

Assessment of the Nature of the Pandemic Shock: Implications for Monetary Policy

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Assessment of the Nature of the Pandemic Shock: Implications for Monetary Policy

Oxana Babecká Kucharčuková, Jan Brůha, Petr Král, Martin Motl, and Jaromír Tonner*

Abstract

The coronavirus pandemic and the related anti-epidemic measures represented an unprecedented negative shock to the global economy in the form of a dramatic fall in economic activity. Since the onset of the pandemic, the question has been to what extent the contraction of economic activity, largely related to anti-epidemic measures (lockdowns), can be interpreted as a negative anti-inflationary shock to demand and, conversely, what proportion of the observed decline in GDP can be attributed to a negative (cost) inflationary shock on the supply side. To contribute to the debate, we have set out our own narrative and conducted model analyses. We have focused on the world's two largest advanced economies – the US and the euro area. An empirical comparison of the pandemic-induced crisis with the global financial and economic crisis and model simulations indicate that the sharp economic downturn observed in 2020 bears, for the most part, the hallmarks of a supply shock. The combination of a negative supply shock, worldwide accommodative monetary policy and large fiscal stimuli led to strong inflationary overheating across the globe. The Czech National Bank reassessed the macroeconomic story from a demand to supply driven economic downturn. This reassessment, together with a gradual, but steady, recovery of economic activity, enabled the CNB – as one of the first central banks in the world to do so – to appropriately tighten its monetary policy from mid-2021 onwards.

Abstrakt

Koronavirová pandemie a související protiepidemická opatření představovaly bezprecedentní negativní šok pro světovou ekonomiku v podobě dramatického poklesu ekonomické aktivity. Od počátku pandemie je otázkou, do jaké míry lze propad ekonomické aktivity související z velké části s protiepidemickými opatřeními (uzavírkami) interpretovat jako negativní protiinflační šok do poptávky a jakou část pozorovaného poklesu HDP je naopak možno přisoudit negativnímu (nákladovému) proinflačnímu šoku na nabídkové straně. Abychom k této debatě přispěli, přinášíme vlastní příběh a provedli jsme modelové analýzy. Zaměřili jsme se na dvě největší rozvinuté ekonomiky světa – USA a eurozónu. Empirické srovnání krize vyvolané pandemií s globální finanční a hospodářskou krizí i provedené modelové simulace ukazují, že výrazný ekonomický propad pozorovaný v roce 2020 nese z větší části známky šoku nabídkového charakteru. Kombinace nabídkového šoku, celosvětově uvolněné měnové

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politiky a rozsáhlých fiskálních stimulů vedla ke značnému inflačnímu přehřívání po celém světě. Česká národní banka přehodnotila makroekonomický příběh z poptávkového na nabídkový ekonomický pokles. Toto přehodnocení společně s postupným, avšak stabilním tempem ožívání ekonomické aktivity umožnilo ČNB – jako jedné z prvních centrálních bank na světě – od poloviny roku 2021 odpovídajícím způsobem zpřísnit svoji měnovou politiku.

JEL Codes: E31, E32, F47.

Keywords: Coronavirus pandemic, demand and supply shocks, inflation, monetary policy, output gap.

1. Introduction

In periods of dramatic change, assessing the nature of the underlying shocks is crucial for macroeconomic analysis and forecasting. The forecast of real macroeconomic variables and inflation depends on whether the development of the real economy is assessed as being driven by demand effects, i.e. effects fostering the co-movement of the real economy and inflation, or supply factors, i.e. factors causing inflation and the real economy to move in opposite directions.¹ This assessment is pivotal for monetary policymakers when forming an appropriate response. The need to interpret the nature of the shock correctly is even more important in the case of the coronavirus pandemic, as this is a crisis whose cause, extent and magnitude is unparalleled in modern economic history. With the retrospective advantage of having data for 2020 and 2021, we set out to investigate the nature, impacts and consequences of the pandemic shock in more detail.

Our analysis, which focused on the world's two largest advanced economies and on the small open Czech economy, indicates that the pandemic shock had significant characteristics of a supply-side shock. Our arguments are based on a comparison of the dynamics of quantities and prices during the global financial and economic crisis (GFC) of 2008–2009 with the pandemic shocks in 2020 and 2021. We have added to the comparison with simulations using the global NiGEM model. These simulations have led us to the same conclusion.

The policies adopted by governments and central banks in the first year of the pandemic were accommodative, i.e. they boosted demand. The governments of individual countries responded to this shock in spring 2020 by large-scale fiscal expansion typically in the form of income-bridging policies and job-retention schemes, accompanied by sharp interest rate cuts by monetary authorities or a further easing of the monetary conditions, including the use of unconventional instruments.² This was, in our view, the right response at the beginning of the pandemic, when there was huge uncertainty about the nature of the shock. There was simply an urgent need to prevent the collapse of economies in a situation of massive and unprecedented uncertainty. During that time, the evidence started to indicate that the economic dynamics during and even more so after the pandemic were far from being a deflationary contraction.

The combination of accommodative policies and the negative supply shock naturally resulted in an inflation surge in 2021. Moreover, the monetary policy of major central banks (especially the ECB and, to a lesser extent, the Fed) was very accommodative during both years. Given the accumulated evidence about the nature of the pandemic shock, we do not think that the accommodative stance was warranted. The global inflation of 2021 was a result of an excessively accommodative policy in an environment of high inflation coupled with strong consumer and

¹ In this article, we define demand and supply shocks in terms of their effect on inflation. We consider this perspective as relevant for central banks seeking to maintain price stability, i.e. low and stable inflation. However, this is not the only definition available. The literature also presents an approach, which defines the supply shock as permanent and the demand shock as temporary (see, for example, Blanchard and Quah, 1989). We chose the former approach due to its relevance to monetary policy and because it is supported by evidence showing that the Phillips curve (i.e. the cyclical relationship between economic activity and inflation) is an empirically valid macroeconomic relationship. See Appendix A, which documents the good health of the Phillips curve.

² An overview of fiscal measures was presented in [The Fiscal Policy Reaction to Covid-19, or the Fast Way out of the Crisis](#) (CNB – Global Economic Outlook 5/2020). Appendix B contains figures on the government spending of the two largest world economies during the pandemic. The response of central banks was described in [Central Banks' Monetary Policy in Response to the Coronavirus Epidemic](#), CNB – Central Bank Monitoring II/2020.

investor demand. In other words, the too accommodative policy maintained by some large central banks throughout 2021 contributed to fueling the global inflationary environment. When this environment coincided with the energy price shock at the end of 2021 and into 2022, the outcome was an unprecedented rise in inflation in the first half of 2022. This development currently threatens to de-anchor inflation expectations (Reiss, 2022) and thus jeopardize the price stability of advanced economies.

The rest of the paper is structured as follows: Section 2 compares the dynamics of prices and quantities in the world's two largest advanced economies during the pandemic years and the global financial and economic crisis of 2008–2009. We show that the two episodes differ in terms of price dynamics, which leads us to conclude that the nature of the underlying mix of shocks is different. The pandemic shock in particular seems more like a supply-side shock. Section 3 contains model-based simulations that also indicate that the pandemic crisis should be considered rather as a negative supply shock. Section 4 discusses the implications for monetary policy: subsection 4.1 summarizes the experience of the Czech National Bank and examines how the shift in the assessment of the crisis has propagated to its quarterly forecasts. Subsection 4.2 argues that the strong inflation dynamics in 2021 were partly fueled by the excessively accommodative monetary policy pursued by large central banks. Section 5 concludes. The appendices contain additional material.

2. A Comparison with the Global Financial and Economic Crisis

The global financial and economic crisis can be used as a natural benchmark for the assessment of supply and demand shocks, as GDP also fell sharply in that period. The 2008–2009 crisis was primarily of a demand nature, i.e. the fall in economic activity was caused by factors from within the economic system in the form of a sudden market response to – and/or market correction of – accumulated macroeconomic and financial system imbalances. This sharp decline in real economic activity and global trade was accompanied by widespread consumer and investor pessimism and a deterioration in the labor market situation. Inflation fell almost everywhere. The fall in economic activity was thus consistently reflected in the opening of the output gap into deeply negative territory. Eventually, central banks responded appropriately in the form of monetary policy easing.

In both episodes under scrutiny, most institutions assessed the output gaps as being negative, i.e. a demand-driven slack in the economy. Table B1 in the appendix contains the vintages of the output gap estimates by the IMF for the 2008–2009 crisis. Consistent with the narrative about the global financial and economic crisis, the estimates of the output gap are in large negative territory. Table B2 contains the corresponding vintages of the estimates of the output gap during the pandemic years. The output gap estimates for 2020–2021 are apparently also negative and signal a demand-driven crisis.³

Whether the analogy between the global financial and economic crisis and the coronavirus pandemic is appropriate can, however, be questioned on intuitive grounds. Unlike the 2008–

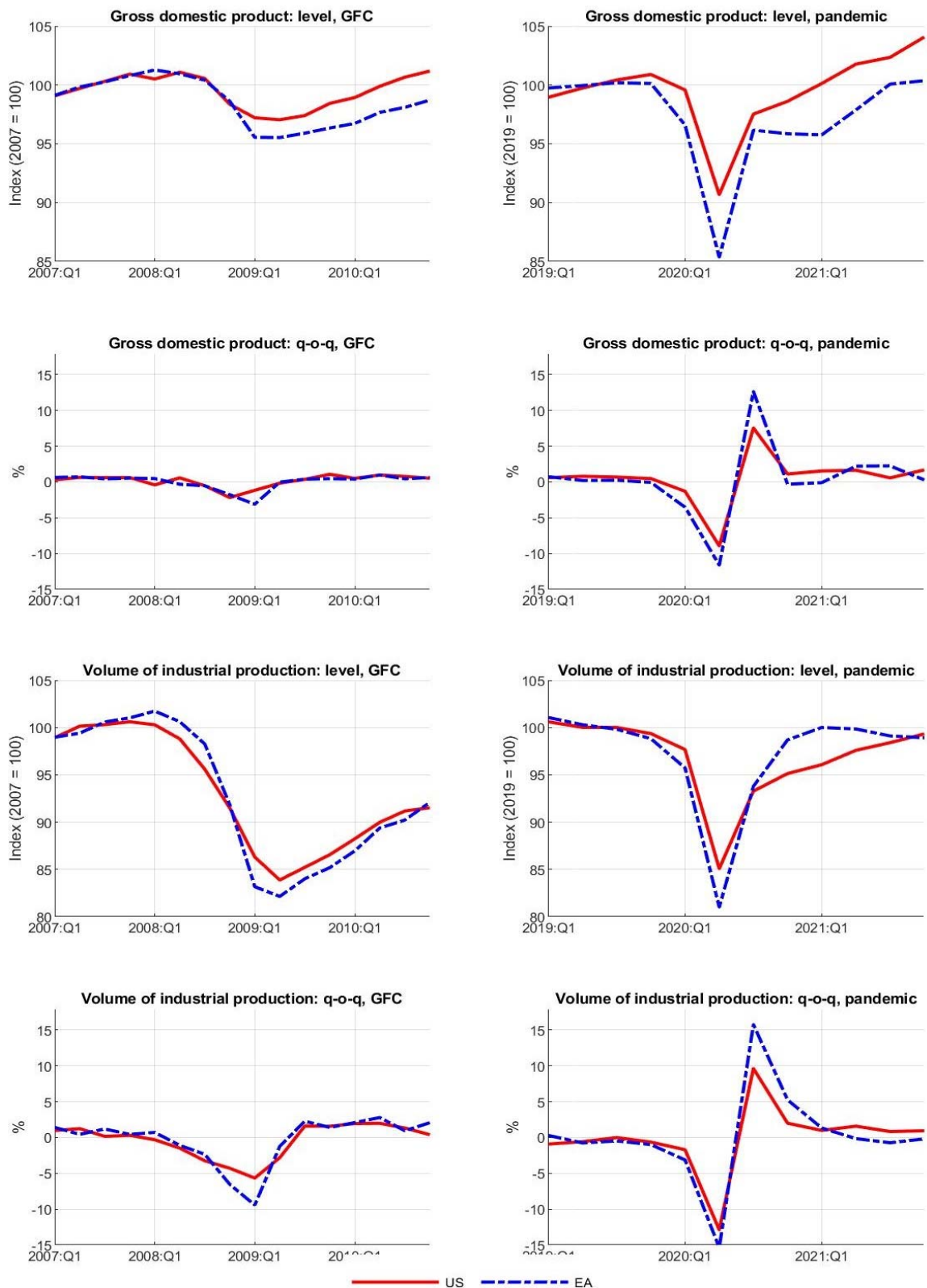
³ In these tables, we report the estimates of output gaps by the IMF as they are based on consistent methodology and cover various countries. We have also explored the estimates by the national central banks. Unfortunately, not all central banks' output gap estimates are publically available. Where they are available (Bank of Japan, Bank of England), they qualitatively confirm the IMF estimates, i.e. they are negative for both episodes.

2009 demand crisis, which was characterized by a deeply negative economic sentiment, the nature of the pandemic shock is as such that many economic agents were willing to consume, produce or invest, but were prevented from doing so by the pandemic situation and anti-epidemic measures. This is apparent from the rapid upswing in economic activity and sentiment reflecting a very strong rebound in demand after shutdowns were lifted in the first half of 2020 (see Figure 1 below).

A simple comparison of economic activity and inflation during the two periods reinforces the difference between the crises. To compare the two, we use various measures of economic activity and the inflation rates of the world's two largest advanced economies: the United States (US) and the euro area (EA). The first period refers to the global financial and economic crisis and runs from the beginning of 2007 to the end of 2010. The fall in economic activity occurred in the two last quarters of 2008 and in the first quarter of 2009. After that, economic activity started to recover. The second period starts in 2019 and ends at the end of 2021. The drop in economic activity occurred in 2020 Q2. Activity started to pick up after that, despite some pandemic measures remaining in place.

It is apparent that the fall in economic activity during 2020 was deeper than during the global financial crisis. Figure 1 displays the level and growth rates of the real GDP and the volume of industrial production for the two economies. The left-hand side column refers to the period of the global financial and economic crisis, while the right-side column refers to the post-2019 period. To highlight the differences, the ranges of the y-axis of the sub-charts on the same row are the same. All indicators of economic activity fell in 2020 Q2 more than during the GFC. This is true for both the levels of economic activity indicators when compared to the pre-crisis years and to their quarter-on-quarter growth rates.

Figure 1: Economic Activity during the GFC and the Pandemic



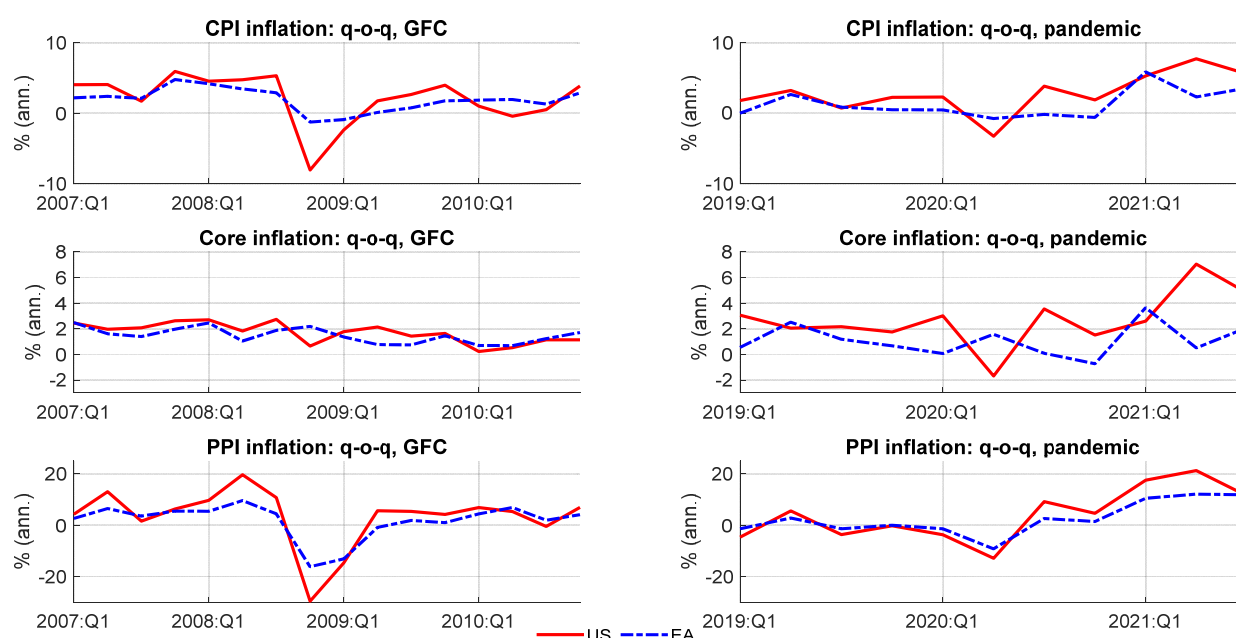
Source: OECD, authors' calculations.

The opposite holds for inflation: inflation rates fell by less during the pandemic than during the global financial and economic crisis. Figure 2 (which is analogous to Figure 1) compares the dynamics of CPI, core CPI (i.e. CPI excluding food and energy) and domestic PPI in manufacturing

in the individual countries under scrutiny. During the global financial and economic crisis, CPI inflation fell dramatically in 2008 Q4 and although it increased somewhat in 2009, it remained low throughout 2009 and 2010. In 2008 and 2009, CPI inflation in the euro area was around 1 pp lower than in the pre-crisis period and was more than 1.5 pp lower in the US. The drop in CPI inflation can be partially attributed to the fall in energy and food prices. Nevertheless, a look at core CPI inflation (excluding food and energy) reveals that the core inflation rates were also lower in 2008 and 2009 than in the pre-crisis period, although the difference between these two periods is smaller for core inflation than for overall CPI inflation.

The same observation that holds for consumer inflation rates is also true for PPI inflation. The drop in PPI was deeper in 2009 Q1 than in 2020 Q2. Moreover, the subsequent dynamics are also different. In 2009 and 2010, PPI dynamics in all countries were much lower than in 2007 and in the first half of 2008. On the other hand, the PPI inflation rate started to rise after 2020 3Q.

Figure 2: Inflation Rates during the GFC and the Pandemic



Source: Eurostat, OECD, authors' calculations.

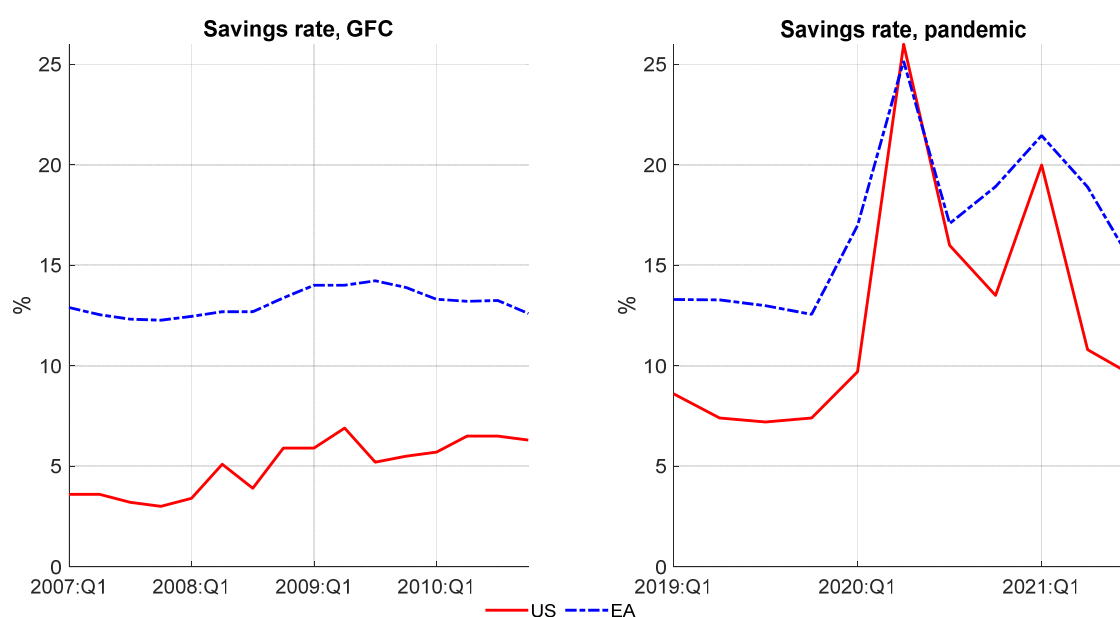
In addition, prices and quantities of international trade behaved differently in the two episodes. The volumes and prices of exports moved in the same direction during the GFC and the price dynamics contributed to the overall fall in nominal exports ranging from about one third (in the EA) to a half (in the US). In 2020 2Q, total nominal exports fell by more than during the GFC, but prices contributed less to that drop both in absolute terms and even more so in relative terms.⁴

The different profile of the saving rate during the pandemic and the global financial and economic crisis can be attributed to differences in household behaviour. During the global financial and economic crisis, the saving rate increased gradually due to households' traditional

⁴ See Babecká Kucharčuková and Brůha (2020), who contrast the dynamics of the volume of international trade prices in both periods.

precautionary savings as they gradually cut their spending in expectation of worse times ahead in a forward-looking manner (see the left-hand sub-chart in Figure 3). By contrast, there was an unprecedented sharp and immediate rise in the saving rate during the pandemic, especially in 2020 Q2 (see the right-hand sub-chart in Figure 3). Anti-epidemic measures heavily affected retail trade and a large number of services, dramatically narrowing consumption opportunities.⁵ These severe operational restrictions, coupled with voluntary or forced social distancing and self-isolation due to a fear of infection, made it impossible for households to consume a large share of their normal expenditure basket.⁶ This was at a time when these restrictions were relatively amply compensated by governments in the form of large fiscal support programs (income-bridging policies and job-retention schemes) thanks to which, in many respects, household incomes have been more or less maintained, unlike in previous crises. By contrast, the easing of restrictions following an improvement in the epidemic situation in 2020 Q3 led to a sharp rise in the trend component of GDP (supply). This was largely accompanied by pent-up demand by customers who wanted to at least partly make up for “involuntarily” deferred consumption during shutdowns. The saving rate thus fell sharply in Q3.

Figure 3: Saving Rates of Households in the Countries under Review during the GFC and the Pandemic



Source: Federal Reserve Economic Data, Eurostat.

⁵ It worth mentioning that some companies actually benefited from the lockdowns and other restrictions introduced by governments. For instance, e-shops increased their sales, which in turn boosted delivery services. Despite its significant expansion, this new trend in consumer behaviour was not able to replace “brick and mortar” stores entirely. It is extremely difficult or even impossible to provide many services remotely (for example, accommodation, food services, cultural activities and recreation).

⁶ There was a related visible shift from the consumption of services to spending on goods, i.e. from paying for experiences to buying items. This trend persisted long after the first Covid-19 wave faded. This has subsequently led to overstretched global value chains, including international logistics, and caused problems with the supply of materials and components in late 2020 and 2021, along with the related massive price increases (see Section 4).

All these observations lead to the conclusion that the mix of shocks behind the global financial and economic crisis and the pandemic was quite different. The muted reaction of both domestic and international trade prices point to the fact that the pandemic shock was largely a negative supply shock. In this respect, the large negative output gaps estimated by the IMF (see Table B2) may be too pessimistic. Given that two central banks (the ECB and the Fed) do not provide their computation of the output gap, it would be interesting to check whether our hypothesis on supply and demand shocks holds in a modeling framework. For this purpose, the next section contains our simulations using the NiGEM model.

We do not claim that the negative supply shock alone can explain the entire pandemic-related economic downturn. Elements of negative demand, a sentiment-type shock, were also undoubtedly present, especially in spring 2020.⁷ This is completely natural, as the outbreak of the pandemic was accompanied by huge uncertainty on the part of households, firms and governments. Nobody knew at the time how the health implications of Covid-19 might evolve and how resilient the market economies would prove to be. It is likely that the resolute fiscal and monetary policy responses helped to alleviate the uncertainty and make economies more resilient. If the policy reactions had not been so resolute, the pandemic crisis could have ended up being driven by negative sentiment or by demand shocks. We claim, however, that the supply nature of the shock started to dominate in mid-2020 at least.

3. A Model Based Analysis: Price Impacts of the Supply and Demand Scenarios of the Drop in GDP

In addition to the previous empirical (narrative) analysis, we also conducted an experiment using the global NiGEM model for the economies under review.⁸ The experiment compared observed inflation with simulations of hypothetical scenarios of the price impacts of the drop in GDP in 2020 corresponding to a 100% demand shock and a 100% supply shock.⁹ The demand scenario describes a situation in which the observed decline in real economic activity in 2020 would be reflected fully in an opening of the output gap into negative territory (a negative demand shock) amid a zero impact on the trend – supply. In the event of this 100% demand shock, the common model assumption for all selected economies is to limit central banks' monetary policy response to the zero lower bound (ZLB) on interest rates. Conversely, the supply scenario assumes that the observed drop in real economic activity in 2020 would be reflected fully in a drop in trend (a negative supply shock) amid a zero impact on the output gap – demand. Within this 100% supply shock, the model assumption for all selected economies is that the monetary authorities will not respond (by raising interest rates) to an inflationary shock to prevent the implementation of economic policy that would contradict the massive expansionary fiscal policy pursued simultaneously since the onset of the coronavirus pandemic. This assumption thus represents a temporary preference for an overshooting of monetary authorities' inflation targets in favor of support of economic growth through maintaining accommodative monetary conditions in a

⁷ Indeed, Balleer et al. (2021) find that prices of some PPI items initially fell, which is consistent with the initial significant element of a demand like shock.

⁸ This model was also used for one of the first quantifications of the economic impacts of the pandemic on the global economy; see Motl (2020).

⁹ These extreme shocks represent simulations as compared to counterfactual scenarios in the form of macroeconomic assumptions from January 2020, i.e. the period before the outbreak of the coronavirus crisis in the analyzed economies.

situation of heightened uncertainty about the combination of supply and demand effects during a sharp pandemic-induced fall in GDP. This, in our view realistic model assumption of no monetary policy response to an inflationary shock in this situation, also partially eliminates a potential monetary policy error that monetary policymakers could easily make if this negative supply shock hypothesis did not materialize to a greater extent.¹⁰ Besides that, all model simulations assume an observed exogenous shock to the exchange rate, including the price of oil. This is all simulated under the assumption of economic agents' rational expectations.

The observed inflation indicates a relatively small opening of the negative output gap at the expense of a drop in the trend in 2020 and hence a smaller share of negative anti-inflationary demand effects. This conclusion – where observed inflation is distinctly closer to the simulations of the 100% supply shock – applies to a similar extent to both economies under review (see Figure 4). Differences in the extent and profile of the inflation response in the individual countries to supply and demand shocks compared to the observed data mainly reflect the different sizes of the observed declines in GDP. Alternatively, this may be explained by hypothetical scenarios and the different impacts of observed exchange rates in individual economies and the degree of pass-through of the exchange rate to import prices and its effect on domestic inflation. Another distinction is the different room for central banks' response before the onset of the coronavirus pandemic in the form of monetary policy easing via interest rates in the 100% negative demand shock scenario.¹¹ The model assumption of an exogenous shock to oil prices, reflecting the sharp fall observed in 2020, was the same for all simulations.

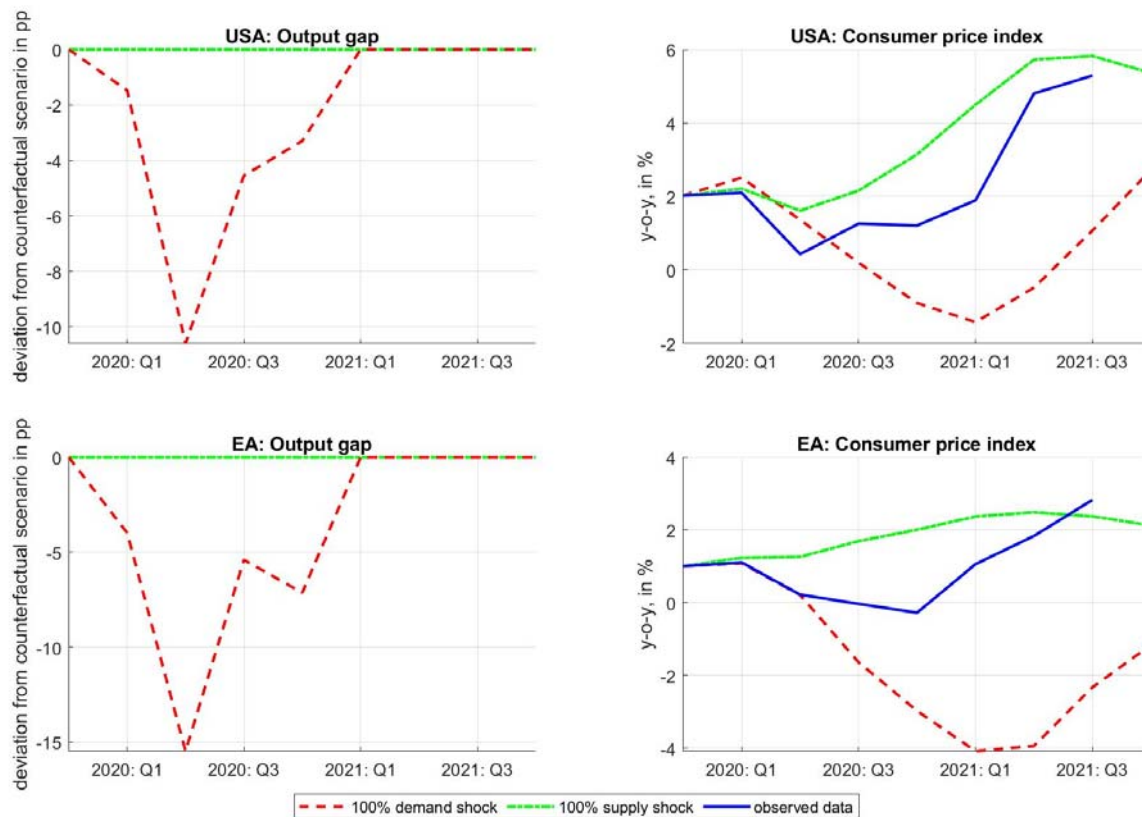
The observed developments, which mainly reflect the economic impacts of anti-epidemic measures offset by extensive fiscal support programmes, thus largely bear the hallmarks of a negative supply shock. This result is also in line with the interpretation of the trend as a production function and its production factors (labor and capital) which approximate the total production capacity in the economy. Any disruptions to production capacity (government-imposed shutdowns of parts of the economy – lockdowns or other restrictions) are thus reflected directly in a drop in supply (trend). Although production factors in the economy are actually ready to produce and still exist, they cannot be used effectively if restricted or shut down completely. An unprecedented shock of this kind, the magnitude of which has never been experienced before, thus has negative impacts mainly on supply, and is therefore stagflationary in nature. A decline in economic activity, especially in the first phase of the shock, can thus be explained by a significant drop in supply. This simultaneously negatively affected real consumption which could not be fully satisfied at the time despite consumers also being willing to spend, at least initially, when people were keen on living their lives and spending but were not allowed to do so.¹² The drop in supply thus manifested itself in a sharp rise in the saving rate of households in the individual economies.

¹⁰ In such a case, a large part of the drop in economic activity would be reflected in a significantly negative output gap, i.e. a strong anti-inflationary effect, which would, by contrast, require more accommodative monetary conditions.

¹¹ Due to the uncertainty regarding the exact quantification and impacts, simulations do not explicitly include the effects of monetary policy easing using unconventional instruments commonly performed by the central banks of these selected economies in different forms and to different extents. All easing of monetary conditions is thus contained in the simulations as an endogenous response within the interest rate component and the observed evolution of the exchange rate.

¹² A sharp drop in consumption, investment and exports triggered primarily by sudden administrative restrictions on supply is reflected in a distinctly weaker anti-inflationary effect than was the standard negative demand shock

Figure 4: Comparison of Observed Inflation with Simulations of Hypothetical Scenarios of the Price Impacts of the Drop in GDP in 2020 Corresponding to a 100% Demand Shock or a 100% Supply Shock



Source: Authors' calculations.

4. Implications for Monetary Policy

4.1 Implications for a Small Open Economy

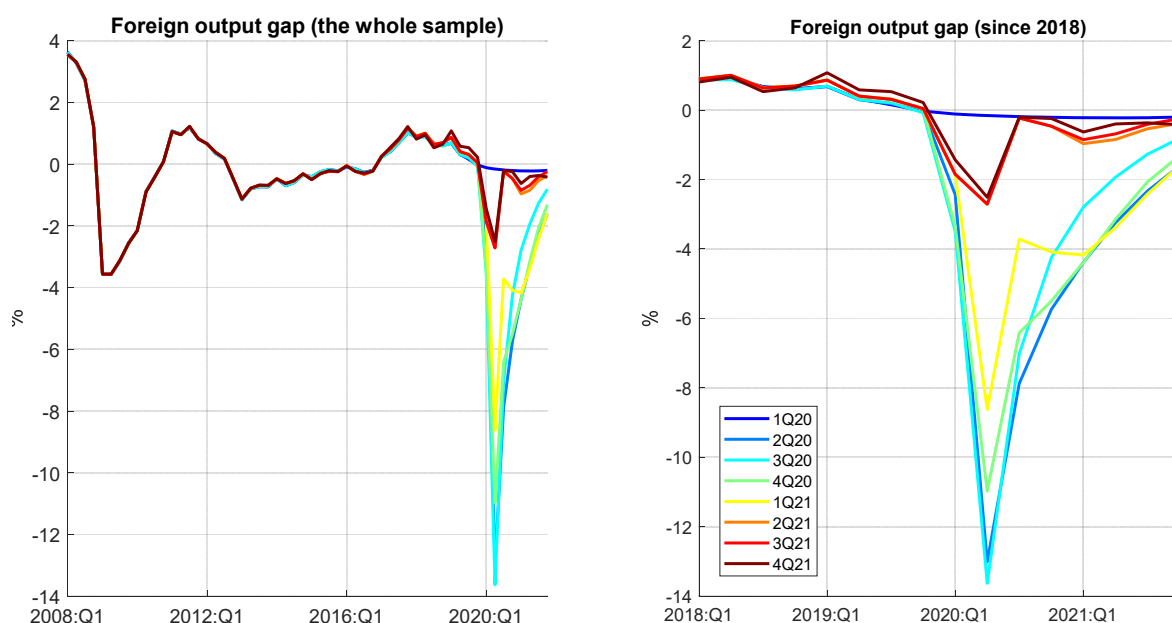
Assessing the nature of the global pandemic shock is important for policy setting in an open economy. There are two reasons for this. First, the outlook for foreign variables (inflation, output, interest rates) is crucial for inflation forecasts in small open economies. Thus, an understanding of the nature and propagation of the pandemic shock in big economies naturally influences external inflation pressures. Second, unlike during the global financial and economic crisis in 2008–2009,¹³ the mechanism of the pandemic shock, i.e. the impact administrative measures had on production and consumption capacities, is probably similar for all advanced countries. Hence, an understanding of how various administrative measures have affected other economies can act as an inspiration for modeling the transmission of the shock in the domestic economy.

observed, for example, during the 2009 crisis, which was a standard (albeit exceptionally deep) crisis stemming from the overproduction/underconsumption of the economies affected.

¹³ The global and financial crisis was a financial crisis for some countries only. For some nations like the Czech Republic, this crisis meant “just” a dramatic fall in the external demand (Ryšánek, Tonner and Vašíček, 2012).

Using the Czech economy as an example, we illustrate below – with the use of the CNB core forecasting model – how the evolution of the assessment of the pandemic shock has affected inflation and policy rate forecasts. Indeed, as data and new information on the pandemic period only gradually became available to CNB staff, they have been shifting their original assessment of the pandemic from being essentially a demand crisis to one characterized less by negative demand effects and more by negative supply effects.¹⁴ The CNB’s main forecasting model (g3+ model, Brázdík et al. 2021) contains a foreign block where the Phillips curve connects the output gap and foreign PPI inflation.¹⁵

Figure 5: Development of the CNB Staff Assessment of the Output Gap in the Effective Euro Area (%)



Source: Authors’ calculations.

The initial assessment of the pandemic shock estimated a very large negative foreign output gap and a negative outlook for foreign prices. This can be seen in Figure 5, which shows the vintage of the CNB staff assessments of the output gap in the effective euro area. During 2020, the staff viewed the gap as opening into largely negative territory, much more so than during the GFC. Consistent with this assessment, the CNB expected the growth in foreign prices to be negative, largely for the overall PPI, but also for the core PPI (see Figure 6 for vintages of forecasts of the PPI in the effective euro area). Accordingly, this influenced the outlook for domestic inflation and the very accommodative domestic policy stance.

Inflation dynamics in 2020 were not consistent with the initial demand-based story. The foreign core PPI inflation did not fall much. Initially, this missing disinflation (given such a large

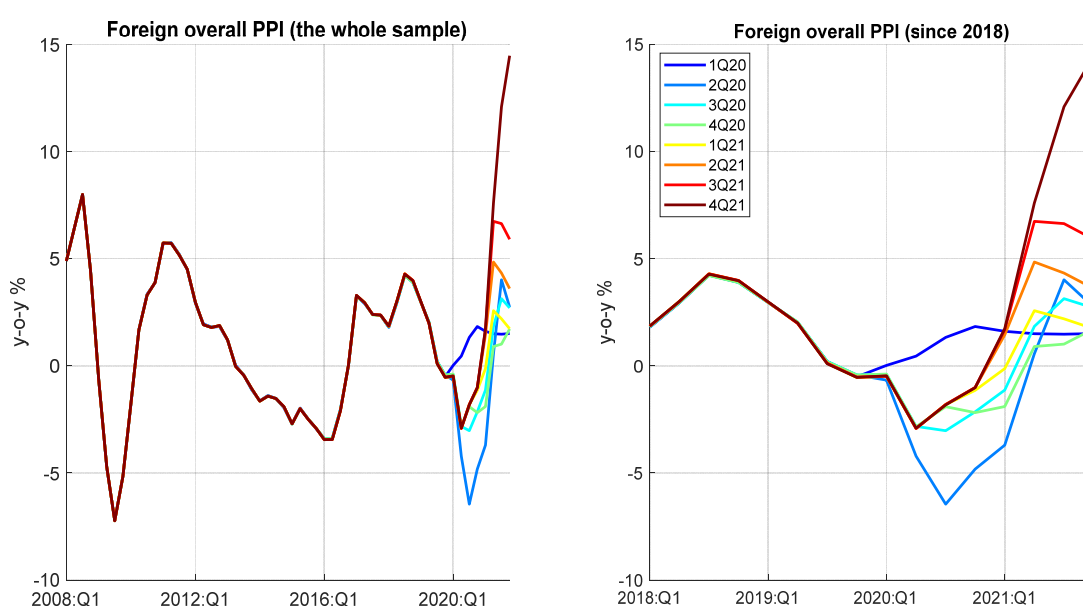
¹⁴ This contrasts with international institutions that did not change their views on output gaps in advanced countries, see Table B2.

¹⁵ A foreign economy block in the CNB baseline forecasting model represents the effective euro area in the form of a small semi-structural small-open-economy gap model. It consists of a few behavioral equations and definitions. The core of the model consists of four equations: the IS curve, the Phillips curve, a monetary policy rule, and the UIP condition.

output gap) was attributed to exogenous cost factors that were considered to be of a temporary nature. However, it later became clear that fundamental inflationary pressures remained high, supported by strong fiscal anti-epidemic measures and accommodative monetary conditions in the euro area.

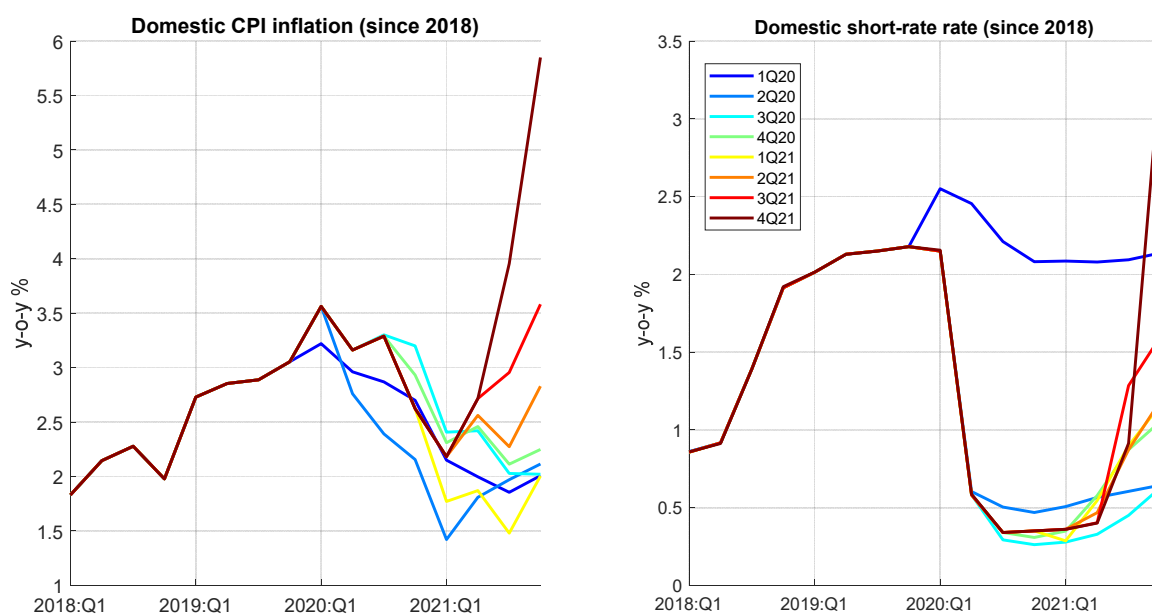
Therefore, the foreign output gap was subsequently reassessed to much more moderate negative values, lower than those identified for the GFC. This allowed for a change in the interpretation of price developments from ephemeral cost factors to a more fundamental story. The reassessment of the output gap in the effective euro area made it possible to correctly identify the nature of domestic inflationary pressures. Of course, this also had implications for domestic inflation forecasts and for monetary policy.

Figure 6: Reassessment of the Outlooks for the (Core) PPI in the Effective Euro Area (y-o-y, %)



Source: Authors' calculations.

A reassessment of the macroeconomic story, together with a slow, but steady, recovery of economic activity, enabled the CNB to significantly change the monetary policy stance. The autumn 2020 forecast had already implied future normalization of domestic monetary policy. This normalization occurred in June 2021, when the CNB started to increase its policy rates. This was based not only on actual data and forecasts of economic activity and inflation, but also on the understanding that the observed increases in prices (both domestic and foreign) were not caused by cost factors alone, which would possibly dissipate, but also – or chiefly – by a combination of the stagflation shock and demand-boosting policies.

Figure 7: Vintages of the 3M PRIBOR (%) and CPI Inflation Forecasts (y-o-y, %)

Source: Authors' calculations.

To lay down the rationale for accelerated interest rate hikes in the second half of 2021, the CNB argues that we have seen strong and long-term domestic inflation pressures in recent years. These have primarily reflected a persistently exhausted labor market, manifesting itself in the lowest unemployment rate in the EU and rapid wage growth, which has been supported by a continuous increase in the minimum wage. In line with that, we have seen strong domestic consumption supported further by expansionary fiscal policy. On the top of that, people started to spend involuntary savings. There was also a general euphoria after the re-opening of the economy in late spring and summer, which strongly encouraged firms to increase their prices to compensate for revenue losses during the lockdowns. Besides that, there has been a mortgage boom in recent years, and an overheated real estate market, with residential property prices rising sharply. Core inflation has been exceptionally high amid this overall macroeconomic situation, driving overall price increases, which are set to accelerate further in the coming months. Besides a general increase in the prices of goods and services, imputed rents (costs of owner-occupied housing) have made a strong and increasing contribution to core inflation. The CNB's forceful monetary policy response in the second half of 2021 aimed not only to return inflation close to the target at the monetary policy horizon, but also to support the anchoring of firms' and households' inflation expectations. These expectations have recently faced significantly elevated inflation and the Czech National Bank did not intend to allow them to become unanchored from the 2% target.

4.2 Implications for the Global Inflation Surge in 2021

When the pandemic crisis hit in spring 2020, the reactions of monetary authorities were ex ante appropriate given the huge uncertainty. The fears of a collapse of market economies naturally led to adopting safeguarding measures. There were fears of debt-deflationary spirals that could have potentially ravaged economies, which had already been weakened by anti-pandemic

measures. Ex post, we can discuss the pace or the extent of these measures. Nevertheless, in the environment of uncertainty, the accommodative direction taken was, in our view, a natural step.

However, it had already become clear in autumn 2020 that the catastrophic deflationary scenario was not going to materialize. Still, the motivation for keeping the accommodative policy stance could be understood. The risk of second-round negative effects of the lockdowns on consumer, producer and investor sentiment could not easily be ruled out. If such negative effects on agents' sentiment had materialized, weak demand would have led to a deflationary environment. Although most pandemic measures were primarily targeting the face-to-face services sector in autumn 2020, there was a non-negligible risk that weaker demand would later start to spill over into other industries. Such spillovers would have then been propagated by trade links between countries, something that had happened during the global financial and economic crisis (Levchenko et al., 2010). The accommodative policy stance was considered a tool that could mitigate such risks.

The situation has escalated since spring 2021 when inflation kicked in. Many had ascribed inflation to transitory factors which should have been quick to disappear. Our story is different: as of spring 2021, advanced countries have witnessed a robust rebound in industry, the resumption of international trade and consumer spending, the latter supported by pent-up demand. This resumption, coupled with excessively accommodative monetary policies, naturally led to a surge in inflation. This is a textbook mechanism. It is also important to bear in mind that prices of commodities, materials, and intermediate goods¹⁶ are not exogenous from the global perspective. The shortage of some materials and intermediate goods thus reflects a surge in global demand that cannot be easily satisfied.¹⁷

The excessively accommodative monetary policy pursued by some major central banks thus led to significant inflationary overheating. If the views expressed in this paper are correct, the inaction of these central banks may have had serious global effects, in particular for smaller central banks that have not given up their goal of maintaining price stability, for which this represented a negative externality. Shocks to energy commodity prices in late 2021 and early 2022 led to an even further increase in inflation. As this shock hit an already inflationary and overheating environment, its impact may be longer lasting than if it had hit a steady-state economy (Harding et al., 2022). The combination of the overheating of the economy in 2021, fueled by accommodative policies together with the energy shock, may increase long-run inflation expectations and jeopardize overall trust in monetary policy. In the coming years, we will see whether central banks across the globe will successfully navigate this difficult terrain (Reiss, 2022).

Apart from the policy lesson, another lesson that can be learned from the tragic Covid-19 pandemic event is a lesson on modeling. Trends in applied macroeconomic models tend to be formulated as relatively smooth curves: usually a random walk with a drift, where the drift can be a deterministic trend, a stable AR process or another random walk. This specification works well on the ex-post filtration of data in normal times. However, such a specification is inappropriate for

¹⁶ Babecká Kucharčuková and Brůha (2021) show that trade in intermediate goods is the most cyclically sensitive part of trade in goods. In the EU, the price of intermediate goods fell more during the GFC than in 2020 2Q, although the decrease in the volume of the trade in intermediate goods was deeper in the latter episodes. This observation supports the conclusion reached in Section 2.

¹⁷ For some sectors or even for some small countries, this shortage and the price increases may be very unpleasant and may represent negative shocks that would cool the local labor market and demand. From the global perspective, this phenomenon is however an endogenous reaction to the surge in global demand.

dramatic events like pandemics or wars. By construction, a significant drop in economic activity would be split into trend and cycles and the split would be determined by the ratio of standard errors of shocks regardless of economic intuition. Modelers therefore have to use their models carefully, confronting model-based filtration with economic intuition. They should not be shy to use their expertise to overwrite the initial mechanical filtration if it does not correspond to their intuition and to the macroeconomic story as a whole. Mechanical filtration and projections, blind to economic reasoning, may easily result in bad policy.¹⁸ Macroeconomic models should be used rather as story-telling devices that guard the internal consistency of forecasts rather than as automatic tools.

5. Conclusion

In this paper, we contribute to the debate on the extent to which the contraction of economic activity, largely related to anti-epidemic measures (lockdowns), can be interpreted as a negative demand anti-inflationary shock and what proportion of the observed decline in GDP can be attributed to a negative supply shock, i.e. an inflationary cost shock. The unprecedented size and nature of the shock dealt by the coronavirus pandemic meant that it was difficult to estimate the structure of supply and demand factors, especially at the beginning. This fundamental uncertainty is reflected in a great diversity of estimates of the magnitude of the negative output gap produced in real time by central banks and international institutions. Through the lens of a decomposition of GDP into the output gap relative to trend, some institutions likened – at least initially – the development of the coronavirus pandemic to the global financial and economic crisis. However, unlike a biological crisis such as a pandemic, the global financial and economic crisis was triggered by factors within the economic system, and its interpretation and consequences in the form of anti-inflationary developments were clearly cyclical. The observed data show that the coronavirus pandemic – just like any other natural disaster – has had standard adverse stagflationary supply-side effects so far. Unlike earthquakes or floods, which are usually local and are short-lived, the coronavirus pandemic is a global and long-lasting catastrophe. Although a pandemic does not directly physically damage production capacities (trend), production shutdowns or restrictions under anti-epidemic measures have ultimately the same effect on the trend, as these production capacities cannot be used in practice. On the other hand, they can be very quickly renewed after the adverse epidemic situation improves, which is reflected in the great volatility of the trend. Therefore, statistical filters, which are often used to estimate the trend and output gap, may – due to their two-tailed nature – lead to misleading conclusions in the case of biological crises.

An empirical comparison of the pandemic-induced crisis with the global financial and economic crisis and model simulations indicate that the sharp economic downturn observed in 2020 bears, for the most part, the hallmarks of a large negative supply shock. This conclusion thus confirms the fundamental difference between the coronavirus pandemic and the global financial and economic crisis which, by contrast, was largely characterized by negative anti-inflationary demand effects. This difference was also observed in household behavior. Whereas during the global financial and economic crisis, household consumption and the willingness to spend were reduced mainly due to a higher degree of caution reflecting negative consumer sentiment, during the pandemic this is chiefly due to administrative decisions to restrict or completely close retail and services. That said, we cannot deny that in the first months after the outbreak of the pandemic, the shock may have been more characteristic of a negative demand shock.

¹⁸ Moreover, the two-sided nature of the filters mostly used means that the mechanical filtration may easily result in strange results, such as that the pandemic had an impact on potential output even before its outbreak.

This – together with the overall uncertainty – created the rationale for accommodative policies. However, at least as far back as summer 2020, it became clear that the pandemic crisis would not have the nature of a standard demand slump. Therefore, the continuation of very accommodative monetary policies was not well-founded in late 2020 and in 2021.

A reassessment of the macroeconomic story together with a gradual, but steady, recovery in economic activity enabled the appropriate tightening of monetary policy in the Czech Republic. In the case of large economies, we think that the excessively accommodative monetary policy of their central banks coupled with continuous fiscal stimuli contributed to the strong inflationary overheating in 2021. If the views expressed in this paper are correct, the inaction of the major central banks around the globe could be considered a strong inflationary factor for the rest of the world.

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Appendix A: Three Cheers to the Phillips Curve

The cyclical relationship between inflation and economic slack is described by the Phillips curve, according to which the two variables are negatively correlated.¹⁹ This means that periods of economic boom are accompanied by positive demand-side inflationary pressures, while periods of economic downturn tend to be associated with anti-inflationary tendencies. This relationship is one of the key building blocks of modern macroeconomic models, including dynamic stochastic general equilibrium models, which have gained ground in central banks as instruments used in their forecasts and monetary policy analyzes.

Over the last 10 years, the stable cyclical relationship between inflation and the output gap as a measure of economic slack has been challenged. This was based on the observed loosening of the correlation between economic growth and inflation; the rhetoric that the Phillips curve “is flat” or “rotates” was used. Has the cyclical relationship between economic activity and inflation indeed been eroded? Before answering this question, it is important to bear in mind that the Phillips curve in modern macroeconomics captures the *cyclical* relationship. However, cyclical components cannot be observed directly, and therefore statistical or econometric models based on observed inflation and economic growth can provide misleading results. This is true for at least two reasons: both variables contain both a non-trivial long-term component and short-term volatility. Both long-term trend movements and short-term volatility may obscure the cyclical relationship under study.

If low-frequency movements in the inflation target or in long-run inflation expectations are not taken into account, the result of the empirical analysis may be misinterpreted as a “flattening” of the Phillips curve. Jorgensen and Lansing (2021) show on US data that anchoring inflation expectations plays a key role in estimating the cyclical relationship between inflation and economic activity. Incorporating the possibility of changing the degree of anchoring of inflation expectations into the New Keynesian Phillips curve allows the “mysterious” behavior of the curve during the Great Recession (“missing disinflation puzzle”) and in the period of subsequent economic recovery (“missing inflation puzzle”) to be reconciled. In other words, the Phillips curve behaves perfectly when inflation expectations are taken into account.

The Phillips relationship can be used in inflation forecasting if low frequency movements are not ignored. Bańbura and Bobeica (2020) document on euro area data that indicators of economic activity have a higher predictive power for inflation if low-frequency movements in inflation are explicitly addressed. Similarly, Jarocinski and Lenza (2018) estimate a series of models where the relationship between economic activity and inflation applies at cyclical frequencies, with the respective time series being adjusted for trend movements by a multidimensional model-consistent Kalman filter.

Inflation is sensitive to short-term movements that can also obscure the Phillips curve. The short-term movements can stem from volatile components such as food and energy prices and from the sporadic changes in the weights and quasi-seasonal factors. That is why, in addition to controlling low frequency movements, Andrieu et al. (2013, 2016) and Ball and Mazumder (2019,

¹⁹ The original contribution of Phillips (1958) was the long-run empirical relationship between the level of unemployment and wage growth. In modern macroeconomics, the Phillips Curve is considered a cyclical phenomenon.

2020) use robust inflation measures less sensitive to short-term volatility to confirm the Phillips curve.

We conclude that the Phillips curve is a valid macroeconomic relationship that may be temporarily obscured by non-cyclical factors. This is true not only for advanced economies such as the EA or the US. Franta and Sutóris (2020) also confirmed the cyclical dynamics of inflation in accordance with the Phillips curve for the Czech economy.

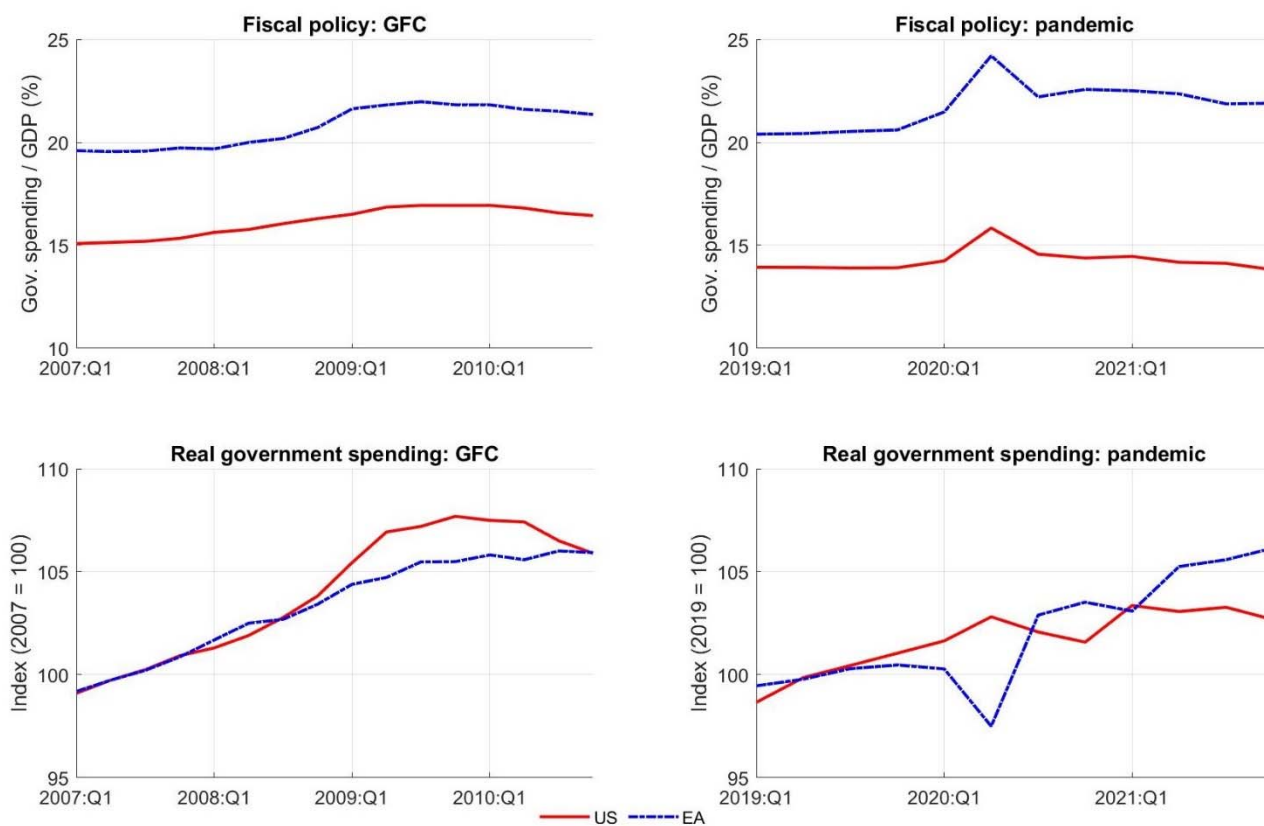
Appendix B: Additional Charts and Tables**Table B1: Vintages of Output Gap Estimates of Major World Economies by the IMF for 2008 and 2009**

	Output gap in the year	WEO		
		October 2008	October 2009	October 2010
USA	2008	0.4	-0.8	-1.8
	2009	-1.6	-4.5	-6.00
EA	2008	0.2	1.2	0.8
	2009	-1.1	-2.9	-3.7
UK	2008	-1.1	-0.1	0.4
	2009	-3.2	-4.9	-4.0
Japan	2008	-0.7	-1.7	-1.6
	2009	-3.2	-4.9	-4

Table B2: Vintages of Output Gap Estimates of Major World Economies by the IMF for 2020 and 2021

	Output gap in the year	WEO		
		October 2020	October 2021	June 2022
USA	2020	-3.2	-3.1	-3.3
	2021	-1.5	0.6	0.3
EA	2020	-5.1	-4.3	-4.3
	2021	-3.2	-3.1	-2.4
UK	2020	-3.9	-4.4	-3.5
	2021	-3.5	-3.1	-0.1
Japan	2020	-3.0	-2.7	-2.7
	2021	-2.1	-1.5	-2.6

Figure B1: Fiscal Policy during Both Crises



Source: OECD

Fiscal policy stances were accommodative during both crisis episodes. During the pandemic, the ratio of public spending to GDP rose significantly. Nevertheless, the rise was caused largely by a fall in the denominator. The increase in real government spending was comparable during both crises.

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