of technology levels in different parts of the globe.

¹⁷¹ It becomes clear that time enters the production function indirectly through K, L, and A. Moreover output changes over time only if inputs change. If there is technological progress, the amount of output increases only if the amount of knowledge A increases. Finally A and L enter the production function multiplicatively. AL is called the effective labour. Technological progress that enters via this effective labour is called labour-augmenting, or Harrod-neutral.

¹⁷² A dot over a variable denotes a derivative with respect to time (f.e. $\dot{X} = \frac{dX(t)}{dt}$). This and equations (2) and (3) imply that A and L grow exponentially. This is arguable. L does not grow exponentially in reality (especially in developed countries).. Whether A grows exponentially is unclear. I suppose that A might have grown exponentially in the last 200 years. Especially IT revolution caused the exponential growth over past 50 years. Whether it will continue to grow in this pace is in jeopardy. Moreover, the Solow model expects constant n and g (constant population growth and technological progress.).

$$\dot{A}(t) = B[\alpha_K K(t)]^\beta [\alpha_L L(t)]^\gamma A(t)^\theta \quad (6),$$

where B is a shift parameter, $\beta \geq 0$, $\lambda \geq 0$. Therefore we have two endogenous variables K (as in the Solow model) and A. Because we might be able to see the result of convergence or divergence of output, we might make a conclusion about the convergence or divergence in the level of technology using these growth models. We rearrange the model¹⁷³ and get finally get the expression for the growth rate of A (technology):

$$g_A(t) = c_A K(t)^\beta L(t)^\gamma A(t)^{\theta-1} \quad (7)$$

3.15.3. Assumptions about parameters

Now, we have to make the assumption about the parameters. The question is how increases in technology (\dot{A}) affect the production of new technology (A). If $\theta = 1$, \dot{A} is proportional to A, if $\theta > 1$ increase in A leads to higher production of new technology and vice versa¹⁷⁴. We expect that $\theta > 1$ in developing countries and $\theta < 1$ in developed countries The degree of returns to scale to K and A in technology production is $\beta + \theta$ ¹⁷⁵. Therefore the key determinant of the globalised economy is how $\beta + \theta$ compares with 1.

Finally, I would like to show that the *Solow residual* captures the technological progress in the model:

$$\frac{\dot{Y}(t)}{Y(t)} - \frac{\dot{L}(t)}{L(t)} = \alpha_K(t) \left[\frac{\dot{K}(t)}{K(t)} - \frac{\dot{L}(t)}{L(t)} \right] + R(t) \quad (4),$$

¹⁷³ For all the steps see Romer (1996, p.96-110)

¹⁷⁴ To put in economic terms, there are increasing returns to scale if $\theta > 1$

¹⁷⁵ Increasing both K and A by a factor of X increases \dot{A} by a factor $X^{\beta+\gamma}$

where $\alpha_k(t)$ is the elasticity of output to capital ¹⁷⁶, $R(t)$ is *the Solow residual* which captures all sources of growth other than contribution of capital accumulation via its private return. The growth levels are inversely related to initial income.

$$\alpha_x(t) = \frac{X(t)}{Y(t)} \frac{\partial Y(t)}{\partial X(t)}$$

¹⁷⁶In general for a variable X :

4. Towards a new paradigm in monetary policy – Czech Republic case study¹⁷⁷

4.1. Introduction

In the times of the biggest financial crisis since the Great Depression, the research and empirics on credit markets becomes much more important than ever. Due to recent changes in the whole economic system, it is necessary to rewrite economic textbooks and to make the attempt to understand modern economy better. Much will be changed in terms of new financial supervision and regulation. Banks are being reorganized and systemic risk will have to be examined in a better way, central banks will need to adjust their policies. For the deeper understanding of the economic system and its relationships, it is useful to examine the monetary transmission mechanism from a new perspective. One option is to use Joseph Stiglitz and Bruce Greenwald's framework for the new economic paradigm concerning the monetary policy they have developed. The main aim of their research is to deepen the existing knowledge about transmission of the interest rate pass-through by focusing on the firms side of the economy.

Thus, understanding the forces inside the black-box of the transmission mechanism is important for effective implementation of monetary policy. Effective monetary policy must study of investment behaviour of enterprises. The "credit channel" of monetary policy is linked with the funding of the businesses. Monetary policy shocks have disproportionately large effects on business funding through this mechanism. The role of enterprise as an engine of economic growth has received considerable public attention in the 1990s due to hundreds of innovating small business driving the entire economic cycle. Recent research focuses on empirical evaluation of credit availability for firms of different sizes and its implications for investment decision-making. The traditional supply side of the credit market (i.e. banks) is also influenced by its expectations of the evolution of credit demand and the ability of borrowers to repay their obligations. Financial stability thus plays an important role. The current financial instability on world markets leads to a

¹⁷⁷ The author would like to thank doc. Pavel Mertlik for his valuable comments on this essay and for the supervision of this whole thesis.

decrease in bank lending to firms and therefore, it influences the transmission mechanism.

While several studies deal with the macroeconomic impact of interest rates (Kieler and Saarenheimo, 1998), there is still insufficient research on the microeconomic level. Corporate investment dynamics in the Czech context have been tested by Lizal and Svejnar (2001) and Filer, Hajkova and Hanousek (2004). Pruteanu (2004) tried to find out whether banks credit-rationed Czech enterprises during 1997–2002. More recently, Horvath (2005) examined a panel of Czech firms, finding evidence that balance sheet indicators matter for the interest rate charged by banks on firms. Benito and Whitley (2003) examine this problem in the context of the UK. They find a significant negative effect of the user cost of capital; moreover, the parameters in the long run are very similar across regions.

In this essay, I will try to link the Stiglitz-Greenwald theory of credit rationing using aggregated Czech data over years 2008 and 2009 where available. It is of a big interest to test the behaviour of banks, firms, and households in the recession times. The result might help to understand banks' approach to their clients, the monetary transmission mechanism, and the behaviour of the central bank in general.

4.2. New paradigm in monetary economics

Together with Bruce Greenwald, Joseph Stiglitz is the author of fundamentally new approach to monetary policy based on information asymmetry¹⁷⁸. Contrary to the prevailing theory of monetary economics, this new approach does not emphasize the role of money in transactions but more broadly, it stresses the role of credit in economic transactions¹⁷⁹. This paradigm works with the supply and demand of loanable funds and it tries to understand how banks and other institutions in the economy use information to assess the ability to repay the loan. The aim is to understand how banks and other institutions in the economy transform the information to evaluate the credit-ability. The

¹⁷⁸ The theory is summarised in the book of Stiglitz and Greenwald (2003) *Towards a New Paradigm in Monetary Economics*

¹⁷⁹ It should be noted that their paradigm is close to post-Keynesian approach to the nature of money (Mertlik, 2009). In the post-Keynesian theory, the source of money is created by demand of businessmen. Loans create deposits and deposits create reserves. Central bank plays two roles: lender of last resort and inflation supervisor. Crediting by commercial banks and their credit policy in post-Keynesian economics is considered as credit rationing.

theory explains factors influencing the willingness and ability of banks to provide loans. It also tries to understand the link between the credit in the economy and variations of output; the theory describes the implications for the economic policy. Moreover, the theory analyses how the changes in the economy – for example the changes linked with the so-called New economy – will influence the structure of the system and its stability. Authors describe conditions under which monetary policy on its own is not effective in bringing the economy back to the state of full employment. They predict that in the future, this situation will be even more common. That is why this theory is of an interest in recent times when banks increase their credit rationing.

Investments and inventories are the core movers of output changes in the reaction to the monetary policy. Stiglitz and Greenwald – in contrast to the theory of real business cycles – believe that money (at least in the short run) – play a big role in the economy. They as well as monetarists put money in the centre of the economic activity. However, Stiglitz and Greenwald argue that the classical theory of transaction demand cannot sufficiently explain the importance of money. They – to the contrary – say that the key for understanding of the monetary economics is the demand and supply of loanable funds. This demand and supply of funds is linked with information asymmetry and the role of banks. The loanable fund market is not identical to markets with ordinary commodities. The critical point is that some loans on the loanable fund market will not be repaid. The central role of the bank then is to realise which applicant for a loan will default. Stiglitz and Greenwald argue that the institutional structure of the banking system should be researched more thoroughly when the monetary policy is applied. Moreover, there are differences between the ability of the monetary policy to perform well in various countries and these differences could be explained with different institutional structure of the banking sector. The whole Stiglitz-Greenwald theory emphasises the role of institutions in the economy and it is thus a contribution to the institutional economics¹⁸⁰.

180 Therefore, it is difficult to assess Stiglitz to one single economic school. Generally, he stands between new institutional and new Keynesian economics

4.3. Banking system

Banks hold a central position within today's economies. They fulfil important transformation functions and other elementary services for market participants. The banking business can principally be divided into Retail-, Wholesale- and Private Banking segments. These segments address the specific needs of different customer groups. Banks provide on-balance-sheet products such as loans and deposits and a range of additional services, such as transaction processing or advisory services. Some banks provide the complete range of products for all segments; others focus on selected product and/or customer segments. Products and services are exchanged for money and banks are intermediaries in this cycle of monetary transactions. Banks process payments and provide a balance between investment and financing needs. Banks are service providers – they produce banking services, which they sell to market participants

There have been certain trends in the banking industry over past years. Retail banking is the mass business of banks characterized by high product and service standardization and limited advisory. Financially better off individuals and larger corporations require more customized products and advise – and they are able to pay for it. Additionally to their basic elementary functions – transforming durability of assets, exchanging currency, taking deposits and granting financing – banks have four very important transformation functions. Only by transforming volumes, maturities, risk and information, banks can fulfil the needs of different market participants with respect to depositing/investing and financing.

Accounts of banks are quite different from financial statements of companies from other industries. A bank's balance sheet shows its lending and deposit business; its assets have to be backed by certain amounts of equity. Banks have no turnover – their revenue is the sum of net interest income, net fee income, net trading income and net other operating income. Banks provide loan and deposit products, which they take on their own balance sheets. There are off-balance items such as derivatives, guarantees that play a significant role in the risk-management of banks. Additionally, banks also provide off-balance-sheet services (processing, advising, etc.) in the areas of lending, depositing and transacting. The

income of banks typically consists of interest income generated from on-balance-sheet products and commission income from services¹⁸¹.

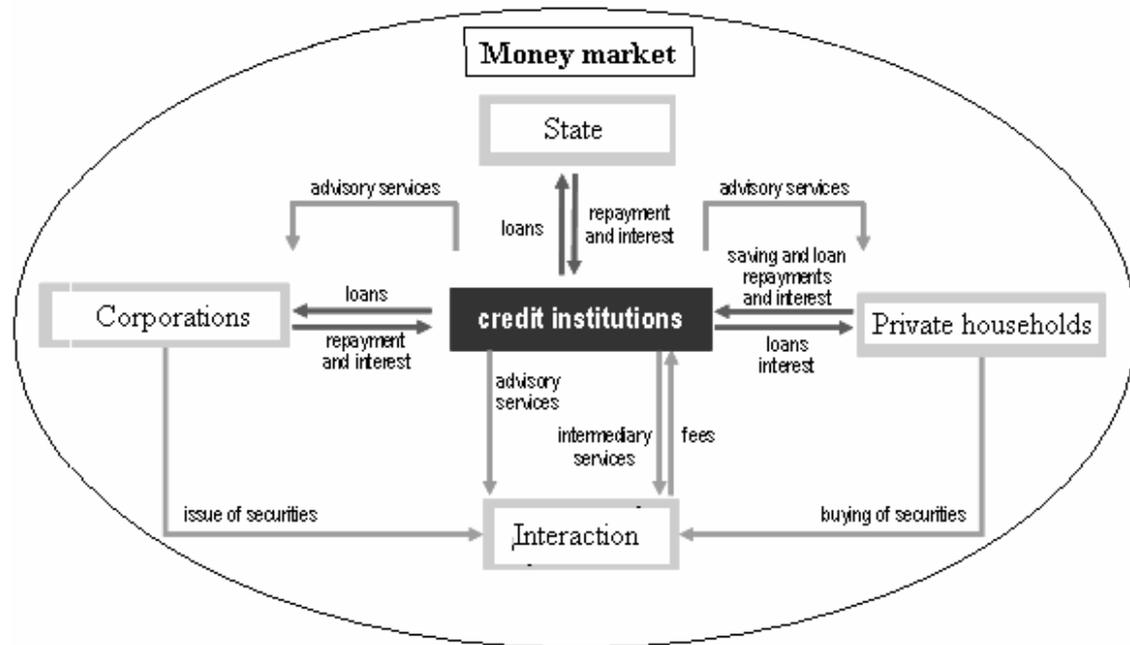


Figure 2: Credit institutions and their role in the economy. Source: Deutsche Bank, Roland Berger Strategy Consultants

¹⁸¹ Source: Roland Berger Strategy Consultants

CORE TRANSFORMATION FUNCTIONS OF BANKS			
<p>Volume transformation</p> <p>Deposit needs and loan needs don't meet (typically small household deposits and larger loans)</p>	<p>Maturity transformation</p> <p>Diverging needs of parties about the maturity of contracts (typically short-term deposits and long term loans)</p>	<p>Risk transformation</p> <p>Risks, e.g. loan default risks are diversified and spread over a large number of depositors</p>	<p>Transformation of information requirements</p> <p>Providing market participants with information (e.g. informing them about funding needs and possibilities)</p>
ELEMENTARY FUNCTIONS			
<p>Transportation function – moving liquid assets and liabilities between participants (e.g. money transfers)</p> <p>Exchange function – mainly currency exchange; exchange of different asset classes</p> <p>Deposit function – safekeeping of valuable assets and liquid assets</p> <p>Financing function – providing market participants with means of financing and liquid assets</p>			

Figure 3: Core and elementary functions of banks in modern economy. Source: Deutsche Bank, Roland Berger Strategy Consultants

4.1. Credit rationing

The key to understanding the supply of loanable funds (credit availability) is to understand the behaviour of banks. In the Stiglitz-Greenwald model, banks are considered to be risk averse. Stiglitz and Greenwald (2003, p.44) justify this assumption that banks face limits on their ability to diversify and divest risks, e.g. they are equity constrained. Bank's risk averse behaviour has implications which depart from the standard neoclassical assumptions¹⁸².

Generally, there are three motives for holding money according to Keynes: Precautionary, speculative, and transactions. However, monetary authorities can influence money supply only via narrower aggregates, such as M1, M2. Moreover, the velocity of money has changed dramatically over past twenty years and the relationship between money and income has not been stable recently.

¹⁸² One of them is perfect risk-sharing. In a complete market with perfect information and without solvency constraint, risks are effectively spread throughout the economy and banks act in risk-neutral manner.

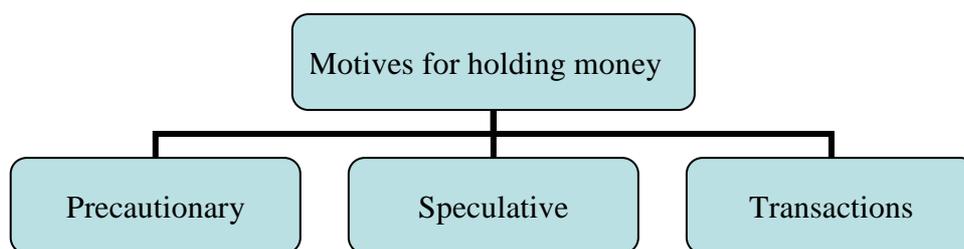


Figure 4: Motives for holding money according to Keynes. Source: Stiglitz and Greenwald (2003)

Andrew Weiss and Joseph Stiglitz pioneered the credit-rationing concept. In 1981 they published a paper concerning the unwillingness of banks to lend even though they have sufficient funds and the demand for loans is higher than equal the supply of loans. The explanation is that further increase of lending would decrease banks' profitability. Stiglitz and Greenwald focus their attention on demand deposits. The pre-condition for the theory of credit-rationing is the imperfection of capital markets. Information asymmetries mean that a bank might behave in a different way than the standard economics would predict. Standard economics says that when there is an excess of demand for credit then the unsatisfied applier for the credit will ask for a higher interest rate¹⁸³, and the equilibrium on the loan-market will be achieved. However, a bank that maximises the expected return might refuse to provide such an applier with a loan as the applier is signalling that – as he is willing to accept a higher interest rate – he is more vulnerable to default. The central determinant of the economic activity is the ability and willingness to bear the risk linked with the provision of loans. Interest rate is not like a conventional price. It is a promise to pay an amount in the future. Therefore, there is no simple relationship between the interest rate and the performance of the economy.

Financial globalization leads to changes in the financial system. A well-functioning financial sector provides funds to borrowers (households, firms, and governments) who have productive investment opportunities. As discussed in Mishkin (2003), financial systems do not usually operate as desired because lenders confront

¹⁸³ To borrow for higher interest, respectively

problems of asymmetric information; lender knows less about the particular project than the borrower does. Asymmetric information can lead to adverse selection and moral hazard. Adverse selection means that low-quality borrowers are the ones more likely to seek out funds in the market. Low-quality borrowers are the ones less concerned about paying back a loan. As argued by Stiglitz and Weiss (1981), adverse selection might lead to credit rationing, in the sense that lenders are not willing to lend even at high interest rates; lenders realize that low-quality borrowers are the ones most attracted to high rates. Moral hazard means that, after obtaining the funds, borrowers have incentives to take risky positions or to use the funds in certain ways that are not beneficial to lenders. Thus, borrowers can obtain large gains if their bets pay off and can default otherwise.

The core of the work on monetary policy by Stiglitz-Greenwald is that monetary institutions and policy have important real effects but for reasons different from those of the standard theory¹⁸⁴. Stiglitz and Greenwald argue¹⁸⁵ that interest rate is not the opportunity cost of a large fraction of the money supply and this fraction seems to be increasing over time.

One of crucial distinction of new Stiglitz-Greenwald monetary theory is therefore the significance of information in credit. As Stiglitz and Greenwald (2003, p.30) note, a central feature of the Arrow-Debreu model of markets is the anonymous nature of markets. Supply and demand is entirely anonymous. However, credit is very different. The terms on which credit will be supplied will depend on judgments about the likelihood that the loan will be repaid. Credit is individual and the information relevant for providing the credit is highly specific¹⁸⁶.

4.2. Financial crisis

Recent financial crisis has had large effects on the real economy. On the other hand, it offered a unique chance to study economic theories and their validity in times of economic recession. It is natural to ask whether aggregate fluctuations can be understood

¹⁸⁴ Stiglitz, Greenwald 2003, p.10

¹⁸⁵ Stiglitz and Greenwald

¹⁸⁶ For example, a lender who has dealt with a particular borrower for a long time possesses tacit information about the borrower. Such a borrower might then face a lower interest rate.

using a Walrasian model (a competitive model without any externalities, asymmetric information, missing markets, or other imperfections). Stiglitz-Greenwald offer approach that is more realistic.

The economic crisis started in October 2008 with the turmoil on the financial markets. Since then, financial markets have become extremely correlated (see Figure 8). Central and Eastern Europe was hit soon. Intuitively, Czech interest rate was affected with the financial crisis. As the economy enters a recession, both the aggregate demand and aggregate supply curves contract. The effect on the price level is not clear (see Figure 5). However, over time, inflation disappears and deflation becomes a threat to the economy.

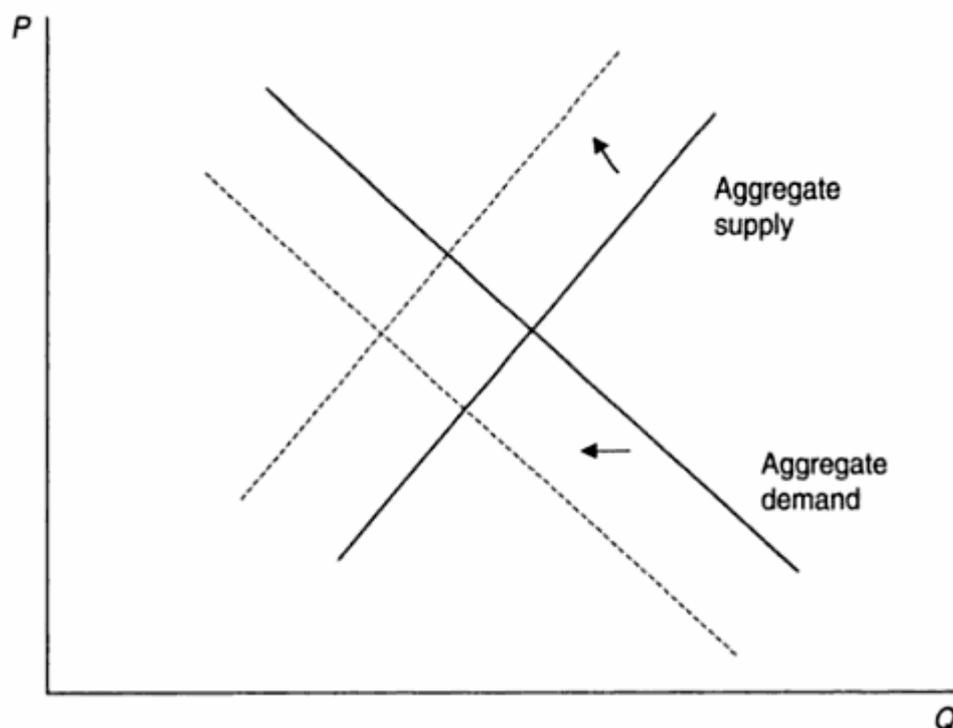


Figure 5: Effect of recession on aggregate demand and supply curves. Source: Stiglitz and Greenwald (2003)

The financial crisis threatens credit availability to both big and small businesses due to higher uncertainty on the market, incomplete transmission mechanism and information asymmetry (credit rationing). During crisis, confidence decreases, screening of credit applicants by banks increases, long-term interest rates rise. From Figures 6 and 7 we can clearly see that the transmission mechanism is not perfect in the Czech Republic.

Czech central bank was steadily decreasing interest rates (see Figure 6); on the other hand, some long-term interest rates increased as a consequence of higher credit rationing.

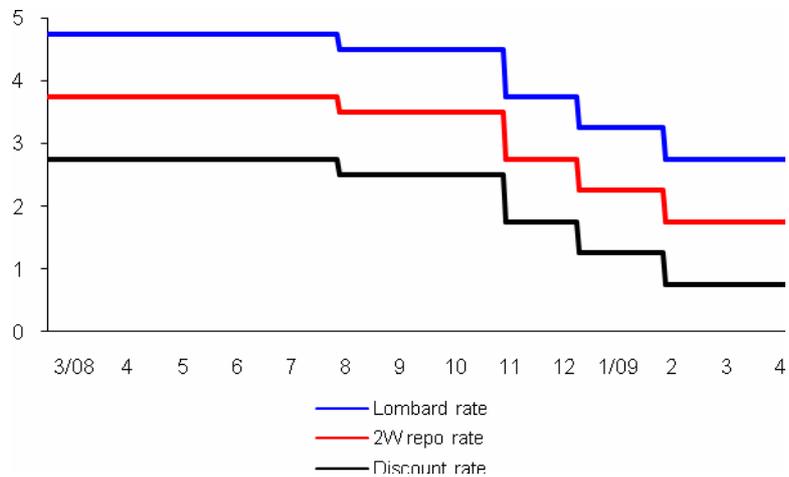


Figure 6: Czech National Bank's interest rates. Source: CNB

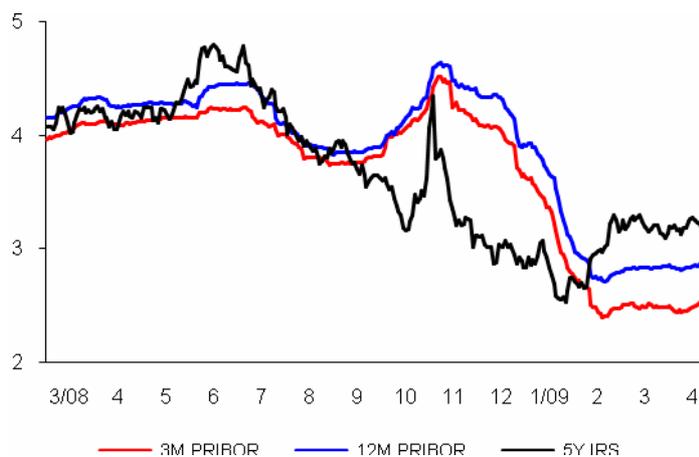


Figure 7: Czech market interest rates. Source: CNB

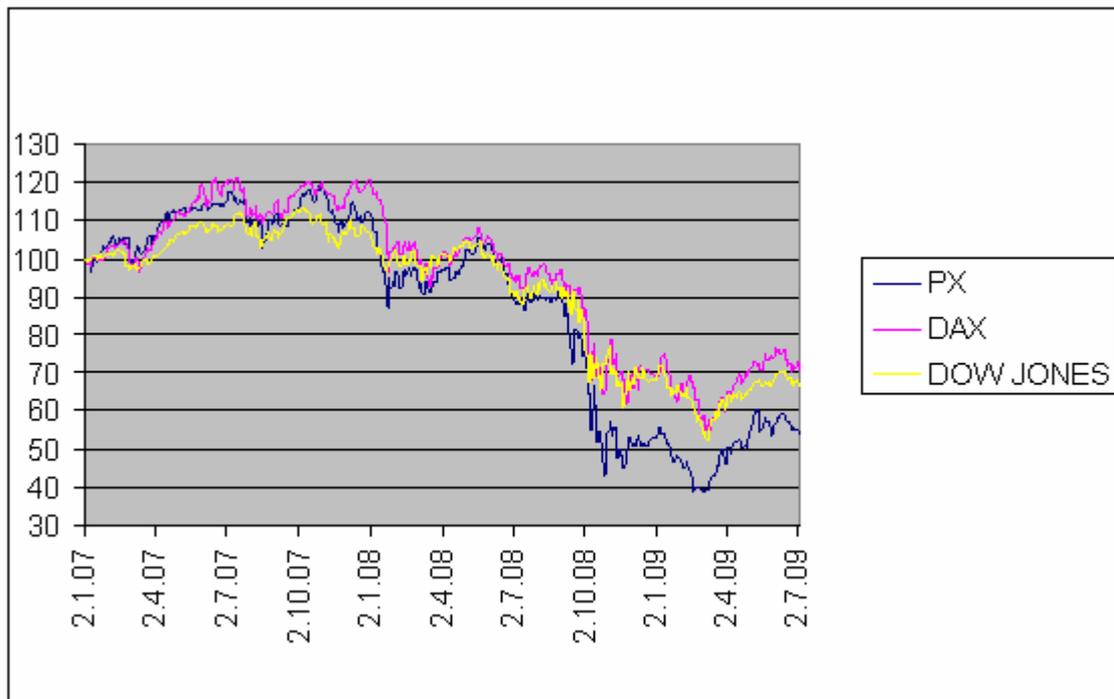


Figure 8: Development of financial markets (in percentage, January 1st, 2007=100%).

Source: yahoo.finance.com, author's calculations

Recession has two consequences. First, the number of good opportunities falls; this is intuitive. As demand slumps, there are fewer opportunities, fewer good investments that would be recovered with the same internal rate of return (IRR). Moreover, investors have less cash and thus less credit is available. Therefore, there is lower general demand. On the other hand, several good investment opportunities become cheaper and can be bought for very low price.

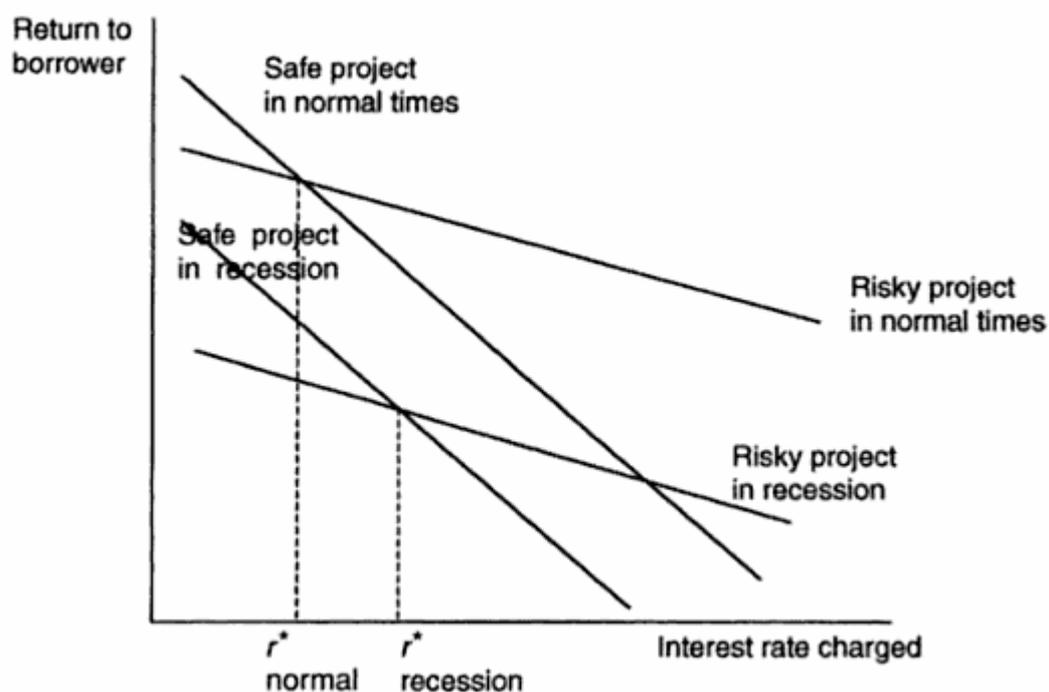


Figure 9: The effect of a recession on real lending interest rates. Source: Stiglitz and Greenwald (2003, p.32)

While standard theories predict that interest rate should fall in a recession, credit rationing theories explain why the real lending interest rate may well increase (see the move from r^*_{normal} to $r^*_{\text{recession}}$ in Figure 9). r^* is the highest rate the lender can charge without the borrower switching to the risky project. Lender's expected returns are higher with the safe project than with the risky one.

In theory, when there is an excess demand for credit, an unsatisfied borrower might offer the bank a higher interest rate. The bank would refuse a customer who offers this higher interest rate reasoning a bad risk. As the economy goes into boom, the returns to all projects may increase, real interest rate should rise. However, in some cases the real interest rate moves counter-cyclically rather than cyclically. Stiglitz and Weiss (1981) have shown that there may be instances where the entrepreneurs' returns to risky projects increase relative to safe projects in booms, so the bank's optimal interest rate at which their expected returns are maximised actually falls¹⁸⁷ (See Figure 9). From the real interest

¹⁸⁷ And thus the market equilibrium interest rate charged to borrowers actually falls

rate data (Figure 10), we can see that this theory holds. Real interest rates¹⁸⁸ to newly extended loans increased. When the economy is credit rationed, it is the quantity of loans, not just the interest rate charged that matters.

It is important to note that PRIBOR is only a quotation. Real interest rates might look – especially during recession times of economic uncertainty – different. During the peak of financial crisis (after Lehman Brothers filed for bankruptcy protection in September 2008), there were significant mark-ups to the quoted Czech interest rates. Moreover, certain long-term interest rates (e.g. 1Y PRIBOR) are rather virtual numbers. They are quoted but no bank would lend for this long. The usual period for these loans is 14 days (maximum 3 months). Therefore, the picture is distracted by uncertainty. At this point (July 2009) there is already enough liquidity on the Czech market (in contrast to the aftermath of the fall of Lehman Brothers). However, this liquidity is short. Households have shifted their deposits from fixed accounts to savings accounts in reaction to uncertainty (Mertlik, 2009).

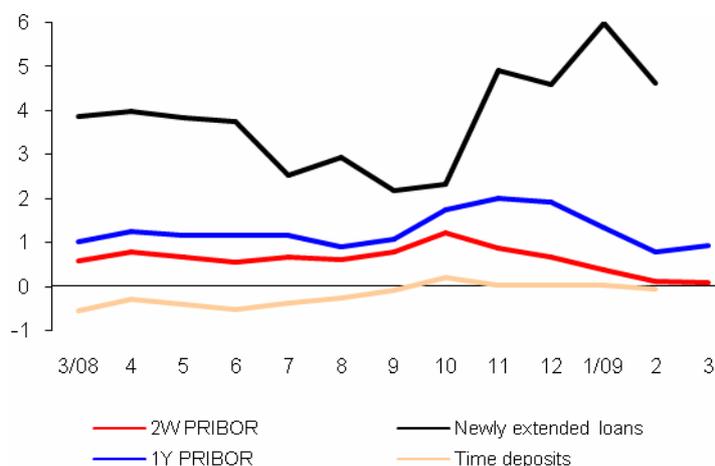


Figure 10: Ex ante real interest rates in the Czech Republic. Source: Czech National Bank

The real interest rate charged may increase and decrease with changing economic circumstances. With credit rationing, the equilibrium interest rate (the rate which

¹⁸⁸ Ex ante real interest rates: nominal interest rates on loans are deflated by the industrial producer price inflation forecasted by the CNB; nominal interest rates on deposits and PRIBOR rates are deflated by the consumer price inflation expected by financial market analysis (Source: CNB Inflation report)

maximises expected returns for the lender) is below the level at which the demand for loanable equals the supply. A leftward shift in the supply curve for loanable funds leads to less lending but no change in the interest rate. The extent of credit rationing is increased. That is because expected returns actually decrease when the interest rate exceeds r^* , the supply of loanable funds decreases (see Figure 21).

The simplest adverse selection model of credit rationing would argue that (assuming only two types of borrowers) the "safer" borrowers drop out at interest rate r^* (see Figure 9), so that if the lender charges more than r^* , he gets only the riskier, lower expected return borrowers. Hence, r^* is the interest rate charged by the lender. If worsening economic conditions (such as current financial crisis) imply that the safe borrower actually drops out of the market (decrease in the demand for loans) at a lower rate than before, the lenders might lower the real interest rate charged. In the adverse incentive model, in with the riskier project becomes more attractive at higher interest rate. Higher interest rates reduce the expected return to the investor on a riskier project by less simply because that there is a lower probability that she will actually pay the higher interest rate (higher probability of default). If an economic downturn lowers the expected return to the riskier project more than the safe project, then the critical interest rate at which borrowers switch is increased. Hence, lenders may increase the interest rate charged without worrying of a switch to greater risk taking (see Figure 9).

These two effects go against each other. Under different circumstances, different effects might prevail. However, there is in general a systematic force that leads to the increase of real interest rate charged as the economy goes to a recession. This hypothesis is confirmed when we look at Figure 7. There was a sharp increase in Czech real interest rates after the collapse of Lehman Brothers¹⁸⁹ in September 2008 and the start of the

189 Lehman Brothers Holdings Inc. was a global financial-services firm that, until declaring bankruptcy in 2008, did business in investment banking, equity and fixed-income sales, research and trading, investment management, private equity, and private banking.

On September 15, 2008, the firm filed for Chapter 11 bankruptcy protection following the massive exodus of most of its employees and clients, drastic losses in its stock, and devaluation of its assets by credit rating agencies. The filing marked the largest bankruptcy in U.S. history. The following day, the British bank Barclays announced its agreement to purchase, subject to regulatory

worldwide financial crisis. On the other hand, the real interest rate has decreased at the first half of 2009 signalling an increase in confidence on the market.

Interest rate respects the probability of repayment of the loan. In the crisis, the probability of default decreases and interest rate rises. In Figure 15, we can see a steady increase especially since summer 2007. On the other hand, there has been a decrease in the first half of 2009 with the exception of longer-term fixation loans. While loans to businesses do not confirm that the decrease of loan provision would be caused by supply of loans (i.e. significantly higher restriction of banks to borrowers), the situation on the household market looks different. There has been a significant decrease in the provision of loans to the household sector (see Figure 19), we might believe that in this sector the decrease in supply was actually bigger than the decrease in the demand for loans, confirming the Stiglitz-Greenwald theory of credit rationing.

It is necessary to note that in reality, the client can seldom offer the bank the interest rate. It is the bank that screens the client, analyses his financial history, his business plan, and potential of the whole business industry. Bank therefore offers the interest rate without any discussion with the client. The only exception might be a restructuralisation of claims. If a firm is unable to repay its debt on time but it has a positive belief about future income streams, it might offer the bank a higher interest rate for this delay in repayment. However, for a new client the bank typically an interest rate on his loan without any discussion with the client (Mertlik, 2009).

4.3. Loanable funds

The loanable funds theory was first developed by Robertson¹⁹⁰ in the 1920s. In that model, the interest rate is determined as the intersection of a downward sloping demand and upward sloping supply curve of funds (See Figure 11). There is no money illusion and both demand and supply depend on real interest rates. As the economy moves into recession, the demand curve (derived from the demand for investment goods) shifts to the left, while the supply of funds (from savings) also shifts to the left (savings fall in response

approval, Lehman's North American investment-banking and trading divisions along with its New York headquarters building. On September 20, 2008, a revised version of that agreement was approved by Judge James Peck.

190 Robertson, D. H. (1922). Money, London: Nisbet.

to decreasing income). However, the decrease in demand is usually bigger and there is decrease in real interest rate, which supports investment.

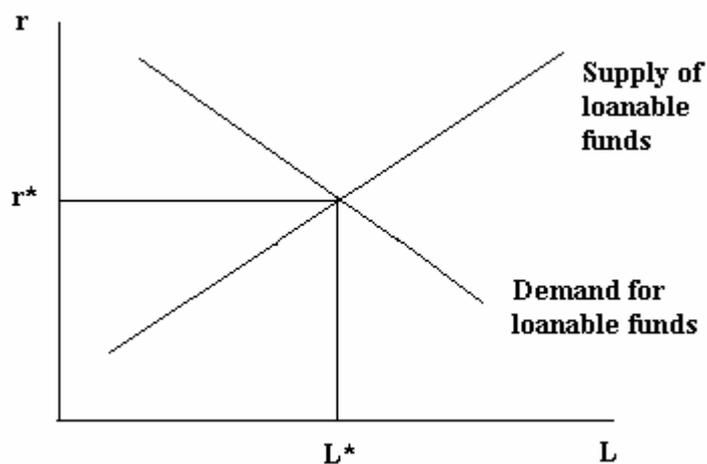


Figure 11: Loanable funds model, no credit rationing. Source: Stiglitz, Greenwald (2003)

On the other hand as described, what matters is not just a supply of savings but also a supply of credit. Financial institutions therefore play a pivotal role in determining the supply of credit. There are large changes in the supply of credit over the business cycle (see Figure 10 and Figure 13). The decrease in the supply in recession may outpace the decrease in the demand for funds. So that even if interest rates were determined by the intersection of the supply and demand for funds, the real interest rate facing borrowers could rise.

The demand for loans might be approximated with fixed capital formation. Czech data suggest that fixed capital formation has been steadily decelerating since the beginning of 2007 (see Figure 12); after September 2008 the deceleration was significant. Therefore, demand for loans has been decreasing over most of 2008 in the Czech Republic. Whether supply of was decreasing is arguable. Interviews with businesspersons confirm that banks are stricter in their lending, which would confirm the theory of credit rationing in recession. Even though there has been decline of loans (see Figure 10, Figure 13, and Figure 19), the decline is driven mostly by demand rather than supply. We can guess this from Barriers to growth (see Figure 14). Growth in investment demand slowed noticeably in 2008. The main factors behind this weakening is decreased demand (see Figure 16). It is

difficult to say to which extent the amount of loans is influenced by demand or by supply. However, it is clear that there has been a move towards higher strictness in loan provision.

In the Czech Republic, 2/3 of loans are short-term loans (up to 3 months). These loans finance mostly inventories. During recent economic slowdown, firms have lower requirements to finance their working capital. Therefore – counter intuitively – banks have problems with finding a client (business) who would need a loan (to finance his inventories). Financing of investment has decelerated. Most of investment projects, which have already been started are financed and will be finished. On the other hand, certain products (such as credit lines) are not used by clients. Alternatively, a client has an open credit line at the bank but does not use. This creates certain obstacles for a good risk-management of the bank (as credit line is an off-balance item) (Mertlik 2009).

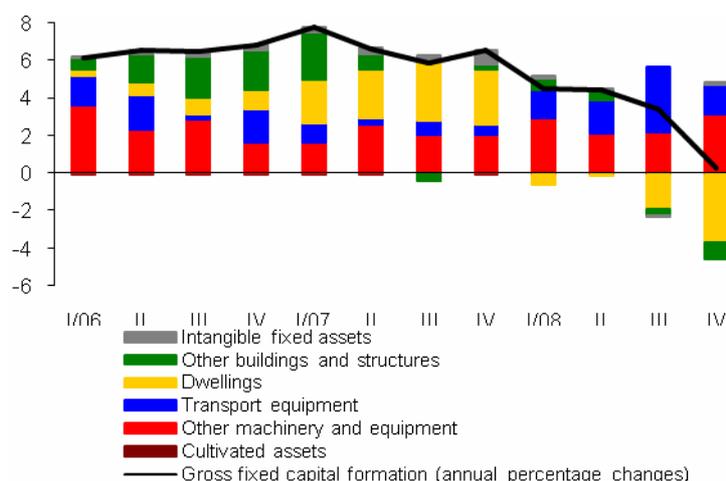


Figure 12: Fixed capital formation. Source: CNB Inflation Report 2009 II

4.3.1. GDP fluctuations

Fluctuations in general are distributed very unevenly over the component of output. Inventories are the first to be influenced in recessions¹⁹¹. Even though inventories generally account only for a small fraction of GDP, its fluctuations account for almost one-third of the shortfall in growth relative to normal recessions. Inventory accumulation is on average

¹⁹¹ It is important to note that inventories are also the most difficult to be measured. Several corrections take place until Czech Statistical Office publishes the final results (Mertlik 2009).

large and positive in peaks, and large and negative at troughs (Romer 2001, p.148). In the GDP equation

$$(1) \quad GDP = C + I + G + NX ,$$

consumption, government expenditure, and net exports are relatively stable over time. Investments play the biggest role in output variations. Residential investment (housing) and non-residential fixed investment (business investment other than inventories) also generally account for disproportionate shares of output fluctuations. In the Czech data, we cannot see the deceleration gross fixed capital formation until the 4th quarter of 2008 (see Figure 23) but in the 4th quarter of 2008 the growth reached 0% (see Figure 12). Gross value added formation weakened noticeably in most branches at the end of 2008. It can be predicted that data for 2009 would be even much worse in this respect. Government expenditure remained relatively stable. However, we might expect significant decrease in government spending as the Czech budget is approaching a difficult situation¹⁹². The downward trend in orders in industry accelerated sharply in last quarter of 2008. Economic growth slowed in 2008 and the main driver of economic growth was household consumption expenditure. Household consumption growth rose slightly at the end of 2008. Business confidence remains low. Even though there has been a steady growth of monetary supply (M2 growth fluctuated around 8% over past year), there has been a significant delay in the transmission mechanism. Over time, however interest rates on some deposits fell. Loans for house purchase rose more slowly than consumer credit for the first time in six years in 2008. New loans to households decreased. The interest rate on large loans to non-financial corporations fell. From this respect, Czech data only confirm the empirical research of the behaviour of output components in recessions. The empirical testing by Romer (2001) suggests that consumer purchases of non-durable goods and services are relatively stable. This is in contradiction to the Czech data. Aggregated Czech data suggest that households are reducing their expenditure on services over time (see CNB 2009).

¹⁹² There will have to be a significant change in the Czech public budget structure, planning, and consolidation of Czech public budgets is necessary in the near future.

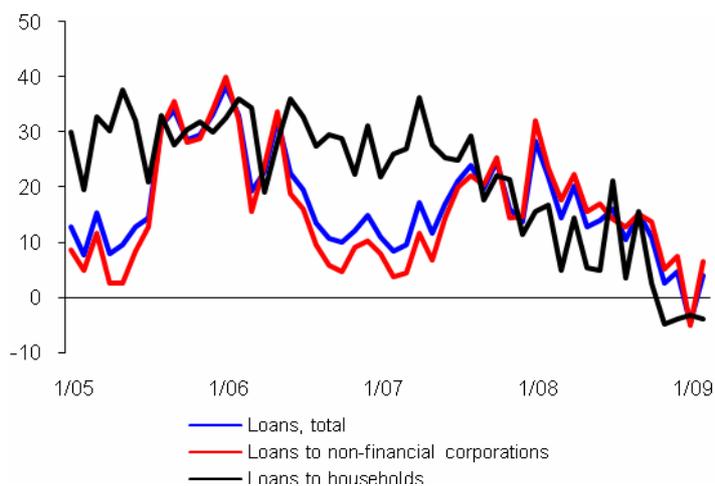


Figure 13: Newly extended loans. Source: CNB Inflation Report 2009 II

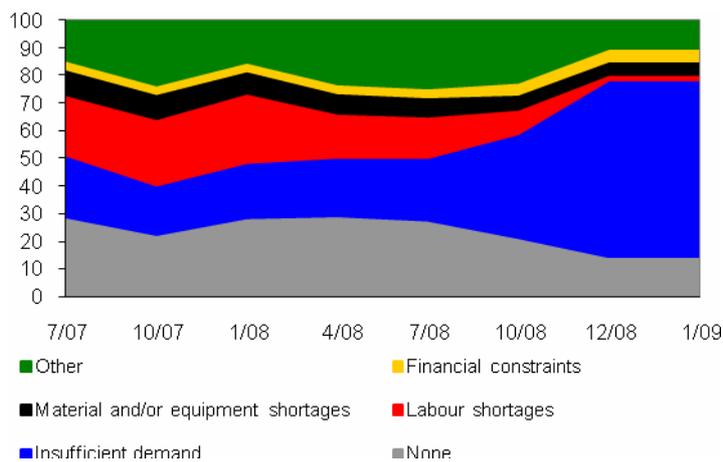


Figure 14: Barriers to growth on the Czech market. Source: CNB Inflation Report 2009 II, Czech Statistical Office

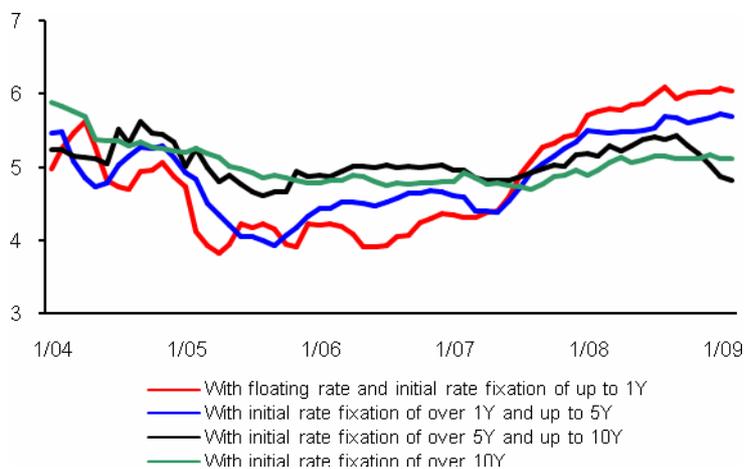


Figure 15: Interest rates on lending for house purchase, Czech data. Source: CNB Inflation Report 2009 II, Czech Statistical Office

The decrease in consumer’s confidence might lead to the decrease of demand for loans. Consumers feel less certain, they are not willing to consume as much as before which further leads to economic downturn. The demand for loans is affected. Moreover, there is credit rationing from the household-side of the economy as well. Even though some banks offer high real interest rates, households and firms do not deposit their cash. The reason is again uncertainty and low confidence in the economy (see Figure 8). This leads to lower quantity of loanable funds (Mertlik 2009).

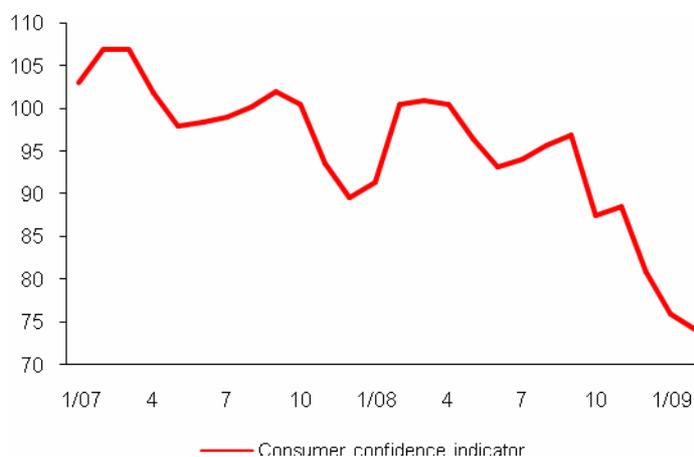


Figure 16: Consumer’s confidence. Czech data, 2005 average=100. Source: CNB Inflation Report 2009 II, Czech Statistical Office

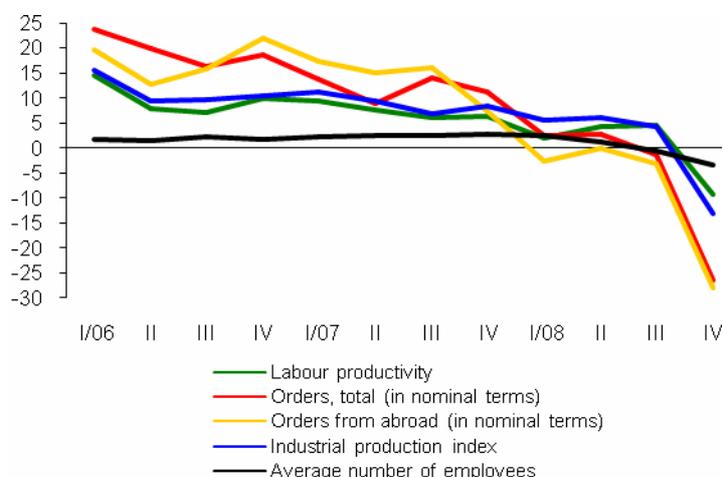


Figure 17: Indicator of development in the industry. Czech data. Source: CNB Inflation Report 2009 II

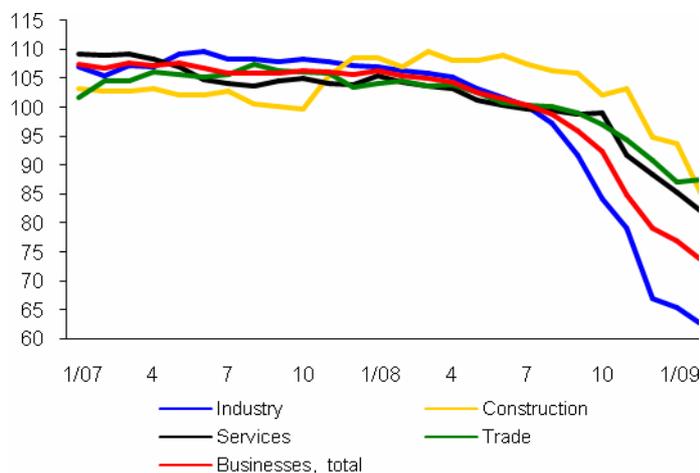


Figure 18: Business confidence. Czech data. Source: CNB Inflation Report 2009 II

Confidence is decreasing (see Figure 18), leading to higher uncertainty. Banks increase their screening and credit rationing becomes regular.

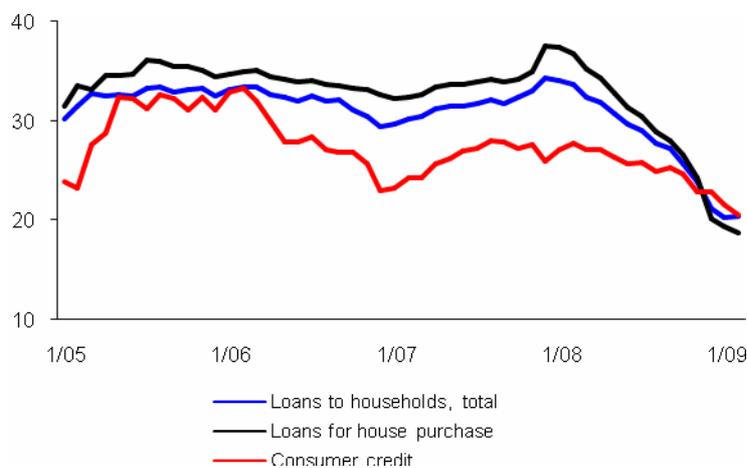


Figure 19: Loans to households. Czech data. Source: CNB Inflation Report 2009 II

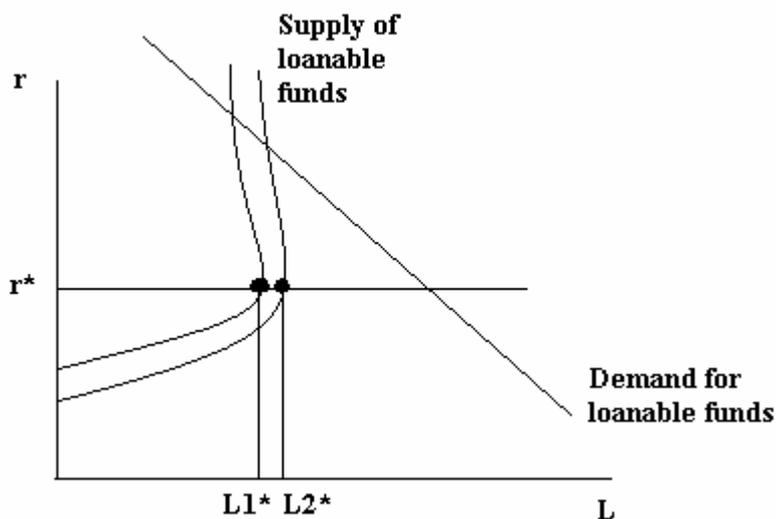


Figure 20: Loanable funds model with credit rationing. Source: Stiglitz and Greenwald (2003)

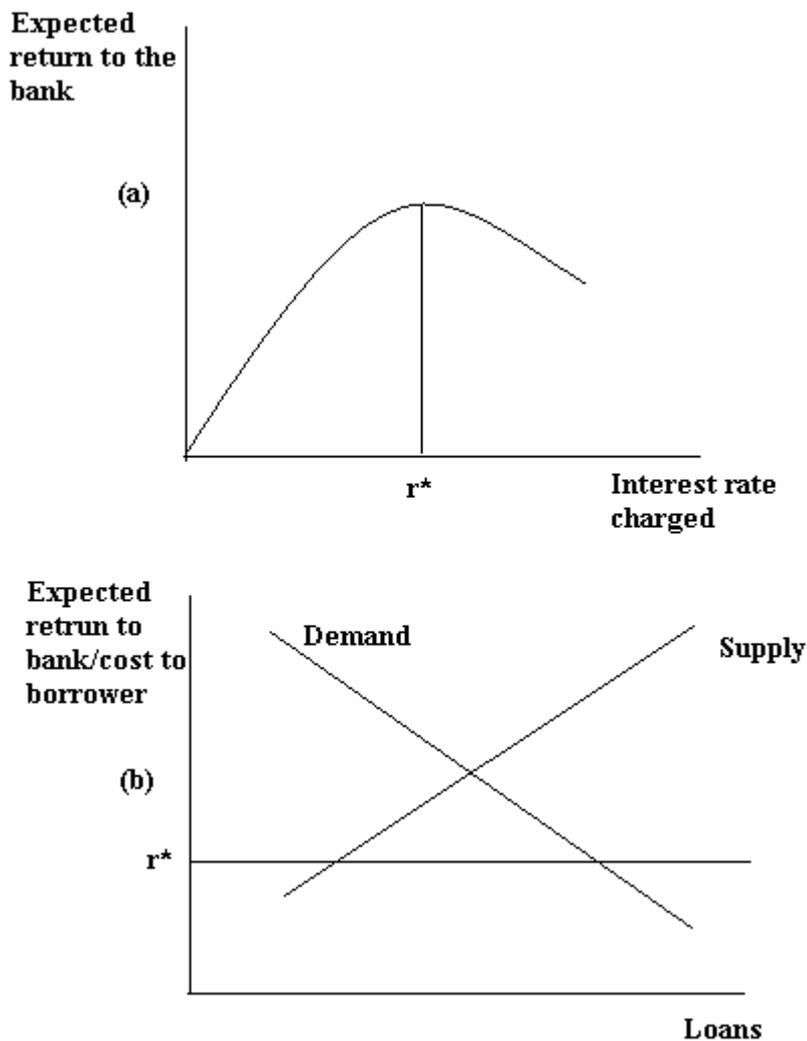


Figure 21. Expected return to bank according to Stiglitz, Greenwald (2003).

The interest rate, which maximizes expected return to the bank:

- (a) there exists an interest rate which maximizes the expected return to the bank
- (b) At “equilibrium” interest rates, the demand for credit (loans) exceeds supply

Market equilibrium is characterised with credit rationing. That is if demand and supply curves intersect at an interest rate above r^* , r^* is still the equilibrium interest rate. In r^* , lender’s expected return is maximised (see Figure 21a). Lenders have no incentive to raise interest rate above r^* because doing so would lower their return (see Figure 21b). In credit markets, in general there is more uncertainty.

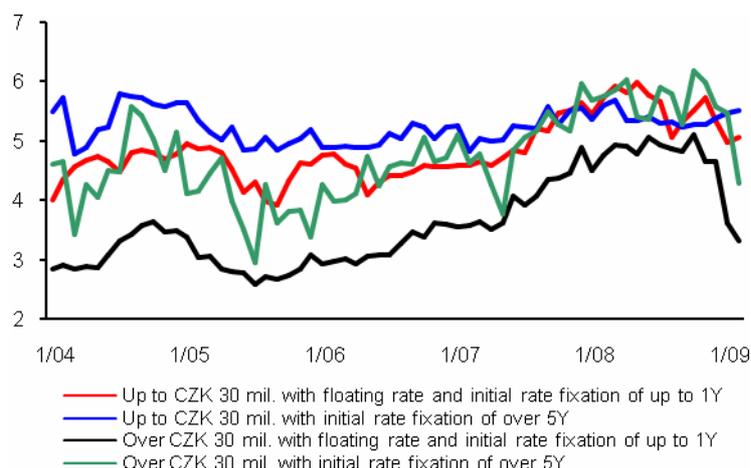


Figure 22: Interest rates on loans to non-financial corporations. Czech data.

Source: CNB Inflation Report 2009 II

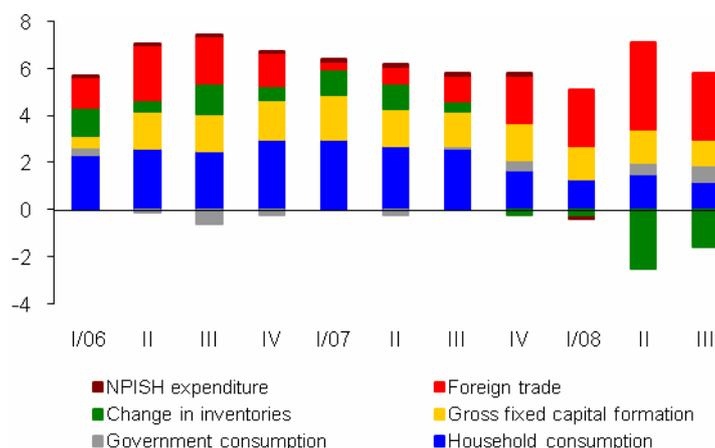


Figure 23: Structure of Czech GDP growth. Czech data. Source: CNB Inflation Report 2009 II

4.4. Conclusion

Recent financial and economic turmoil is a real time laboratory for theoretical economics. The crisis allows for testing various hypotheses under the condition of recession and economic downturn. The Stiglitz-Greenwald theory, we have used, is a result of more than 25 years of work (both independent and collaborative) and has much to offer. The theory can help to understand the link between interest rate and bankruptcy; it implements new concepts such as information asymmetry, signalling, and screening into monetary economics. I have tried to link the paradigm developed by Stiglitz and Greenwald on recent Czech data. From analysing the Czech data, we can conclude that banks increase their screening and credit rationing in the times of economic decline. Generally, I may argue that the development of interest rates, the behaviour banks, and the credit market fulfils the assumptions of the theory (with exceptions described). We can reject the hypothesis that Czech banking sector follows standard neoclassical assumptions about interest rates and credit markets. We can clearly observe credit rationing. Therefore, we might conclude that uncertainty is very crucial during recession. However, the crisis is not over yet and I may hardly predict the behaviour of the economy after the crisis. For the full understanding of the whole transmission mechanism in the current recession, we still have to wait several years. In conclusion, Czech data confirm that credit rationing increases, information asymmetry increases, and the transmission mechanism does not function well during economic decline.

4.5. Appendix: Transmission effectiveness

I am aware that using aggregated data sets limits for a deeper understanding of the effects of interest rate changes; aggregation makes several influences hidden. For example, several distribution effects of monetary policy are lost. Hence, the following part is the description of the Czech National Bank's project testing the transmission mechanism from the microeconomic perspective¹⁹³. For the effective transmission of monetary policy, it is crucial how the interest rate of non-financial enterprises and households are affected with the financial market rates. The analysis of effective transmission is even more important in the times of economic crisis. For the analysis, interest rates of new loans and deposits of non-financial enterprises and households for individual banks we used. The time period is January 2004 – December 2008. Median of client's interest rates was used. Therefore, the direct link between interest rates of the financial market and client's interest rates could be assessed.

Czech data confirm that the interest rates remain correlated the strongest with money market rates. The rate of loans to non-financial enterprises fixed to one year is the strongest linked with the rate 1M PRIBOR (small loans i.e. <CZK 30m) and with the rate 3M PRIBOR (big loans, i.e. >CZK 30m). In the case of mortgage loans, the correlation analysis suggests that the strongest link is to 10-year government bonds and to 1M PRIBOR. For the interest rate on deposits with agreed maturity up to 2 years, the most important is 1M PRIBOR and with 3-year maturity it is 3M PRIBOR.

The character of transmission was estimated using the error correction model:

$$\Delta br_{it} = \alpha_1 + \alpha_2 \Delta mr_t + \beta_1 (b_{it-1} - \beta_2 mr_{t-1} - \mu) + \varepsilon_{it}$$

where br is client's interest rate, mr is financial market interest rate with the strongest link to the client's interest rate, β_1 is the speed of return to equilibrium, β_2 represents the long-term transmission, μ is constant in the equilibrium, coefficient α_2 indicates the short-term transmission.

¹⁹³ Available in the CNB Inflation Report 2009 II

The money market interest rate transmission to the loan to non-financial enterprises interest rates was relatively strong (see Box 1). There was complete long-term transmission for small loans to enterprises and incomplete transmission for bigger loans to enterprises. It might suggest lower competitiveness and a stronger link to the client in this loan market segment.

In the case of short-term transmission, loans with flexible and fixed rate up to 1 year follow the money market rates: 70% of transmission occur during one month (small loans) and 90% (big loans). Rates fixed for more than one year do not react during one-month period. The interest rate to non-financial enterprises adjustment to the changes on the money market is between 1-2 months. The mortgage interest rate transmission is incomplete. There is a clear mechanism of return to the equilibrium. The transmission is spread in time, interest rates on average do not react within one-month period. Deposits with maturity up to 2 years there is a significant long-term and short-term transmission, however incomplete.

The result of the analysis for a shorter period of time (2006-2008) was similar. However, since the second half of 2008 there has been an increasing average standard deviation of interest rates on mortgages and on deposits to enterprises (Box 2). That suggests a bigger differentiation of clients by banks. The explanation is a worsened risk profile of borrowers and higher foresight of banks.

BOX 1			
ESTIMATES OF MONEY MARKET INTEREST RATE TRANSMISSION TO CLIENTS'S INTEREST RATES (REGRESSION COEFFICIENT, STANDARD DEVIATION IN PARATHESIS).			
SOURCE: CZECH NATIONAL BANK			
	Short-term transmission α_2	Total transmission β_2	Speed of return to equilibrium β_1
Interest rates on loans			
Non-financial enterprises (loans up to CZK 30 m)			
Floating and fixed up to one year	0.70(0.15)**	0.94(0.06)***	-0.50(0.11)***

Fixed over one year	0.52(0.44)	0.95(0.09)***	-0.49(0.20)***
Non-financial enterprises (loans above CZK 30m)			
Floating and fixed up to one year	0.90(0.30)***	0.81(0.03)***	-0.53(0.10)***
Fixed over one year	0.90(2.20)	0.78(0.08)***	-0.53(0.10)***
Mortgages	-0.13(0.23)	0.62(0.03)***	-0.34(0.11)***
Interest rate on deposits			
Maturity up to two years	0.70(0.09)***	0.93(0.02)***	-0.61(0.09)***
Maturity over two years	0.68(0.63)	0.47(0.06)***	-0.28(0.14)*
***, **, * represent statistical significance on 1%, 5%, and 10% significance level			

BOX 2						
STANDARD DEVIATION OF INTEREST RATES ON LOANS IN CHOSEN CZECH BANKS						
SOURCE: CZECH NATIONAL BANK						
	II/08	III/08	IV/08	10/08	11/08	12/08
Mortgage loans	0.68	0.78	0.95	0.88	0.92	1.04
Non-financial enterprises						
Up to CZK 30 m, fixed rates up to one year	1.79	2.08	2.24	2.17	2.28	2.28
Up to CZK 30 m, fixed rate above 1 year	2.52	2.49	2.54	2.46	2.59	2.58
Over CZK 30 m, fixed rates up to 1 year	1.26	1.10	1.28	1.10	1.03	1.70

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¹⁹⁴ The literature in this part follows also the literature from the two preceding parts

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5. Projekt diplomové práce

Termín diplomové zkoušky:	letní semestr 2008/2009
Autor diplomové práce:	Martin Pospíšil
Vedoucí diplomové práce:	Doc. Ing. Pavel Mertlík, CSc.

Téma: Applicability of Stiglitzian economics

Cíl práce: Cílem je popsat pojetí ekonomie Josepha Stiglitze a aplikovat jeho modely na ekonomiku. Hlavním tématem Stiglitzova výzkumu jsou informační asymetrie. Stiglitz stojí mezi novou keynesovskou a institucionální ekonomikou. Společně s Bruceem Eichengreenem jsou hlavními nositeli nového paradigmatu v měnové politice. Práce se tedy bude zabývat základy teorie, mikroekonomickými předpoklady a hospodářskými doporučeními.

V práci bude hledána odpověď na následující otázky:

- Jaké jsou předpoklady a závěry Stiglitzovy ekonomie
- Chovají se firmy a domácnosti podle předpokladů Stiglitzova modelu?
- Jakou roli hrají informační asymetrie, tržní nedokonalosti?
- Lze aplikovat tento Stiglitzův model jako celek nebo jeho části na českou ekonomiku?

Osnova:

- Teoretické předpoklady Stiglitzova přístupu k ekonomii, informační asymetrie, tržních selhání
- Hospodářská doporučení
- Nové paradigma měnové politiky
- Testování nového paradigmatu
- Vyhodnocení
- Závěr

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Podpis vedoucího bakalářské práce

Podpis autora

