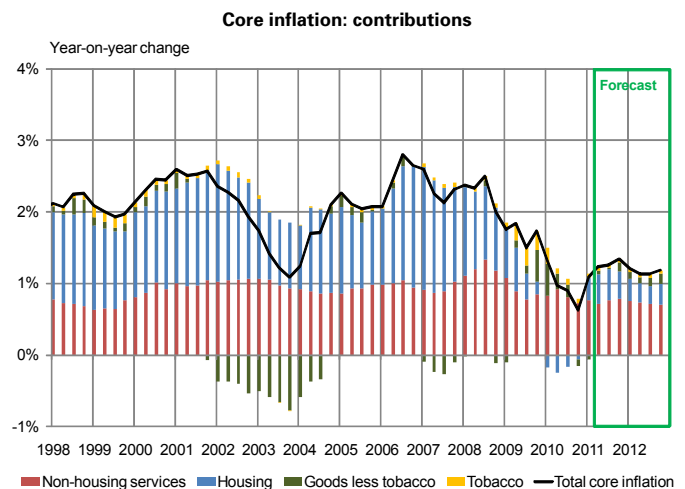


Neither deflation nor inflationary spiral in the United States: what can be learnt from a sectoral model of core inflation

This study was prepared under the authority of the Directorate General of the Treasury (DG Trésor) and does not necessarily reflect the position of the Ministry for the Economy, Finance and Industry.

- Opinions on the inflation outlook diverge in the United States. The economic recovery, rising energy prices, and the current monetary policy of the Federal Reserve (Fed) now lead some observers to predict an "inflationary spiral." For others, the under-utilization of productive capacity, high unemployment, household debt reduction, and a still-troubled real-estate market suggest the opposite scenario: the persistence of very low inflation-or even a "deflationary risk."
- While changes in total inflation are largely driven by fluctuations in energy prices, the overall price trend is better captured by a less volatile measure: inflation less energy and food prices, known as "core" inflation. On present evidence, the knock-on effect of energy prices on other prices and on wages (the "second round" effect) in the United States seems modest. This finding downplays the risk of an "inflationary spiral," sometimes mentioned in the U.S.
- Our study shows that the dynamics of U.S. core inflation can be usefully captured by analyzing its three sectoral components: prices of housing (approximately 40% of the index), prices of non-housing services (slightly more than 30%), and prices of goods (slightly less than 30%). Our model identifies the determinants of price changes in the three sectors and enables us to predict the change in core inflation from the variations in each component.
- The aggregation of sectoral results suggests moderate core inflation of around 1% in 2011 and 2012.
- This analysis, therefore, rules out two risks for the time being: a persistence of the deflationary trend observed since 2008 (and, a fortiori, a "deflationary risk"), and an inflationary spiral. It also allows a better analysis of the Fed's monetary policy and provides some grounds-given the institution's remit-for moderating the criticisms directed against that policy.

Sources: Bureau of Labor Statistics (BLS), DG Trésor calculations.



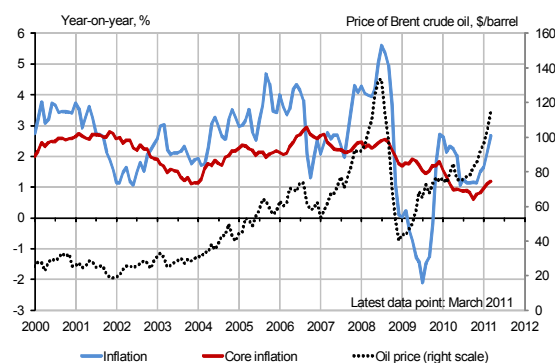
1. The United States has experienced a downward trend in inflation since 2008, reflecting specific sectoral dynamics

1.1 Fluctuations in energy prices, but a slowdown in the overall price trend

U.S. inflation, as measured by the year-on-year change in the consumer price index (CPI), has fluctuated sharply since 2007 owing to the steep rise in energy prices until July 2008, their strong decline thereafter, and their upswing in 2009.¹ The year-on-year change in the total ("all items") CPI moved from 5.6%² in July 2008 to -2.1% a year later. With energy prices trending up since 2009, inflation has turned positive again, and the recent rise in oil prices drove inflation up further to 2.7% in March 2011.

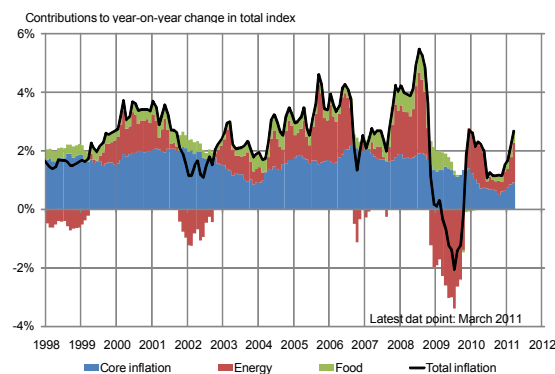
Food and energy prices are subject to volatile changes, intrinsically hard to forecast. By contrast, core inflation—i.e., total inflation less energy and food components—followed a downward trend between 2008 and 2010, before returning to a positive pace in early 2011. The core CPI, which accounts for nearly 80% of the total index, fell from 2.5% in summer 2008 to 0.6% in October 2010—the weakest year-on-year growth since the series was created in 1957—before rising to 1.2% in March 2011.

Chart 1: Total inflation and core inflation



Source: Bureau of Labor Statistics, DG Trésor calculations.

Chart 2: Inflation: core, energy and food



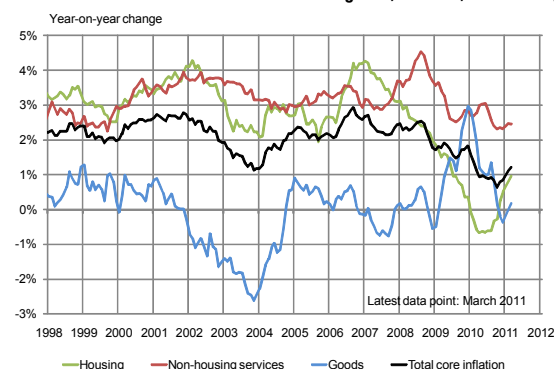
Source: Bureau of Labor Statistics, DG Trésor calculations.

Note: the index for each month (black line) is equal to the sum of contributions (colored lines).

1.2 These changes reflect different sectoral dynamics and justify a sectoral modeling of inflation

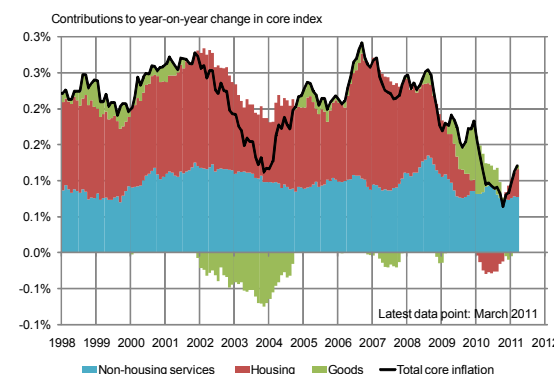
The 2008-2010 "downtrend" reflects a combination of distinct sectoral dynamics. To identify these, it is useful to break down the core index into three main components: "housing," "non-housing services," and "goods." This disaggregation is based on the methodology described in Box 1.

Chart 3: Core inflation: goods, services, and housing



Source: Bureau of Labor Statistics, DG Trésor calculations.

Chart 4: Core inflation: contributions



Source: Bureau of Labor Statistics, DG Trésor calculations.

Note: the index for each month (black line) is equal to the sum of contributions (colored lines).

The "housing" sub-index (which accounts for some 40% of the core CPI and 30% of the total CPI) slowed sharply between 2007 and 2010, moving from 4.3% in January 2007 to -0.7% in April 2010, before turning around. The "non-housing services" component (slightly more than 30% of the core index), which had been oscillating between 3% and 4% since the 2000s, initially rose from mid-2007 to end-2008 then eased to 2.5% in March 2011. The third sub-index, for "goods" (slightly less than 30% of the core index), had been fluctuating around 0% between 2005 and 2008, then climbed to 3.0% in 2009 before declining to 0.2% in March 2011.

- (1) Because of the 2007-2008 world food crisis, the food-price index also drove up inflation between end-2007 and early 2009.
- (2) Throughout our analysis, except where mentioned, the figures given for inflation and its components are the twelve-month changes in prices (i.e., year-on-year changes).

Box 1: Method for decomposing inflation

Our methodology for decomposing inflation is based on the table of relative weights of components, published by the BLS every December.^a The table gives the relative weight of each CPI component normalized to 100, whose change is the result of two effects:

- a price effect: the increase in the price of one component increases the component's relative weight in the CPI, assuming the other components remain constant;
- a volume effect: a component's increased relative weight in the CPI may also reflect an increase in the quantity of the component consumed by U.S. households in their basket of goods, assuming the prices of all the goods in the basket remain unchanged.

Whereas the sub-annual changes capture only the price effect, the annual publication of the relative-weights table also captures the volume effect. To calculate the components' relative weights for months other than December, we therefore apply the formula:

$$\alpha_{it}^{IPC} = \alpha_{i\beta}^{IPC} \times \frac{P_{it}}{P_{i\beta}} \times \frac{P_{IPC\beta}}{P_{IPCt}}$$

With α_{it}^{IPC} the relative weight of CPI component i in month t , based on reference month β (β = december), $\alpha_{i\beta}^{IPC}$ the relative weight of CPI component i in month β , P_{ix} the price index of component i in month x and P_{IPCx} the total price index in month x .

From these monthly weights, we can construct series "scaled" to the components of a specific index, such as the core CPI. For this purpose, we construct the corresponding series βA_{it}^I using the formula:

$$A_{it}^I = \frac{\beta \alpha_{it}^{IPC}}{\beta \alpha_{it}^{IPC}} \times P_{It} = \beta \alpha_{it}^I \times P_{It} \text{ avec } \alpha_{it}^I = \frac{\alpha_{i\beta}^{IPC}}{\alpha_{i\beta}^{IPC}} \times \frac{P_{it}}{P_{i\beta}} \times \frac{P_{I\beta}}{P_{It}}$$

I is the index studied, and i its components. $\beta \alpha_{it}^I$ can be interpreted as the relative weight of component i in index I in month t , based on reference month β . The series βA_{it}^I accordingly corresponds to the non-normalized weight to component i in index I , and fulfills:

$$P_{It} = \sum_{i \in I} \beta A_{it}^I$$

The contributions of each component of I in the change in I between $t-x$ and t are equal to:

$$C_{it}^I = \frac{\beta A_{it}^I - \beta A_{it-x}^I}{\beta A_{it-x}^I} \times \beta \alpha_{it-x}^I$$

i.e., the product of its growth rate and its weight in the index studied, the two terms of the equation being based on the same reference period.^b

a. See this page on the BLS website: http://bls.gov/cpi/cpi_riar.htm.

b. It is important to keep the same reference month for the different terms of the equation in order to capture the price effect alone. Choosing different bases would entail different growth rates for the reconstructed A_{it} series and the initial P_{It} .

These contrasting sectoral trends suggest that the determinants of price changes are not identical in the different sectors considered. To better distinguish the

factors that shape the movement of the different price indices and to deduce the future dynamics of core inflation, we therefore need to differentiate our model for each component.

2. Modeling of core-inflation dynamics by sectoral component points to moderate price movements in 2011-2012

To forecast the overall price movement, we break down the core-inflation model into three components: "housing," "non-housing services," and "goods." The econometric results are reported in detail in the Appendix.

2.1 The impact of the real-estate crisis on housing prices should fade, but gradually

The weight of the "housing" component³ is particularly high in the United States, at approximately 40% of the total CPI, versus under 10% in France and on average in the euro zone.

This is largely due to differences in index calculation methods, as both the harmonized euro-zone CPI and the non-harmonized French CPI totally exclude owners' "housing services."⁵ In the U.S., the "housing" component of inflation therefore includes rents paid by tenants (slightly less than 20%), but mainly fictitious rents imputed to owners (nearly 80%).⁶ These notional rents are assessed not on housing prices, but on rents paid for what are deemed to be equivalent housing units. Their movements are thus fairly similar to those of rents.⁷

(3) The BLS publishes this component under the heading "shelter."

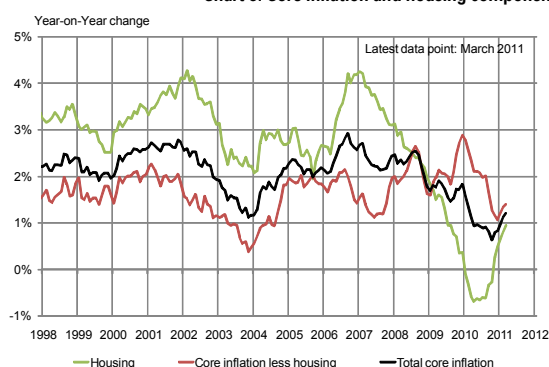
(4) In U.S. national accounting (as in French national accounting), all households—whether they own or rent their main residence—are consumers of "real-estate services": for tenants, the consumption is equal to the rents paid for occupying their dwellings; for owners, the consumption is equal to their imputed (i.e., fictitious) rents.

(5) See Lecat, R. (2003), "La prise en compte des services de logement dans l'indice des prix à la consommation: une comparaison internationale," *Bulletin de la Banque de France* no. 115, July.

(6) To this one must add two more marginal items: "lodging away from home" (such as hotels and boarding institutions, for a total of ca. 2%) and "tenants' and household insurance" (ca. 1%).

(7) The main difference is the inclusion of maintenance charges, which are included in actual rents but not in imputed rents.

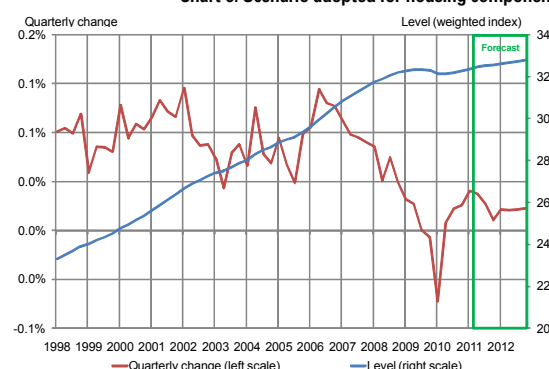
Chart 5: Core inflation and housing component



Source: Bureau of Labor Statistics, DG Trésor calculations.

The "housing" component explains 80% of the decline in core inflation between January 2008 and October 2010. According to the modeling of U.S. rents developed by the DG Trésor,⁸ real-estate prices are the main determinant of rent changes, both long-term and short-term. The real-estate bubble⁹ was a key driver of core-inflation movements, and the cyclical nature of inflation was essentially linked to the real-estate cycle. In our forecasts, the drop in the "housing" component seems to be largely behind us. The DG Trésor scenario for the sector¹⁰ calls for a moderate upturn in housing index prices.

Chart 6: Scenario adopted for housing component

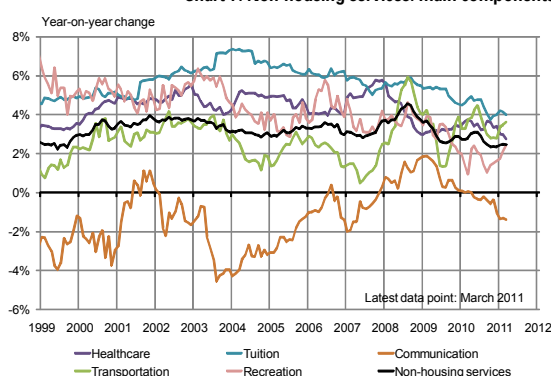


Source: Bureau of Labor Statistics, DG Trésor calculations.

2.2 Price movements in "non-housing services" should remain fairly dynamic

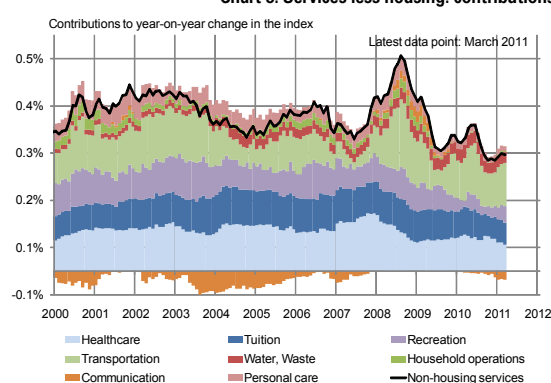
The "non-housing services" component is an aggregate of about ten services, of which the five leading ones (85% of the total) are: transportation, healthcare, recreation, communication, and tuition.

Chart 7: Non-housing services: main components



Source: Bureau of Labor Statistics, DG Trésor calculations.

Chart 8: Services less housing: contributions



Source: Bureau of Labor Statistics, DG Trésor calculations.

Note: the index for each month (black line) is equal to the sum of contributions (colored lines).

The "transportation" component is sensitive to energy-price variations,¹¹ while prices in the "communication" component have registered a fairly persistent decline since the early 2000s.¹² Apart from these two items, price movements for most services have remained rather stable, oscillating around 3% a year, and have been relatively insensitive to cyclical economic fluctuations.¹³

Accordingly, our model for prices of non-housing services relies essentially on changes in domestic unit labor costs (ULCs). In the long run, however, we note that service-sector price growth (ca. 3% per year) is outpacing the rise in ULCs (ca. 2% per year). A study by Peach, Rich, and Antoniadis on the subject¹⁴ attributes the difference to two causes: first, the fact that the income elasticity of demand is higher in the service sector than in the goods sector; second, and more important, the fact that productivity gains in the goods sector exceed those in the service sector, notably because of a higher import substitutability in the goods sector (Balassa-

(8) See, for example, Eyraud, L. (2006), "Risques inflationnistes aux États-Unis," *DPAE* no. 117 (July).

(9) On the real-estate bubble and the modeling of real-estate prices in the U.S., see, for example, Sorbe, S. (2009), "Un modèle de prix de l'immobilier pour estimer l'ampleur de la bulle américaine," *Revue Économique*, January, and Grossmann-Wirth, V., Rivaud, S., and Sorbe, S. (2011), "Comprendre la formation de la bulle immobilière américaine et son éclatement," *Économie et Statistique* (forthcoming).

(10) Real-estate prices should continue to decline in 2011, before moving up again gradually in 2012.

(11) Which notably explains the rise in the "non-housing services" index in 2008.

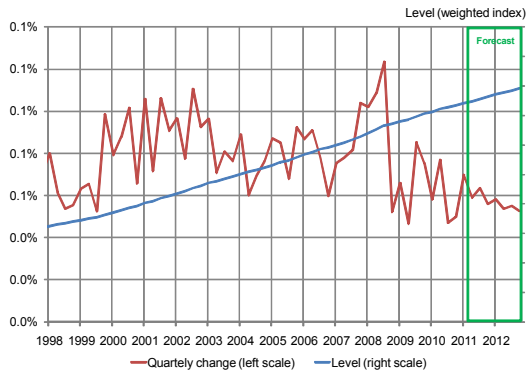
(12) This reflects the major technological advances in the sector.

(13) We tested the correlation of the year-on-year change in the price of each sub-component of non-housing services with several lags in the output gap. We find that only the "household operations" component is strongly correlated with the cycle. As it accounts for only 3% of non-housing services, the aggregate index is not strongly correlated with the cycle (27% correlation). This is confirmed by the econometric estimate, where the output gap is not conspicuous in the equation.

(14) Peach, R.W., Rich, R., and Antoniadis, A. (2004), "The historical and recent behavior of goods and services inflation," *Economic Policy Review*, vol. 10, no. 3, December, pp. 19-31.

Samuelson effect). To capture this growth-rate differential, we therefore incorporate a trend in the long-term equation.¹⁵

Chart 9: Scenario adopted for services component (less housing)



Source: Bureau of Labor Statistics, DG Trésor calculations.

Between now and 2012, our model indicates a still relatively dynamic "services less rents" component, consistently with its steady and rather non-cyclical pattern since the late 1990s. Its growth rate however, should stay below its long-term average, as ULCs will continue to register sluggish gains owing to high unemployment within the forecasting period.

2.3 By contrast, the price of "goods" is expected to post a weak increase in 2011 and 2012

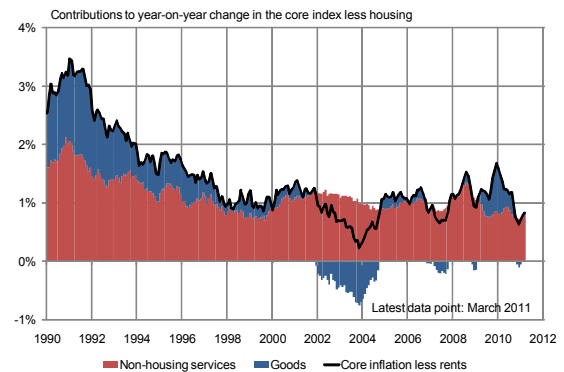
After a clear desinflationary trend in the 1990s, the growth of the "goods" component of core inflation remained rather weak in the 2000s (averaging under 1% year-on-year) and even turned significantly negative in 2002-2004, before rebounding sharply in 2009 and until early 2010.¹⁶

Breaking down the core index for goods into its components, we note that the contributions of automobiles and tobacco to the change in the index were particularly significant in 2002-2004 and 2009-2010: vehicle prices (30% weight) explain more than 50% of the core inflation for goods in 2003 and 2009, and tobacco prices (4% weight) explain 30% of the increase in 2009.

Beyond its large share of the aggregate index, the strong contribution of automobiles to total price changes in goods is explained by the high price volatility in the sector, due to the temporary measures often implemented to stimulate demand.¹⁷ For tobacco, the steep price rise in 2009 is due to the increase in tobacco taxes, compounded by additional

price increases by producers. As this type of movement is hard to forecast over a two-year horizon, we have excluded the tobacco index from our model.

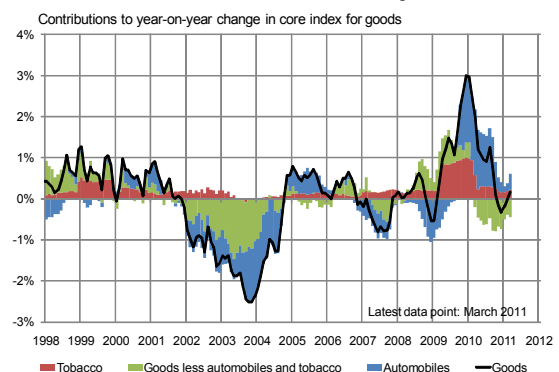
Chart 10: Core inflation: contributions



Source: Bureau of Labor Statistics, DG Trésor calculations.

Note: the index for each month (black line) is equal to the sum of contributions (colored lines).

Chart 11: Core inflation for goods: contributions



Source: Bureau of Labor Statistics, DG Trésor calculations.

Note: the index for each month (black line) is equal to the sum of contributions (colored lines).

There are several possible explanations for the desinflationary trend observed in the 1990s not only in the U.S. but in many other industrialized countries.¹⁸ We identify globalization and the intensification of international trade (associated with the entry of cheap-labor emerging economies into the world market) as the main determinants of the price downward trend in the goods sector.¹⁹

(15) As unit labor costs in the service sector are not available, we have been unable to include them in the equation. The only available breakdown of labor costs, which distinguishes between the manufacturing and non-manufacturing sectors, nevertheless tends to confirm the argument based on differences in productivity: ULCs have grown faster in the non-manufacturing sector than in the manufacturing sector, despite similar wage trends in both sectors.

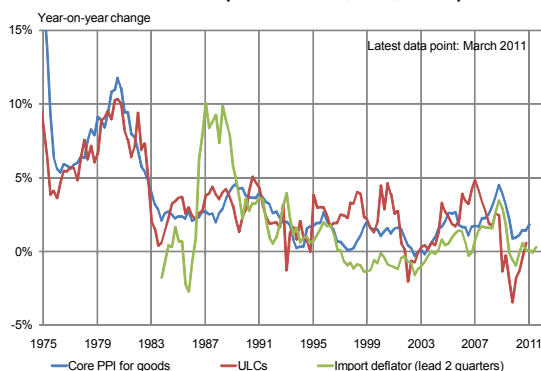
(16) Inflation in the "goods" component reached 3% in December 2009, its highest level since July 1992.

(17) For instance, the strong positive contribution of automobile prices in 2009 was likely due, among other reasons, to government incentives to vehicle purchases under the Obama stimulus plan. Technical seasonal-adjustment factors may also have played a role, as suggested by the *Wall Street Journal*: cf. "Technical Factors Boost Auto Prices in Inflation Data," *Real Times Economics*, WSJ blogs, June 17, 2009.

(18) Kenneth Rogoff (2003), for example, identifies several factors that may explain the decline in inflation since the 1990s, such as the central banks' good management and credibility, the acceleration in productivity (especially in the U.S.), and—above all—the increase in international competition, which is the focus of his article. See Rogoff, K. (2003), "Globalization and global disinflation," *Economic Review*, issue Q IV, pp. 45-78.

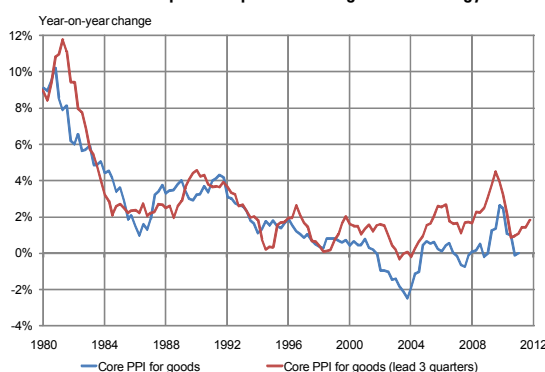
(19) For a sectoral discussion of the impact of international competition on inflation, see, for example, Auer, R. and Fischer, A.M. (2008), "The Effect of Low-Wage Import Competition on U.S. Inflationary Pressure," *Working Papers* 2008-18, Swiss National Bank.

Chart 12: Producer price index (PPI), ULCs, and import deflator



Source: Bureau of Labor Statistics, DG Trésor calculations.

Chart 13: Inflation and producer price index of goods less energy and food



Source: Bureau of Labor Statistics, DG Trésor calculations.

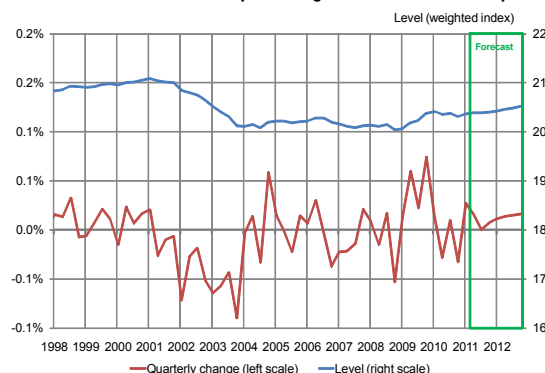
The two charts above show that international competition influences the production of goods as well as their distribution. In the intermediate-goods market, producer-price changes were closely correlated with ULC changes until the 1990s. The two series then diverge, and the producer-price

trend gradually converges toward the trend for imported-goods prices. Similarly, in the retail market, we observe a slowdown in consumer prices relative to producer prices. This may be due to a reduction in suppliers' margins and/or an increase in the proportion of imports in the consumer's goods basket.

On the basis of this analysis, we model "goods" core inflation in two stages: first, we model producer prices from unit labor costs and import prices;²⁰ then, we model consumer prices from producer prices.²¹ To capture the impact of the entry of low-production-cost countries in the U.S. market, we incorporate China's share of total U.S. goods imports into the long-term equation.²²

The two equations show that cyclical fluctuations pass through to final goods prices with an estimated one-year lag. After an increase mainly due to temporary factors in 2009, and absent a new significant rise in energy prices, the "goods" component should therefore return to the weak growth pattern observed since the 2000s, amid the persistence of a wide output gap over the forecasting horizon.

Chart 14: Scenario adopted for "goods less tobacco" component



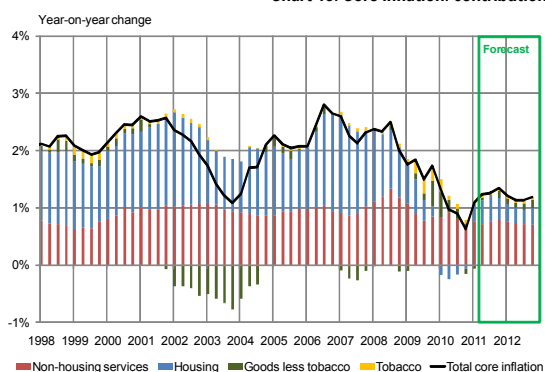
Source: Bureau of Labor Statistics, DG Trésor calculations.

3. Overall, core inflation is expected to remain moderate, strengthening the rationale for the Federal Reserve's current monetary policy

3.1 The aggregation of the three components of core inflation suggests moderate inflation in 2011-2012

Our forecast suggests that the wider output gap will continue to exert mild pressure on prices of goods in the next two years, but core inflation will be sustained by the turnaround in rent prices and further growth in service prices.

Chart 15: Core inflation: contributions



Source: Bureau of Labor Statistics, DG Trésor calculations.

(20) For a discussion of the impact of import-price markups and ULCs on the CPI, see, for example, a recent paper from the Bank for International Settlements (BIS): Sekine, T. (2009), "Another look at global disinflation," *BIS Working Papers* no. 283, May.

(21) For a review of the literature on the link between producer prices and consumer prices, see, for example, Caporale, G., Katimi, M., and Pittis, N. (2002), "Causality Links between Consumer and Producer Prices: Some Empirical Evidence," *Southern Economic Journal*, vol. 68, no. 3, pp. 703-711.

(22) We have not incorporated import prices into our estimate of consumer prices, as they are too closely correlated with the producer prices already present in the equation (multicollinearity).

Between now and 2012, core inflation should therefore remain moderate but positive. For the time being, our model appears to rule out the risk of a persistence of the deflationary trend observed since 2008, but also the risk of a sudden resurgence in core

inflation due to rising energy prices.²³ With unemployment still running high and the output gap still wide, the Fed's monetary policy seems unlikely to create an inflationary risk.²⁴

Box 2: Impact of an oil-price rise on core inflation

The economic literature is relatively unanimous in finding a weak pass-through of energy prices to core inflation in the current period. For instance, T. Clark and S. Terry (2009) reckon that core inflation has declined rapidly since 1975, despite the rising volatility of energy prices and the fact that monetary policy has taken them less into account (since approximately 1985).^a S. Stehn (2010), who relies on the work of Blanchard and Galí (2007),^b presents similar results: he estimates that the impact of energy and food prices on core has dropped to a level now so weak (elasticity under 0.01) as to be often non-significant.^c

In the model used in this study, a rise in energy prices directly influences core inflation of goods and non-housing services. The elasticities are nevertheless weak (0.01 in the short term) and the two components account for only 60% of core inflation. Accordingly, our equations imply that a 20% rise in the oil price will result in a 0.04% increase in the core CPI within one quarter and a 0.2% increase (in level terms) within two years. There is little change in the results of these estimates after inserting the equations into the DG Trésor macroeconomic model of the U.S.: this suggests limited second-round effects.^d

We conclude that the oil-price rise passes through to total inflation via a direct effect due to the share of energy in the index rather than via a knock-on effect on core inflation. The impact of a 20% rise in oil prices on total inflation is 0.4% within one quarter and 0.8% within two years.^e

- a. Clark, T.E. and Terry, S.J. (2009), "Time variation in the inflation pass through of energy prices," *Research Working Paper* RWP09-06, Federal Reserve Bank of Kansas City.
- b. Blanchard, O. and Galí, J. (2007), "The Macroeconomic Effects of Oil Price Shocks: Why are the 2000s so Different from the 1970s?," *NBER Working Papers* 13368, National Bureau of Economic Research.
- c. Stehn, Sven J. (2010), "Commodity Price Pass Through Into Core Inflation Likely To Be Small," Goldman Sachs, *USDaily*, February 2, 2011.
- d. These results should, however, be treated with caution. The model examined is based on historical price series and takes only partially into account the initial level of the barrel price of oil—which is particularly high today—to which the rise applies. The final impact of an oil-price rise may therefore be slightly underestimated.
- e. These results seem consistent with the estimates obtained for France using the Opale 2010 and Mésange 2010 models for total inflation. See Klein, C. and Simon, O. (2010), "Le modèle Mésange nouvelle version réestimée en base 2000," *Document de travail de la DG Trésor*, no. 2010/02, March; Bardaji, J., de Loubens, A., and Partouche, H. (2010), "La maquette de prévision Opale 2010," *Document de travail de la DG Trésor*, no. 2010/07, December.

3.2 This analysis provides an understanding of the stance of U.S. monetary policy in the context of the Fed's remit

Several presidents of regional Federal Reserve Banks have called for a tightening of U.S. monetary policy in response to the economic upturn and pressures on commodity prices.²⁵ However, the majority position consists in maintaining an accommodative monetary policy in the short/medium term—a stance endorsed at the latest meeting of the Federal Open Market Committee (FOMC) and in recent statements by Ben Bernanke (Fed Chairman), William Dudley (President of the New York Federal Reserve), and Janet Yellen (Fed Vice-Chairwoman).²⁶ It should be recalled that the Fed's targets

include "maximum" levels of activity and employment as much as price stability. The analysis reported in this issue provides an understanding of the Fed's current posture under the terms of its remit. Barring a new surge in commodity prices, our findings suggest that Fed policy is likely to remain accommodative in 2011 and 2012.

**Vincent GROSSMANN-WIRTH
and Clotilde PFINGSTAG**

(23) Our chosen scenario nevertheless assumes no new significant rise in energy prices such as the one observed in Q1 2011.

(24) Given the weakness of (solvent) credit demand from households and businesses, the accumulation of excess reserves held by banks has had no knock-on effect on the money supply and credit.

(25) See, for example, the recent statements by Jeffrey Lacker, President of the Richmond Federal Reserve Bank, and Charles Plosser, President of the Philadelphia Federal Reserve Bank, on April 1 and 14, 2011, respectively.

(26) Dudley, Bernanke, and Yellen spoke on the issue on April 1, 4, and 11, 2011, respectively. In her speech, Yellen stated that, as core inflation is "a better indicator" than total inflation of future inflation trends, the Fed was giving precedence to tracking core inflation for determining its monetary policy. The current policy, these officials argue, is thus justified by the fact that core inflation is still running below its "target" level, estimated at slightly under 2% by the members of the Monetary Policy Committee. Meanwhile, Fed Chairman Bernanke, in answer to a question, explained: "I think the increase in inflation will be transitory. [...] Our expectation at this point is that in the medium term inflation, if anything, will be a bit low. We will monitor inflation and inflation expectations very closely."

Appendix: Modeling core-inflation components

The following variables are used [the original French acronyms have been kept in this English version]:

IPC_LOG: "housing" component of core CPI

IPC_SERVICES: "non-housing services" component of core CPI

IPC_BIENS: "goods less tobacco" component of core CPI

RATIO_LOY: cost of housing use

PRIX_IMMO: real-estate prices

IPC_NRJ: "energy" component of consumer price index

CSU: unit labor costs

IPP: producer price index of goods less energy and food

IMP_DEFL: import deflator

RATIO_CHIN_IMP: China's share of U.S. goods imports

OG: output gap

TX_PROFIT: share of profits in value added

The letter L before a variable name means that the variable is expressed in log form. The letter D denotes the first-difference operator. The figures in parentheses (-x) indicate the number of lags studied.

The estimated equations are the following:

$$\begin{aligned} \text{DLIPC_LOG} = & -0.020.\text{LIPC_LOG}(-1) + 0.008.(\text{LRATIO_LOY}(-1) + \text{LPRIX_IMMO}(-1)) \\ & (-7.8) \quad (5.6) \\ & + 0.035.\text{DLPRIX_IMMO}(-4) + 0.058 \\ & (3.2) \quad (9.4) \end{aligned}$$

R² ajusted: 0.56 DW : 1.86

Estimation period: Q1 1990 - Q4 2009

$$\begin{aligned} \text{DLIPC_SERVICES} = & -0.03.(\text{LIPC_SERVICES}(-1) - \text{LCSU}(-1) - 0.004.\text{TREND}) \\ & (-2.9) \\ & + 0.61.\text{DLIPC_SERVICES}(-2) + 0.01.\text{DLIPC_NRJ} + 0.10 \\ & (7.5) \quad (2.9) \quad (2.9) \end{aligned}$$

R² ajusted: 0.51 DW : 1.61

Estimation period: Q1 1990 - Q4 2009

$$\begin{aligned} \text{DLIPP} = & -0.05.\text{LIPP}(-1) + 0.03.\text{LIMP_DEFL}(-1) + 0.02.\text{LCSU}(-1) \\ & (-3.3) \quad (5.4) \quad (1.8) \\ & + 0.0005.\text{OG}(-1) + 0.22.\text{DLIPP}(-1) + 0.25 \\ & (3.1) \quad (3.0) \quad (3.2) \end{aligned}$$

R² ajusted: 0.71 DW : 2.09

Estimation period: Q2 1980 - Q4 2009

$$\begin{aligned} \text{DLIPC_BIENS} = & -0.04.(\text{LIPC_BIENS}(-1) - \text{LIPP}(-1)) \\ & (-3.1) \\ & -0.08.\text{RATIO_CHIN_IMP}(-1) + 0.29.\text{DLIPP}(-3) + 0.01.\text{DLIPC_NRJ} \\ & (-4.6) \quad (3.7) \quad 1.9) \\ & + 0.001.\text{DTX_PROFIT} + 0.26.\text{DLIPC_BIENS}(-1) \\ & (3.0) \quad (3.1) \end{aligned}$$

R² ajusted: 0.75 DW : 1.96

Estimation period: Q1 1980 - Q4 2009

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