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Convergence of Consumption Structure

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Abstract

Purpose of this paper is to analyze the convergence of the consumption structure, both at the empirical and the theoretical levels. The basic empirical result is that the consumption structure converges quite quickly. We feel that the income effect is not sufficient to explain this high speed. That is why we introduce some post-Keynesian motives of consumer behaviour. We present a model of the dynamics of consumption structure and describe different simulation experiments with this model. These experiments are based on the actual data about consumers in the Czech Republic and in Germany (in fact, we approximate by German consumers the old EU members’ consumers). The results of simulations show that the behavior of the model really leads to the convergence of the consumption structure in the Czech Republic and the old EU members, so the post-Keynesian motives of consumer behavior are among possible explanations of the empirical fact of convergence.

JEL Classification: C6, D1

Keywords: fiscal convergence, consumption, post-Keynesian theory, model, simulation.

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1. **Introduction**

Purpose of this paper is to analyse the convergence of the consumption structure, both at the empirical and the theoretical levels.

For the convergence of consumption patterns, a couple of theoretical explanations can be used. Our paper is based on the processes described by the post-Keynesian theory of the consumer choice. This theory does not assume perfect information and perfect rationality based on mathematical optimization as the mainstream economic theory does. It starts with the fact of the existence of the so-called fundamental uncertainty: in reality it is usually impossible to assign probability to possible outcomes. This leads to the so-called procedural rationality: some behavior is rational if we can logically explain it, be it by imitation of self-behaviour in the past or behavior of some reference group.

After establishing the empirical fact of convergence, the post-Keynesian motives of consumer behavior are specified. Thereafter, a model of the dynamics of consumption structure is presented and simulation experiments with this model are described. These experiments are based on actual data about consumers in the Czech Republic and in Germany (in fact, we approximate by German consumers the old EU members consumers).

2. **Does the Consumption Structure Really Converge?**

Let us look at three figures based on the Eurostat and OECD data sources. In Figure 1, the development of consumption expenditures for different categories of goods and services in the new EU members from 1995 to 2003 is demonstrated. Except of the expenditures for food and non-alcoholic beverages, no many clear trends can be distinguished.

For each year, we calculated for each consumption category the variance of percentage shares of consumption, both for the group of old and the group of new EU members. We used the sum of variances across all consumption categories as our measure of convergence of consumption structure. The result is in Figure 2, the convergence of consumption structure is clearly visible. Figure 2 is based on Eurostat data – Consumption Expenditures of Private Households.

In Figure 3, we touch the question of the long-run stability of the consumption structure. Based on a mix of OECD and Eurostat data, it seems that once the consumption structure has converged, it stays relatively stable, as it is the case for the old EU members for the years 1980, 1990 and 2000.

The convergence is quite quick, about two thirds of the gap between the old and new EU members were closed in 8 years.

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2 On samba.fsv.cuni.cz/~cahlik/Articles' Support an Excel file with all the data and calculations can be found.

3 OECD Environmental Data, COMPENDIUM 2002, General data, OECD Environment Directorate.

4 We do not work with the full set of countries here, because of the lack of data. Nevertheless, in our opinion, the results are quite robust. Different sets of countries explain slight differences in results between Figures 2 and 3.
Figure 1  Development of Consumption Expenditures in New EU Members

Development of Consumption Expenditures in New EU Members (%)

- Food and non-alcoholic beverages
- Alcoholic beverages, tobacco and narcotics
- Clothing and footwear
- Housing, water, electricity, gas and other fuels
- Furnishings, household equipment and routine maintenance
- Health
- Transport
- Communications
- Recreation and culture
- Education
- Restaurants and hotels
Figure 2  Convergence from 1995 to 2003

Figure 3  Long – Run Stability of Consumption Structure in the Old EU Members
3. Post-Keynesian Motives of Consumer Behavior

In contrast with the mainstream neoclassical theories of consumer behavior, in the post-Keynesian approach to consumption, outlays for different goods are determined by social and psychological motives.

In our model we assume four different motives of consumer choice:

1. Autocorrelation
   Consumer choice depends on consumption in preceding period.

2. Positive social correlation
   Consumers imitate the consumption behavior of other consumers, both in the same employees group and the same income group, where the social contacts are supposed to be mostly during their leisure time.

3. Negative social correlation
   Consumers want to differ from consumers in lower income groups. In our model, we take into account just the consumption pattern in the nearest lower income group.

4. Aspiration towards higher social groups
   Consumers want to show the same consumption pattern as consumers in higher income groups. In our model, we take into account just the consumption pattern in the nearest higher income group.

For each consumer all motives are differently weighted and based on this we get his or her final consumption structured among all types of consumption.

4. Model of the Dynamics of Consumption Structure

Model analyses the structure of consumption we get from the decision making of single consumers dividing their income among different types of consumption according to the motives described above.

Income is based on outlays for consumer goods in preceding period. We have a closed cycle in which consumers pay in sectors – industrial branches - producing different types of goods. Their payments are then divided among employees, after taking away taxes. The share of each employee depends on the preceding structure of employees’ incomes. The role of the state is just the reallocation of tax income among employees in the form of social transfers. The share of transfers of each employee depends again on preceding income.

What the employees get they spend in the next period for different types of consumer goods.

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5. The theoretical background is here the concept of procedural rationality.
6. Even if we take into account just the nearest groups, after a sufficient number of periods the change of consumption behavior of each income group impacts all other income groups.
7. This motive is the key motive for the modeling of the convergence of the consumption pattern in the CR towards the consumption pattern in the EU. From the point of view of Czech consumers, consumers in the EU are in the highest income group.
9. We use a unique tax rate for all income groups. From simulation experiments with the model we have learned that the introduction of taxing into the model slows down the convergence of the model. A progressive tax rate would further strengthen this feature.
10. Health care and education are assumed to be financed privately in our model. The performance of the model would not change much if we allowed public financing from taxes.
11. We do not model savings in our model.
So each individual plays both the role of an employee in an industrial branch and a consumer. The structure of the model is in Figure 4.

**Figure 4** Basic structure of the model

Model runs in closed cycles – periods. The basic information we get from each cycle is:
- the structure of consumption in the cycle according to different types of consumption,
- the income of each employee he or she will spend in the next cycle as a consumer and
- the shifts of employees – consumers among different income groups.

In each period, following steps are done:

1. The actual income of each consumer is divided among all types of consumption. The outlay for each type of consumption depends on following outlays in the preceding period, each outlay weighted by an exogenously given weight ($w_0, \ldots, w_5$):
   - own outlay (weight $w_0$)
   - average outlay of the same income group (weight $w_1$)
   - average outlay of the same employee group (weight $w_2$)
   - average outlay of all consumers (weight $w_3$)
   - average outlay of the nearest lower income group (for all but the lowest income group) (weight $-w_4$)
   - average outlay of the nearest higher income group (for all but the highest income group) (weight $w_5$).
2. Total outlays for all consumption types are calculated – these outlays are equal to total incomes of relevant employee branches.

3. For each branch, we decrease the total income by taxes\textsuperscript{12} and distribute the rest among employees – (consumers in the next period) based on their previous incomes\textsuperscript{13}.

4. We redistribute among employees – consumers the tax income in the form of government transfers; based on their income group in the preceding period and two exogenous parameters - number of recipient groups and the progression of transfers\textsuperscript{14}.

5. We divide employees – consumers among income groups.

Simplifying assumptions of the model are:
- no shifts of employees among branches
- no financial sector.

Farther simplifying assumptions we used in the simulation experiments described below are:
- no savings
- no economic growth
- no GDP shocks.

5. Data and Parameters Used for Simulation

We set the length of one period to be one month. We work with 1000 employees – consumers, on the start of the program we distribute them equally among five income groups. Based on the Statistics of Family Accounts we calculate the original distribution of outlays for each consumption type of each income group. We add the highest income group, where the original distribution is calculated from the data for Germany\textsuperscript{15}. The original distributions are in Figure 5.

\textsuperscript{12} For a fixed tax rate, we can tax either on the branch level or on the individual’s level, it does not influence the result.

\textsuperscript{13} In our model we have just one factor of production, so everything can be divided among wages.

\textsuperscript{14} We assume just private consumption. All tax income of the government is transferred back to consumers.

\textsuperscript{15} For the Czech Republic, the source of data is the Family Accounts Statistics published by the Czech Statistical Office (2001). The source of data for Germany is the statistics "Budget und Ausstattung Privater Haushalte", published by the "Statistisches Bundesamt Deutschland" (2002).
Consumption structure in the EU differs especially in food and beverages, where the share of outlays in the EU is lower, it is evident that this share decreases with growing income in the Czech Republic as well. Considerable difference is in education, the outlays in the CR are just marginal.

The average income per person in the CR is 10,000 CSK, starting employee’s income is calculated from the starting distribution of outlays among branches and from the distribution into income groups\(^\text{16}\).

Starting number of employees in each branch we calculate so as to get the same average wage in each branch. We assume that the distribution of employees into income groups is the same for all branches.

We assume that the structure of consumption in the EU is constant during the convergence period.

6. Discussion of Simulation Results

We set the default parameters of the model to:

\[ w_0 = 0.5; \quad w_1 = 0.2; \quad w_2 = 0.2; \quad w_3 = 0.15; \quad w_4 = 0.1; \quad w_5 = 0.05. \]

With these parameters, the most decisive motive for each consumer is his or her previous consumption (weight 50 %). Both the membership in an income group and in an employees group have the same influence on the consumption decision (weight 20 %). The weight with that the consumers take the decisions of all consumers into account is 15%. The negative social correlation has twice as high weight as the aspiration towards higher social group (10 % and 5 %).

With these default parameters, the development of total incomes of sectors – industrial branches during the first 50 iterations is in Figure 6.

\(^{16}\) Employees from the first income group get 10.7 % of the branch income, the second 14.7 %, the third 18.3 %, the fourth 23.2 % and the highest Czech 33.1 %. Based on the Family Accounts Statistics. In the same way are calculated the employees incomes in all periods.
We can see a clear tendency of decrease in expenditures on food and beverages and increase in expenditures on housing and education. In Figure 7 and Figure 8 we can see the development of expenditures for these consumption types for specific income groups.
It is evident that after a couple of periods, all income groups will converge toward the EU. In Figure 9 we can see that after 50 iterations, the structure of consumption in the fourth and fifth income groups is in principle identical to the structure in the EU and even the differences for the three lower income groups are not big.

So the model suggests, that the structure of consumption in the CR can approach the structure of consumption in the EU-15 in 50 periods (about 4 years). The convergence of the model with chosen parameters is completed approximately after 140 periods (about 12 years).
To present this result in a similar way as in the empirical analysis of convergence, we use in Figure 10 the sum of variances as the measure of convergence.

**Figure 10  Convergence of consumption structure (with default parameters)**

![Graph showing convergence of consumption structure](image)

7. The impact of changes of the tax rate on the speed of convergence

With the growth of the tax rate the differences among incomes diminish\(^\text{17}\). Above the 60% tax rate, the redistributional effect is so high that we get strong fluctuations in both incomes and expenditures. Below the 60% tax rate, we do not get any considerable impact of the tax rate changes on the speed of convergence. In Figure 11 and Figure 12 we can see the impact of the tax rate changes on expenditures in two industrial branches.

\[^{17}\text{All tax income is redistributed as transfers.}\]
In contradiction with the intuitive expectations, the growing tax rate makes the convergence of higher income groups slower even in the case in which the share of
expenditures is originally higher than in the EU-15 and so the expenditures during the convergence diminish. This can be explained by the fact that the change of income is one of the factors of consumption and with growing tax rate the share of this change on the preceding income ceteris paribus decreases. The relative impact of this change on the consumption structure decreases as well. But this effect is again negligible for the tax rate below 60%.

Tax burden makes the convergence slower just in one phase of the convergence process, once the differences in expenditure shares diminish, farther motives, for example the negative social convergence gain and the described effect dies out.

8. Simulation experiments with other parameters

We have performed a lot of simulation experiments with different parameters. Interested readers can perform different simulations themselves with the software realization of our model on the [http://instituty.fsv.cuni.cz/~honzak/eu/](http://instituty.fsv.cuni.cz/~honzak/eu/) web page.

The software model allows the user to enter different model parameters as e.g. number of simulated cycles, weights of individual consumer branch/group incomes, indirect tax, savings, taxes and transfers per income groups. Also modelling of the industrial branches growth, probabilities of shocks, their kind and duration is provided by the interactive model. All parameters are preset to reasonable values. Moreover, the user-friendly interface allows to set options dedicated to generating the results. It means that the user can check or uncheck individual tables and graphs options according to his or her wishes. The possibility to include/exclude individual courses and tables helps to arrange the results well.

After performing the calculation results are displayed on an individual page. The top part of the page summarizes the entered model parameters and used abbreviations. Tables and graphs comprising expenditures on food and beverages, alcohol and tobacco, clothing and shoes, housing and energy, furniture, health, transportation, telecommunications, recreation and culture, education, lodging and food and "other goods" follow. The separation of results according to individual branches should allow the user to easily imagine the development/progression in individual branches. The progression of savings, size of groups and incomes is also included in the form of tables and graphs. Finally, the total growth of the model economy is summarized in a table and a graph together with disturbances.

Our simulation experiments have been oriented to answer the basic question: Why do we get the convergence to the EU-15? The answer is quite clear, it is the aspiration motive towards higher income groups that makes the consumption structure in new member countries converge to the old members. With $w_5=0$, we get the convergence for the five lower groups that are tied together with other motives as well. But the equilibrium is different than the equilibrium for the old members. We can show it for example for expenditures on food and beverages, see Figure 13.

With $w_5>0$, we get the convergence towards the EU level even with all other weights set to zero.
9. Summary

Based on empirical analysis, we have proved the fact of convergence of the consumption structure in the new EU members to the old EU members. The convergence to a relatively stable consumption structure seems to be quite quick – the most of the gap was closed in 8 years.

We feel that such a quick convergence cannot depend in the income effect only. That is why we have introduced a model for the analysis of the empirical fact of convergence of consumption structure in the Czech Republic towards the consumption structure in the European Union, based on post-Keynesian motives of consumer behavior.

The basic result of simulations is that the behavior of the model leads to the convergence of the consumption structure in the Czech Republic to the old EU members, if we let the aspiration towards higher income groups work. Other motives of consumption and change of other parameters can speed up the convergence, but the aspiration motive is decisive.

Farther elaboration of our experiments could go in the direction of analyses of impacts of the tax structure on the speed of convergence. We would expect that the increase of progression in taxes leads to higher speed of convergence in lower income groups and slows down the speed of convergence in higher income groups.

And the model is prepared for simulations with different saving rates, growth rates and GDP shocks.
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