The Impact of Consumption Smoothing on the Development of the Czech Economy in the Most Recent 30 Years

Stanislava Hronová [1] | *Prague University of Economics and Business, Prague, Czech Republic*
Luboš Marek [2] | *Prague University of Economics and Business, Prague, Czech Republic*
Richard Hindls [3] | *Prague University of Economics and Business, Prague, Czech Republic*

Abstract

The household final consumption expenditure is an important factor in economic development and, at the same time, a reflection of households' economic behaviour. When economic recession occurs, households respond in their consumption not immediately, but with a certain delay, which somewhat slows down and alleviates the crisis. On the other hand, when recovery comes, a slower growth in consumption delays the economic boom. The Czech economy has undergone four crises in the most recent 30 years. The goal of the present paper is to establish whether the delayed consumption effect has been valid for the turbulent development in the Czech economy and what is the role played by expenditure on assets with different durability. Our source is the publicly available data from the Czech Statistical Office.[4]

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INTRODUCTION

Evolution of the Czech economy has been rather dramatic since the early 1990s. First there were the problems of the beginning economic transformation (a significant drop in economic performance,

[1] Department of Economic Statistics, Faculty of Informatics and Statistics, Prague University of Economics and Business, W. Churchill Sq. 4, 130 67 Prague 3, Czech Republic. Corresponding author: e-mail: hronova@vse.cz, ORCID 0000-0002-3568-9755.
[2] Department of Statistics and Probability, Faculty of Informatics and Statistics, Prague University of Economics and Business, W. Churchill Sq. 4, 130 67 Prague 3, Czech Republic.
[3] Department of Statistics and Probability, Faculty of Informatics and Statistics, Prague University of Economics and Business, W. Churchill Sq. 4, 130 67 Prague 3, Czech Republic.
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in particular, in industrial and building operations, as well as a high growth in prices and the unemployment rate); then the economic recovery culminated in 1995 and 1996. Compared with other countries in Central and Eastern Europe, the Czech economy overcame with an admirable speed the obstacles on the way to a market economy. However, that speed concealed unsolved or unresolved problems concerning the processes of privatisation, restructuring the industrial and banking sector, etc. Together with additional factors, those problems contributed to the economic crisis of 1997 and 1998. In 2000, the economic development returned to growth. The beginning six years of the 21st century can be viewed as the most successful period of the Czech economy regarding its evolution.

The recovery phase (2001–2004) and the subsequent phase of peak economic growth (2005–2006) were not quite the same. The period 2001–2004 was characterised by stable economic growth (higher than the average of the EU countries) supported by high growth rates of industrial and construction production, growth of household and government consumption, gradual improvement of foreign trade relations, including exchange rates, strengthening of CZK, stabilisation of CZK, and, respectively, the growth of the economy in the 1990s. In terms of the negative aspects of the development, it is necessary to mention in particular the growing deficit of the state budget, doubling of the general government debt, growth of the general government deficit, deterioration of the balance of revenues, and the increase in foreign indebtedness in relation to GDP towards the end of this period.

In the period 2005–2006, the main factors of growth were changed – foreign trade became the engine of economic growth, CZK further strengthened, the level of general government debt was stabilised, the general government deficit decreased, and the unemployment rate went down. On the other hand, the imbalance in the current account of the balance of payments was deepening, the terms of trade were deteriorating, foreign indebtedness was increasing, consumption was rising and, consequently, household indebtedness was also rising. However, the favourable performance of the Czech economy was brought to an end by the onset of first the global financial crisis in 2008–2009 and the subsequent recession of 2012–2013.

2014 marked a return to recovery with low inflation, low unemployment rate and declining government debt. However, 2020 brought unpredictable problems with the Covid-19 disease pandemic, which undoubtedly led (not only in the Czech Republic but also in other countries) to a significant decline in GDP and an increase in government debt. Government restrictions to combat the pandemic (closure of shops, restaurants, hotels and other services), coupled with household concerns, caused a drastic reduction in household consumption.

In general, under favourable economic conditions (such as economic growth, decreasing unemployment rate, rising real wages, etc.) households spend more. Increased consumption and investments are covered by increasing income. In case of shortages, households incur debt – for consumption in the form of short-term loans, for investment (in housing and dwellings) in the form of long-term loans. However, at times of peak economic growth, household final consumption expenditure generally stabilises and grows at a lower rate than GDP. By doing so, households are actually 'cooling down' an overheated economy.

The unfavourable economic situation leads households to reduce consumption. However, this response comes not immediately, but with a certain time lag. In this context, the phenomenon of deferred consumption is discussed. On the other hand, households respond relatively quickly to the arrival of a recovery and their stable demand mitigates the rapid onset of the boom. Households thus smooth out the phases of the business cycle by their behaviour during the crisis and the boom.

The reasons for, evolution and effects of economic crises are not the same, and this is all the more true with respect to the crises that the Czech Republic has experienced over the most recent 30 years. How have the different causes and evolutions of crises affected the behaviour of Czech households?

What did the economic crisis triggered by the pandemic bring about in their behaviour? How do households cope with the feeling of insecurity in relation to consumption? Do they limit their spending overall or differentiate it according to the durability of consumption items?

Although it is certainly too early to analyse household consumption behaviour during the pandemic, we would like to answer these questions by analysing data for the Czech Republic for the period 1993 to 2020. The source is publicly available data from the Czech Statistical Office.

Section 1 presents the theoretical background and provides a brief overview of the views on a phenomenon called consumption smoothing. Section 2 describes the specifics of the economic development in the Czech Republic since 1990. Section 3 presents the linear dynamic model used and the data to which the model was applied. Section 4 presents the results of the analysis in terms of the response of households to the coming signals of the crisis and shows that whatever the economic cause of the crisis, household consumption behavior is comparable, but differentiated according to durability of goods.

1 THEORETICAL BACKGROUND

Households' behaviour regarding consumption is quantified by the household final consumption expenditure indicator. Household final consumption expenditure includes the value of purchased (new and used) goods and services of short-term and durable consumption, excluding dwellings, houses and land, and also includes a part of unpaid consumption (imputed rents, benefits in kind, agricultural and food products from subsistence farming, domestic services, etc.).

Households are represented by the institutional sector of the national accounts, which is broadly defined as the consumer sector. The main economic function of households is consumption and the main sources of funding for this activity come from labour income or social and property income. However, in addition to consumers, the household sector also includes entrepreneurs (small producers) whose main economic function is the production of non-financial market goods and services and whose resources are derived from the sale of the results of their own activities. Their economic behaviour is therefore different from that of consumers and analogous to that of non-financial enterprises.

Household consumption must be considered in the context of the size and structure of their disposable income and of their saving, since households are important contributors to national saving, which is (according to economic theory) the basis of economic growth and prosperity. Consumers enter the process of income distribution as the entity that pays less than it receives (households mainly have to pay taxes on production and imports, social contributions and receive wages, and social benefits and other income). In this way they generate, in the form of disposable income, sufficient resources to meet their current needs (in terms of final consumption expenditure) and at the same time generate savings (from which they fund their non-financial and financial investments). Households therefore represent a sector that should provide sufficient resources to generate national saving and, at the same time, the entity that should generate sufficient spare resources in the economy to alleviate the deficit to which the economy of the general government traditionally leads, thereby contributing to the reduction of the country's deficit vis-à-vis the rest of the world. Households as consumers thus play an indispensable role in the economy as the entity whose economic result is positive (expressed in the national accounts by the balance of their non-financial account). This means that consumers traditionally act as creditors.

Households as entrepreneurs have the characteristics of the economic behaviour of non-financial corporations (although of course there are differences here too, due precisely to the position of the small producer). For such producers, information on value added and its value structure, as well as on investment, are crucial data. The Czech Statistical Office (as well as other statistical offices) provides

data not only for the household sector as a whole, but also for the consumer and entrepreneur[5] subsectors. However, it turns out that the household sector account is primarily a consumer account, so if we assess the economic behaviour of consumers by analysing the data in the household sector account from the level of disposable income generation, we will not commit serious errors of interpretation.

In years of economic prosperity, household final consumption expenditure and investment generally rise, supported by the supply of consumer and mortgage credit. As a result, the savings rate and the financial savings rate fall. Households finance part of their consumption and investment with loans, which leads to an increase in household indebtedness in the form of loans and, together with a falling saving rate and financial savings rate, may, despite a favourable economic climate, lead to households becoming over-indebted and unable to meet their obligations.

Years of recession or even crisis mean a reversal in household behaviour, manifesting itself in a restrained approach to consumption, and a reduced willingness to invest as well as in long-term credit. In years of crisis, households usually reduce their financial investments or try to save their spare funds in less risky assets.[6] However, these changes do not come immediately, but always with a certain delay.

Household consumption is also seen as playing a corrective role in the economy.[7] In times of recession, it is the 'delayed' response of households (when their traditional consumption behaviour persists for a short period of time) that slows down and initially even moderates the onset of the recession. And on the other hand, as the economic recovery begins, it is the slower growth of consumption that helps the recovery but delays the rapid onset of the boom. Economists often speak of a phenomenon known as consumption smoothing.

Consumption smoothing is thus an economic feature that reflects a stable approach to consumption from the household perspective. Households therefore shift their consumption from times of higher income to those with a risk of lower income (that is in times of recession) in order to achieve greater economic stability and predictability. In contrast, in times of uncertainty and adverse economic outcomes, households reduce (or partially postpone) consumption to avoid future adversity and reduce their current uncertainty. This postponement then persists for some time after the beginning signs of economic recovery. In this way, households delay the onset of the recovery.

The issue of deferred consumption's impact was already addressed in the 1950s by, for example, Modigliani and Brumberg (1954). Friedman (1957) showed in his permanent income theory that if permanent income falls, consumption falls as well. Another model that put emphasis on consumption smoothing twenty years later was Hall's model, inspired by Friedman himself, see Hall (1978). To a certain extent, Hall's work opposed the idea, quite common up to that time, that households have only a marginal propensity to consume and therefore current consumption is closely linked to current income. On the contrary, he advanced the idea that, assuming useful and purposeful behaviour, households optimally try to keep consumption stable in the long run, thereby effectively 'smoothing' it.

The issue of household behaviour in different phases of the economic cycle, in particular their response to the arrival and evolution of the crisis, has been addressed by a number of authors in the context of the financial and fiscal crisis of 2008–2009 and the subsequent recession of 2011–2013. For example, Hamburg et al. (2008) addressed the question of the relationship between income, consumption

[5] In the Czech Republic, entrepreneurs account for about two-thirds of the gross value added of the household sector, but only a quarter of fixed capital investment, a tenth of household financial liabilities and only a twentieth of household financial assets – see Hronová et al. (2016).

[6] See Hronová and Hindls (2013).

[7] This is logical, as household final consumption expenditure accounts for more than one-half of gross domestic product in developed countries.

and wealth in Germany and showed that this relationship is dynamic and that it does not settle to a steady state after a certain period of time. Households will not increase their consumption expenditure unless they consider their economic situation to be good and stable. Rising income and rising market prices of their financial and non-financial assets, coupled with economic growth, increase their willingness to spend and invest. Household investment in real estate (or financial assets) is not included in the household final consumption expenditure indicator, but it is a strong signal of a satisfactory economic climate. Conversely, a fall in consumer confidence is one of the signals of a coming recession or crisis. Campelo et al. (2020) investigated this relationship using data from Brazil, showing that indicators of consumer confidence and economic climate are better able to predict trends and changes in household final consumption expenditure, and that improvements in consumer confidence positively affect households' attitudes towards consumption.

The occurrence of recession and crisis leads to an increase in the unemployment rate, and thus to a fall in household income and an increase in household insecurity. Hurd and Rohwedder (2016) showed, using the example of US households, that unemployment is reflected in a decline in household income and expenditure, but the decline in expenditure is significantly less pronounced than the decline in income; in other words, consumption declines more slowly than income. When entering the labour market, that is when income jumps, consumption expenditure rises. It however returns to its original level more slowly.

Jappelli and Pistaferri (2010) have critically reviewed various theoretical approaches to estimating the response of household consumption to changes in income and suggest that the underlying factor influencing household behaviour is the decline in income and the unavailability of credit. This is because households are unable to 'smooth' consumption due to credit constraints. Similar conclusions were reached by Aron et al. (2012), who looked at models of the impact of income growth or decline and credit availability as a kind of financial accelerator. However, using the US, UK and Japan as examples, they showed that the real interest rate had negative effects in the US and UK, but positive effects in Japan. Using Ireland as an example, Gerlach-Kirsten et al. (2013) showed that household consumption responds differently to different types of crises. When (economic and financial) crises are accompanied by problems in the housing market, the effects on consumption are much deeper and especially affect households burdened by mortgage loans.

A new element that has clearly affected the level of household consumption expenditure has been the Covid-19 pandemic, which has restricted not only households' purchases but also their movements, habits and preferences. It is too early to assess the impact of this pandemic on household spending, but some work has already looked at this phenomenon (a summary of existing studies on this topic can be found in Chrislelis et al., 2020) and shows that household consumption expenditure has fallen significantly in all European countries and in the USA. However, this has not only been due to insecurity and partial income constraints, but also to the inability to make certain expenditures in consequence of restaurant and hotel closures, transport and tourism constraints, etc.

There are therefore several reasons why households cut back on consumption in times of economic recession (and crisis). First of all, there are the constraints on resources (due to loss of employment, reduced income, and general uncertainty), and then there is the reduced access to additional resources, mainly credit. These constraints and insecurity are reflected in a cautious approach to the purchase of durable goods and investment (both non-financial and financial).

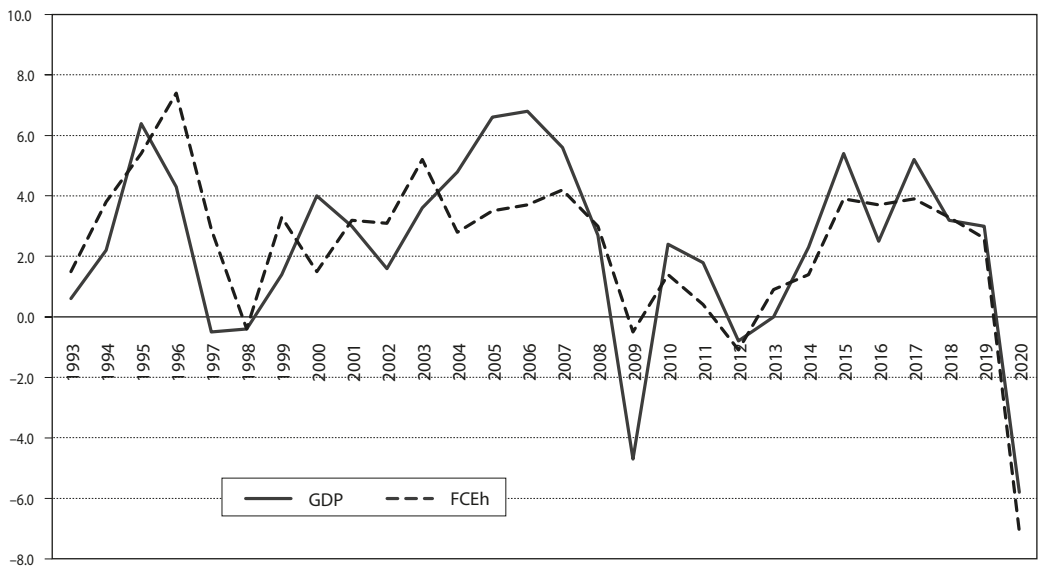
The above findings suggest that the corrective (smoothing) role of household final consumption expenditure is particularly pronounced in the case of expenditure on durable goods. On the other hand, significant changes depending on the phases of the economic cycle cannot be expected for non-durable goods. For expenditure on semi-durable goods, a time dependence closer to that of expenditure on essential (that is non-durable) goods can be expected. We would like, by analysing data for the Czech

Republic, to confirm this hypothesis, namely, that the household spending on durables plays a dominant role, while spending on non-durables is independent of the economic growth rate. At the same time, we would like to show that, regardless of the differences in economic reasons for the crises, the response of households manifested in final consumption expenditure is analogous.

2 SPECIFICS OF CRISES IN THE CZECH REPUBLIC

In the analysis presented here, we will examine the response of Czech households to the crises that have accompanied the Czech economy since 1993. As already mentioned in the Introduction, these crises included the post-transition crisis in 1997–1998, the financial and fiscal crisis in 2008–2009; and overly restrictive fiscal policy meant a renewed fall into recession in 2012–2013. These facts are documented in the chart of GDP development in the Czech Republic. The addition of a chart of annual growth rates of household final consumption expenditure shows that the response of households to changes in the economic situation has smoothed out the reversals in GDP development.

Figure 1 Year-to-year GDP growth rates (%, real terms) in the Czech Republic and final consumption expenditure of Czech households



Source: <*https://apl.czso.cz/pll/rocenka/rocenka.presmsocas*>

However, it is clear that households' responses in terms of changes in final consumption expenditure are not the same in all phases of a crisis; this observation undoubtedly stems from the different initial conditions, causes, evolution and depth of each crisis. As mentioned above, the Czech Republic has experienced four crises since 1990.

The first crisis was purely domestic and resulted from the rapid economic transformation and the desire to move from a centrally planned to a market economy as soon as possible. In this period of relatively free market conditions, in the absence of a number of legislative measures, the drafting and approval of which were delayed by the privatisation process, new economic entities were created that had no chance of winning recognition in international competition; former large state-owned enterprises were not restructured in time; and a number of monetary institutions were created without adequate capital backing. After the

initial shock of price liberalisation,[8] with an acceptable unemployment rate,[9] and with real wages rising, households have, since 1993, been willingly increasing their final consumption expenditure. Although signs of an impending crisis were already coming in 1997 (reflected in a 0.5% fall in GDP), household final consumption continued to grow (by a 2.9% year-to-year increase). The fall in final consumption expenditure came as late as in 1998 (by 0.4%, with an equally significant decrease in GDP), but already in 1999 households helped to kick-start the economy, increasing their spending by 3.3%.

The period after 2000 was a period of prosperity in the Czech Republic, with economic growth peaking in 2006 (with a GDP growth by 6.8%). This growth was mainly driven by investments and foreign exchange. The Czech Republic's accession to the EU (in 2004) has had a significant impact on the economy, the domestic currency was strengthening, an acceptable inflation rate did not significantly worsen the position of households, even despite a higher unemployment rate.[10] The signals of the coming global financial and fiscal crisis hit the Czech economy with a delay (as late as in 2009, GDP dropped by 4.7%, with a high government deficit amounting to 5.4% of GDP and a jump in government debt by 6 percentage points). Households again cushioned this drop by a decrease in their final consumption expenditure by only 0.5%. However, with a pro-growth economic policy, the Czech economy would undoubtedly have recovered quickly from the crisis, even at the cost of not improving the government deficit. The reality was, however; different: the government's unwillingness to support economic growth and a harshly restrictive fiscal policy meant a new fall into recession in 2012 (with a 0.8% decrease in GDP) and stagnation in 2013. The pressure to restrain government spending (government debt reached 49% of GDP in 2012) and the climate of fear created around high government debt affected households' behaviour, and their final consumption expenditure fell more significantly than GDP in 2012 (namely, by 1.1%). As in 1997–1998, the cause of this recession was domestic; namely, it was inappropriate economic policy (too much optimism in the 1990s, too much pessimism after 2009).

After 2014, another period of prosperity came. Key sectors (industry, construction, services, and foreign trade) prospered, the growth was supported by business and government investments, the government already reported a positive balance in 2016, government debt relative to GDP was declining, real wages were rising, and inflation and unemployment rates remained below 3%. An unexpected external factor – the arrival of the Covid-19 pandemic – caused a sharp decline in economic activity in all spheres. Production cutbacks in a number of large industrial enterprises, closure of shops and services, restricted population movements and the resulting losses in transport and tourism, reduction of household consumption to only basic products, etc. The government mitigated the impact of the pandemic on enterprises and households through a system of subsidies and compensations. This approach prevented a spike in unemployment and business failures, but at the cost of a government deficit amounting to 6% of GDP (up from surplus 0.3% in 2019) and a rise in government debt to 38.1% of GDP (up from 30.3% in 2019); GDP fell by 5.8% year-to-year, and household final consumption expenditure by 7.1%. The causes of this crisis are neither domestic nor economic. The pandemic situation froze the global economy. Life and health insecurity, in addition to economic insecurity and the inability to 'spend', marked the consciousness of households. As a result, their final

[8] The average annual inflation rate in the Czech Republic in the first year of the economic transformation (1991) was 56.6%, in 1993 (as a result of the tax reform) it was 20.8%, and in the remaining years (1992, 1994 to 1998) it was around 10%. Compared to other former socialist countries, these figures can be considered a success (in 1991, the annual rate of inflation rate in Bulgaria was around 330%, in Romania around 160%, in Poland around 70% and in Hungary around 35%).

[9] Between 1991 and 1997, the unemployment rate in the Czech Republic remained below 5%.

[10] In the period 1999–2008, the average annual inflation rate was around 3% and the average annual unemployment rate around 8.5%.

consumption expenditure fell more than GDP. Concerns about rising prices, speculative demand for real estate and the existence of unrealised purchasing power on the consumer goods market caused that the demand for real estate (including for holiday accommodation) significantly increased in the Czech Republic, which led to a significant rise in property prices.[11]

3 DATA AND METHODS USED

The aim of our analysis is to demonstrate the dampening nature of household consumption in terms of the phases of the business cycle, in other words the dampening of the downturn by a delayed decline in consumption. In carrying out the analysis, we will use data on GDP growth for the Czech Republic and on the evolution of household final consumption expenditure in total, as well as of its components sorted by durability.

Analysis of this data should confirm the interdependence between the quarterly GDP time series and the time series of household final consumption expenditure, as well as identify lags, if any, in this dependence (see *www.czso.cz*). For this analysis, we have used the values of both indicators in current prices for the period 1995–2020 (a total of 104 data items for each quarterly time series). We also have year-to-year quarterly indices based on the values of both indicators in the previous year's chained prices.

In order to confirm the hypothesis that expenditure is dampening the household final consumption, it is necessary to:

- test the interdependence between these two series;
- detect any time lags in this interdependence; and
- describe this dependence with the aid of an appropriate model.[12]

We have used the cross correlation function (CCF) – Box et al. (1994), or Pankratz (1991) – to demonstrate the linear dependence between the time series analysed. The CCF has the advantage of determining not only the intensity but also the direction of the linear dependence including time shifts. The CCF is defined as:

$$\rho_{XY}(k) = \frac{\gamma_{XY}(k)}{\sigma_X \sigma_Y}, \tag{1}$$

where X_t and Y_t are the analysed time series. The value of CCF at k is then defined as the covariance between X_t and Y_{t+k} for $k = 0, \pm 1, \pm 2, \ldots$, divided by a product of the standard deviation values of both series; here σ_X and σ_Y stand for the standard deviation values of the series X_t and Y_t (respectively). The following formula obviously holds for the CCF:

$$\rho_{XY}(k) = \rho_{XY}(-k). \tag{2}$$

The CCF definition and properties can be found in Wei (2006), or Box et al. (1994). In developing the model, we used the theory of transfer function models (TFM) – again, see Box et al. (1994), or Pankratz (1991). This class of models allows us to model the interdependence of the respective time series and describe it with the following stochastic model:

$$Y_t = c + \nu_0 X_t + \nu_1 X_{t-1} + \nu_2 X_{t-2} + \ldots + \nu_K X_{t-K} + \frac{1}{(1-\phi_1(B))(1-\Phi_1(B^L))}\varepsilon_t, \tag{3}$$

where the variables are compliant with the standard usage met in the relevant literature: Y_t is the output series, X_t is the input series, c is constant, ν_i are unknown parameters for $i = 0,\ldots,K$, $\phi_1(B)$

[11] A 12% year-to-year increase in apartment prices occurred.
[12] The entire analysis has been carried out in SCA software.

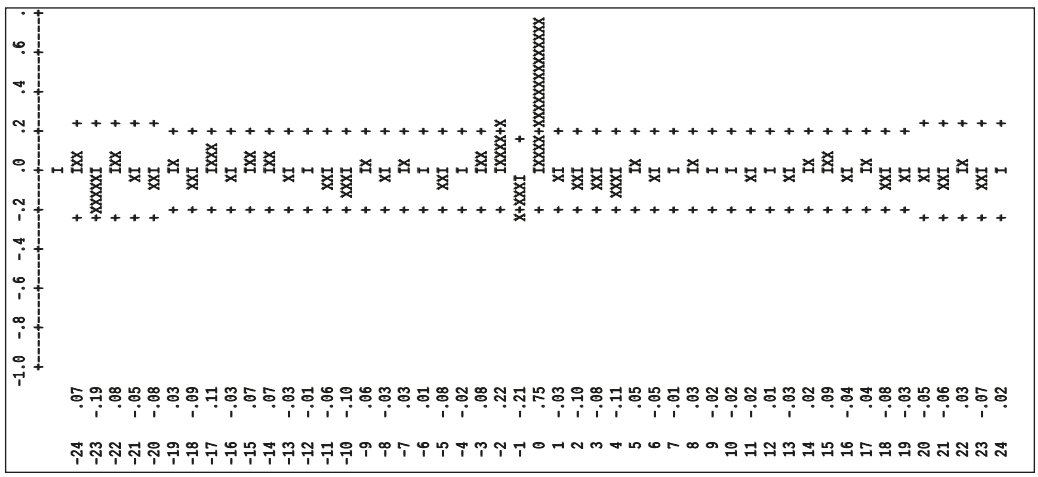
is the autoregressive operator of order 1, $\Phi_1(B)$ is the seasonal autoregressive operator of order 1, ε_t is the random variable (white noise), B is the shift operator ($BY_t = Y_{t-1}$), and L is the length of season (see, for exemple, Box et al., 1994).

The input X_t series is in our case the GDP series; the output Y_t series is that of final consumption expenditure values. The model is based on the idea that households' final consumption expenditure depends on the GDP values but responds to them with a certain time lag. It means that the expenditure value at time t depends on the GDP values at times t, t–1, t–2, …

4 RESULTS OF ANALYSES

We have first studied the interdependence between the quarterly time series with regard to possible time lags contained in this interdependence. To this end, we determined the CCF values and immediately tested their significance. Both series must, as a pre-processing step, be transformed to achieve stationarity. We have used current and seasonal differentiating of order 1 to obtain stationary series. The results are clearly visible in Figure 2.

Figure 2 Cross correlation between household final consumption expenditure (*t*) and GDP (*t*–1)



Source: Own calculations, <*www.czso.cz*>

The chart indicates that CCF takes on significant values at *t, t*–1 a *t*–2. In words, household final consumption expenditure at time *t* depend on the GDP values at times (quarters) *t, t*-1 and *t*-2. Prior our calculations, both series have been stationarised as already described.

The described dependence allows us to construct a linear dynamic model of the form:

$$Y_t = 0.3268X_t - 0{,}0509X_{t-1} + 0.1532X_{t-2} + \varepsilon_t - 0.6301\varepsilon_{t-1} \tag{4}$$

where Y_t is the time series of households' final consumption expenditure (delayed) values, differentiated both currently and seasonally, X_t is the time series of the GDP values, also differentiated both currently and seasonally, and ε_t is the white noise.

It should be noted that this model has passed a battery of tests (tests of residue, the unit root, homoscedasticity, and Dickey-Fuller tests) and has been proved to be fully adequate. An important indicator of its quality is the linear independence between the residuals of the TFM model and the stochastic output series model. We have built this stochastic model, computed the residuals

and then calculated the CCF between the residuals of these two models. The CCF values are not significantly different from 0, so this important quality criterion for the TFM model also provides an argument in its favour.

The quality of the model constructed using the data on household final consumption expenditure and GDP at current prices is excellent, as indicated by the value of R-SQUARE = 0.999. The results of our analysis are illustrated by the output of the SCA program (see Table 1).

Table 1 SCA software output (time series in current prices)

PARAMETER LABEL	VARIABLE NAME	NUM./ DENOM.	FACTOR	ORDER	CONS-TRAINT	VALUE	STD ERROR	T VAL
1 V0	GDP	NUM.	1	0	NONE	.3268	.0221	14.56
2 V1	GDP	NUM.	1	1	NONE	-.0509	.0223	-2.98
3 V2	GDP	NUM.	1	2	NONE	.1532	.0245	6.71
4 PHI4	SPOTREBA	MA	1	4	NONE	.6301	.0997	6.99

EFFECTIVE NUMBER OF OBSERVATIONS . . 97
R-SQUARE 999

RESIDUAL STANDARD ERROR. . . . . .474429E+04

Source: Authors' own calculations, <*www.czso.cz*>

We reach similar conclusions if we use the time series of the corresponding year-to-year quarterly indices instead of the original time series. The analysis and calculation procedures are completely analogous to the previous case. The interdependence in the *t, t*–1 and *t*–2 quarters is again identified. The results of the analysis based on year-to-year quarterly indices taken as the input data are again illustrated by the output of SCA software (see Table 2).

Table 2 SCA software output (time series of year-to-year quarterly indices)

PARAMETER LABEL	VARIABLE NAME	NUM./ DENOM.	FACTOR	ORDER	CONS-TRAINT	VALUE	STD ERROR	T VAL
1 V0	KGDP	NUM.	1	0	NONE	.5707	.0668	12.48
2 V1	KGDP	NUM.	1	1	NONE	-.1440	.0668	-3.01
3 V2	KGDP	NUM.	1	2	NONE	.2892	.0693	5.98
4 PHI4	KSPOTREB	MA	1	4	NONE	.7923	.0675	6.12

EFFECTIVE NUMBER OF OBSERVATIONS . . 89
-SQUARE 798
RESIDUAL STANDARD ERROR. . . . . .119044E+01

Source: Authors' own calculations, <*www.czso.cz*>

The resulting model's form is analogous, but the parameter values are, of course, different:

$$Y_t = 0.5707X_t - 0{,}1440X_{t-1} + 0.2892X_{t-2} + \varepsilon_t - 0.7923\varepsilon_{t-1}, \quad (5)$$

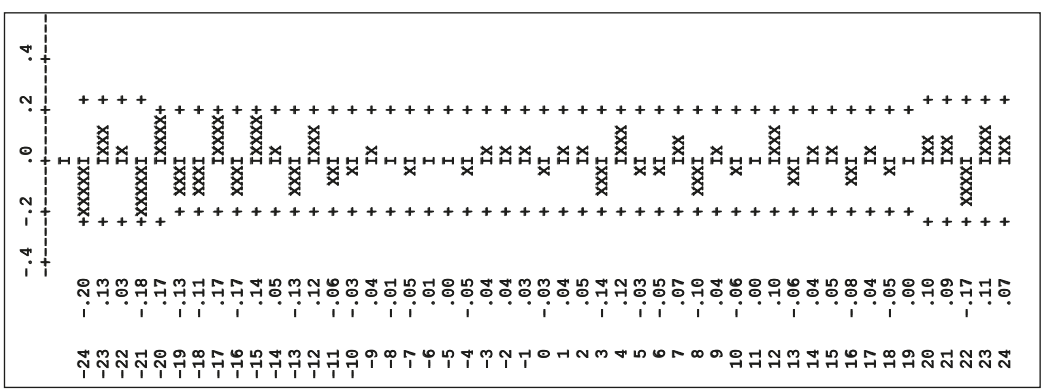
where the Y_t time series contains the year-to-year quarterly indices for households' final consumption expenditure, differentiated both currently and seasonally, the X_t time series contains the GDP year-to-year quarterly indices, again differentiated both currently and seasonally, and ε_t is the white noise. This model has also gone through a battery of tests (tests of residue, the unit root, homoscedasticity, and Dickey-Fuller tests) and has been proved to be fully adequate. Results of a test for independence between the TFM model residua and the stochastic model for year-to-year quarterly indices for households' final consumption expenditure also indicate that the quality of the TFM model is good.

Our data analysis has thus confirmed the dependence between the quarterly time series of total household final consumption expenditure and GDP, including time lags of one and two quarters. We have derived a linear dynamic model that describes this dependence well. The model has been proved to be perfectly adequate, passing all quality tests. We have obtained the same model (with different parameter estimates, of course), even if we, instead of the original series, analysed the time series of year-to-year quarterly indices of household final consumption expenditure and GDP.

From the perspective of households' response to the incoming crisis signals, it is undoubtedly important to classify expenditure on consumption items according to their durability. We have at our disposal values for expenditure on durable, medium-term and non-durable goods (and, by analogy, the corresponding year-to-year quarterly indices). Expenditure on non-durable goods (food, beverages, tobacco, pharmaceuticals, cosmetics, fuel, etc.) is not expected to change significantly with the coming crisis, as it represents expenditure to cover essential needs. By contrast, expenditure on durable goods (motor vehicles, furniture, refrigerators, washing machines, music equipment, computer equipment, jewellery, etc.) is expected to respond to the coming crisis in a manner analogous to household final consumption expenditure in total. This is because it is expenditure on 'surplus' items (and usually pre-planned items, the purchase of which can be postponed and the expenditure made only when the economic development of the national economy has been stabilised). A certain degree of caution on the part of households may be assumed for expenditure on medium-term consumer goods (clothing, footwear, household goods, sports equipment, books, toys, etc.) when the symptoms of the crisis appear; however, purchases of medium-term consumer goods cannot be postponed significantly. Some delay in final consumption expenditure can therefore be expected, but it will undoubtedly not be as significant as in the case of expenditure on durable goods.

Our analysis (again based on CCF) has fully confirmed the described assumptions concerning households' responses to a coming crisis: the expenditure on non-durable goods is independent of changes in GDP. The CCF chart (see Figure 3) also confirms this observation.

Figure 3 Cross correlation between expenditure on non-durable goods and GDP



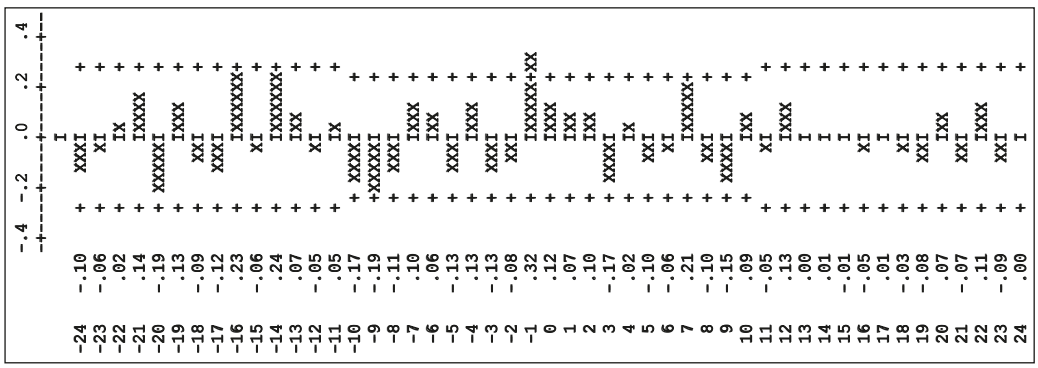
Source: Authors' own calculations, <*www.czso.cz*>

In other words, everyday items are purchased by households regardless of the coming or ongoing economic crisis. It therefore makes no sense to formulate a dependency model as in the other cases analysed here.

In the case of households' spending on medium-term consumer goods, it turns out that this series depends on GDP values only at the t–1 quarter and not on thee values at t or t–2. This means that

it responds to changes in GDP with a lag of exactly one quarter. This can be clearly seen in the graphical output showing the CCF (see Figure 4). This illustrates the specific nature of these products – they are not necessities (especially clothing, footwear), but their acquisition cannot be postponed for a long time.

Figure 4 Cross correlation between expenditure on medium-term consumer goods and GDP



Source: Authors' own calculations, <*www.czso.cz*>

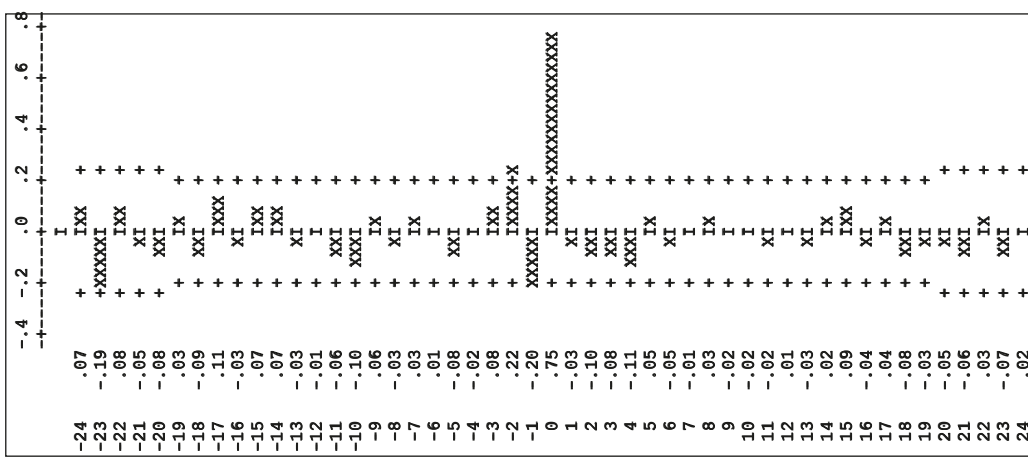
The adequate model takes on the form:

$$Y_t = 0.0313X_{t-1} + \varepsilon_t - 0.8266\varepsilon_{t-1}, \tag{6}$$

where the Y_t time series contains the values of expenditure on the medium-term consumer goods, differentiated both currently and seasonally, the X_t time series contains the GDP values, also differentiated both currently and seasonally, and ε_t is the white noise.

For durable goods spending, this time series at quarter t turns out to depend on GDP values at quarters t, t–1, and t–2. This fact confirms the assumption that the character of the dependence and lags is the same as in the case of total household final consumption expenditure. Again, we have calculated the CCF and the graphical output (see Figure 5) shows a linear dependence including a time lag of one and two quarters.

Figure 5 Cross correlation between expenditure on durable goods and GDP



Source: Authors' own calculations, <*www.czso.cz*>

Based on this observation, we have derived a model with the following transfer function:

$$Y_t = 0.0575X_t - 0.0234X_{t-1} + 0.0175X_{t-2} + \varepsilon_t - 0.4976\varepsilon_{t-1}, \quad (7)$$

where the Y_t time series contains the expenditure on durable goods values, differentiated both currently and seasonally, the X_t time series contains the GDP values, also differentiated both currently and seasonally, and ε_t is the white noise.

CONCLUSIONS

Although the economic crisis caused by the Covid-19 pandemic in 2020 did not have economic causes, it again raised a number of questions about the nature of economic development, the links between the evolution of the values of macroeconomic aggregates, the predictability of crisis turning points in the economy and, last but not least, the role of household economic behaviour in exacerbating or smoothing the unevenness in the national economic development.

The Czech economy has not escaped the turbulent development occurring in the most recent 30 years. The initial problems associated with the transition from a centrally planned to a market economy, coupled with the rapid privatisation of industry, the rapid development of the banking sector, the collapse of Czechoslovakia and the slow revision of existing legislation in the early 1990s, were seemingly quickly resolved. However, the harsh realities of the market economic environment brought about a rapid sobering up from the 'successful' economic transformation in 1997 and 1998, when the Czech Republic's GDP fell by around 1% in each of those years. To restart economic growth, it was necessary to create favourable conditions for foreign investors, as domestic entities lacked the necessary financial resources and technological facilities.

The change in economic policy (finalising the restructuring and modernisation of industry, recovery of the banking sector, and stabilisation of monetary policy) marked a turning point in economic development and, around the year of accession to the European Union (2004), the Czech Republic was at the peak of economic growth. Initially, the financial and credit crisis, which spilled over from the USA to the whole world, marked the end of the economic growth phase and the plunge into crisis, the consequences of which the Czech economy recovered from only very slowly. The government's overly restrictive budget policy, in particular, the refusal to support the modest recovery in 2010 and 2011, was partly to blame. It made the country fall back into the recession in 2012 and 2013. The decline in household final consumption expenditure and business investment was then only a reflection of the climate of the overall distrust prevailing in the economy at that time.

From the perspective of the Czech economy, the period after 2014 can be assessed as a period of prosperity and rising living standards. Although in 2018 and 2019, the annual GDP growth slowed down (to around 3% of annual growth in both years under review) in comparison with 2017, the Czech economy did not show any warning signs of the coming crisis. Non-economic factors, such as the pandemic, were not provided for. The drastic anti-epidemic measures (closure of borders, shops, restaurants, hotels and a number of manufacturing companies) meant that GDP fell by 5.8% and fixed capital investment by 7.2%. Household concerns about health risks, together with the closure of shops and services, led to a 7.1% fall in final consumption expenditure. It is too early to assess the full impact of the 2020 crisis, but there is no doubt that its causes were not economic. At the same time, household behaviour and its impact on economic development cannot be assessed in the same way as in the case of crises caused by economic reasons.

The causes of the crises that the Czech economy went through were various; in 1997–1998, the reasons for them can be found exclusively within the Czech economy. The crisis in 2009 had external causes; it came from the USA as a credit and financial crisis, which turned into an economic crisis, with symptoms

of an economic slowdown already coming in 2008. The crisis of 2012–2013 again had internal causes, that is the wrong economic policy; and the crisis of 2020 was the result of non-economic factors.

The variety of causes of the crises in the development of the Czech economy leads us to try to confirm or refute the hypothesis about the corrective role of household economic behaviour in the development of the economy. We assume that, in years of economic growth, household spending on final consumption and investment increases. In terms of the nature of consumption, (with a slight increase in spending on short-term items) they are mainly oriented towards the purchase of durable items. By contrast, in years of recession and crisis, households first cut back on spending on durable goods, but still with a certain delay. Demand for non-durable items (food, beverages, tobacco, pharmaceuticals, cosmetics, fuel, etc.) remains unchanged.

If we are to confirm or reject the hypothesis that, whatever the economic cause of the crisis, household consumption behaviour is comparable yet differentiated by durability, we use a linear dynamic time series model. By analysing the data, we have confirmed the dependence between the quarterly time series of total household final consumption expenditure and GDP, including time lags of one and two quarters. The model has been proved to be perfectly adequate, passing all quality tests. The same conclusions have been reached when modelling the dependence of the year-to-year quarterly growth rates of household final consumption expenditure and GDP.

When we analyse the time series of quarterly household final consumption expenditures by durability and GDP, our hypothesis is confirmed, as it turns out that expenditures on non-durable items are independent of changes in GDP. Thus, households purchase everyday items regardless of the upcoming or ongoing economic crisis.

On the other hand, for expenditure on durables, this time series at quarter t has been shown to depend on GDP values at quarters t, t–1, and t–2, confirming our hypothesis of the same dependence and lag as for household final consumption expenditure in total.

In the case of household expenditure on medium-term consumer goods (clothing, footwear, household goods, sports equipment, books, toys, etc.), this series turns out to depend on GDP values only at quarter t–1 and does not depend on the value at time t or on the value at time t–2. This one-quarter interval only confirms the specific character played by the medium-term consumer goods in household expenditure. These products cannot be regarded as superfluous and their purchase cannot be postponed for a longer period. In this sense, spending on durable goods is relatively weakly smoothing. The dominant role in the corrective effect of lagged final consumption expenditure is, therefore, in line with our assumption, played by expenditure on durable goods.

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