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Facing a Break Point in Global Inflation Transmission?

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Facing a Break Point in Global Inflation Transmission?

by

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Abstract:

The paper addresses the issue of the co-movements of national inflation dynamics with a common factor of a global dynamic. Based on the previous work of Ciccarelli and Mojon (2005) on global inflation the authors look at the more recent development in particular after the outbreak of the global financial crisis in July 2007. As a working hypothesis they try to find out if there is already sufficient empirical evidence available in the data that the massive liquidity pumped into the global financial system by central banks around the world together with the massive fiscal deficit spending of governments to cushion the recession could lead in the medium-term to an inflationary shock. Such rare events occurred in the past five decades only three times. We test especially after updating the data from 2004 until 2008/2009 depending on the data availability if there are already indications that inflationary pressures are building-up refuting expectations of many experts that the current global recession will increase the pressures on the global prices towards a global deflation. The combination of a coordinated reflationary monetary policy together with the fiscal stimulus packages already setup by governments around the globe should according to the fiscal theory of the price level tend to increase the joint-impact of these monetary expansions by the central banks and the governments towards a strong and rapid turn-around in the global price dynamics. Using an approach first established by Hamilton and Flavin (1986) we test for fiscal sustainability of the fiscal deficit positions in the US. The key question following from this is that after setting this process of an acceleration of global inflation into motion it could be hard to get the Genie back into the bottle. The experience of stagflation in the late 1970s and early 1980 are a warning sign that reflationary policies could lead to a significant overshooting in the reflationary macroeconomic impulse created around the globe.

Key Words: Inflation, common factor, global recession, monetary and fiscal policy, OECD countries

JEL classification: E31, E37, F42

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Introduction

With the spectre of a world wide depression and ensuing deflation in everybody's mind writing a paper about global inflation is in need of explanation. It is certainly true that in the short run a deflation is the more urgent problem to be solved. But when the measures used to fight deflation create an even larger problem in the future the economic profession should at least warn the policy maker about a possible conflict of interest. In fighting the present economic downturn and a possible deflation and to save the international financial system governments all over the world created large fiscal stimulus packages and expanded the monetary base. In their spring economic forecast the European Commission projects that the general government deficit of the USA will total -12.1 per cent of GDP this year. Even the deficit of most of the European countries will be well above the three per cent limit, in Germany with -3.9, in France with -6.6 and in Spain even -8.6 per cent of GDP (see European Commission 2009). The questions arises how this large stimulus will affect the price level especially given the vast amount of liquidity injected into financial markets. It has been argued that the liquidity injections are not a large problem since they can be revoked. The ECB has issued short term credits with a maturity of one week or less. So it should in principle be no problem to sterilize the excess liquidity if one assumes that no political pressure is put on the ECB board. The situation in the USA is slightly different and appears to be deteriorating. To finance the large budget deficit the Fed started to buy government bonds. The sterilization process with government bonds is subject to market conditions. When the Fed does not find a buyer no money will be deducted. So in the USA is an increasing potential for a soaring inflation rate (see the most recent statement of Ben Bernanke(2009) on July 21 on this issue).

Since the breakdown of the Bretton Woods system the resulting flexible exchange rate mechanism should allow each country or monetary union like the Eurozone to control their internal inflation rate. However, a growing literature has emerged which challenges this belief based on empirical results (see e.g. Reinhart, Rogoff 2002). There seems to persist even after the breakdown of the Bretton Woods system a strong tendency around the world to maintain a stable exchange rate even if fundamentals would suggest a major realignment. Exchange rates are not adjusted to correct imbalances timely and smoothly opening a transmission channel for inflationary/disinflationary contagion across countries. This gave an incentive to study the degree of co-movement of inflation rates at the global level and its potential origins (see e.g. Borio, Filardo 2006; Ruffer, Stracca 2006, Ciccarelli, Mojon 2005).

Recent research e. g. Ciccarelli and Mojon (2005) indicates a global component for inflation. Therefore an increasing inflation potential in the USA is not only worrisome for the USA themselves but also for the rest of the industrialized countries and through second round effects for all countries. They find that the variance of inflation in industrialized countries – namely 22 OECD countries – is explained by a global component in the range of 70 percent and that there is an error correction mechanism mitigating national price shocks so that in the long run the global inflation level is reached again. In light of recent developments it is unclear if this mechanism is still working. We therefore use the most recent data set to test for a structural break in the relationship found by Ciccarelli and Mojon (2005). If this relationship is still found to be stable we start to investigate the link between the American developments – especially the large budget deficit – and global and therefore local inflation, i.e. the global inflation nexus.

We proceed as follows: section two gives a brief discussion of the data set used. Thereafter we conduct part of Ciccarelli and Mojon (2005) analysis and test for a structural break due to the financial crisis. We then discuss fiscal theories of the price level and test empirically whether the US fiscal deficit is sustainable. The last section naturally draws some conclusions.

Data

In this section we describe the data set used to estimate Global Inflation and to gauge the results presented by Ciccarelli and Mojon (2005).

We use the quarterly Consumer Price Indices (CPIs) of 22 OECD members⁴, which have been members of the OECD for most of the sample period, from the OECD main economic indicators data base from 1960 to 2009. For the analysis year-on-year inflation rates are calculated. To eliminate the lowest and the highest frequencies a band pass filter has been employed on the CPI values. In order to analyze the volatility over a business cycle the filter removes all frequencies over the period of 6 to 32 quarters assuming that a business cycle lasts somewhere from 1.5 to 8 years.⁵

Three different measures have been employed to estimate Global Inflation: a simple cross-country average, an aggregate OECD inflation, and a static factor.

The first is a simple cross-country ‘average’ of the four quarter inflation rates of the pool of countries included in the sample. The aggregate OECD inflation is calculated from the OECD total consumer price index published by the OECD. This zone aggregate is a weighted average of all 30 OECD countries’ inflation. The weights used are based on the previous year’s private final consumption expenditure adjusted by Purchasing Power Parities (PPP). Both measures have been de-meaned and standardized. The third measure is a static factor analysis which decomposes the principle component of the inflation rates of the group of countries (see e.g. Forni et al., 2000; Stock and Watson, 2002)

The Global Inflation then is acquired as follows

$$\Pi_t = \Lambda f_t + \varepsilon_t . \quad (1)$$

$\begin{matrix} n \times 1 & n \times 1 & 1 \times 1 & n \times 1 \end{matrix}$

The first term denotes the effect of a common factor (f_t), assuming that all countries are diverse and respond differently through Λ . The error term ε_t reflects the intrinsic dynamics within the principal component which are generated by shocks whose effects remain local. f_t and ε_t are assumed to be independent (orthogonal vectors) to each other. Moreover the error term ε_t follows a normal distribution $\varepsilon_t \sim N(0, R)$. In order to estimate the static principle component f_t as in Stock and Watson (2002) with unit variance the inflation rates have been de-meaned and standardized.

⁴ The 22 OECD countries in the sample are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden Switzerland, United Kingdom and United States. The eight OECD countries not included are: Mexico, Korea, Turkey, the Czech Republic, Hungary, Poland, the Slovak Republic and Iceland.

⁵ In the analysis the band pass filter of Baxter and King (1999) has been employed using the non-cyclical series.

Figure 1 shows all three measures of Global Inflation. The picture is only slightly different from the one in Ciccarelli and Mojon (2005). Both the average and the static factor look almost identical. An explanation for the deviation of the OECD aggregate could be the different sample of countries within the aggregate. Moreover the figure reflects the historic development over the past 50 years. Besides five or six smaller cycles the measures show two pronounced peaks during the seventies and the early eighties corresponding to the two oil price shocks and the turn down in the productivity level of the countries in consideration. Thereafter follows a period of declining inflation due to tight monetary policies. These developments are present in all 22 countries and therefore unsurprisingly visual in the trend components of Global Inflation.

[Figure 1 to be inserted]

At the end of the study period the figure shows an increase in the Global inflation until the middle of 2008 and thereafter a break down which reflects the development in the actual financial crisis. There has been an increase in the inflation rates in all OECD countries that is now followed by a decline in the growth rate of inflation and even decreasing commodity prices.

Does global inflation still matter?

In a system of flexible exchange rates the exchange rate mechanism should mitigate local price shocks so that inflation should not be transmitted from one country to another. As was pointed out by e.g. Summers (2004) the exchange rate system is far from being flexible but is better characterised as a quasi-fixed regime. *De jure* we have at least among the industrialized countries flexible exchange rates but *de facto* central banks intervene if they think that the exchange rate is too far of the fundamental value. This leads to a bandwidth fixed exchange rate without official target values for the bandwidth being announced. Given the nature of the international financial system the exchange rate no longer can work as a shock absorber. Therefore it is not too surprising that Ciccarelli and Mojon (2005) find strong evidence for the theory that inflation in industrialized countries is mainly driven by a common component for which the term global inflation was coined.

The recent financial crisis is affecting a lot of economic spheres already. With monetary policy trying to safe the financial system it is unclear if the quasi-fixed exchange rate system

is still operational. It can be argued that central banks only concentrated on their domestic banking systems therefore having no degree of freedom when it comes to stabilizing the currency. On the other hand this crisis is not only a financial but also a current account crisis with world trade shrinking as dramatically as during the beginning of the Great Depression. With some countries already starting to flex their protectionist muscles – Russia e.g. increased their tariffs – the pressure on central banks might increase to use the exchange rate as policy instrument to increase foreign demand (see e.g. Erber, Thiessen 2009). It is therefore unclear whether global inflation still matters but seeing the drastic measures undertaken in mainly the USA with a huge injection of liquidity, a tremendous budget deficit and the monetarization of those budget deficits by the Fed concerns for a future surge in inflation rates is growing. When the global inflation link is still working like in the past these concerns are not limited to the USA. We therefore start to test if the link still works.

Using the analytical approach of Ciccarelli and Mojon (2005) we estimate for each country a simple equation with one of the respective measures of global inflation as dependent variable:

$$\pi_t^i = \alpha + \beta\pi_t^* + \varepsilon_t \quad (2)$$

where π_t^i is country i th inflation rate at time t . The asterisk denotes global inflation. ε_t is the error term. In Figure 2a and 2b the actual inflation rate for some countries as well as for the Eurozone is shown together with the estimated value using equation 2. The fitted value is pictured as dashed line while the actual inflation is the solid line. The global inflation measure used in the Figures is the unweighted average.

[Figure 2a and 2b to be inserted]

For most countries and also for the Eurozone global inflation is a closely tracking the actual inflation rate in each country. Exceptions are Japan and Germany whose inflation rates are not well explained by global inflation. In Japan this could be due to the adverse development of disinflation in comparison to the other OECD countries whereas in Germany the reason could lay in the leadership of the Deutsche Mark and therefore in the independent policy of the Deutsche Bundesbank without orientation in global developments. The peak inflation rates in the mid 70s and early 80s are explained by global inflation which is not so surprising since they were triggered by global shocks namely the oil price shocks. What is more surprising is that global inflation also explains the national inflation rates absent from global shocks (see

Ciccarelli and Mojon 2005 for a detailed analysis). Looking at the most recent data it becomes apparent that the global inflation rate in all countries and regions is explaining the actual development quite well. Table 1 shows the R^2 obtained from the regression of equation 2 for different countries and different measures of global inflation.

[Table 1 to be inserted]

For all three measures the share of variance explained by global inflation is quite high. The share is comparatively low for countries like Japan and Germany as it was also apparent from the visual inspection of Figures 2a and 2b. But with around 50 percent of the variance explained by the global inflation measure it is still a quite good approximation. The average share of inflation explained is 70 percent for the unweighted average and the static factor and still around 60 percent for the OECD inflation rate. For the whole Eurozone the explanatory content of the global inflation rate is even higher. Notable exception is the Eurozone inflation rate with base year 2005 when the OECD measure for global inflation is used. Here only about 20 percent of the variance is explained while well above 80 percent are explained by the other measures. The OECD inflation rate generally fares worse than the other measures but this drop is still surprising.

To test whether the financial crisis has changed anything in the link from global to local inflation we apply a standard Chow-test to test for a structural break in the data. The start of the financial crisis was the decline in housing prices in the USA that started around the beginning of 2006 and spread to the financial system in the USA around mid 2007 when the Fed had to make their first large liquidity injection in this crisis. The global recession than can be targeted roughly in the first quarter of 2008 at least in the Eurozone and the USA. The peak of this crisis – at least until now – was reached with the bankruptcy of Lehman Brothers in September 2008 and the subsequent steep decline in world trade and production. To test for a structural break we employ the Chow-test for each country using equation (2) with the simple average as global inflation measure⁶. Since mid 2007 is the start of the financial crisis, we take the second quarter of 2007 as the first quarter to test for a structural break and then test succinctly for each following quarter until the first quarter of 2008. It would be better to test for more recent structural breaks given the dramatic events of the last month but a lack of data

⁶ The results for the alternative measures do not differ significantly and are available upon request.

points prohibit this. In Table 2 the probability of the F-test are given under the Null-hypothesis that there is no structural break.

[Table 2 to be inserted]

The only country with a significant structural break is Belgium. Ireland comes close to a significant break in the second quarter of 2007 when one employs the 10 percent significance level. All other countries have probabilities that are well above any conventional significance level. Visual inspection using Figure 2a and 2b show that there is – at least for G7-countries – no structural break visible in the most recent data.

We therefore take it as established that the relationship between global and local inflation put forward by Ciccarelli and Mojon (2005) still holds despite the recent crisis⁷. One might object that the influence is due the global shock of the recent events and not a sign that the old regime of quasi-fixed exchange rates still exists. This might be true but can not be proofed given the relatively few data points at hand. Therefore we assume that the quasi-fixed exchange rate system exists and inflation can be transmitted from one country to another.

The Fiscal Theory of the Price Level

The fiscal theory of the price level (FTPL) examines the key question of the influence of fiscal deficits on national inflation rates. It in particular examines the effect on inflation if a time-inconsistent deficit policy neglecting the principle of Ricardian equivalence⁸ is established. By choosing a non-Ricardian, i.e. unsustainable fiscal policy even the long-term inflation rate could be influenced and its control by central banks be disturbed. Three authors have been most influential at formulating the theory of the fiscal price level (E. Leeper, 1991; C. A. Sims, 1994, Woodford, 1994, 1995, 2001). Their approach is in stark contrast to the

⁷ Further analysis in the vain of Ciccarelli and Mojon (2005) were also conducted but omitted for the sake of brevity. The results support that the earlier findings from Ciccarelli and Mojon (2005) still hold and are available upon request.

⁸ Ricardian equivalence, (Ricardo, 1846) in its present form is an economic theory that suggests consumers internalize the government's budget constraint and thus the timing of any tax change does not affect their change in spending. Consequently, Ricardian equivalence suggests that it does not matter whether a government finances its spending with debt or a tax increase, the effect on total level of demand in an economy will be the same.

traditional monetarist framework like that of Irvin Fisher (1911) and Milton Friedman (1970) stating that the central bank has complete control over the price level regardless of the fiscal policy stance of the government. It is not the attempt of this paper to discuss the entire controversies concerning the flaws and short-comings of the FTPL⁹ – especially the notion that governments behave in a not optimizing and time inconsistent way implied by an unsustainable policy can be criticised for numerous reasons. But probably nowadays after the outbreak of the worst global financial crisis the issue of time consistency as a natural assumption of economic behaviour has become less credible. The emergence of behavioural finance and in particular behavioural public economics (Bernheim, Rangel 2008) increased the willingness in the economics discipline to accept that economic decisions are not based on super rational economic agents but is better described by bounded rationality and myopic perceptions. Additionally, the emergence of public choice theory (see e. g. Buchanan 2003; Mueller 1989; Tullock 1989, 2008) has raised the issue of governments making decisions not based on maximizing overall social welfare but selfish and group specific aims.

In a monetary system of fiat money¹⁰ the sustainability of the public finances plays a central role for the price stability of the respective monetary area. The reason being that the moral hazard of governments to influence the central bank to use their ability to create liquidity by taking in government bonds in exchange for central bank money is too tempting to run instead of raising taxes or cutting back on public spending in a situation which needs fiscal consolidation¹¹. This implies that fiscal discipline is necessary for price stability: unsustainable deficits will require inflation in the future (see e.g. Corsetti, Roubini 1991; Tujula, Wolswijk 2004; Balassone, Cunha, Langenus, Manzke, Pavor, Prammer, Tommasino 2009).

⁹ Major critics of this approach have been N. Kocherlakota and C. Phelan (1999), W. Buiter (2002), B. T. McCallum (1999, 2001, 2003), B. T., McCallum and E. Nelson (2006), O. J. Arce (2004, 2005), and D. Niepelt (2004). They focus on the critique concerning the assumptions and implications derived from the FTPL. One key challenge is the assumption of the violation of Ricardian-equivalence needed to obtain the results of a persistent impact of fiscal policy on the price level. Further objections have been raised that the theory does not lend to empirical testing. However, the test of unsustainable fiscal deficits e.g. by Corsetti and Roubini (1991) give a clear hint on Non-Ricardian-equivalence fiscal policies which are unsustainable.

¹⁰ Fiat money is money declared by a government to be legal tender. The term derives from the Latin fiat, meaning "let it be done". Fiat money achieves value because a government accepts it in payment of taxes and says it can be used within the country as a "tender" (offering) to pay all debts. In effect, this allows it to be used to buy goods and services and to pay taxes. Where fiat money is used as currency, the term fiat currency is used. The most widely-held reserve currency, the US dollar, is a fiat currency.

¹¹ It is noteworthy that Ben Bernanke recently as well pointed out the issue of establishing a credible long-run fiscal stability in the US as an important issue to obtain price stability in the long-run (see Bernanke, 2009).

One key policy conclusion from the policy analysis based on the FTPL is that the central bank needs to assure cooperation of governments to commit to a sustainable fiscal policy. This is necessary in order to fulfil their key objective to maintain a reasonable degree of price stability. The Stability and Growth Pact of the member states of the EU has set strict limits to enforce sustainable fiscal policies in all member states to guarantee price stability.

Since the FTPL deviates from the clear assignment of policy targets that the central bank is responsible for the price stability and the government is responsible for stabilizing the economy over the business cycle, the FTPL has been considered to be a heterodox theory. The key element is the assumption that governments do not necessarily face an intertemporal budget constraint. It could by this kind of Non-Ricardian-policy counteract the behaviour of the remaining economic agents to make their expected price paths invalid at any time. By aiming at disequilibrium fiscal policy a government can always invalidate the assumptions of the other market agents that are based on price paths assuming the validity of Ricardian intertemporal budget constraints to hold for all agents.

Therefore in this paper we use the approach first presented by Hamilton and Flavin (1986) to test for unsustainable fiscal deficit positions in the USA under the current circumstances. As Corsetti and Roubini (1991) suggested from testing for unsustainability of fiscal policies this might give a hint for a future unavoidable policy shift to correct these imbalances. However, the approach of Corsetti and Roubini (1991) looks at a sustainability of the real fiscal deficits, i.e. they do not distinguish between a real fiscal balancing through higher inflation rates on the one hand and a stabilization of the fiscal position of the government through normal means of increased revenues by higher taxes or by lowering public spending on the other hand. To link this analysis with the previous one on the global transmission channel of inflation we intend to combine the ideas of Ciccarelli and Mojon (2005) with the ideas of Corsetti and Roubini (1991) to obtain a better understanding of the origins of global inflation. Is the current deterioration of public finances around the world due to unprecedented high stimulus packages run to avoid a lasting depression and financed by unorthodox monetary policies like those of the Fed or the Bank of England – i.e. buying governments bonds on a large scale in exchange of central bank money - a major risk to spill inflationary pressures in the future around the world (for an analysis addressing the EU member countries see e.g. Afonso, Rault 2007). It would as well be interesting to study the more general effects of public deficits not only on inflation (see e.g. Afonso, Sousa 2009), but this is again beyond the scope of the current paper.

Testing for unsustainable fiscal policies in the USA

In each period t the governments' debt level D_t is given by

$$D_t = (1+r)D_{t-1} + (G_t - T_t) + v_t \quad (3)$$

with G_t being government expenditures and T_t tax revenues; r is the average real interest rate v_t is a white noise shock representing deviations of the actual real interest rate in t from the average real interest rate. After iterating (3) forward and applying the expectation operator on both sides of the equation (3) becomes

$$D_{t-1} = E_t \lim_{N \rightarrow \infty} (1+r)^{-(N+1)} D_{t+N} + E_t \sum_{j=0}^{\infty} (1+r)^{-(j+1)} (G_{t+j} - T_{t+j}) \quad (4)$$

assuming that the sum of the white noise shocks is stationary with mean zero. The No-Ponzi-game-condition states that

$$\lim_{N \rightarrow \infty} (1+r)^{-(N+1)} D_{t+N} = 0 \quad (5)$$

has to hold. Hamilton and Flavin (1986) show that testing for (5) with equation (4) is mathematical equivalent to testing for a speculative bubble as explored by Flood and Garber (1980). Equation (5) in this case is fulfilled if both D_t and $(G_t - T_t)$ are stationary time series. It is therefore straight forward to test for fiscal sustainability by testing whether the debt level or the deficit has a unit root.

The data for the US fiscal stance are taken from the Congressional Budget Office (CBO) historical data set. Annual data are taken for the period 1970 to 2008. The time series are then augmented by the CBO projection for 2009 to 2019. Two scenarios were calculated by the CBO. One baseline scenario that measures the primary fiscal deficit as well as the debt level given all expenditures legislated at the time of the projection. The second scenario takes into all spending plans proposed by the US president but the act not yet passed. The time series are deflated using the GDP deflator. For the present analyze the more conservative baseline scenario is used. As a unit root test we employ the Augmented-Dickey-Fuller-test.

[Table 3 to be inserted]

Results for the unit root test are shown in table 3 for the primary deficit time series and in table 4 for the budget deficit. The hypothesis of a unit root for the primary deficit is rejected at the 5%-significance-level but for the debt level a unit root can not be rejected. This implies that the US fiscal policy at present is not sustainable.

[Table 4 to be inserted]

Conclusions

Currently the global financial and economic crisis has led to an unprecedented spending spree of governments all around the world running huge public deficits to counter the ongoing contraction of the respective national economies. However, this has already raised concerns that this might lead sooner or later to a significant crowding out effect in financial markets. The multi trillion Dollars, Euros and other currencies spend by governments around the world lead to a drastic expansion of the monetary base of the global economy. This is currently justified by the near collapse of the commercial banking system and in order to support the necessary liquidity (see e.g. Adrian, Shin 2009). However, this liquidity has to be sterilized in a timely manner when the commercial banking system begins to work again properly. This could become a severe problem for all central banks now running unorthodox monetary policies.

One finding of the first part of our analysis is that the transmission mechanism of global inflation identified by Ciccarelli and Mojon (2005) still persists. Therefore inflationary/deflationary processes emerging in large economies like the US economy still could have a major impact on the rest of the world. Furthermore, the current deterioration of public finances will generate huge pressures on the governments around the world to bring back their fiscal positions towards a sustainable one. The lessons learned from the persistent failure of the Japanese government to get cumulative increasing public deficits under control, is a clear warning sign.

Private global savings will become insufficient to absorb the multi trillion government bonds issued to finance the public deficits. Major central banks like the Fed in the US or the Bank of England have as well started to buy all kinds of assets including government bonds to stabilize the financial markets and keep interest rates across the whole yield curve down, which otherwise of the excess demand of public financing would significantly rise in the coming months. After exhausting the traditional interest rate policy by approaching more or less near zero nominal interest rates in a couple of countries, such as the US, Japan, UK, Switzerland or the Euro zone, these unorthodox monetary policy measures have become the major instrument to support the financial sector. Through easing monetary policy the aim is to avoid in particular a deflationary downward spiral and to increase real interest rates. However, such a policy already raised public concerns that it lacks an exit strategy to reduce

excess liquidity as soon as the global and respective national economies have stabilized and a recovery has taken hold. If central banks around the world fail to mop-up excess liquidity in a timely manner, this will lead sooner or later to a significant acceleration in the overall inflation process. Again more restrictive monetary policy would be necessary when inflationary expectations take hold in the economy. Therefore the chief economist Oliver Blanchard (2009) has requested that central banks around the world should begin to design an exit strategy from their current unorthodox policy regime which takes care of price stability in the medium- and long-run. This might contribute significantly to contain global overall inflationary expectations in particular in medium- and long-term (see e.g. Adrian, Wu 2009 for an approach to determine the intertemporal inflation expectations). Taking the results of Luca Benati (2009) seriously – that there is a strong long-term co-movement between money growth and inflation - there is no time to waste to design an exit-strategy for returning to a sustainable monetary and fiscal policy in the US and around the world.

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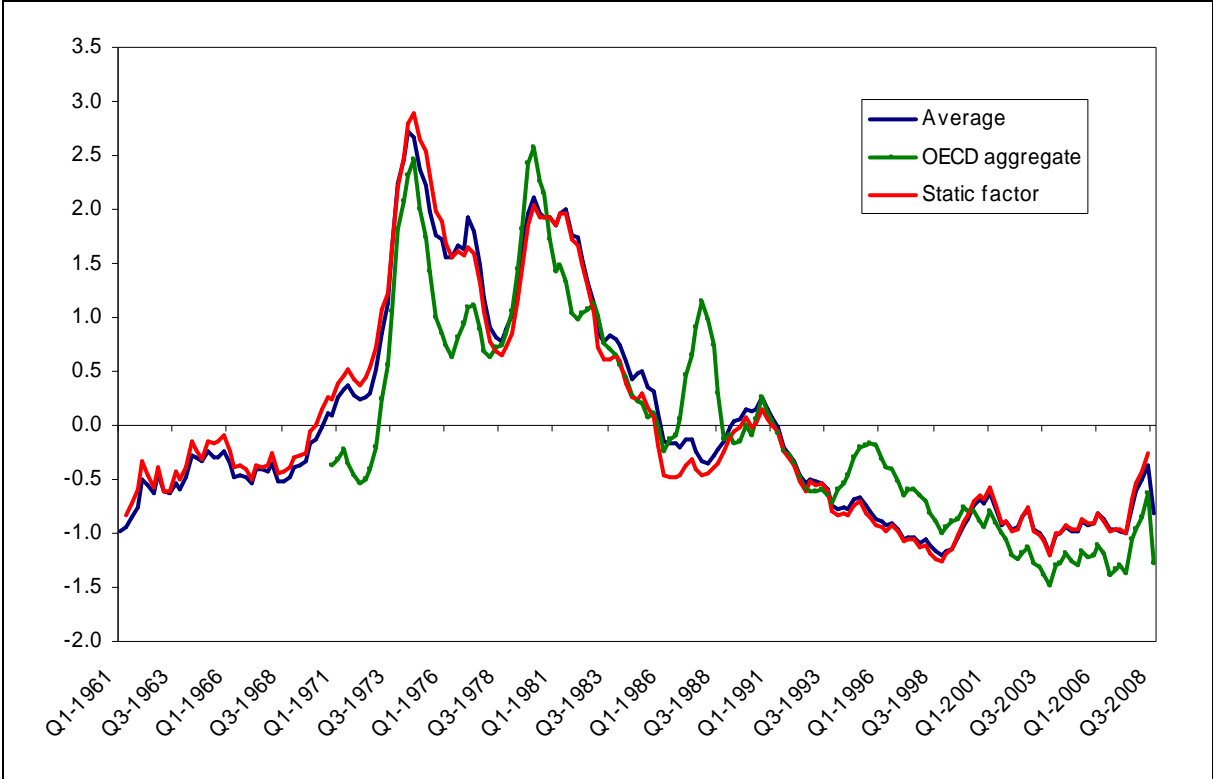
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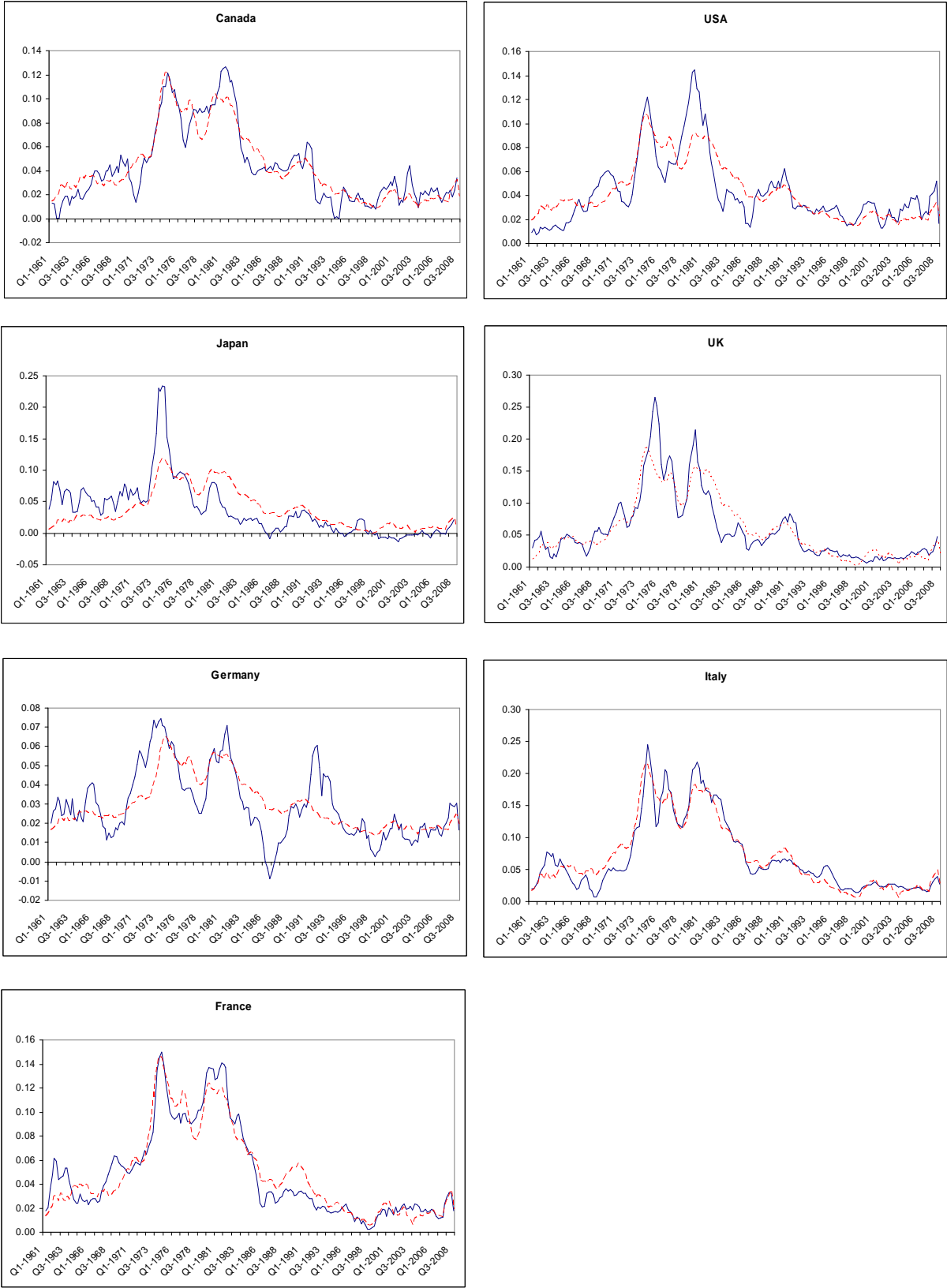
Appendix

Figure 1 : Measure of Global Inflation



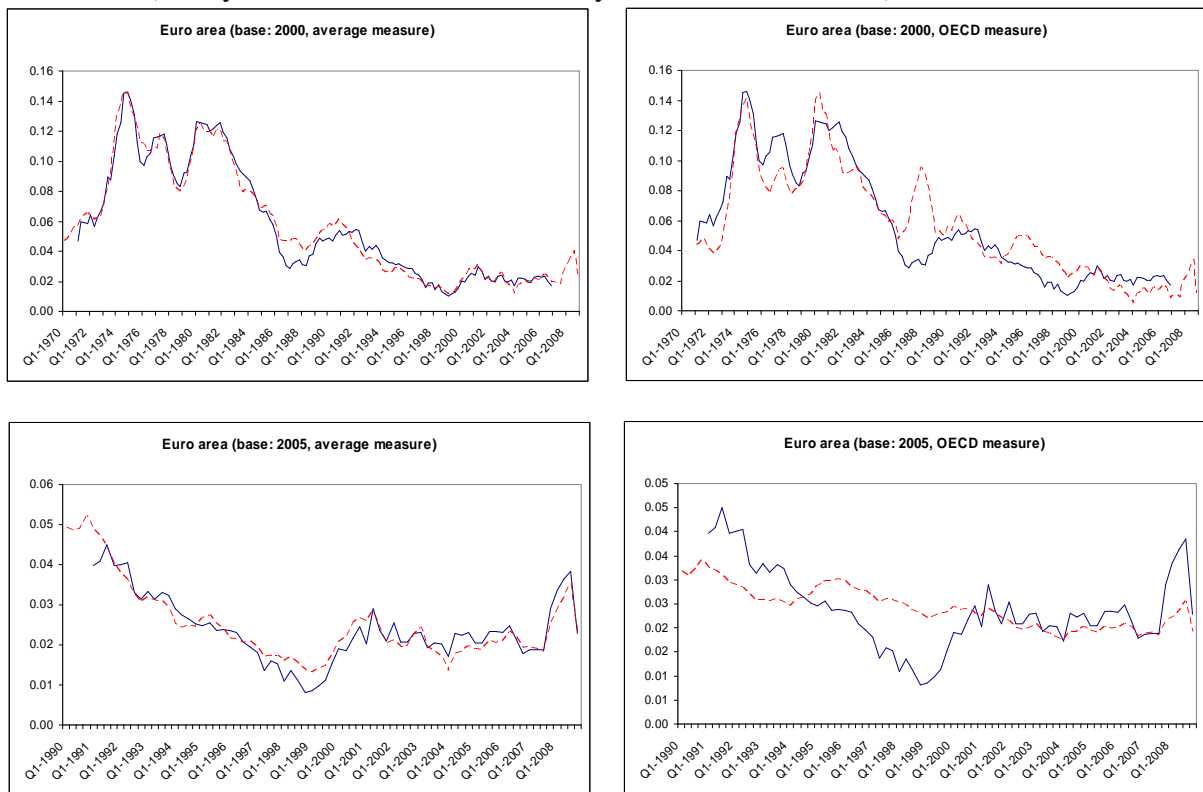
Note: Three measure of Global Inflation: Cross-country average, aggregate OECD measure and static factor.

Figure 2a: G7 domestic inflation and their projection on Global Inflation
 Canada, USA, Japan, UK, Germany, Italy and France (1961-2008)



Note: Domestic Inflation and their projection on the Global Inflation (measured by simple average). Estimation technique: OLS. Dependent variable is a year-on-year inflation rate.

Figure 2b: Euro area inflation and their projection on Global Inflation
 (base year: 2000, 1970-2006; base year: 2005, 1990-2008)



Note: Euro area inflation with the base year 2000 and 2005 and their projection on Global Inflation measured by simple average and aggregate OECD measure. Dependent variable is the year-on-year inflation rate.

Table 1: Share of inflation variance explained by alternative measures of Global Inflation

	Average	OECD	Static factor
Australia	0.78	0.68	0.74
Austria	0.66	0.50	0.74
Belgium	0.78	0.55	0.83
Canada	0.85	0.75	0.83
Denmark	0.84	0.76	0.84
Finland	0.80	0.71	0.83
France	0.90	0.79	0.90
Germany	0.53	0.35	0.60
Greece	0.51	0.63	0.41
Ireland	0.79	0.58	0.83
Italy	0.90	0.84	0.87
Japan	0.48	0.49	0.55
Luxembourg	0.73	0.46	0.77
Netherlands	0.49	0.33	0.58
New Zealand	0.68	0.60	0.63
Norway	0.70	0.70	0.70
Portugal	0.71	0.59	0.63
Spain	0.77	0.66	0.74
Sweden	0.77	0.69	0.75
Switzerland	0.39	0.32	0.44
United Kingdom	0.80	0.66	0.83
United States	0.69	0.72	0.68
Mean	0.71	0.61	0.71
Median	0.75	0.64	0.74
Euro area (2005)	0.87	0.22	0.89
Euro area (2000)	0.97	0.80	0.96

Note: 1961:2-2008:4. The euro area aggregate inflation is not included in the pool of 22 countries used to estimate Global Inflation. The OECD aggregate series starts 1970:1, the euro area series (2005) starts 1990:1 and the euro area series (2000) starts 1970:1 ends 2006:4.

Table 2: Probability of structural breakpoint

	2007 Q 2	2007 Q 3	2007 Q 4	2008 Q 1
Australia	0.70	0.70	0.70	0.69
Austria	0.49	0.48	0.45	0.57
Belgium	0.01	0.01	0.01	0.01
Canada	0.71	0.84	0.95	0.79
Denmark	0.93	0.93	0.93	0.86
Finland	0.54	0.60	0.68	0.63
France	1.00	0.99	0.99	1.00
Germany	0.49	0.51	0.58	0.70
Greece	0.57	0.60	0.62	0.67
Ireland	0.10	0.29	0.71	0.92
Italy	0.72	0.71	0.71	0.73
Japan	0.86	0.88	0.90	0.93
Luxembourg	0.21	0.22	0.24	0.32
Netherlands	0.87	0.87	0.92	0.96
New Zealand	0.99	0.99	1.00	0.99
Norway	0.34	0.59	0.97	0.94
Portugal	0.30	0.30	0.30	0.33
Spain	0.75	0.78	0.79	0.77
Sweden	0.97	0.96	0.96	0.98
Switzerland	0.70	0.83	0.93	0.94
United Kingdom	0.91	1.00	0.96	0.94
United States	0.22	0.23	0.23	0.27

Note: Chow's Breakpoint Test is used to see whether there are structural breaks in the data at specific dates. The Null Hypothesis: No breaks at specified breakpoints, can not be rejected with the indicated probability for each country. Global Inflation is measured by simple average of the 22 countries.

Table 3: Unit root test for real primary deficit

Null Hypothesis: REAL_DEFICIT has a unit root
 Exogenous: Constant
 Lag Length: 1 (Automatic based on SIC, MAXLAG=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.398919	0.0170
Test critical values:		
1% level	-3.610453	
5% level	-2.938987	
10% level	-2.607932	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
 Dependent Variable: D(REAL_DEFICIT)
 Method: Least Squares
 Date: 07/06/09 Time: 11:26
 Sample (adjusted): 1981 2019
 Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
REAL_DEFICIT(-1)	-0.427311	0.125720	-3.398919	0.0017
D(REAL_DEFICIT(-1))	0.326526	0.156777	2.082739	0.0444
C	-1.242619	0.486344	-2.555021	0.0150
R-squared	0.253202	Mean dependent var		-0.045219
Adjusted R-squared	0.211713	S.D. dependent var		2.347261
S.E. of regression	2.084028	Akaike info criterion		4.380286
Sum squared resid	156.3542	Schwarz criterion		4.508252
Log likelihood	-82.41557	Hannan-Quinn criter.		4.426199
F-statistic	6.102891	Durbin-Watson stat		1.974433
Prob(F-statistic)	0.005220			

Table 4: Unit root test for real debt level

Null Hypothesis: REAL_BT has a unit root
 Exogenous: Constant, Linear Trend
 Lag Length: 1 (Automatic based on SIC, MAXLAG=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-0.828039	0.9540
Test critical values:		
1% level	-4.211868	
5% level	-3.529758	
10% level	-3.196411	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
 Dependent Variable: D(REAL_BT)
 Method: Least Squares
 Date: 07/06/09 Time: 11:27
 Sample (adjusted): 1981 2019
 Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
REAL_BT(-1)	-0.027553	0.033275	-0.828039	0.4133
D(REAL_BT(-1))	0.631252	0.139838	4.514172	0.0001
C	-1.309372	1.519996	-0.861431	0.3949
@TREND(1970)	0.134421	0.091942	1.462022	0.1527
R-squared	0.503635	Mean dependent var		3.078390
Adjusted R-squared	0.461090	S.D. dependent var		3.930825
S.E. of regression	2.885639	Akaike info criterion		5.054285
Sum squared resid	291.4420	Schwarz criterion		5.224906
Log likelihood	-94.55855	Hannan-Quinn criter.		5.115502
F-statistic	11.83755	Durbin-Watson stat		1.721287
Prob(F-statistic)	0.000017			