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OUTLINE of the THESIS

for

GÁBOR REGŐS

CHAPTERS FROM THE TOPIC OF RISK IN ECONOMICS

Ph.D. dissertation

Supervisor:

János Vincze, Ph.D.

associate professor

Budapest, 2014.

Department of Macroeconomics / Department of Mathematical Economics and Economic Analysis

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Contents

1. Preliminary studies and the goals of the dissertation

My master's thesis can be considered as the direct antecedent and as the main motivation for the chosen topic. Risk already appeared in my master's thesis as a factor influencing economic decisions. Topic of my master's thesis was the comparison of different types of power plants with multi criteria decision models. Research of different risk related topics – especially with quantitative tools – turned out to be a less studied topic (except in finance), so it worth to research effects of risk on other fields. Of course topic of insurance can always be connected to risk as it is one of the most natural ways to manage risks. Accordingly the dissertation analysis the effects of risk at three fields and it is completed with an introductory chapter describing the methods to analyze and measure risk.

So, the first chapter reviews the risk and its measure. Motivation of this chapter is to introduce what exactly risk is (however several different definitions can be found in the literature) and that how it can be measured. The last part of this chapter presents the "measurement" methods country risk and sovereign risk, thus primarily deals with the assessment methods of the different credit rating agencies.

As this chapter is a literature review, it is strongly based on the literature.

From the references cited at the risk's definition I would highlight the study of **Aven and Vinnan (2007)**, who defined risk as the combination of an event's probability and consequence – perhaps it is the most common definition. **Allen et al. (2004)** defined risk as exposure to damage or loss. Besides, several other definitions can be found in the literature. The chapter also emphasizes the difference between risk and uncertainty and refers to the related debates.

At the measurement of the risk I deal both with qualitative and quantitative tools but in the further chapters I rather use the quantitative ones. At the qualitative tools I refer to the study of **Fight (2004)** in more cases. At the qualitative tools I first present the features expected (which are however in many cases not satisfied) from such methods according to **Gregoriou et al. (2010)**. At the presentation of the quantitative methods I refer to the work of **Jorion (2007), Krokhmal et al. (2011), Hamilton (1994)** and others.

Sovereign ratings of countries (and financial assets) received a high attention in the last few years, that's why I find their introduction very important. Here I refer to the description of the credit rating agencies.

The second chapter deals with the topic of risk in agriculture. Here the main motivation is that it is the sector which is the most exposed to risk considering the non-financial sectors of the economy. But the motivation is also given by many relevant questions which can be found in this sector. I now highlight two questions but the thesis also deals with some further topics in detail. The first main question of this chapter is that how does the presence of risk influence the main macroeconomic indicator of a small open economy. Its importance is given by the expected increase of the risk due to the global climate change – at least in some countries. The other question of this chapter is that whether state should support agricultural insurances. This question is also important as several ways to support agricultural insurances are present in the world and the question whether such support should exist and in which form also often appears often in Hungary.

The first part of the chapter introduces the main risk factors appearing in agriculture and the most important tools (especially the insurance) which can help to manage insurance. From the referred studies I would highlight the study of the Wold Bank (2005) and the OECD (2009) ors the studies of **Huirne et al. (2007)** and **Harwood et al. (1999)** and besides in case of risk management the papers of **Kovács (2009, ed.)** and **Anderson (2001, 2003).**

The following part of the chapter belongs to the topic of economic history: an important possible consequence of the risk caused by the weather (lower yields), famine is introduced through historical examples. In this chapter this kind of risk is analyzed in detail. Irish famine of the 19th century is presented in detail but several other examples are also cited in the thesis. From the cited literatures I would highlight the papers of **Mokyr and Ó Gráda (2002), Guinnane and Ó Gráda (2001), van der Berg et al. (2007), Ó Gráda (2007a)** and **Zadoks (2008).**

The following part answers the questions with an RBC model. A direct antecedent can be the paper of **Da-Rocha and Restuccia (2006)** in which the authors analyzed the role of agriculture in business cycles in case of closed economies. Several other authors prepared models about the macroeconomic role of agriculture – for example the paper of **Alvarez-Cuadrado and Poschke (2011)**. **Krugman's (1991)** paper is also important in case of preparing such a model. He investigated that why does an industrial core and an agricultural periphery appear in certain countries. In his paper due the transportation costs industrial production is concentrated in the region where the demand is higher. **Matsuyama (1992)** investigated the role of agriculture's productivity applying an endogenous growth model with

two sectors. According to his results in case of a closed economy there is a positive relationship between agriculture's productivity and economic growth while in case of an open economy this relationship is negative. **Gollin et al. (2007)** analyzed that why did economic growth begin 250 years later in some countries than elsewhere. They explained this phenomenon on the following way: in poorer countries more people work in agriculture as due to the less developed technology more labor is needed to produce the same output and a higher share of their income should be spent on agriculture as they are poor. In such countries import of agricultural products is generally low, thus they have to produce the necessary food.

The third chapter deals with the risks related to the pension system, especially with the demographic risk. Demographic risk is defined as the risk of lower fertility, thus, having less people (worker) in the next generation which should support more pensioners. Relevance of demographic risk is widely known: there are less and less children in the developed countries (and especially in Hungary) while pensioners live for longer and longer, thus ensuring a suitable pension is more and more difficult. Recently a related proposal appeared that we discuss in detail. This proposal means that value of the pensions should depend on the number children brought up by the pensioner. It is the main question of this chapter. what happens if such a system is introduced what kind of macroeconomic and demographic consequences does it have. Another question appearing in the literature is also analyzed in the chapter. Several authors describe in the literature that introduction of a pension system decreased fertility as the old no longer needed children who could support them in their old years as pension is also one kind of insurance against childlessness. This effect is presented by **Sinn (2004).**

The idea (not yet analyzed from a macroeconomic point of view) suggesting that pension should depend on the number of children surfaces in **Sinn's (2005)** works. He also emphasizes the economic consequences of the demographic problems: an increasing segment of the output has to be spent on pensions and as pensioners will represent the majority in the society, their opinions will likely be of great significance, according to the democratic laws. **Sinn and Uebelmesser (2012)** state that it will be so in Germany by 2016: the necessary reforms would have a positive effect on the following generations as well as the youth, although as pensioners will possess the majority among the voters, the acceptance of positive changes will not be quite possible. **Cremer and Pestieau (2000)** also emphasize that reforming pension systems is a political problem: suitable reforms are available but blocked.

Hyzl et al. (2004) propose that everyone should contribute to the pensions system in the same extent regardless to the number of children (as it is unknown before) but in the determining processes of the amount of pension paid, the number of children should be considered – as in case of a pay-as-you-go system future pensioners also contribute to the future output by bringing up children. **Vecernik (2006)** shows the necessity of the consideration of childbearing through the example of the Czech pension system.

Cigno (2010) keeps the problem a planning error of the pension system and proposes a two-pillar pension: in the first pillar the right to pension could be gained in the usual way, according to the ratio of earlier contributions, while the second pillar would enumerate the number of children born. **Banyár (2011)** also proposes the consideration of the number of children brought up in his work analyzing the eligibility of deficit arising from the pension reform. He presents three models: in the first one no pension could be paid for individuals without children: the ones who saved the cost of childbearing should have ensured funds to cover their old-age living expenses. A second solution would be the dependency of the retirement age on the number of children. In the third proposed solution the pension's amount itself would depend on the above mentioned number – as in the model of this paper.

The fourth chapter is about monetary policy and investigated how the Hungarian (and with a short the Czech, Polish and Romanian) monetary policy answered to changes in country risk. In this chapter country risk is defined not only as sovereign risk but in a broader sense as common in the literature: e.g. political risk and investment also belong to country risk. Motivation of the research is given by increases in the base rate in 2008 and in 2011 as these decisions could not be explained with the changes of the inflation or the output gap – they had other reasons. From these changes in the base rate the one on 22 October 2008 was the most important when the Monetary Council of the National Bank of Hungary increased the base rate from 8,5% to 11,5% due to the increase of the country risk (and the depreciation of the currency).

A common tool to analyze a country's monetary policy is to estimate the Taylor rule for the country. The original version of the Taylor rule (**Taylor 1993**) defined interest rate as a function of the output gap and the inflation's deviation from its target. In his paper Taylor has not yet estimated the rule with econometric tools but analyzed the fit of the rule with given parameters. The original rules was prepared to the United States, so to a relatively closed country. In case of a small, open economy (such as Hungary) exchange rate can also have

some role in the rule – see for example the paper of **Clarida et al. (1998)**. However it must be remarked that Taylor debated in several papers and lectures that exchange rate could improve the monetary policy's ability to stabilize the output and the inflation (**Taylor 2000, 2001, 2002**).

Several authors estimated Taylor rules for Hungary: **Maria-Dolores (2005), Hidi (2006), Siklos (2006), Paez-Farrell (2007), Vasícek (2009), Orlowski (2010)** and **Frömmel et al. (2011)**. The different authors estimated different specifications for different time periods (between 1994 and 2009) applying monthly or quarterly data. According to their results, the Hungarian monetary policy can be described with a Taylor rule and since 2001 the monetary policy really applies an inflation targeting framework. In the studies the inflation gap and the exchange rate were the most important variables. Role of output gap was different in the studies.

Summarizing, the dissertation would like to answer the following questions:

- What kind of methods exist to measure and assess risk?
- What are the consequences of agricultural risk? What are the consequences of this risk's increase?
- Should government support agricultural insurances?
- What kinds of risks affect the pension systems? Can demographic risk be decreased with a pension which depends also on the number of children bought up by the pensioner? What are the macroeconomic consequences?
- How did changes in country risk affect the monetary policy of Hungary and that of some surrounding countries?

2. Methods of the dissertation

I present the methods applied in the 2nd, 3rd and 4th chapters of the dissertation.

The second chapter which is about risks in agriculture applies a **real business cycle** (RBC) model. The model presents a small, open economy in which the agricultural sector faces serious risk. This risk has effects on the farmer's decision. In this framework I analyze the effects of risk, risk preferences and efficiency of diversification on the model's steady state and I investigate the effects of a higher agricultural price and of a better/worse yield.

In the last part of this chapter, a third company, an insurance company is also given to the model. Its task is to decrease the risk of the farmers. In this part the government is also introduced. It has to collect taxes and spend the revenue on the subvention of insurance. With the model I analyze the effects of the tax and subsidy on the penetration and on the main economic indicators.

The third chapter uses an **overlapping generations** (OLG) model. In the model two generations live in each period (young, old). The young work and bear children while the old are already pensioners, they do not work any longer. In the model fertility is endogenous, households can decide on it. In the model there are two types of consumers. The difference between them is that one type likes childbearing more than the other one. With the model I analyze the effects of the pay-as-you-go pension system's introduction in which the pension depends only on the previous contributions and the effects of a possible pension reform resulting a pension system also depends on the number of children brought up by the pensioner.

In the last part of the third chapter effects of some further risks are analyzed.

The fourth chapter uses **econometric** tools to estimate different versions of the **Taylor rule**: in the base scenario a backward-looking rule without smoothing and after forward-looking and rules considering the actual period with and without smoothing. To the estimation the **Generalized Method of Moments** (GMM) was applied. At the analysis of the Hungarian Taylor rule sensitivity analysis are also executed: measurement of risk, inflation and output gap is changed. It is also investigated what would happen if instead of monthly data, quarterly data were applied and that how does the splitting of the analyzed period influence the obtained results.

3. Results of the dissertation

The first chapter presents some well-known and not so well-kown methods to assess the riskiness of an alternative, an asset, etc. The most important conclusion of this chapter can be that there is no unique measure usable in each situation: thus, the analyst has to choose the appropriate measures and parameters.

The chapter also presents the most important tools of country risk's assessment including the methodology of the most important credit rating agencies. As it could be seen also at this presentation, although the agencies have a well-defined methodology, there is some possibility to form the classification subjectively. Of course it also means that country risk does also not have a best measure, all measure should be considered as indicative.

The second chapter is about risks in agriculture. The chapter first reviews the most important risk factors in agriculture and the possible tools to manage them. The most important ones are diversification, insurance, derivative markets, controls, vertical integration and the state intervention to stabilize prices. The next part present the most extremist result of this risk, the famine through some examples from economic history.

In the following part an RBC-type model is prepared to analyze the effects of agricultural risks in case of a small, open and developed economy – the main contributions of the thesis begin here. With the model effects of risk, risk-preferences and diversification were analyzed on the most important variables of the model. The obtained results show **that increase of risk or risk sensitivity result the abandonment of agriculture but do not have significant result on the welfare.**

An increasing efficiency of diversification has an opposite effects: share of agriculture in the GDP increases. Effects agricultural product's price change was also investigated: increase of price raised the share of agriculture in the GDP and the lower consumption of these products. It also means that as in the future not only a higher risk, but also higher prices can be expected, it is possible that increasing prices compensate the declining share of agriculture resulted by the higher risk.

Thus, raising risk does not have any significant effect on the welfare in case of a small, open, developed economy but strongly influences the share and importance of agriculture. It also means that agricultural sector has to learn adapting to changing circumstances if it wants to keep its role in an economy.

The chapter also deals with the causes of low penetration and in agricultural insurance a possible tool of its increase: its financial subsidy. Of course the insurance present in the thesis is a strong simplification as it covers all risks by assumption. However, in practice in many cases the insurance is only against one or some risks making the interpretation of penetration difficult.

According to the obtained results, subsidy of agricultural insurance does not make any important change in the economy's performance if financed from VAT-incomes and not from personal income taxes. However the subsidy means a transfer from consumers to agricultural producers. So, such a subsidy can be suggested to economic policy, if it would like to help farmers – also through helping them to manage their risks.

The third chapter is about risks related to pensions systems. The first part describes these risks.

The second part of this chapter deals with demographic risk and with one its possible solutions: introduction of a pensions system, in which allowances also depend on the number of children bought up by the pensioner. In the chapter a pay-as-you-go pension system is applied. **According to the results, the proposed pension reform is able to increase fertility but has negative effects on the economy's performance.**

The last part of the third chapter analyzes the effects of some risks in the three, earlier defined pensions systems: when there is no obligatory pension system, a basic pay-as-you-go system and a pay-as-you-go pension system in which pensions depend on the number of children brought up by the pensioner. I obtained that **there are no important differences among the three pension systems considering their reaction to risks.**

Chapter four analyses the Hungarian monetary policy from the point of view whether it considered country risk at its decisions. Several versions of the Taylor rule were estimated to it.

If we explain monetary policy's decisions with risk measures instead of exchange rate, Taylor rule's fit can improve in a significant degree: risk parameter was positive and significant, so, the Hungarian monetary policy responded to changes of country risk: a higher country risk resulted a higher base rate. However, improvement of the rule's fit depended strongly on the applied risk measure.

Sensitivity analysis was executed to the other variables of the rules (output gap, inflation), thus, I checked whether other measurements of output gap or inflation would change the other parameters and the model's fit. These changes did not effects the other parameters and the models fit in a significant degree. The other inflation measures gave a worse fit than the core inflation used as base case while fit with other output gap measures was better – although these measures are less supported by theory.

I also investigated whether behavior of monetary policy changed in 2008 as a result of the crisis – although periods before and after the crisis were both short. After the crisis the monetary policy did not respond to changes of the output ap while inflation gap and exchange rates were both significant before and after the crisis.

Another sensitivity analysis was executed considering the data's frequency: what happens if **quarterly data** is used instead of the monthly one. The obtained parameters did not change significantly, except that of the output gap which increased and became significant. Inflation gap, exchange rate and risk kept their significance, but **advantage of the rule with risk disappeared compared to the rule with exchange rate. It means that relation between risk and interest rate is stronger in a quarter than in the medium run.**

Monetary policy of some surrounding countries (Czech Republic, Poland, Romania) was also analyzed from the same point of view. In this case the analysis was no longer so detailed as at the Hungarian case. **While in Romania (similarly to Hungary but in a higher degree) the monetary policy responded with the raise of the interest rate to the higher risk, in the Czech Republic no such effect was found and in Poland the base rate was decreased in this case.**

As the obtained results were quite different in the four countries, I tried to find a possible reason of it: such a reason can be the **share of foreign currency denominated loans**.

I found at all countries that monetary policies really applied an inflation targeting framework (the only exception is perhaps Poland): the inflation gap had an important role in the rules while the output gap was not so important.

The main own results in the thesis are the following:

- **Increase of agricultural risk does not have significant effect on the welfare of a small, open and developed economy; it only decreases the share of agriculture in the GDP while a more efficient diversification can improve it.**
- **State subsidy of agricultural insurance does not influence welfare in a significant degree if the government finances it from VAT and not from personal income tax.**
- **Demographic risk is nowadays an important problem of pension systems. Its possible solution can be the introduction of a pension system, in which the pension would also depend on the number of children brought up by the pensioner not only on the contribution. This reform is able to increase fertility but has adverse effects on the economy.**
- **From the other risks point of view no important difference could be found in the three different pension systems (no obligatory pension, simple pay-as-you-go pension, pay-as-you-go pension with child allowance).**
- **The Hungarian monetary policy responded to changes of country risk at its decisions – in the inflation targeting framework -: a rising country risk resulted a higher base rate.**
- **Romania followed a similar monetary policy from the risk's point of view as Hungary, while the Czech monetary policy did not respond to changes of country risk. In Poland weak evidence was found to an expansive monetary policy in case of a higher country risk. A possible reason of the obtained differences can be the different share of foreign currency denominated loans.**

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