WHEN SHOULD POLAND ENTER THE EURO ZONE? DECISION MAKING WITH THE ANP

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Homo Supermatricus – the humans of the future will make momentous decisions this way with the supermatrix

-T.L. Saaty

ABSTRACT

The paper presents a solution to a real, current and significant problem for Poland. Poland, as a new EU country should join the Economic and Monetary Union – the Euro Zone – after fulfilling the convergence criteria set by the Maastricht Treaty, as soon as possible. Entering the zone, it should gain in many economic, social and political fields. We can therefore look for new opportunities. However, entering the Euro Zone also results in costs and risks. The paper aims to find such an alternative, which would maximize benefits and opportunities, and minimize costs and risks. The alternatives were developed – early, medium-term and late entry of Poland's into the Euro Zone. The problem was solved by use of Analytic Network Process. Whether using the multiplicative or the additive/negative mathematical formulae, the conclusions show, without any doubt, that Poland should enter the Euro Zone late, that is, after 2011.

Keywords: Euro Zone, convergence indicators, Analytic Network Process (ANP)
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1. Introduction

January 1, 2002 brought the European Union into life – 300 million EU inhabitants (Austria, Belgium, Finland, France, Germany, Greece, Holland, Ireland, Italy, Luxembourg, Portugal and Spain) received a new euro currency. On May 1, 2004, 10 subsequent countries (Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, the Slovak Republic and Slovenia); and on January 1, 2007, two more countries, Bulgaria and Romania, committed themselves to enter the monetary union as soon as possible after they fulfilled convergence criteria. According to the Maastricht Treaty of February 2, 1992, all EU member countries shall, as the end result, enter the economic and currency union. Entering countries had or have to accept the Treaty without any conditions.

Only Great Britain and Denmark had not entered the Euro Zone, but they have an "opt-out". Sweden did not manage to get social acceptance on giving up their "crown" and accepting euro in 2003 by referendum, without defining the date of its entry into the currency union. In the euro line, Bulgaria and Romania have been members since January 1, 2007.

Poland's entering the Euro Zone is the subject of many academic conferences (A. Nowak, A. Stępniak, 2003; Strategies 2002, Positive and negative sides 2006), analyses in the form of articles and books, newspapers articles and journals, especially Rzeczpospolita, Gazeta Wyborcza and Wprost. One Internet browser search yielded 16,600 items for "Poland's entry into the Euro Zone".

Poland is divided on the issue. For example, Monetary Policy Council and its President Prof. Leszek Balcerowicz favor a quick entry, claiming it will accelerate its economy (Positive sides,. 2006). According to Balcerowicz, Poland's entry into the monetary union will have a positive impact on:

- inflation control,
- low, long term interest rates,
- better price comparability in euros,
- transaction prices costs reduction in the foreign exchange transactions,
- lower margins on the money borrowed on international market

L. Balcerowicz claims Poland loses 0.2% of its economic growth by postponing its entry into the Euro Zone. Similar opinion is shared by A.S. Bratkowski, Pekao bank Main Economist (Poland in the Euro Zone …, 2006). However, he does not mention costs and risks related to this entry. Also, there are no detailed calculations related to the loss.

Prof. Jakub Mazur offers a contrary opinion. Mazur identifies Poland's entry into the Euro Zone with the loss of national identity (Mazur 2006). In his article "Arguments for and against the Economic and Monetary Union", Mazur (2002) comments on 14 points presented by the propagators of Poland's entry into the Economic and Currency Union and 14 points given by the opponents of the Euro Zone entry. As a conclusion he divides Polish economists into groups of supporters – those who are for the very fast membership in the Euro Zone (for example A. Bratkowski, K. Jakubiszyn) and those who suggest a slow or medium-term entering process (e.g. E. Pietrzak, D. Rosati). Mazur supports the idea to keep Polish zloty without entering the Euro Zone. Similarly Gary S. Becker – Noble Prize Winner in the field of economy in 1992 r. discourages Poland from entering Euro Zone (Bureaucrats' currency, 2006).

Also skeptical towards euro currency were Paul De Grauwe – one of the euro fathers, and the late Milton Friedman – Nobel Prize Winner in the field of economy (1976), the most widely known 20th century economist (Piński & Piński 2006).

Bogdan Borusewicz, Poland's Senate President (Positive sides ....2006) who seems to hold the most balanced opinion on that issue, claiming that it would be politically irresponsible on the part of the government if the planned entrance were to take place before Poland reaches a direct level of economic convergence. This decision could result in enormous social costs and the threat of its fast exclusion from the Euro Zone. He cites Italy, where the costs of remaining in the Euro Zone are higher than exit costs.

The Business Centre Club supports fast entry into the Euro Zone, its opinion motivated by the foreign investments growth and accelerating the economic growth ratio.

Poland President Lech Kaczyński, together with Minister of Finance Zyta Gilowska, support the referendum on the date (undetermined) of Poland's entry into the Euro Zone.

Because of a significant economic distance between Poland and the former 15 "old" EU members (amounting to 20 to 30 years in relation to the most developed countries), a decision on entering the Euro Zone will take into account the following four merits:

- benefits Poland shall obtain after entering the monetary union
- costs we shall bear in relation to preparation for and presence in the Euro Zone
- extra benefits, that is opportunities to be drawn from our presence in the monetary union
- extra costs, that is risks related to our entry into the Euro Zone

This paper aims to estimate those parameters. Sooner or later, Poland has to enter the Euro Zone. The open question is the timing. Therefore, a decision on certain alternatives shall be made. However, each decision on the issue has elements of discovery, irrational incidentally, economic, social, political, organizational, and managerial and other results.

The practice to undertake decisions concentrates on weighing alternatives to fulfill a set of desired objectives. A decision means a choice of one of them. In each decisional problem there is at least one optimal decision where it can be objectively stated that there is no other, better decision, keeping the decision process neutral. The problem is to choose that alternative that fulfils a comprehensive objectives' set. Poland's entry into the Euro Zone is a multicriteria problem, which requires the participation of many players. The behavior and opinions of various participants follow differences in reality perception and processes involved in this reality. They also follow the fact that each person represents a separate world of values, and the participants' viewpoints are based on various, often conflicting, value systems, related points of view assumed at assessment, and a different reality perception. That leads to making multicriteria decisions on Poland's entry into the Euro Zone.

As far as solving multicriteria, the literature points to various methods (Figueria, Greco & Ehrgott, eds. 2005), but the best ones are AHP, ANP (Adamus & Gręda 2005) and they were used in this paper to make a decision on the optimal timing of Poland's entry into the economic and monetary union.

Following Prof. A. Stępniak (Zone, 2003) the article will present three different variants of Poland's entry into the Euro Zone, providing other entry dates and countries that can enter the monetary union together with Poland.

- Early entry into the Euro Zone (in 2008/2009), together with the following countries: Cyprus, Malta, the Slovak Republic;
- Medium-term entry into the Euro Zone (in 2010/2011), with the following countries: Lithuania, Latvia and Estonia;
- Late entry into the Euro Zone (after 2011), with the following countries: Czech Republic, Hungary and perhaps Bulgaria and Romania.

Those alternatives shall be analyzed in the context of benefits, costs, opportunities and risks. Poland's entry into the Euro Zone shall be given a holistic approach accounting for all the parameters. Poland shall enter the Euro Zone when the relation between benefits and opportunities exceeds costs and risks. The problem thus defined shall be solved with the use of multicriteria decision support method ANP – Analytic Network Process (Saaty, 2001), (Figueria, Greco & Ehrgott, eds. 2005).

Poland and EU members (with exception of Great Britain and Denmark) must be ready to enter the monetary union after fulfilling the following conditions:

- Conditions for economy stabilization convergence
- Institutional adjustments,
- European Union acceptance.

2. Conditions for Euro Zone membership: Convergence criteria defined by Maastricht Treaty

The European Union Treaty signed on February 7, 1992 in Maastricht set to determine macroeconomic criteria provided below, which shall be used to evaluate EU member states aspiring to the monetary union.

The Convergence (approximation) criteria have to be fulfilled by all states in the Euro Zone not only nominally but also in real sense, that is to say they must have effective economy in a relatively long period of time.

- Annual budget deficit (of public finance) – percentage of planned or real GDP deficit measured in market prices shall not exceed 3% annually.

- Public debt – the share of debt in GDP in the year preceding the analysis, measured in market prices shall not exceed 60% of GDP. Exceeding those two most important criteria in 2006 by Hungary (budget deficit amounted to 4% of GDP, and the economic growth has not exceeded 4% of GDP) moved the country's entry into the Euro Zone to the years 2010 to 2014.

- Inflation rate – should be lowered than 1.5 % over its average rate in the three EU countries with lowest inflation rate (2.8% in 2006).

- Long term interest rate –should not be higher than the average in three countries with the lowest inflation level increased by 2% (approximately 6% in 2006). Interest rates shall be measured based on the long term state T-bonds or other comparable instruments, taking into account differences in national deficits.

- Stable currency exchange rates – for two years before the Euro Zone entry, the national currency must remain in ERM II (European Currency Exchange Rates) where differences cannot be larger than +/- 15 % from the central parity.

Poland, like other Euro Zone candidates, cannot count for any preferences in this respect. Interpretation of convergence criteria for candidate countries is stricter than the one used for the current Euro Zone members. An\ example is Lithuania, which was not accepted to the Monetary Union. It has exceeded the inflation rate by only 0.03%. The EU Committee for economic and monetary has rejected its attempts to join the Euro Zone.

Institutional adjustments

The moment they joins the Euro Zone, Poland and other countries will be forced to adapt their monetary policy instruments to the requirements of European Central Bank. The most important problem is overflow of the Polish banking sector which generates steps taken by the Polish National Ban, which is opposite to those of the European Central Bank, which puts the money into the banks instead of taking the overflow from them. Also, the open market operations must be adapted to the system obligatory within ECB.

3. Poland's economic position relative to other Euro Zone countries and those aspiring to join the European Union.

At the moment, the Euro Zone includes 13 states: Austria, Belgium, Finland, France, Germany, Greece, Holland, Ireland, Italy, Luxembourg, Portugal, Spain, and since January 1, 2007,

Table 1
Selected macroeconomic indicators for the years 1995-2000-2005 -2006 of states in the Euro Zone and those attempting to join

Country	GDP dynamics (%)				Budgetary balance (%)				Public debt (% GDP)				Inflation (%)			
	1995	2000	2005	2006	1995	2000	2005	2006	1995	2000	2005	2006	1995	2000	2005	2006
Germany	1.0	2.9	0.9	**2.8**	-3.3	-1.2	-3.3	**-1.7**	58.3	60.3	67.7	**71.4**	1.7	2.1	2.1	**1.7**
France	2.0	3.8	1.8	**2.0**	-5.5	-1.4	-1.5	**-2.6**	52.8	57.4	66.8	**75.0**	1.8	1.8	2.0	**1.7**
Italy	3.0	3.1	4.0	**1.9**	-7.6	-0.5	-1.8	**-4.5**	125.3	110.6	106.4	**119.9**	5.2	2.6	2.3	**2.1**
Holland	2.2	3.5	0.7	**2.9**	-4.2	2.2	-0.3	**0.5**	79.0	56.0	52.9	**59.7**	1.5	2.3	1.6	**1.2**
Belgium	2.0	3.6	1.5	**3.2**	-4.3	0.1	0.1	**0.1**	132.2	109.3	93.3	**90.7**	1.1	2.7	2.6	**1.8**
Luxembourg	3.8	9.1	3.5	**6.2**	2.7	5.8	-1.9	**0.1**	5.8	5.6	6.2	**9.8**	1.0	3.2	3.9	**2.7**
Spain	3.0	4.2	3.4	**3.9**	-7.0	-0.3	1.1	**1.8**	67.2	60.4	43.2	**47.1**	2.2	3.4	3.7	**3.5**
Portugal	3.0	3.7	0.8	**1.3**	-4.6	-1.5	-6.0	**-3.9**	65.9	53.4	63.9	**73.2**	2.2	2.8	-	**3.1**
Ireland	12.0	10.1	4.7	**6.0**	-2.2	4.5	1.0	**2.9**	78.9	39.0	27.6	**30.4**	2.5	5.3	2.5	**3.9**
Austria	2.0	3.5	1.8	**3.1**	-5.2	-1.6	-1.5	**-1.2**	69.4	63.6	62.9	**68.9**	1.5	2.0	1.9	**1.4**
Finland	5.0	5.1	2.2	**5.5**	-3.7	6.9	2.6	**3.8**	58.1	44.0	41.1	**46.2**	0.3	3.0	1.1	**1.6**
Greece	2.0	4.4	3.7	**4.3**	-0.2	-0.8	-2.4	**-2.3**	110.1	102.8	107.5	**92.5**	2.2	2.9	3.4	**3.2**
Great Britain	3.0	3.8	1.7	**2.8**	-5.4	4.4	-3.6	**-2.9**	53.9	45.7	42.8	**46.6**	2.3	2.1	2.1	**2.3**
Sweden	4.0	4.4	2.6	**4.2**	-7.9	4.0	2.9	**2.1**	77.6	65.7	50.3	**53.9**	2.7	1.0	1.3	**1.4**
Denmark	3.0	2.6	2.8	**3.2**	-2.3	2.5	4.9	**4.2**	73.3	57.1	35.8	**34.7**	2.5	3.0	2.0	**1.9**
Euro Zone	**-**	**-**	**4.7**	**2.7**	**-5.0**	**0.2**	**1.0**	**-1.6**	**73.4**	**70.1**	**70.8**	**76.1**	**2.7**	**2.4**	**2.3**	**2.2**
Bulgaria			5.5				-11.3				29.9				5.0	
The Czech Republic			4.8	**6.4**			-2.6	**-2.9**			30.5	**35.6**			1.6	**2.6**
Estonia			9.8				-10.5				4.5				4.1	
Lithuania			7.6				-7.2				18.7				2.7	
Latvia			10.2				12.7				12.1				6.7	
Poland	**7.0**	**4.0**	**3.5**	**5.8**	**2.9**	**3.0**	**-2.5**	**-3.9**	**51.6**	**42.4**	**50.2**	**49.8**	**27.9**	**10.8**	**1.3**	**1.3**
Romania			4.1				**-8.6**				**15.2**				**9.0**	
Slovenia			4.0				-1.4				29.1				2.5	
The Slovak Republic			5.5	**8.3**			-2.9	**-3.4**			34.5	**37.0**			2.8	**4.5**
Hungary			3.9	**3.9**			-6.1	**-9.2**			61.5	**73.2**			3.5	**3.9**
Maastricht criterion							**0-3.0%**				**=<60.0**				**=<2.8**	

Source: Calculations based on: Eurostat CIA FACTBOOK. 2006, UniCredit New Europe Research Network

Slovenia. New EU members and Sweden, which has not determined by referendum the date of its entry into the monetary union, are in line to join the union.

Table 1 presents selected macroeconomic indicators for the years 1995, 2000, 2005 and 2006 of countries already present in the Euro Zone and of those attempting to join.
Indicators can be divided into three groups:

- Gross Domestic Product (GDP) dynamics,
- Fiscal criteria (public finance deficit and public debt),
- Inflation.

Analyzing Poland's GDP dynamics in the years 1995, 2000, 2005 and 2006 in relation to countries in the Euro Zone, we may say that GDP tendency is similar to countries such as Finland or Sweden. Most probably, had it not been for the cooling of Poland in 1995 (Balcerowicz), the dynamics of its GDP would be one of the highest in Europe. In 2006 GDP in Poland increased by 6% in comparison to the year 2005, and the analysts predict its growth in 2007 up to 7%. Unfortunately, this indicator does not take into account many features, such as knowledge, education, health, beauty, cultural and natural resources, sensitivity and courage; in other words all that makes life sensible.

Fiscal criteria are not favorable for Poland. Although the relation of public debt to GDP does not exceed 60% set by the EU (49.8% in 2006), yet budget deficit in 2006 exceeds the admissible limit of 3%. It should be underlined that Poland uses the right to include resources gathered in pension funds in the public finance sector (up to the year 2008). If part of pension system reform costs were included in the budget deficit, then one would expect the budget to exceed by even higher value. Therefore, public finance regulation will be the largest challenge before Poland's entering the Euro Zone.

Among the countries attempting to join the Euro Zone, it was only Slovenia, the Slovak Republic and the Czech Republic fulfilled budget deficit criterion in 2005. Among all EU countries, in 2005, the budgetary surplus was present in Denmark (4.9%), Sweden (2.9%), Finland (2.6%), Spain (1.1%), Ireland (1.0%) and Belgium (0.1%).

The largest deficit was experienced by the countries aspiring to the Euro Zone were: Latvia (-12.7%), Bulgaria (-11.3%) and Estonia (-10.5%). Among candidate countries to enter the monetary union in 2005, the lowest deficit was present in Slovenia (-1.7%).

The debt of Euro Zone countries still exceeds the agreed limit of 60% set by the EU (70.8% average in 2005, 76.1 % in 2006); including the largest countries: Germany, France and Italy. In the Maastricht Treaty, high penalties were levied on the countries not following convergence criteria. Unfortunately, it is impossible to enforce them.

Reference value for inflation criteria in 2005 was 2.8 percentage point. Poland has fulfilled this criterion since 2003, a year before it entered the European Union until now (May 2007).

Among the countries aspiring to enter the Euro Zone in 2005, the criterion was fulfilled by the Czech Republic, Lithuania, Poland and the Slovak Republic as well as countries outside the Euro Zone: Denmark, Sweden and Great Britain. Poland also fulfils a long term interest rate criterion.

Due to the lack of all macroeconomic criteria listed in Table 1 for Cyprus and Malta within the EU structure and candidates to the euro structure, this paper does not analyze their results. Cyprus and Malta already participate in the European Exchange Rate Mechanism (ERM II), and plan to have common euro currency already in 2008. Also Lithuania, Latvia, Estonia and Denmark have introduced their currencies to the European Rate Mechanism II (2006).

Other countries do not hurry to change their domestic currency into euro. Prof. Jan Winiecki of the Polish Economists Society observed that (Glapiak 2007) while some all the time can not cope with the necessity to fulfill conditions defined in the Maastricht Treaty, others move the date of Euro Zone entry for political reasons.

The date Poland enters the Euro Zone depends on the date all Maastricht Treaty convergence criteria are fulfilled, including the most important one: regulating public finance. Poland's entry into the Euro Zone not only means enormous benefits, as some think, but also great responsibility for euro currency stability and the EU economy.

The key important element for Poland as part of the EU structures is reasonable and responsible use of synergy effect, through integration with EU countries to further the increase its civilization level. Poland's entering the monetary union is connected to multiple benefits but also costs, as well as opportunities and risks for the society and the Polish economy. Those values were verbally defined in hundreds of articles and discussions. However, none of those estimate the values for benefits, costs, opportunities and risks. Therefore, this paper aims to estimate their levels. To solve the problem, the author uses a multicriteria decision support method ANP – Analytic Network Process (Saaty, 2001).

4. The Essence of ANP

Analytic Network Process – ANP is a new theory supporting decision process, as a more developed version of Analytic Hierarchy Process (Saaty, 2000), one of the most widely known multicriteria decision making method. ANP can be used to solve the most complex decision problems.

In the ANP method we use a systematic approach to multicriteria problems. It was initiated as a reaction to increasing specialization and the lack of communication between different fields. One of the founders of the systemic approach, L. von Bertalanffy (biologist), in the 1950s, claimed that live organisms and also organizations are complex systems. In his view, the whole is more than a sum of elements. In order to able to say something about the whole, and also connections among them, the parts have to be examined in context. The basic assumptions of the systemic approach are as follows

- Everything is related to everything else
- Nothing stems from anything in a simple way – we can never predict all consequences of any phenomenon, process or activity.

Network thinking is an interesting tool, inspiring the decision maker's intellect in solving multicriteria problems. It is based on the paradigm of a holistic and systematic approach to the problem. To use it, however, one needs to use a precise and adequate language. To make terms and notions precise requires multilateral discussions of decision makers, experts and other decision making process participants. That, in turn, makes it possible to consider variants and deepen self-criticism of all process participants. Using the network thinking process take more time, but solving difficult problems can possibly spare many unpleasant surprises. Using systemic reasoning, we can perceive connections, feedbacks, loops between events, processes, persons and network elements.

In making multicriteria decisions, a decision maker has to compare one with different goals, criteria, subcriteria, decisional variants etc. Those comparisons are made based on his knowledge, experience and intuition.

Everyone has the ability to subjectively experience the world with self-awareness, self-consciousness, the freedom of choice, the ability to make conscious or unconscious decisions, and the ability to differentiate between the good and the evil. That all amounts to validating actions – both his own and those of others.

For the ANP model, it is the network that is a very important notion. It is a structure of clusters, nods and connections between the nods. A nod, as a network element, has a very wide meaning. It can designate people, institutions, machines, technology, workplaces, information carriers etc. In other words, nods are subjects resulting from relations with others. All connections between them that make sense can be treated as relations between the nods. For the network elements defined in a general sense should be defined in more detail. In such networks, nods can signify virtual entities or people participating in the network, with some engagement as decision makers, managers and implementations (Schael 1997).

Usually, networks have feedbacks (lines going both directions between clusters) and can have internal dependencies (a loop in the cluster points to nods in which clusters have connections with each other). A hierarchy is a simple type of network.

A cluster is logical grouping of factors or elements within a given decision to be considered. Factors or elements are nods. In the network, the parts as groups of elements (responding to levels in the hierarchy) are not present in any given order. Connections of components are made by determining whether and to what extent elements of a given group influence elements of another group, and vice versa. It assumes the form of arrows, which in that case can go both ways (feedback). Components with network elements also have loops, if elements within them are internally dependent (internal dependence). In relation to groups of alternatives in the network, it can (although does not have to) include feedback to other components.

Networks can occur (can be generated) from the hierarchy through gradual increase of a number of hierarchical connections. Saaty (2001) introduces a specific terminology for this type of hierarchy and their modifications to the feedback system. It follows the fact that each decision problem can be presented in the network form.

Presenting problem structure in the network form results from the fact that many decision problems cannot be presented in the form of hierarchy, as they require taking into account interdependencies and influences of elements positioned on higher levels of hierarchy upon elements on lower levels. ANP introduces a free form of ordering elements instead of a tight importance chain (as in the hierarchy) but also the importance of alternatives themselves, which determine the importance of criteria. It is not only the importance of criteria that determines the importance of alternatives (as in the case of hierarchy)

The author of AHP/ANP methods is and American mathematician Professor Thomas Saaty from the University of Pittsburgh. He started working on the AHP method development in the early 1970s, and in 1975, started developing the ANP model. As late as in 2001 his book on ANP model was published, entitled *Decision Making with Dependence and Feedback, The Analytic Network Process*. T.L. Saaty is an author and co-author of many books and more that 300 articles on AHP/ANP methods.

Feedback makes it possible to take into account future factors (in the present perspective) that will determine what we expect and what we aim to achieve in the future. A practical tool, serving the implementation of the ANP and allowing for undertaking more complex decisions is software developed by Rozann Saaty with William Adams Super Decision©. AHP method is supported by the Expert Choice software. As for software, it should be noted that both AHP and ANP had to wait until fast computers came into being to be used more widely. ANP supermatrix requires the computer support to a much greater extent than hierarchically structured AHP. That is why, three

years after Saaty's book on ANP method and developing and spreading Super Decision problems, it became possible to account for dependencies between elements and their feedback. It brought wide interest and use of AHP/ANP models.

5. Steps in choosing the best alternative for Poland's entry into the Euro Zone in the framework of the Analytic Network Process (ANP).

1. Presenting a decisional problem in details in the context of ANP method, that is, decision's goals, criteria, subcriteria, actors decision process participants; their objectives, points of view on the problem to be considered, and possible alternatives of Poland's entry to the Economic and Monetary Union in the European Union. Providing detailed factors that will influence the final decision.

2. Describing control criteria and subcriteria within four control hierarchies for merits (personal merits): benefits (B), opportunities (O), costs (C) and risks (R) of the above defined decision.

3. In control criteria subsets for BOCR, we build a structure in the form of a hierarchy tree including key elements (criteria and subcriteria). Each subnet is constructed in the form of a cluster with objectives' nod. Clusters of the main BOCR merits (benefits, opportunities, costs and risks) Subcriteria clusters are related to one of the main criteria. In order to calculate priorities we connect goals with criteria and each criterion with their subcriteria. In order to calculate priorities for subcriteria, we make pairwise comparisons for all network elements. Each subcriterion is a potential "control criterion" in the further network analysis.

4. We make criteria pairwise comparisons separately for each BOCR, and next subcriteria to criteria in the four control hierarchies (on T.L. Saaty's fundamental scale: from 1 to 9). In the case of benefits and opportunities, we ask a question while comparing criteria and subcriteria what ensures the largest benefits in the case of Poland's entry into the Euro Zone and what constitutes the largest hidden benefits – opportunities in relation to the control criterion. In the case of costs and risks a question should be asked: What is the largest cost in the preparation phase? At the moment Poland enters the monetary union what will lead to the largest hidden costs and risks? The worst alternative gets the highest priority for risks and costs.

   We calculate global priorities by multiplying priorities for a criterion times a priority for a subciterion for the four designated BOCR merits.

5. For further implementation of decision process, those subcriteria which for the four BOCR control criteria account for about 70% to 80% of the total sum of priorities for all subcriteria. These are usually those sub criteria, which achieved the merits for the global priorities over 3%. The values of global priorities for subcriteria were calculated by dividing each local priority for a subcriterion by four (four BOCR control criteria). Author experience shows that it is usually 30% to 40% of the most important subcriteria from the entire network (with priorities over 3%) that account for circa 70% to 80% of the total sum of priorities for all subcriteria. It significantly simplifies our decision process to follow, because we only analyze the most important criteria determining Poland's entry into the Euro Zone, following the Vilfredo Pareto "20/80" rule. This rule, formulated by the Italian economist, means that 80% of results achieved by each manager follows implementation of 20% of his tasks whereas 80% of activities are responsible only for 20% of effects.

6. Constructing a general clusters' (or components') network and their elements, concerning all BOCR control criteria. Subnets in relation to control criteria are the lowest network level in the model of Poland's entry into the Euro Zone.

7. Building decision subnets for each selected control criterion. During that step, we introduce a cluster of alternatives (defined previously as a) fast Poland's entry into the Euro Zone, b) midterm Poland's entry into the Euro Zone c) late Poland's entry into the Euro Zone. A cluster of the above defined alternatives must be present in each decision subnet with other clusters.

8. For each control criterion (or subcriterion) those clusters are defined (with their elements) which influence other clusters (or elements) in relation to a given criterion, or they themselves can be under influence of other clusters or elements. Importance (being under influence or exerting influence) must be applied to all criteria of all control hierarchies for a total response. In a graphic presentation of the model, clusters are connected with arrows following their external and internal dependencies and influences. There is an arrow from each cluster connecting it to another cluster that influences that cluster or its elements.

9. We make appropriate connection between nods and make pairwise comparisons of clusters with each other, In relation to a given criterion. In benefits (B) decision subnet, we make pairwise comparisons of clusters (on T. Saaty's fundamental scale), by asking questions which cluster (or its elements) are the most beneficial in the context of analyzed subcriterion. Similar questions are asked with Opportunities (O) subnet. The best alternative receives the highest priorities for benefits and opportunities. In Risks (R) and Costs (C) decision subnets during cluster pairwise comparisons, we ask which are more expensive or risky. The worst alternative receives the highest priorities for Risks and Costs.

10. For each control criterion, we construct a supermatrix. Appropriate categories should include priorities following cluster comparisons in the net.

11. Each pair of elements within the clusters are compared in accordance to their influence on each element in subsequent clusters with which they are connected (external dependency) or elements of the same clusters (internal interdependency). While making comparisons, we should always take into account the criterion that is a context for our comparisons. Elements are compared in accordance with influence of a given element influences another element to a greater extent, and the greater importance within T. Saaty's scale than another element it is compared to. Those comparisons must take into account control criterion or control hierarchy criterion.

12. Clusters are also compared, pairwise, with respect to their influence on the control criterion. Calculated weights are used to weigh elements of respective blocks of supermatrix columns. Zero is assigned to those comparisons where there is no influence between compared clusters. This way we obtain a supermatrix stochastically weighted.

13. Estimate the importance of each subsystem, that is benefits (B), opportunities (O), costs (C) and risks (R) of a problem in question. In taking any decision its significance differs in relation to (B), opportunities (O), costs (C) and risks (R). Hence we have to prioritize them by estimating strategic criteria. Those criteria constitute our system of merits, with respect to them we estimate the importance of best alternatives (B, O, C, R) of the problem we are solving – for example very high, high, medium, low, very low.

14. Synthesizing priorities limited by weighting each idealized criteria. We choose the best alternative using the multiplicative formula (BO/CR) dividing a multiplication of variant priorities for benefits and opportunities by the multiplication of costs and risks The other formula for choosing the best variant is additive – negative bB + oO – Cc – rR. In the latter formula the importance of each subsystem i.e. benefits (b), opportunities (o), costs (c) and risks (r) for a given problem must be estimated. The optimal variant has a higher result.

15. Finally, a sensitivity analysis of the final result is performed. The analysis concerns "what – if" questions. It make possible to determine whether the final answer is stable and to what extent it will allow to change the input data concerning evaluations or priorities. It is particularly interesting to see whether those changes can be measured with a compatibility index.

6. Prioritization of ANP model control criteria for Poland's entry into the Euro Zone

Table 2 presents prioritization of control criteria for the merits: benefits, costs, opportunities and risks. Prioritization is based on pairwise comparison on T.L. Saaty's fundamental scale (1 - 9). Criteria were divided into economic and social, and compared among each other with respect to benefits, opportunities, costs, and risks. With respect to all merits, economic criteria overweigh the social ones.

Next, local priorities were calculated for 27 subcriteria for all merits.

Among benefits, it was the economic criterion that achieved the highest priority - Stable economic growth (0.4340), in the category of opportunities, the most important economic subcriterion is the growth of export (0.4990) and social - tax lowering (0.7500).

Among costs the most important subcriteria proved the following: dependence upon the EU economic trends (0.4030) and the adjustment of monetary policy instruments to the requirements of the European Central Bank (0.3680). A relatively high priority was assigned to social costs - giving up own monetary policy (0.4070). The highest risks were assigned to the lack of competitiveness of products (0.5140) and the increase in energy prices (0.2330). Global priorities vector was normalized to the value of 1.

Subcriteria, for which the priorities are equal or exceed (0.03) (3%), were included in the analysis (marked bold in the table).

7. Decision subnet analysis for each selected control criterion BOCR

At this stage, a cluster of three alternatives was introduced into the model. These alternatives had been defined earlier as the following scenarios: (a) early entrance of Poland into the Euro Zone, (b) medium-term entrance of Poland into the Euro Zone, (c) late entrance of Poland into the Euro Zone.

Figure 1 presents the 13 sub-criteria, selected earlier from amongst 27 sub-criteria, analyzed using the *Super Decisions* software.

Table 2
Prioritization of control criteria and elements of ANP model for benefits, opportunities, costs and risks of Poland's entry into the Euro Zone

Merits	Criteria	Subcriteria	Local priorities	Global priorities
Benefits	Economic (0.7500)	Eliminating exchange risks	0.1080	0.0200
		Lowering costs of obtaining capital	0.0510	0.0090
		Stable economic growth	0.4340	**0.0820**
		Public finance improvement	0.3070	**0.0580**
		Increase in debt support for the economy	0.1000	0.0190
	Social (0.2500)	People trust to money	0.4790	**0.0300**
		Closer tights with EU	0.2810	0.0180
		Unprofitable companies restructuring	0.2400	0.0150
Opportunities	Economic (0.8000)	Export increase	0.4990	**0.1000**
		Investment capital inflow	0.1340	0.0270
		Manufacturing unit costs decrease	0.0830	0.0170
		Financial system stability	0.2840	**0.0570**
	Social (0.2000)	Tax lowering	0.7500	0.0380
		Free market strengthening	0.2500	0.0120
Costs	Economic (0.6700)	Adaptation of monetary policy instruments to ECB requirements	0.3680	**0.0620**
		Adaptation of open market operations to ECB requirements	0.2290	**0.0380**
		Dependence on EU economic trends	0.4030	**0.0680**
	Social (0.3300)	Increase of bankrupt companies	0.2540	0.0210
		Flexibility decrease in economic growth	0.3390	0.0280
		Giving up own monetary policy	0.4070	**0.0340**
Risks	Economic (0.8000)	Euro rate fall + strengthening of currencies outside EEA	0.1770	**0.0360**
		Lack of competitiveness outside new products and quality increase	0.5140	**0.1030**
		Energy prices increase outside EU	0.2330	**0.0470**
		Speculating capital inflow	0.0760	**0.0150**
	Social (0.2000)	Unemployment increase	0.3590	0.0180
		Weakening of national identity	0.4230	0.0210
		Social unrest	0.2180	0.0110

Figure 2 illustrates the ANP model of "benefits" of Poland's entry into the Euro Zone. The sub-criteria with global priority equal to or bigger than 0.03 were analyzed under the subset of "benefits".

Figure 3 shows the ANP model of "costs" of Poland's entry into the Euro Zone. The sub-criteria with global priority equal to or bigger than 0.03 were analyzed under the subset of "costs".

Figure 4 presents the ANP model of "opportunities" of Poland's entry into the Euro Zone. The sub-criteria with global priority equal to or bigger than 0.03 were analyzed under the subset of "opportunities".

Figure 5 illustrates the ANP model of "risks" of Poland's entry into the Euro Zone. The sub-criteria with global priority equal to or bigger than 0.03 were analyzed under the subset of "risks".

Figure 6 demonstrates a network of connections and mutual influences between particular elements for the permanent economic growth sub-criterion. It has been assumed that its indicator (Gross Domestic Product – GDP) is dependent on decisions of the following institutions: Government, Parliament, Monetary Policy Council, Ministry of Finance, European Parliament, National Bank of Poland, and on individual decisions of consumers and producers (enterprises).

By comparing these elements pairwise, their priorities were estimated, which illustrate their relations in the context of the permanent economic growth. In addition, the three alternatives were compared with each other within a net of their influences and feedbacks with the three elements presented by Figure 7, and their priorities were calculated in the context of the permanent economic growth.

Similar procedures were performed for the remaining 12 sub-criteria in relation to all merits, namely: benefits, costs, opportunities and risks.

The overall results for all comparisons are shown in Table 3.

According to the outcomes presented in Table 3, the optimal date of joining Poland to the Euro Zone is the latest possible date, after 2011 to be more specific, together with the countries such as Czech Republic, Hungary and perhaps Bulgaria and Romania. For the 3 sub-criteria analyzed as benefits, only one (*improved condition of public finances*) indicates late entrance to the Euro Zone as optimal, while the two remaining (*permanent economic growth* and *people's trust in money*) indicate medium-term period of the entrance.
Considering opportunities of Poland's entrance into the Euro Zone, it can be observed that from amongst three components analyzed, only one (*increased export*) points to the medium-term scenario, while the remaining two components (*financial system stability* and *tax rate decrease*) suggest the latest possible entry.

Table 3 shows the analysis of the four components related to costs and three components related to risks. Their priorities decisively point to Poland's **late** entry to the Euro Zone.

Table 3.
Prioritization of decision alternatives for control criteria and subcriteria in the models: benefits, costs, opportunities and risks.

Merits	**Benefits**			**Costs**			
Criteria	**Economic (0.7500)**		**Social (0.2500)**	**Economic (0.6700)**			**Social (0.3300)**
Alterna-tives	Stable economic growth (0.4340)	Public fin. improve ment (0.3070)	People's trust in money (0.4790)	Adjust-ment of monet. policy to ECB (0.3680)	Open market adjust-ment (0.2290)	Economic tendency improve-ment (0.4030)	Own monetary policy resigna-tion. (0.4070)
Late entry into Euro Zone	0.8759	1.0000	0.6122	0.0867	0.0867	0.1014	0.1314
Middle time entry into Euro Zone	1.0000	0.1895	1.0000	0.2873	0.2873	0.4110	0.3624
Early entry into Euro Zone	0.3607	0.0838	0.3255	1.0000	1.0000	1.0000	1.0000

Merits	**Opportunities**			**Risks**		
Criteria	**Economic** (0.8000)		**Social** (0.2000)	**Economic** (0.8000)		
Alternatives	Stable financial. system (0.2840)	Export growth (0.4990)	Tax lowering (0.7500)	Lack of competition (0.5140)	Euro rate fall (0.1770)	Energy price increase (0.2330)
Late entry into Euro Zone	1.0000	0.4971	1.0000	0.1314	0.1771	0.1619
Middle time entry into Euro Zone	0.3462	1.0000	0.3815	0.3624	0.9410	0.4162
Early entry into Euro Zone	0.1240	0.5092	0.4369	1.0000	1.0000	1.0000

The overall results are shown in Table 4.

Table 4
Decision alternatives' prioritization for benefits, opportunities, costs and risks

Alternatives	Benefits	Opportunities	Costs	Risks
Late entry into Euro Zone	0.8714	0.6795	0.0991	0.1070
Medium time frame entry into Euro Zone	0.7237	0.7629	0.3414	0.3819
Early entry into Euro Zone	0.2600	0.3695	1.0000	0.7478

In selecting the optimal alternative date of Poland's entry into the Euro Zone, it is essential to link the values of the priorities' alternatives with the control hierarchy of benefits (B), costs (C), opportunities (O) and risks (R). It can be performed in two ways: (1) using mathematical formula (BO/CR), in which the values of variants' priorities for benefits multiplied by opportunities (B*O) are divided by the values for costs multiplied by risks (C*R); (2) using mathematical formula (bB+oO-cC-rR), which requires defining levels of importance for sub-systems of benefits (b), costs (c), opportunities (o) and risks (r). In the latter case, so called strategic criteria are defined, for which their importance is estimated. This stage allows us to look at the problem from more general perspective, that is, from the viewpoint of the criteria such as: increased welfare of Polish society, financial integration of the national banking system with the European Central Bank, social and political integration with the EU countries. Each of the main listed criteria have their subcriteria.

A model of the strategic criteria is illustrated in Figure 8.

The strategic criteria enable the connection of results for benefits and opportunities with those for costs and risks, and presenting the final result. The scale (personal criteria), based on which the importance of benefits, costs, opportunities and risks have been estimated is presented in Table 5.

Table 5
Determining ratings priorities

Personal criteria	**Very high**	**High**	**Medium**	**Low**	**Very Low**	**Pi**
Very high	1	2	3	4	5	0.42
High	1/2	1	2	3	4	0.26
Medium	1/3	1/2	1	2	3	0.16
Low	1/4	1/3	1/2	1	2	0.10
Very low	1/5	1/4	1/3	1/2	1	0.06
Total						1.00

Table 6 clearly demonstrates that the most important criterion to be considered in analyzing the country's entrance to the Euro Zone is *increased welfare of Polish citizens* (0.43), followed by *financial integration* (0.28). The values derived from prioritization of the strategic criteria for benefits (0.3280) and opportunities (0.1840) are higher than the respective values derived for costs (0.2720) and risks (0.2160). At this stage, it can be asserted that benefits and opportunities from Poland's entry to the Euro Zone will outweigh the potential costs and risks.

Yet, the main research objective of this study is to recommend when Poland should join the Euro Zone. As explained in the previous sections, this is the only decision-making option we can consider. In order to provide an explicit answer, third step of analysis was performed, which included the above estimated priorities for benefits, costs, opportunities and risks. Pair-comparisons of three decision-making variants based on importance of the BOCR values led to the selection of the best possible alternative (Table 7).

Table 6
Priorities estimation for merits: benefits, costs, opportunities and risks
Ratings priorities: very high (0.42), high (0.26), average (0.16), low (0.10), very low (0.06)

Criteria	**Subcriteria**	**Merits**			
		Benefits (B)	**Costs (C)**	**Opportunities (O)**	**Risks (R)**
Improvement of Poles' living standards **(0.43)**	Per capita GDP level reaching the EU level (0.14)	High (0.26)	Very high (0.42)	Low (0.10)	High (0.26)
	Economic growth stabilization (0.15)	Very high (0.42)	High (0.26)	Average (0.16)	Average (0.16)
	Export dynamic growth (0.14)	High (0.26)	Average (0.16)	Low (0.10)	Average (0.16)
	Direct investment capital (0.14)	High (0.26)	High (0.26)	Low (0.10)	Average (0.16)
	Private spending increase (0.14)	High (0.26)	Low (0.10)	Average (0.16)	Low (0.10)
	Unemployment rate fall (0.14)	Very high (0.42)	High (0.26)	Average (0.16)	Average (0.16)
	Economic development flexibility (0.15)	Low (0.10)	High (0.26)	Low (0.10)	Average (0.16)
Financial integration **(0.28)**	Monetary policy transferred to ECB (0.16)	Low (0.10)	Average (0.16)	Low (0.10)	Average (0.16)
	Exchange risk elimination (0.48)	High (0.26)	Very low (0.06)	Average (0.16)	Low (0.10)
	Foreign EU currency reserves elimination (0.29)	Average (0.16)	Low (0.10)	Average (0.16)	Low (0.10)
	Speculation capital intensive inflow (0.07)	Very low (0.06)	Very high (0.42)	Very low (0.06)	Very high (0.42)
Social integration **(0.18)**	Labor mobility increase (0.37)	High (0.26)	High (0.26)	Average (0.16)	Low (0.10)
	Easier trading exchange between Poland and EU countries UE (0.38)	High (0.26)	Low (0.10)	Average (0.16)	Low (0.10)
	Limits on national sovereignty with respect to own monetary policy (0.25)	Very low (0.06)	Average (0.16)	Very low (0.06)	Average (0.16)
Political integration **(0.11)**	European identity acquiring (0.15)	High (0.26)	Average (0.16)	Average (0.16)	Low (0.10)
	Closer ties with EU (0.24)	High (0.26)	High (0.26)	Average (0.16)	Average (0.16)
	Foregoing national identity (0.15)	Very low (0.06)	Average (0.16)	Low (0.10)	Average (0.16)
	Decreasing possibility of competition between governments in fields of investment and manufacturing (0.46)	Very low (0.06)	High (0.26)	Low (0.10)	High (0.26)
Priorities		**0.3280**	**0.2720**	**0.1840**	**0.2160**

Table 7
Synthesis of final priorities of the three alternatives

Alternatives	**Benefits (0.3280)**	**Opportunities (0.1840)**	**Costs (0.2720)**	**Risks (0.2160)**	**Multiplicative formula BO/CR**	**Additive – Negative formula bB+oO-cC-rR**
Late entry into Euro Zone	0.8714	0.6795	0.0991	0.1070	40.4241	0.3520
Medium time frame entry into Euro Zone	0.7237	0.7629	0.3414	0.3819	3.3219	0.1797
Early entry into Euro Zone	0.2600	0.3695	1.0000	0.7478	0.0961	-0.3347

The optimal alternative for Poland is late entrance into the Euro Zone. Such outcome has been achieved by both formulas: multiplicative and additive-negative.

The problem discussed in this paper represents a "hot topic" in Poland, and was analyzed based on the ANP method. This method allows solving multi-criteria problems in reality. It requires the advanced knowledge and experience of decision makers, as well as a great amount of work to grasp all significant factors and their mutual interactions. It has been suggested that nearly all complex problems can be solved using this method.

Figure 1 Control hierarchy of dependencies and feedbacks in the model of Poland's entry into the Euro Zone.

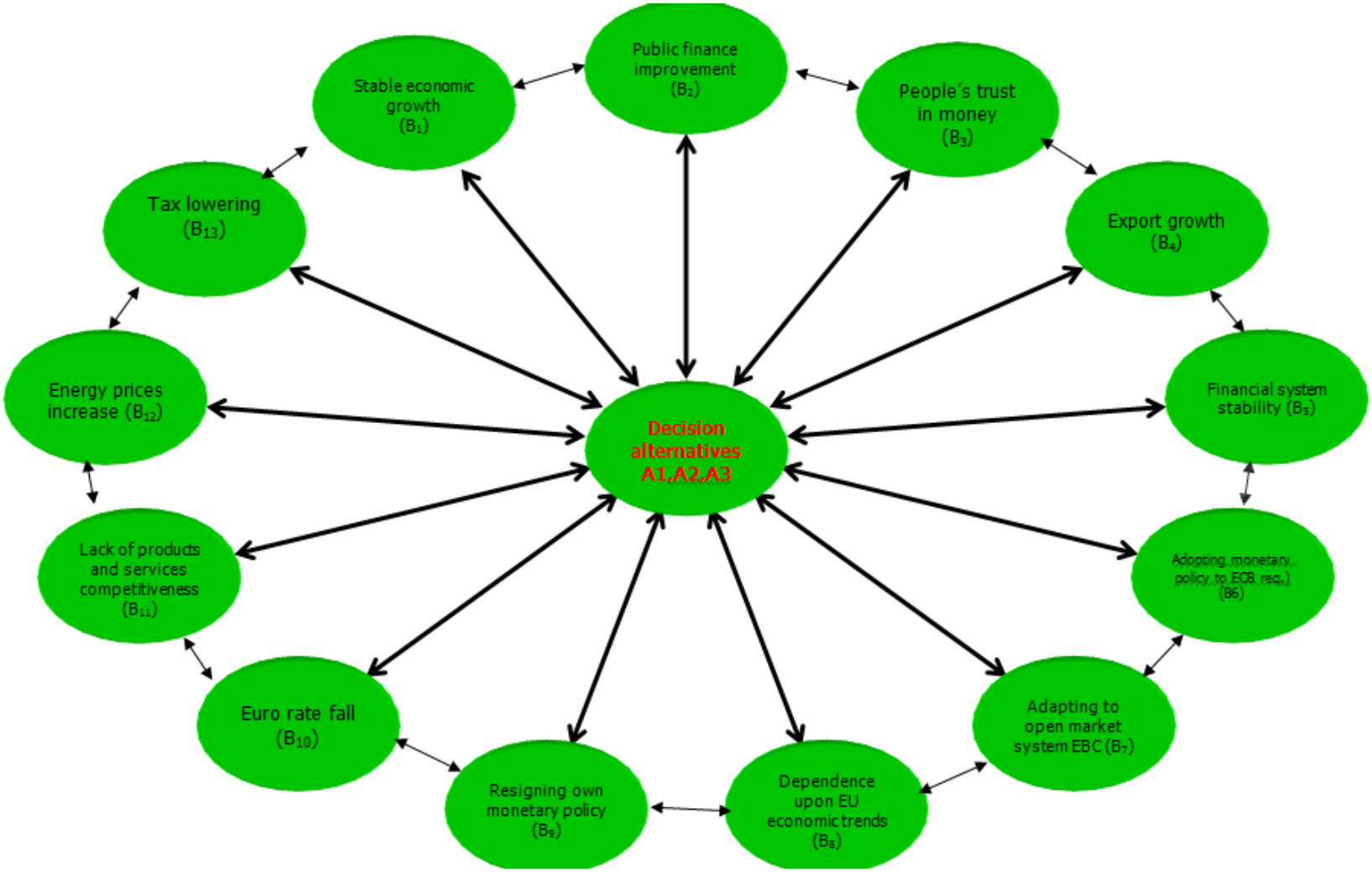


Figure 2 Subnet under Benefits following Poland's entry into the Euro Zone

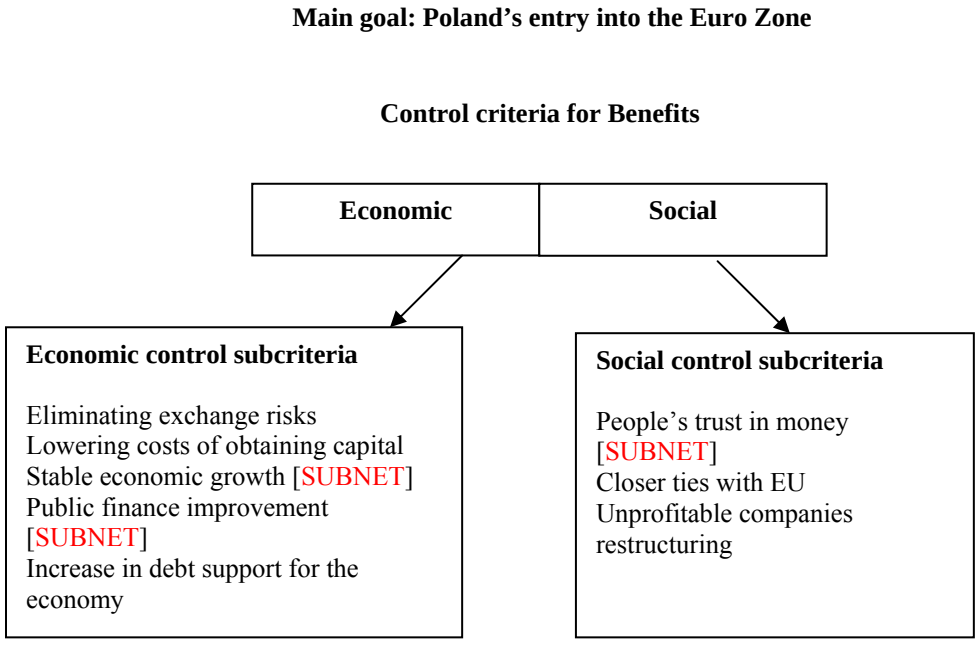


Figure 3 Subnet under Costs following Poland's entry into the Euro Zone

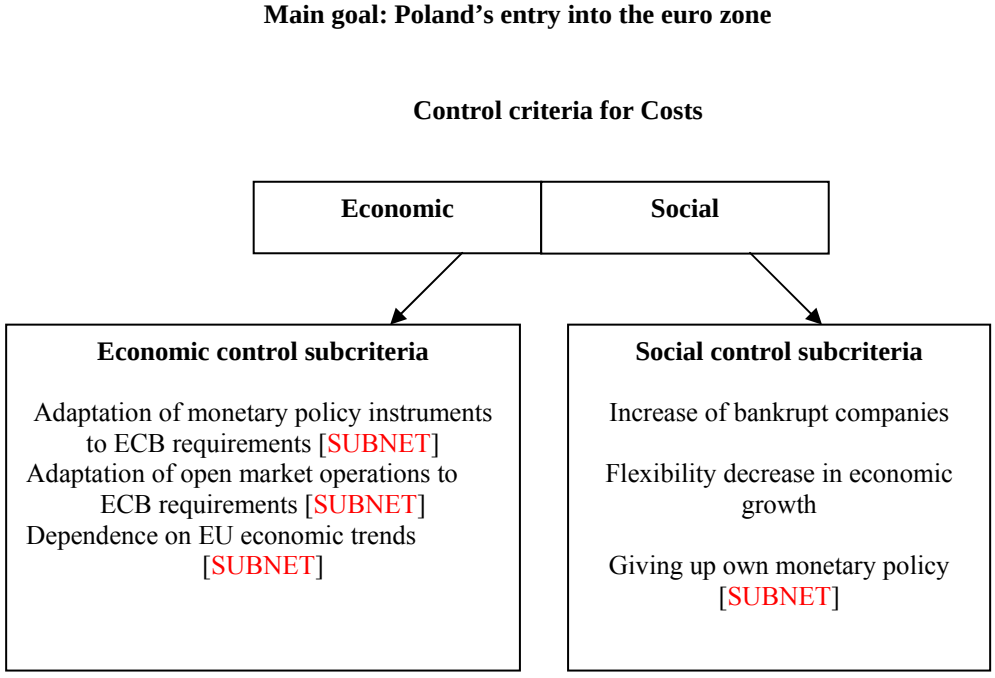


Figure 4: Subnet under Opportunities following Poland's entry into the Euro Zone

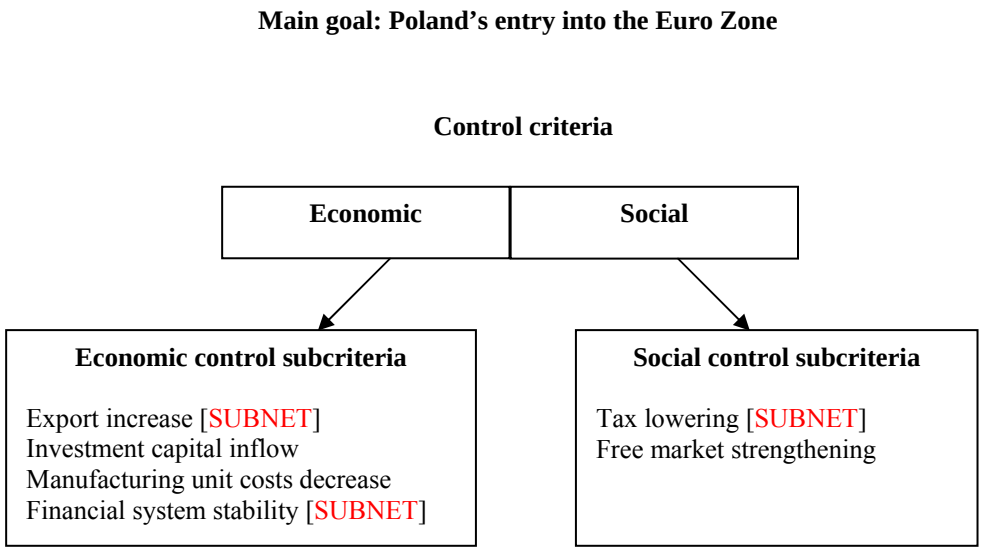


Figure 5: Subnet under Risks following Poland's entry into the Euro Zone

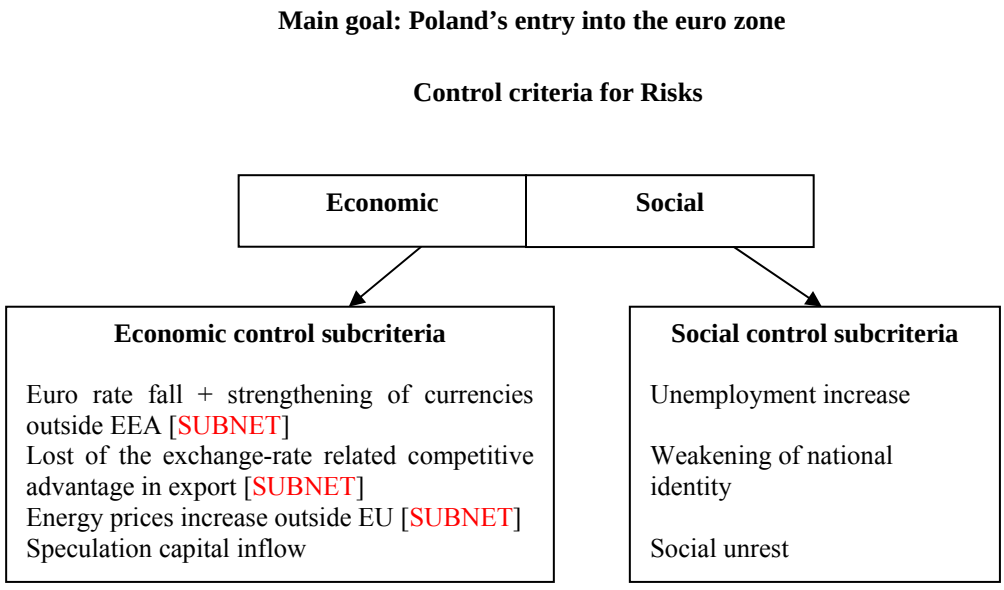


Figure 6: Example of an ANP Subnet model - benefits of "Poland's entry into Euro Zone"

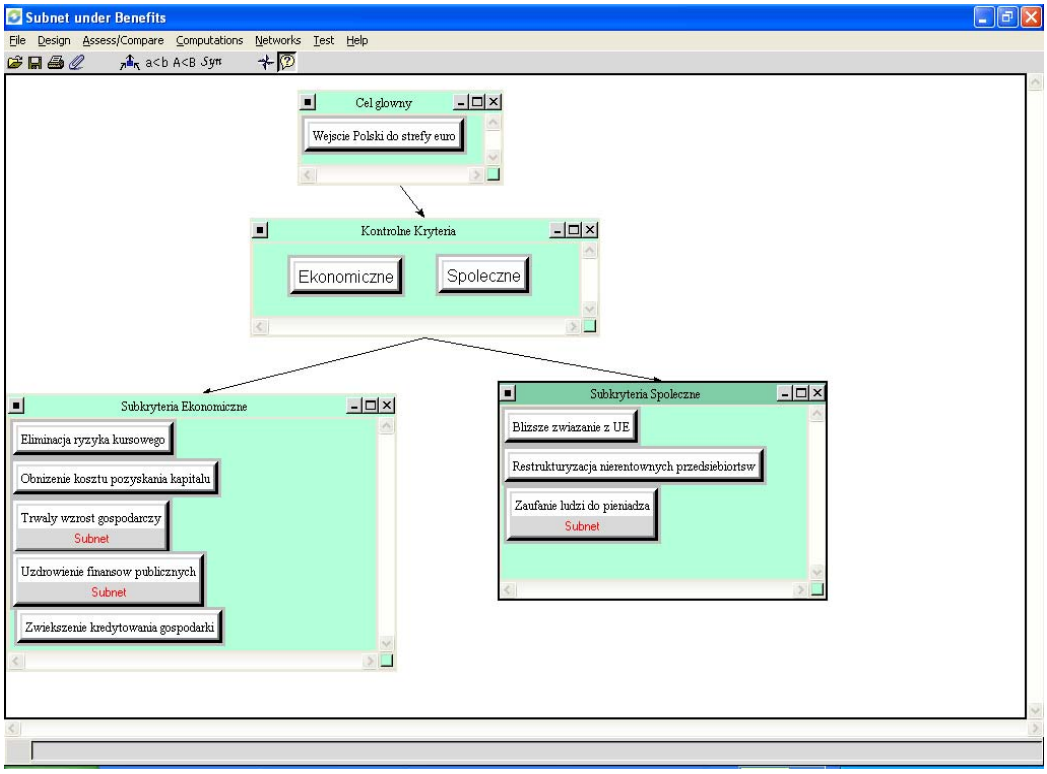


Figure 7 ANP Subnet for "Stable economic growth" under economic benefits

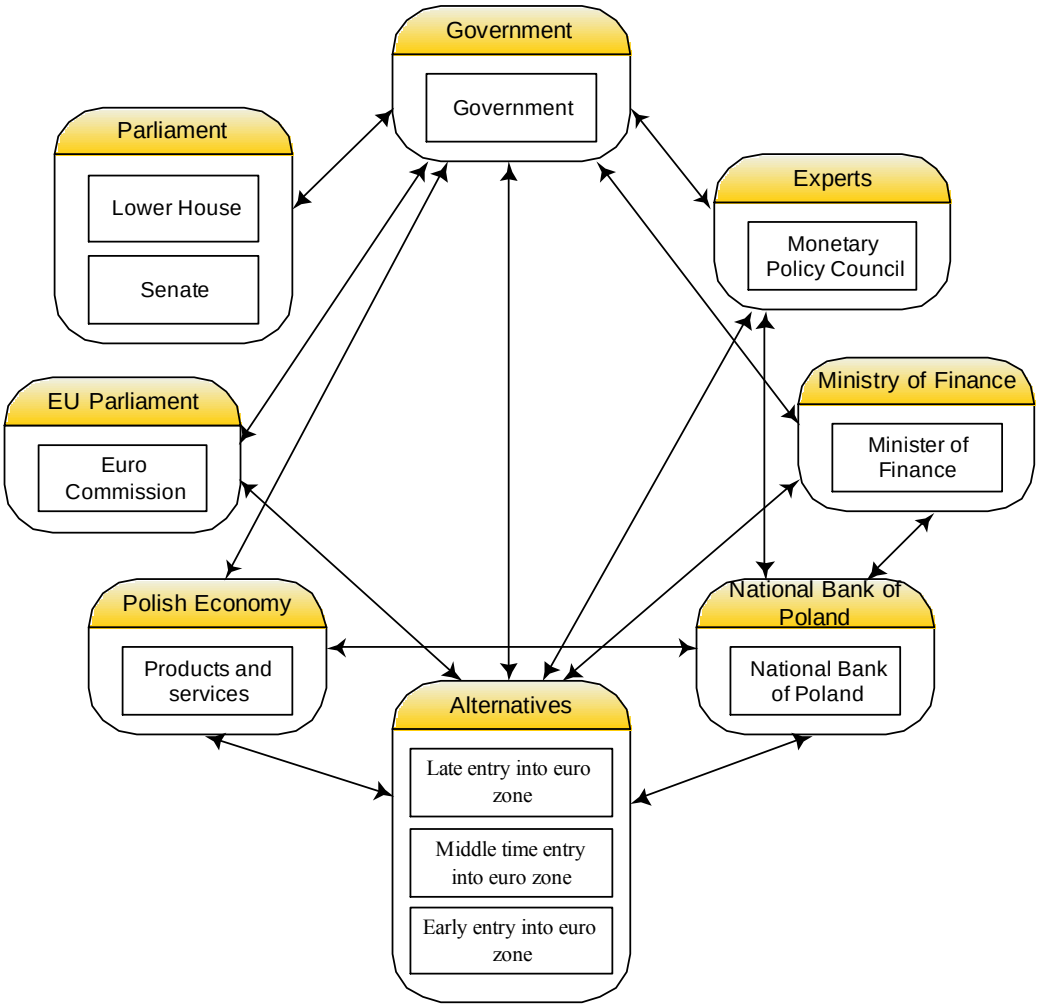
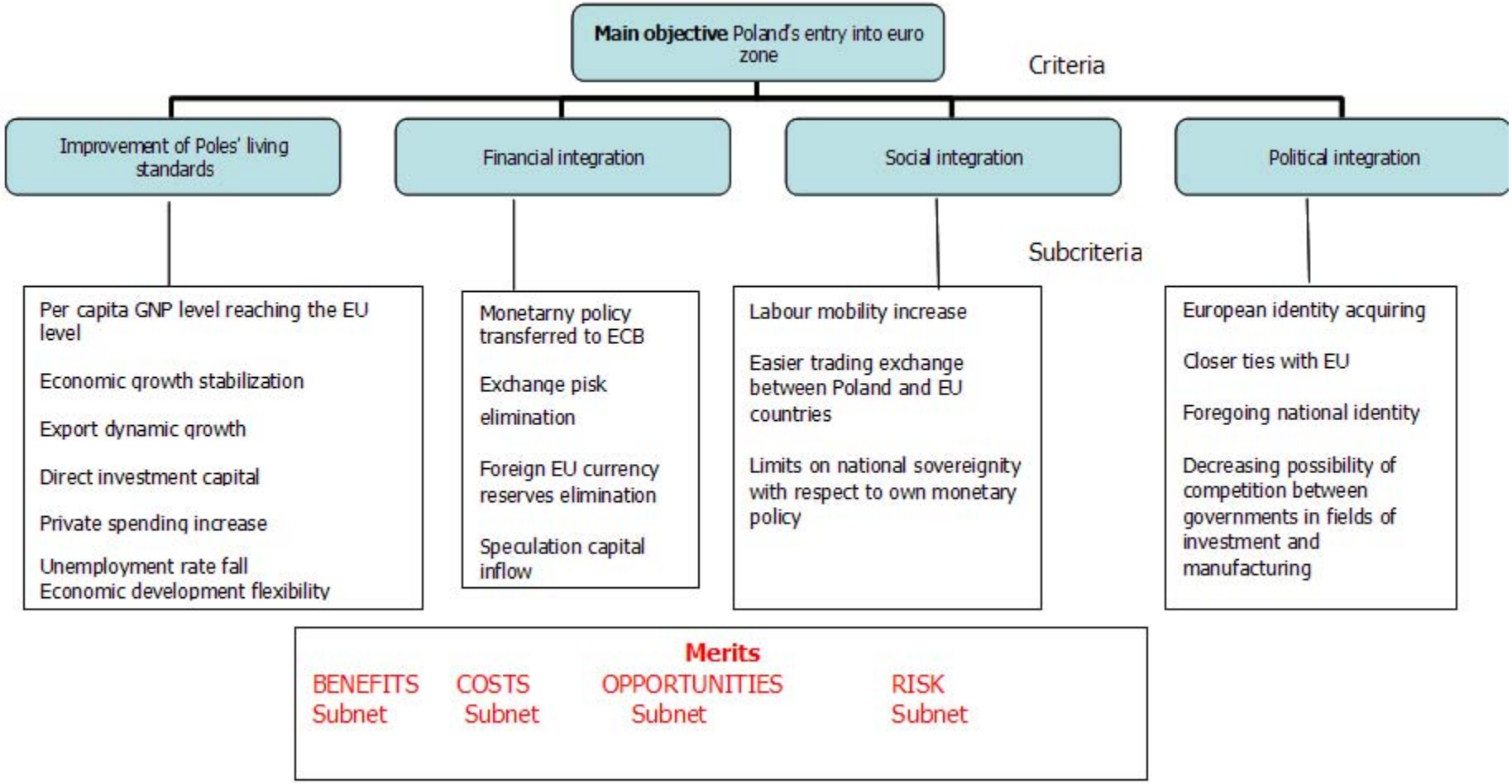


Figure 8: Strategic criteria model for Poland's entry into "Euro Zone"



8. Final conclusions

The issue of Poland's entry into the Euro Zone is not only very important for Poland but also very complex, strongly related to the main decision makers in Poland , including the government, Ministry of Finance, Poland's economy, European Central Bank, other banks in Poland etc.

Those relations are internally and externally connected with feedbacks and loops. Poland, preparing to enter the Euro Zone, should strengthen its economic growth, and then, during a longer period of time, fulfill all the criteria of the Maastricht Treaty. Only such sequence can improve the welfare of the Poland's citizens, which will benefit not only Poland, but also the European Union.

Poland's entry into the Euro Zone shall take place as soon as possible, but only after the benefits and opportunities overweigh costs and risks. The date of the entry into the Euro Zone shall be determined in the group of experts (academics, politicians, practitioners) with the use of ANP method.

The problem of entry date shall not be solved by means of a referendum. Finding appropriate solution requires significant knowledge and experience, an accounting of all possible criteria and their mutual dependence both within and outsider the system.

As a result of a detailed network analysis of the problem with use of Analytic Network Process and the solution achieved with Super Decisions, the following conclusions can be drawn:

1. The ANP model accounts for 27 BOCR criteria, including economic and social factors determining Poland's entry into the Euro Zone.

2. As a result of prioritization, both mathematical formulae give the same results for Poland's late entry in the Euro Zone as the best alternative.

3. Poland's entry into the Euro Zone shall only take place when joint benefits and opportunities exceed costs and risks

4. Sensitivity analysis may slightly change the priorities of discussed analyses, but that would require extreme conditions for BOCR prioritization and their control criteria.

5. From the Analytic Network Process perspective, the problem to be solved reveals its significant complexity, various dependencies with main decision makers in Poland and the economies and cultures of Poland, European Union and the rest of the world.

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