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The Crisis: Basic Mechanisms and Appropriate Policies

Olivier Blanchard*

It is much too early to give a definitive assessment of the crisis, not least because it is far from over. It is not too early, however, to look for the basic mechanisms that have taken us where we are today and to think about the policies we need to implement now and later.

Let me start with Figure 1. The first column (which is barely visible) shows the estimated losses on US subprime loans and securities as of October 2007 amounting to about USD 250 billion. The second column shows the expected cumulative loss in world output associated with the crisis, based on current forecasts. This loss is constructed as the sum, over all countries, of the expected cumulative deviation of output from trend in each country, based on IMF estimates and forecasts of output as of November 2008, for the years 2008 to 2015. Based on these forecasts, the cumulative loss is projected to run at USD 4,700 billion, or about twenty times the initial subprime loss. The third column shows the decrease in the value of stock markets, measured as the sum, over all markets, of the decrease in stock market capitalization from September 2007 to November 2008. This loss is equal to about USD 26,400 billion, or about one hundred times the initial subprime loss! The question is obvious: how could such a relatively limited and localized event as the subprime loan crisis in the United States have effects of such magnitude on the world economy?[2]

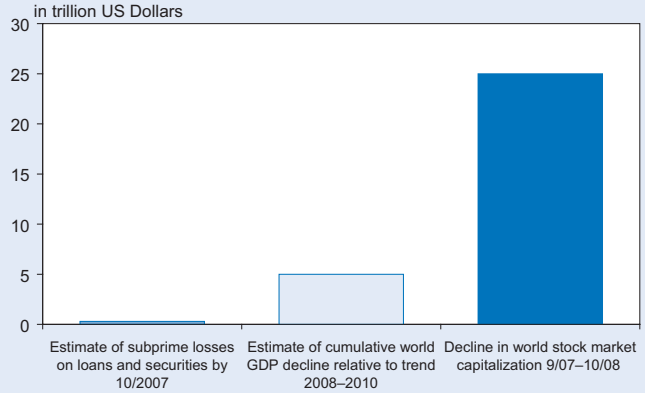
To answer this question, I shall proceed in four steps:

First, by identifying the essential initial conditions which have shaped the crisis. I see them as fourfold: the underestimation of risk contained in newly issued assets; the opacity of the derived securities on the balance sheets of financial institutions; the connectedness between financial institutions, both within and across countries; and, finally, the high leverage of the financial system as a whole.

Second, by identifying the two amplification mechanisms behind the crisis, once the trigger had been pulled and some of the assets appeared bad or doubtful. I see two related, but distinct, mechanisms:

Figure 1

Initiial Subprime Losses and Subsequent Declines in World GDP and World Stock Market Capitalization



Source: IMF and World Federation of Exchanges.

* Massachusetts Institute of Technology, National Bureau of Economic Research and International Monetary Fund. This is the lecture given at the Ludwig Maximilian University of Munich on the 18th of November 2008. I thank Stijn Claessens, Giovanni Dell'Ariccia, Gianni de Nicolo, Hamid Faruqee, Luc Laeven, Krishna Srinivasan, and many others in the IMF Research Department for discussions and help. I thank Ricardo Caballero, Charles Calomiris, Steve Cecchetti, Francesco Giavazzi, Anil Kashyap, Arvind Krishnamurtlhy, Andrei Shleifer, and Nancy Zimmerman, for discussions along the way. I thank Ioannis Tokatlidis for research assistance.

[2] Ironically, the other shock which dominated the news until the financial crisis led to the opposite question: how could the very large increase in oil prices from the early 2000s to mid-2008 have such a small apparent impact on economic activity? After all, similar increases are typically blamed for the very deep recessions of the 1970s and early 1980s. The plausible answer, which I shall not explore in this lecture, but which is very much worth investigating, must be that the economy has become less fragile in some dimensions, more fragile in others.

first, the sale of assets to satisfy liquidity runs by investors; and, second, the sale of assets to reestablish capital ratios. Together with the initial conditions, these mechanisms can lead, and indeed have led, to very large effects of a small trigger on world economic activity.

Third, by showing how the amplification mechanisms have played out in real time, moving from subprime to other assets, from one institution to another, and from the United States, first to Europe, and then to emerging countries.

Fourth, by turning to policies. It is too late to change the initial conditions for this crisis. Therefore, current policies should be aimed at limiting the two amplification mechanisms at work at this juncture. Future regulation and policies should also aim, however, at avoiding a repeat of some of those initial conditions. In short, we need to both fight current fires and reduce the risk of fires in the future.

Initial conditions

The trigger for the crisis was the decline in housing prices in the United States. But, in the years preceding, four developments had combined to potentially turn such a price decline into a major world crisis.

Assets were created, sold and bought, which appeared much less risky than they truly were

Conditional on no housing price decline, most subprime mortgages appeared relatively riskless: the value of the mortgage might be high relative to the price of the house but it would slowly decline over time as prices increased. In retrospect, the fallacy of the proposition was in its premise: if and when housing prices actually declined, many mortgages would exceed the value of the house, leading to defaults and foreclosures.[3]

Why did the people who took these mortgages, and the institutions which held them, so underestimate the true risk? Many explanations have been given and many potential culprits have been named as well. Let us list some of them: (1) large savings by Chinese households, leading to a low world interest rate and thus a "search for yield" by investors disappointed with the return on truly safe assets; (2) large private and public capital inflows into the United States in search of safety, leading suppliers to offer what looked like safe assets to satisfy the demand; (3) too expansionary a monetary policy in the United States with the implicit promise of low interest rates for a long time; (4) the "originate and distribute" model of mortgage financing, leading to insufficient monitoring by the loan originators. Each of these explanations contains a grain of truth, but only a grain. Why would a low world interest rate necessarily lead to a "search for yield"? Why should Alan Greenspan have set a higher US interest rate, if low interest rates reflected low equilibrium world rates and there was no pressure on inflation? Why should investors have bought mortgages from originators if they knew that monitoring was deficient?

I suspect that the fundamental explanation is more general. History teaches us that benign economic environments often lead to credit booms, and to the creation of marginal assets and the issuance of marginal loans. Borrowers and lenders look at recent historical distributions of returns and become more optimistic, indeed too optimistic, about future returns.[4] The environment was indeed benign in the 2000s in most of the world, with sustained growth and low interest rates. And, looking in particular at US housing prices, both borrowers and lenders could point to the fact that housing prices had increased every year since 1991, and had done so even during the recession of 2001.[5]

Nor was this understatement of risk confined to subprime loans. Credit default swaps (CDS), which sound complex but are in effect insurance policies, were issued against many risks. For low premia, firms and institutions could insure themselves against specific risks, be it the risk of default by a firm, by a financial institution or by a country. And CDS issuers were happy to accept these low premia, as they assumed the probability of having to pay out was nearly negligible.

Securitization led to complex and hard-to-value assets on the balance sheets of financial institutions

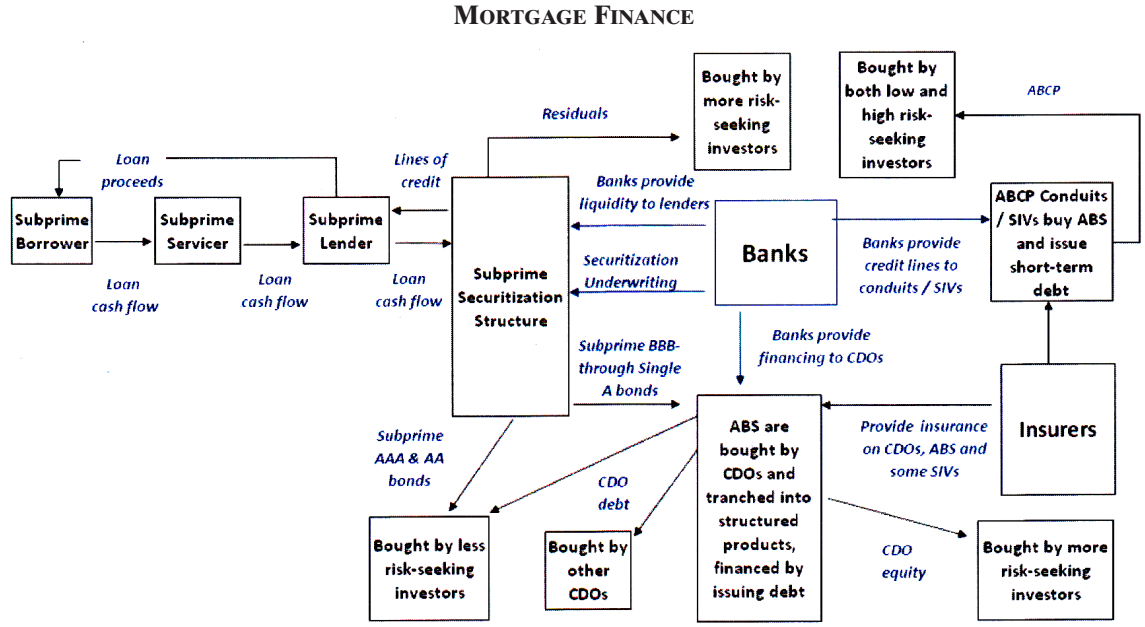
Securitization had started much earlier but changed its scale in the last decade. In mid-2008, more than

[3] On the relation between property values, mortgages and foreclosures, see Foote et al. (2008).

[4] For an analysis of credit booms and busts over a large number of countries, see Claessens et al. (2008).

[5] A point that Calomiris (2008) has called "plausible deniability" (that prices would ever go down).

Figure 2



Source: IMF (2007).

60 percent of all US mortgages were securitized. In the mortgage market, mortgages were pooled to form mortgage-based securities (MBS) and the income streams from these securities were separated ("tranched") further to offer more or less risky flows to investors.

Figure 2, taken from the 2007 IMF Global Financial Stability Report gives a sense of the complexity of that part of the financial system. It shows how initial mortgages were securitized, cut in tranches and then held by various investors and financial institutions with different degrees of risk aversion.

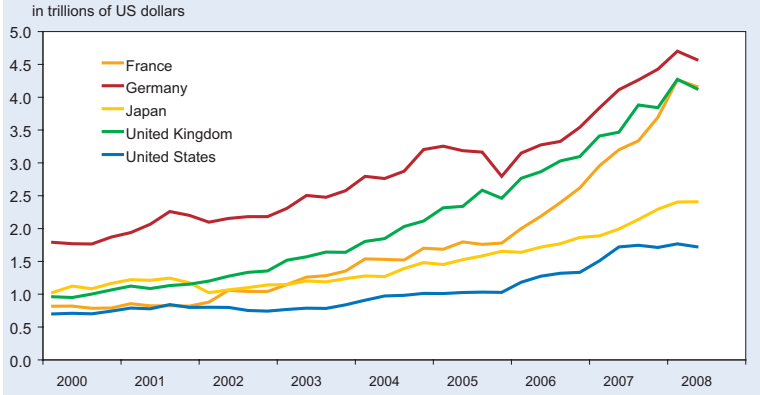
Why did securitization take off in such a way? Because it was, and still is, a major improvement in risk allocation and a fundamentally healthy development. Indeed, looking across countries before the crisis, many (including myself) concluded that the US economy would resist a decrease in housing prices better than most economies: the shock would be absorbed by a large set of investors, rather than just by a few financial institutions. This argument ignored two aspects which turned out to be important. The first was that, with complexity, came opacity. While it was possible to assess the value of simple mortgage pools (MBS), it was harder to assess the value of the derived tranched securities (CDOs), and even harder to assess the value of the derived securities resulting from tranches of derived securities (CDO^2s). Thus, worries about the original mortgages translated into large uncertainty about the values of the derived securities. And, in that environment, the fact that the securities were held by a large set of financial institutions implied that this large uncertainty affected a large number of balance sheets in the economy.

Securitization and globalization led to increasing connectedness between financial institutions, both within and across countries

In the same way as securitization increased connectedness across financial institutions, globalization increased the connectedness of financial institutions across countries. One of the early stories of the crisis was the surprisingly large exposure of some regional German banks to US subprime loans. But the reality goes far beyond this anecdote. Figure 3 shows the steady increase in foreign claims by banks from the major five advanced countries, an increase from USD 6.3 trillion in 2000 to USD 22 trillion by June 2008. In mid-2008, claims by these banks just on emerging market countries exceeded USD 4 trillion. Think of what this implies if, for any reason, those banks decided to cut back their foreign exposure; unfortunately, this is indeed what we are seeing now (The figure stops in June 2008. Much of the decrease has happened since then).

Figure 3

CONSOLIDATED FOREIGN CLAIMS OF REPORTING BANKS ON THE REST OF THE WORLD
Classification by nationality of reporting banks



Source: IMF.

Leverage increased

The fourth important initial condition was the increase in leverage. Put another way, financial institutions financed their portfolios with less and less capital, thus increasing the rate of return on that capital. What were the reasons behind it? Surely, the optimism and the underestimation of risk were again part of it. Another important factor was a number of holes in regulation. For example, banks were allowed to reduce required capital by moving assets off their balance sheets into so-called "structured investment vehicles" (SIVs). In 2006, for instance, the value of the off-balance sheet assets of Citigroup (= USD 2.1 trillion) exceeded the value of the assets on the balance sheet (= USD 1.8 trillion). (By mid-2008, the write-downs and returns of some of the assets back to the balance sheet had decreased this ratio back to less than one half.) The problem went far beyond banks: for example, at the end of 2006, the "monoline insurers" (i.e. insurers insuring a particular risk, e.g. default on municipal bonds), operating outside the perimeter of regulation, had capital equal to USD 34 billion to back insurance claims against more than USD 3 trillion of assets.

Whatever the reason, the implications of high leverage for the crisis were straightforward. If, for any reason, the value of the assets became lower and/or more uncertain, then the higher the leverage, the higher the probability that capital would be wiped out, the higher the probability that institutions would become insolvent. And this is, again, exactly what we have seen.

Amplification mechanisms

Around the end of 2006, US housing price indexes stopped rising and then started to decline steadily. This implied that many marginal mortgages, especially the subprimes extended during the previous expansion, would default. As we saw in Figure 1, the expected loss from these defaults as of October 2007 amounted to USD 250 billion. One might have hoped that this loss would be easily absorbed by financial institutions, with limited financial or economic implications. But, as we know, this has not been the case. The larger crisis is the result of two amplification mechanisms, interacting with the initial conditions I focused on earlier.

The first amplification mechanism is the modern version of bank runs

Let me first go quickly back to basics. Think of financial institutions in the simplest terms, i.e. with assets on the left-hand side of their balance sheet, liabilities on the right-hand side, and capital as the difference between the value of the assets and the value of the liabilities. As long as capital is positive, the institution is solvent; if it is negative, the institution is insolvent. Therefore, when the probability of default on some assets increases, both the expected loss and the uncertainty associated with the asset side of the balance sheet increases. The value of capital becomes both lower and more uncertain, increasing the probability of insolvency. The first amplification mechanism then has two parts.

Depositors and investors are likely to want to take their funds out of the institutions, which might become insolvent. In traditional bank runs, say during the Great Depression, it was the depositors that took their money out of the banks. Two changes have taken place since then. First, in most countries, depositors are now largely insured, so they have few incentives to run. And banks and other financial institutions largely finance themselves in money markets, through short-term "wholesale funding". Modern runs are no longer literally runs: what happens is that institutions which are perceived as being

at risk can no longer finance themselves on these markets. The result is, however, the same as in the old bank runs: faced with a decrease in their ability to borrow, institutions have to sell assets.

To the extent that this is a macroeconomic phenomenon (i.e. to the extent that many institutions and investors are affected at the same time), there may be few deep pocket investors willing to buy assets. If, in addition, the value of the assets is especially difficult for outside investors to assess, the assets are likely to sell at "fire sale prices", i.e. prices below the expected present value of the payments on the asset. This, in turn, implies that the sale of the assets by one institution further contributes to a decrease in the value of all similar assets, not only on the balance sheet of the institution which is selling, but on the balance sheets of all the institutions which hold these assets. This again reduces their capital, forcing them to sell assets, and so on. The amplification mechanism is at work, and you can see how the size of the amplification is determined by initial conditions.

To the extent that the assets are more opaque and thus difficult to value, the increase in uncertainty will be larger, leading to a higher perceived risk of insolvency, and thus to a higher probability of runs. For the same reasons, finding outside investors to buy these assets will be more difficult, and the fire sale discount will be larger. To the extent that securitization leads to exposure of a larger set of institutions, more institutions will be at risk of a run. And finally, to the extent that institutions are more leveraged, which means that they have less capital relative to assets to start with, the probability of insolvency will rise more, again increasing the probability of runs. As we have seen, all these factors were very much present at the start of the crisis. This is why this amplification mechanism has been particularly strong.

The second amplification mechanism comes from the need of financial institutions to maintain an adequate capital ratio

Faced with a decrease in the value of their assets, and thus lower capital, financial institutions need to improve their capital ratio, either to satisfy regulatory requirements or to satisfy investors that they are taking measures to decrease the risk of insolvency. In principle, they then have a choice. They can either get additional funds from outside investors – the additional capital. Or they can "deleverage", i.e. decrease the size of their balance sheets by selling some of their assets or reducing their lending.

In a macroeconomic crisis, finding additional private capital is likely to be difficult. This is for the same reasons as earlier: there may be few deep pocket investors willing to put up funds. And to the extent that the assets held by the financial institutions are difficult to value, investors will be reluctant to put their funds in the institutions that hold them. In that case, the only option for these institutions is to sell some of their assets. The same mechanism as before is then at work: the sale of assets leads to fire sale prices, affecting the balance sheets of all the institutions that hold them, leading to further sales and so on. And, for the same reasons as before, opacity, connectedness and leverage all imply more amplification.

The two mechanisms are distinct. Conceptually, runs can happen even in the absence of any initial decrease in the value of assets. This is the well-known multiplicity of equilibria: if funding stops, assets must be liquidated at fire sale prices justifying the stop in funding in the first place. But, clearly, runs are more likely the higher the doubts about the value of the assets. Conceptually, firms may want to take measures to reestablish their capital ratio even if they have no short-term funding problem and do not face runs. The two mechanisms interact, however, in many ways. A financial institution subject to a run may, instead of selling assets, cut credit to another financial institution, which may in turn be forced to sell assets. Indeed, one of the channels through which the crisis has moved from advanced countries to emerging market countries has been through cuts in credit lines from financial institutions in advanced economies to their foreign subsidiaries, forcing them in turn to sell assets or cut credit to domestic borrowers.

Dynamics in real time

The amplification mechanisms are now clear, but this is true only in retrospect. In real time, when housing prices started declining, most economists and policy makers expected the impact to be much more limited. The scope of the amplification mechanisms only became clear over time. Here is the story in real time.

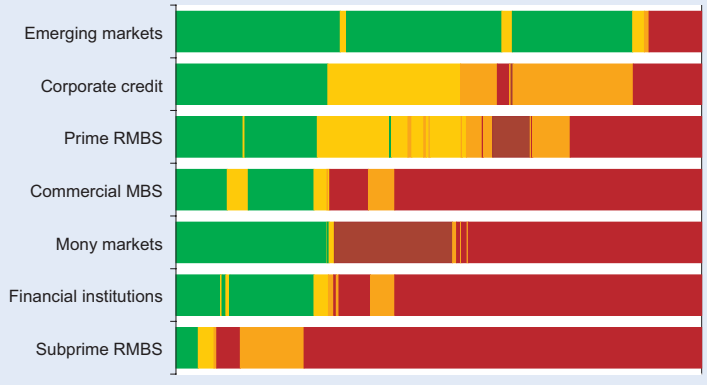
Contagion across assets, institutions and countries

The widening of the crisis to a steadily growing number of assets, institutions and countries is shown in Figure 4. The figure is a "heat map" constructed by the IMF, which shows the evolution of heat indexes for a number of asset classes. The construction of the index is complex but the principle is simple: the larger the decrease in the price of the asset, or the higher the volatility of the price, each relative to its average value in the past, the higher the value of the index. As the heat index increases, the color goes from green to yellow to orange and to red (corresponding to 1, 2, 3 and 4 standard deviations respectively, so orange and red should be seen as very rare events).

Figure 4 shows the history of the crisis. Starting from the bottom, see how the crisis started with subprime mortgages in early 2007, extended to financial institutions and money markets (the markets where financial institutions borrow and lend to each other) in the summer of 2007, to regular mortgage pools (Prime RMBS) and corporate credit at the end of 2007, and to emerging market countries in the fall of 2008. At the time of this writing, all classes are in red, showing an exceptional decrease in prices and increase in volatility.

Figure 4

HEAT MAP: DEVELOPMENTS IN SYSTEMIC ASSET CLASSES

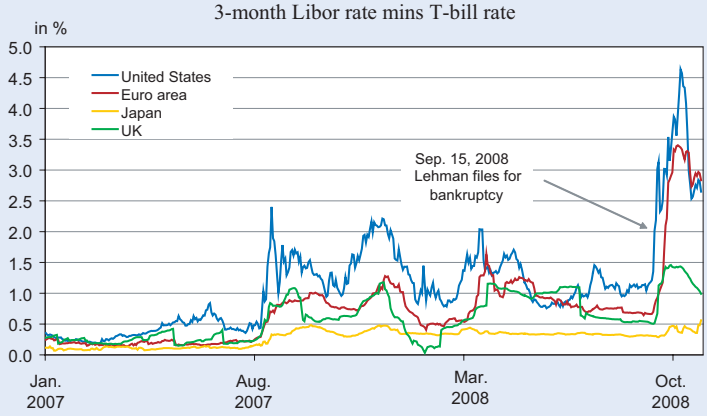


Source: IMF(2008b).

Figure 5

TED SPREADS

3-month Libor rate mins T-bill rate



Source: Boomberg and IMF estimates.

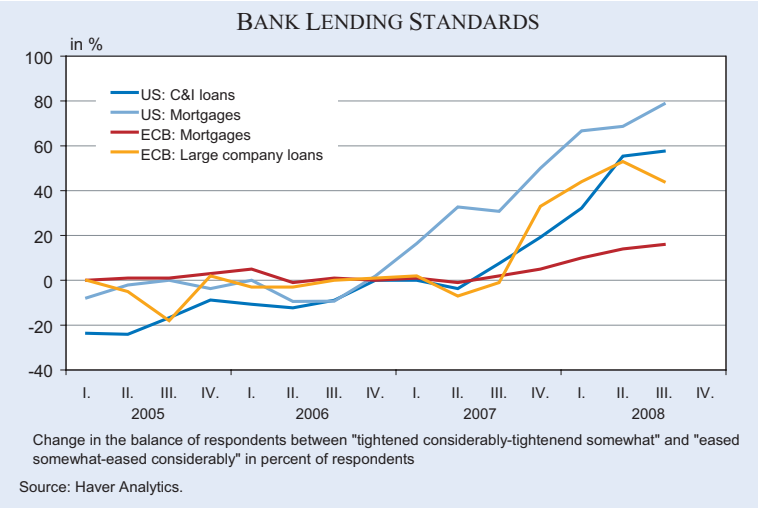
Increase in counterparty risk

Figure 5 shows how the crisis led to an increase in counterparty risk between banks, i.e. to an increase in the perceived probability that a bank borrowing from another bank may not be able to repay. For four different economies it plots the "Ted spread", which is the difference between the average rate charged by banks to each other for 3-month loans (the "3-month Libor rate), and the three-month T-bill rate, the rate at which the government can borrow. Note how the spreads increased from the middle of 2007 on, especially in the United States and Britain, and how they jumped when the US government let Lehman Brothers file for bankruptcy in September 2008.

Until then, financial markets had assumed that the government would not let large, systemic banks fail. The failure of Lehman Brothers, and the fact that claims on Lehman became frozen for a long time, convinced them otherwise, leading to a very large jump in the spread. (Note the partial decline at the very end. I shall return to it later.)

Associated with this large increase in perceived counterparty risk, was a sharp decrease in the maturity of the loans that banks were willing to make to each other. The result was the attempt, by each bank, to keep

Figure 6



Change in the balance of respondents between "tightened considerably-tightenend somewhat" and "eased somewhat-eased considerably" in percent of respondents

Source: Haver Analytics.

enough cash on hand and limit its reliance on borrowing from other banks.

Tightening banking standards

One of the ways a financial crisis affects the economy is through credit rationing, i.e. the tightening of lending standards by banks that are deleveraging. This is indeed what has happened.

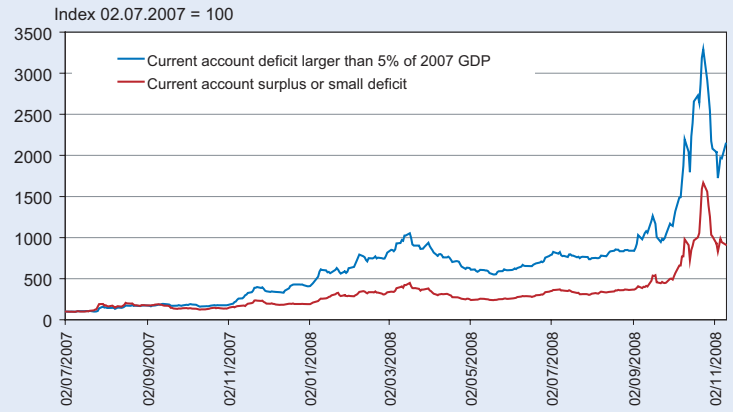
Figure 6 shows the evolution of an index for changes in bank lending standards in the United States and the euro area, for both mortgage loans and for commercial as well as industrial loans. The index, which is based on a quarterly survey of bank loan officers, reflects the difference between the balance of respondents who say that they have "tightened considerably/tightened somewhat" and those who say that they have "eased somewhat/eased considerably". The figure shows how credit has become steadily tighter for firms and households since mid-2008.

Emerging market spreads and sudden stops

Deleveraging has not been limited to domestic credit. For more than a year after the start of the financial crisis, it looked as if emerging markets might be shielded from the crisis. The premium that most emerging market country governments had to pay relative to the US government (the "sovereign spread") was small and did not increase much. As Figure 7 shows, things changed dramatically, however, in the fall of 2008. In the process of deleveraging, advanced country banks started drastically reducing their exposure to emerging markets, closing credit lines and repatriating funds. Other investors did the same. The selling was across the board but not totally indiscriminate: the figure shows that the premium jumped up substantially more for countries with large current account deficits.

Deleveraging in the form of capital outflows presents additional macroeconomic problems. Not only do countries have to deal with a domestic credit problem (as banks experience a run and the mechanisms we saw earlier are at work), but they have to deal with the pressure on the exchange rate. If they have reserves or if they have access to foreign credit (e.g. credit from central banks or loans from the IMF), they can use them to limit the depreciation. Otherwise, they may have to accept a large depreciation that, if domestic liabilities are denominated in foreign currency (which they often are), leads to further burdens on debtors, be they households, firms, or financial institutions. The mechanism is familiar from past crises, especially the Asian crisis, and can lead to major economic disruptions. It is playing out in a number of countries today.

Figure 7



Source: Bloomberg and IMF staff estimates.

From the financial crisis to a full-fledged economic crisis

For some time after the start of the financial crisis, its effects on real activity appeared limited. Yet, this did not last long. Lower housing prices and lower stock prices triggered initially by the decreased stock market value of financial institutions, higher risk premia and credit rationing, started taking their toll in the second half of 2007. In the fall of 2008, however, the effect suddenly became much more pronounced. The worry that the financial crisis was becoming worse and might lead to another Great Depression, led to a dramatic decline in stock markets and to a dramatic fall in consumer and firm confidence around the world.

Figure 8a

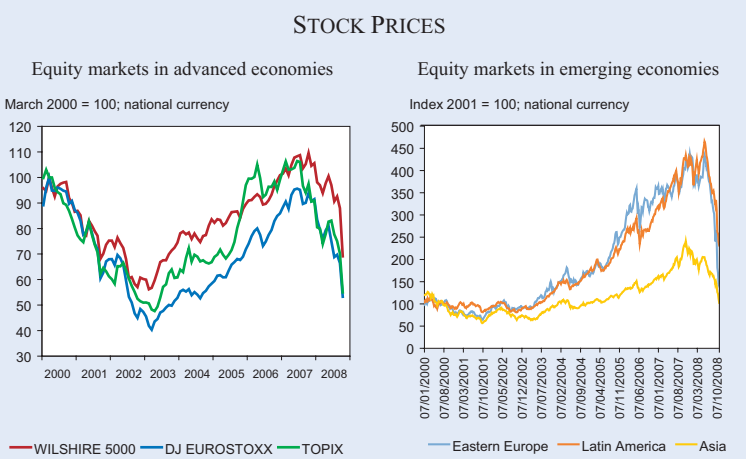


Figure 8a shows the evolution of stock price indexes from markets both in advanced economies and in emerging market countries: After a long and steady increase from 2002 on, stock prices started declining in the second half of 2007 and then fell abruptly in the fall of 2008. Figure 8b shows the evolution of business confidence and consumer confidence. It shows the dramatic fall in both indexes for the United States, the euro area and emerging economies in the fall of 2008.

In turn, these developments have led to a large decrease in demand and in output. Figure 9 shows the IMF growth forecasts as of mid-November: most advanced countries now have negative growth which will also prevail in 2009. Emerging market countries are expected to have positive growth but much lower than they have had in the past. The world is clearly now facing a major economic crisis.

Policies for the short run

It is clearly too late to change the initial conditions which led to the crisis. Thus, in thinking about policies for the short run, the purpose must be to dampen the two amplification mechanisms.

Dampening the runs

The way to limit runs is conceptually straightforward: it is for the central bank to provide liquidity against good enough collateral. If they have access to such funds, financial institutions do not need to sell assets at fire sale prices and the first amplification mechanism does not operate.

This is exactly what central banks have done, acting as "lenders of last resort" since the beginning of the crisis. Traditionally, such liquidity provision was limited to banks, and the list of assets which could be used as collateral was relatively narrow. What central banks have done during this crisis is to steadily increase both the set of institutions and the list of

Figure 8b

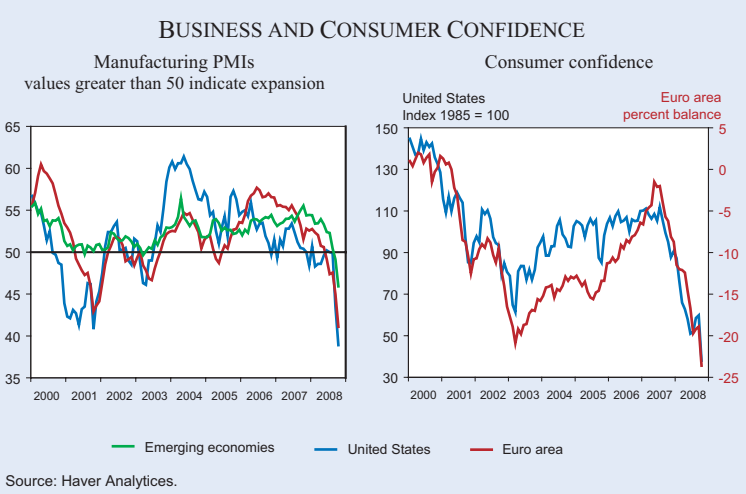
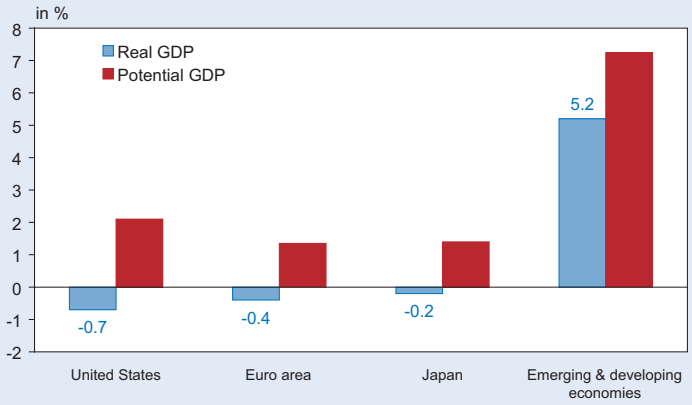


Figure 9

REAL AND POTENTIAL GDP FORECASTED GROWTH RATES FOR 2009



Source: IMF (2008a), November Update.

assets that qualify as collateral. In particular, the US Federal Reserve has pursued an especially aggressive liquidity policy since mid-2008. As a result, the monetary base has increased from USD 841 billion in August 2008 to USD 1.433 trillion in November, an increase of USD 592 billion in four months.

Has this provision of liquidity been successful? The answer appears to be yes, at least with respect to domestic institutions. However, for those countries suffering from capital outflows, including most emerging market countries, things have been tougher. A few countries have had access to credit in foreign currency from the major central banks, in the form of swap lines. But the others have been exposed. Iceland, which had a very large banking sector relative to its economy, with assets and liabilities largely denominated in euros, became one of the first major casualties of the crisis. Faced with runs (in this case, the inability to borrow in money markets) and not being part of the euro area and thus not having access to the liquidity provided by the European Central Bank, the three major Icelandic banks went bankrupt, creating a deep economic crisis for the country as a whole. Few countries are as exposed as Iceland was. But many are likely to face similar runs and may need quick access to foreign liquidity.

Asset purchases and recapitalization

The provision of liquidity eliminates the amplification mechanism. It does not, however, address the reestablishment of capital ratios. Based on the evidence from the resolution of a large number of previous banking crises that occurred in a large number of countries, what needs to be done is fairly well established and has basically two components.

First, the state must isolate bad or potentially bad assets. There are various approaches to doing this. One is to leave the assets on the balance sheet of the institutions, but the state provides a floor to their value in exchange, for example, for shares in the institution. Another, which I find more attractive, is for the state to take the assets off the balance sheet altogether by buying them in exchange for cash or for safe assets such as government bonds. The central question is that of the price at which to buy them. One can think of two extreme prices: the (pre-intervention) market price, which may well be a fire sale price and thus embody a large liquidity discount; or the estimated expected present value – known as the "hold to maturity" price. The right solution is to set the price between these two extremes, giving, on the one hand, institutions incentives to sell and, on the other hand, taxpayers a reasonable expectation that, if the assets are indeed held to maturity by the state, they will actually benefit from the purchase in the long run.

The effect of such asset purchases is twofold. First, it sets the value of the assets on the balance sheets and, by reducing uncertainty, it allows investors to better assess the risk of insolvency. Second, it increases the price of these assets from their fire sale price to something closer to their underlying expected value and thus improves the balance sheets of all the institutions that hold these assets directly or indirectly.

These purchases are, however, half of what needs to be done. Once the value of the assets is clearer, some institutions may turn out to be insolvent and thus should be closed. Most are likely to show positive, but too low, capitalization and therefore must be recapitalized. This can be done through public funds only or through matching public and private funds in exchange for shares. The purpose is to return these institutions to a level of capital so that they do not need to further deleverage, to further sell assets or cut credit.

Where are we today on these two fronts? For some time, governments saw the crisis as one of liquidity,

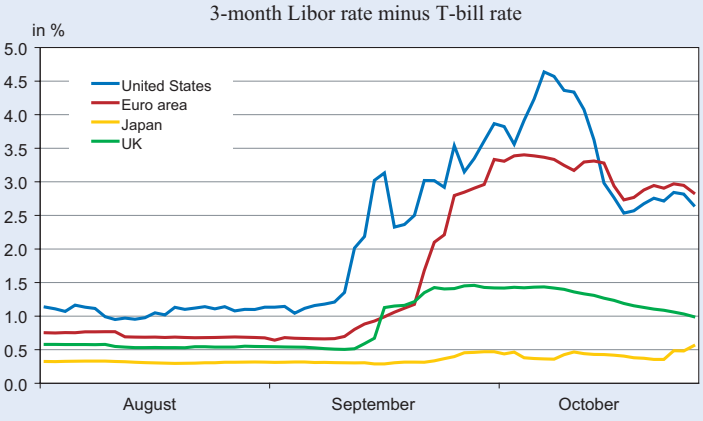
thus a problem to be handled by the central banks through liquidity provision. In the fall of 2008, it became clear that undercapitalization was a major issue. In October 2008, the United States introduced the "troubled asset relief program (TARP)", allowing the Treasury to buy assets or inject capital up to USD 700 billion. A few weeks later, major countries agreed to put in place financial programs along the lines sketched above at the meetings held both in Washington and in Paris. Since then, France has committed to spend up to EUR 40 billion, Germany up to EUR 80 billion, the United Kingdom GBP 50 billion, etc. In addition, in order to alleviate worries about solvency before the programs are fully implemented, most governments have extended the guarantees accorded to depositors to interbank claims that are claims of banks on other banks.

The size and the complexity of the required programs are enormous and many governments are still exploring their way. Particularly in the United States the TARP appears to have changed direction twice, with an initial focus on the purchase of troubled assets through auctions, then a shift in focus to recapitalization, and in the more recent past, (for example, in the case of Citigroup) a reliance on both, providing a floor on the value of some of the assets on the balance sheet and recapitalization. Other programs appear to be more consistent but the funds are being disbursed slowly.

Are these programs working? The verdict is mixed. As Figure 10 shows, the spread between the interbank lending rate and the T-bill rate has declined but remains surprisingly high despite the interbank guarantees and the recapitalization of some banks. Little has been done to dispose of bad assets and public capital injections have been limited. Uncertainty about the course and the details of policy has made private investors hesitant to invest funds without knowing the nature of future public interventions. The result is that deleveraging continues with banks continuing to reduce credit both domestic and abroad.

Issues of coordination are also at work. The provision of guarantees for some assets can lead investors to move into those assets, making things worse for non-guaranteed assets. We have seen this in the United States for non-guaranteed mortgages. The provision of guarantees by one country can lead investors to move to that country, making things worse for other countries. This was the case, for example, when Ireland unilaterally offered guarantees to investors in the fall of 2008. Putting capital controls in one country to slow down capital outflows can lead to the perception that other countries will do the same, therefore triggering capital outflows in those countries. Protecting domestic depositors and investors at the expense of foreign depositors and investors can create the risk of major outflows from depositors and investors in similar situations elsewhere and the risk of similar measures by other countries. The attempt by Iceland to do just that led Britain to invoke an anti-terrorist law to get Iceland to change its mind. Finally, guarantees and other measures taken in advanced countries make it more attractive for investors to put their funds in these countries and can consequently lead to further capital outflows from emerging market countries. As Figure 11 shows, the sovereign spreads on emerging countries have decreased from their October height but they remain very high.

Figure 10



Source: Bloomberg and IMF estimates.

I have focused on the measures needed on the financial side. The sharp fall both in demand and output in the past couple of months also requires measures to increase demand. Interest rates of government bonds are already very low, so the scope for using traditional monetary policy is limited. The focus must be now on other policies. On the monetary side, "quantitative easing" which is the purchase of assets other than government bonds by the central bank, can

Figure 11

EMERGING MARKETS SOVEREIGN SPREADS
Composite index (02.01.2006 – 12.11.2008)

Source: Bloomberg and JP Morgan.

reduce spreads in dysfunctional credit markets. It is clear, however, that fiscal policy has to play a central role here. At the time of this writing, most countries are developing fiscal packages, intended at increasing demand directly and decreasing the perceived risk of another "Great Depression". The IMF has argued for a 2 percent global fiscal expansion, with a commitment to do more if the macroeconomic situation becomes worse than current forecasts. Sustaining world demand is likely to be a central issue in the next few months.

Policies to avoid a repeat

Looking forward beyond the crisis (something difficult to do these days), the following questions arise: how can we avoid a repeat of the same scenario? And how can we decrease the fragility of the financial system without impeding its efficiency too much? Much work is already going on both in international institutions and in academic departments, ranging from the examination of rules governing rating agencies to constraints on executive compensation, to rules for valuing assets on balance sheets to the construction of regulatory capital ratios, and so on. I have neither the expertise nor the time here to go into details. But I can try to give you a sense of the broad directions.

Recall my basic argument that the scope of the crisis is due to the interaction between initial conditions and amplification mechanisms. We have already discussed how liquidity provision and state intervention can dampen the amplification mechanisms. The remaining question in our context is: should we try to avoid recreating some of the initial conditions which led to the crisis?

Some of these initial conditions are clearly here to stay. Securitization and, by implication, relatively complex derivative securities allow for a much better allocation of risk. The challenge is to prevent complexity from turning into opacity; here we can probably do much better than we have done in the past. Or, to take another initial condition, cross-border activities and large cross-border positions are also essential to competition and the allocation of funds and risk in the world. They should not and will not go away.

What should be done is to decrease leverage. Leverage of the financial system as a whole was almost surely too high before the crisis. Regulation can enforce lower leverage. This requires, however, increasing the perimeter of regulation beyond banks to many other financial institutions. The challenge here is how and where to draw the perimeter, whether, for example, to put hedge funds in or out, and, if they are in, what rules to put them under. One must also go beyond leverage within the financial system and look at leverage for the economy as a whole: highly levered firms or households are also highly exposed to small fluctuations in the value of their assets. The irony is that many existing tax rules favor such leverage, ranging from the tax deductibility of mortgage interest payments by households to the tax deductibility of interest payments by firms. We have to revisit these rules.

Even if and when new regulation is introduced and tax laws are changed, we should be under no illusion that systemic risk will be fully under control. Regulation will be imperfect at best, and always lag behind financial innovation. There will still be benign times and they will lead to underestimation of risk (the first of the initial conditions I listed above). Thus, a major task of regulators will be to monitor and, if needed, react timely to increases in systemic risk. In doing so, they will face two sets of challenges.

The first is about monitoring itself, what information to collect, and how to use it to construct measures of

systemic risk, both at the national and international level. Some of the information needed is just not available today. We do not know, for example, the distribution of CDS positions among investors and countries. This is one of the reasons why many advocate moving trading from over the counter to a centralized exchange; this would allow, in particular, for better collection of information. And, even if the information becomes available, how to construct measures of systemic risk is a difficult conceptual exercise. We are surely not there yet.

The second challenge is how to react when measures of systemic risk increase. Pro-cyclical capital ratios, in which capital ratios increase either in response to activity or to some index of systemic risk, sound like an attractive automatic stabilizer. They can dampen the build-up of risk on the way up, and the amplification mechanisms on the way down. The challenge lies clearly in the details of the design, the choice of an index, the degree of pro-cyclicality.

Another avenue is to use monetary policy more actively. The idea that monetary policy should be used to fight asset price or credit booms is an old and controversial idea. Before the crisis, some consensus had developed that monetary policy was a very poor tool to fight asset price booms, and it should care only about asset prices to the extent that such prices had effects on current or prospective inflation. The crisis has certainly reopened the debate.

Conclusion

Let me end where I started. This lecture is being written in the middle of the crisis. And, as I write it, the crisis appears to be entering yet a new phase, in which a drop in confidence is leading to a drop in demand and a major recession. This, in turn, raises a set of new issues, from the dangers arising from the interaction between a deep recession and a weakened financial system, to the risk of deflation and liquidity traps, to further capital outflows from emerging countries and sudden stops, to an increased risk of trade wars, to the effects of the collapse of commodity prices on low-income countries. I am afraid you will have to invite me again next year for an update.

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Food and Energy Prices

Policy Lessons Drawn from the Recent Food and Fuel Price Inflation

Karen H. Johnson*

During the twelve months ending in June 2008, global food prices surged at alarming rates and the price of crude oil reached new highs. The rapid pace of food and energy price inflation in turn fed through to bring measures of overall consumer price inflation to undesirably high rates in a wide range of countries. Through the first half of 2008, food was seen as a global crisis, riots broke out in several countries, and debate raged over how to explain this sudden development. Over the remainder of 2008, both food prices and oil prices rapidly retraced their recent gains, with prices for globally traded major foods falling to their average of May 2007 and crude oil prices dropping to levels not seen since 2004.[1] At the present time, the global economy remains caught in a dramatic economic slowdown, and prices of food and energy are helping to bring down headline inflation rates.

In light of the importance of food and energy and their respective prices to all participants in the global economy, it is essential that we come to an understanding of the forces at work in the present episode and draw some lessons for policy going forward. We must evaluate the debate concerning the causes of rising commodity prices in light of their rapid turnaround. And we must take care to extend our time horizons, both backwards and forward, to a sufficiently long view that does not allow us to prematurely conclude that energy and food price inflation have disappeared and are no longer possible problems.

This paper will focus primarily on developments in the prices of globally traded foods and the implications of these prices for a range of countries and their policies. Many of the issues discussed are also relevant for energy prices, but the paper will not discuss issues that are purely energy related. Global food and energy price inflation interact in that energy prices are a cost in the production of food and the incentives for biofuel production that arise from high energy prices have implications for food production and hence food price inflation. On average, global food prices shifted to an upward trajectory in 2003, and my discussion will review the basic facts of food and energy price developments since then. The five-year interval 2003–2008 marked a period in which food prices accelerated, reversing a trend decline in relative food prices that had been occurring for many years. The discussion will then examine the elements of global demand and supply for major food crops and the factors that have been at work since 2003. Careful consideration of the behaviors behind demand and supply should shed light on the fundamental forces responsible for the sharp rise and then partial reversal that we have seen in prices. No single economic development or group of economic agents is responsible for the spike in food (and energy) prices. Rather, a combination of factors brought about the conditions that led to rapid inflation and then reversal in food and energy prices. These events cannot be blamed on speculators. They are also not simply the consequence of exchange rate shifts, such as the fall in the value of the dollar during much of 2008. Understanding the history of the relevant demand and supply factors should provide insight into likely future developments and policy needs.

Food (and energy) price inflation bears directly on several components of economic policy. Central banks around the world are charged with the responsibility of maintaining stable overall consumer prices. The extraordinary events of 2008 raise questions as to how central banks should react to food and energy price inflation in setting monetary policy so as to achieve broad price stability. Food production is regarded as an appropriate sector for public

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[1] Price quotes are from the IMF commodity database.

policy in almost all countries. The recent sharp changes in food prices may suggest that many countries should rethink how they have been designing agricultural policy. Agricultural products constitute a major and important component of global trade. The events of the food crisis of 2008 are closely tied to agricultural trade practices. The concluding section of this paper will seek to extract from the understanding developed of food and energy price inflation a set of constructive policy recommendations for monetary policy, agricultural policy and trade policy for the world's advanced countries and emerging market economies.

The development of food prices

The evidence on food price inflation over the past five years is complex in that there are several different ways one can measure food prices. The IMF publishes an index of primary food prices in dollars that includes items that are produced and traded worldwide.[2] That index shows that from June 2007 until June 2008 prices for these food items on average rose more than 40 percent, an astonishing rate that triggered the perception of crisis. This spike came at the end of a five-year period over which this index of food prices had risen at an average annual rate of nearly 15 percent. This rapid rate of food price inflation contrasts with an average rate of increase in this same index of about 1.6 percent per year from 1957 to 2003. The sharp change in global economic conditions in the last several months has resulted in food prices retracing their spike, and the IMF index in December was at a level last recorded in May 2007, but still well above its 2003 average value.

An essential part of the explanation of the behavior of food prices is that they are determined in world markets and influenced by events throughout the world economy. A measure calculated in any one currency, such as the US dollar, includes effects not just from food prices but also from swings in the exchange rate of the dollar in terms of other currencies. To minimize these effects, the IMF calculates an alternative index measured in Special Drawing Rights (SDRs), a unit of account that averages across four currencies, the dollar, the euro, the yen and the pound and so largely nets out the effects of changes among those exchange rates. The average annual rate of increase in the index of food prices measured in SDRs from 1972 to 2003 was about 1 percent. In the twelve months to June 2008, this index rose nearly 35 percent, and in the five years from 2003 to mid-2008 it rose at an annual average rate of about 11 percent. By December 2008 its value had fallen to its level in May 2007.

To understand the process of food price inflation, we need to ensure that food prices were not just rising along with ALL prices, in many currencies. Hence we need a measure that compares food prices over time to non-food prices. One such measure is a calculation of food prices relative to the IMF index of prices of exports of manufactured products by all advanced economies. From 1957 to 2003 this relative price reflected a downward trend in food prices of more than 2.5 percent per year. From 2003 to 2008, this measure switched to increasing more than 4 percent per year. So in 2003, the long-established trend of a relative decline in food prices reversed, and these prices rose through the middle of 2008, when market conditions abruptly changed.

The recent pattern of energy price inflation is similar to that for food price inflation. In July 2008, the IMF index of dollar energy prices peaked at a level more than 80 percent above its year-earlier value: the index measured in SDR prices had risen only slightly less. By December both indexes were below their 2005 averages.

The role of demand

Given that global food prices were pushed up over the five years through mid-2008, it is likely that demand was increasing over that time. A wide range of data on global food consumption confirms the view that consumption of the major food crops rose significantly during those five years, a time when world growth of output intensified (see Johnson 2008).[3] The period from 2003 through the middle of last year witnessed strong, sustained growth of world GDP, although that growth has since clearly slowed sharply. This period of global expansion allowed standards of living to rise in many countries – a welcome outcome. Moreover, the composition of that growth changed importantly. For many decades, emerging market and developing countries have been growing faster than the more advanced, indus-

[2] The IMF food price index is an index of selected cereals, vegetable oils and protein meals, meat, seafood, sugar, bananas and oranges. Data prior to 1980 were taken from the IFS and rebased to link to post-1980 data, which use world export weights from 2002 to 2004.

[3] Data on global food consumption can be found in the database provided by the US Department of Agriculture.

trialized countries. But their economies, even taken together, remained small. Since the recovery from the 2001 recession, however, their aggregate size has reached a magnitude that, along with their more rapid growth, has resulted in their contribution to the change in world output accounting for about two-thirds of the total (IMF 2008, 25). Although data are not yet complete to reveal the details of world growth during the second half of 2008, it is widely expected that during the global slowdown nearly all growth has arisen in emerging market economies. As a result, the features of these economies and the patterns of their growth are now important determinants of developments on world markets.

This change in the pattern of world growth matters because food consumption is a higher share of household spending in the emerging market and developing countries than is the case in the advanced countries. The weights used in consumer price indexes reflect this difference, with the weight on food for the United States a bit below 14 percent whereas on average in Latin America it is over 20 percent and in China and the rest of emerging Asia it is about 30 percent.[4] In addition, as households achieve higher incomes, the mix of food consumed changes, with meat and, to some extent dairy products, becoming a larger share of diets. Since it requires several pounds of grain to produce one pound of meat, total demand for grains, in particular, rise with this change in composition.

Are speculators to blame?

Although subsequent events have moved sharply in the opposite direction, in spring 2008 there was much debate that "speculators" were driving up food prices. This was in response to investments by financial firms, such as investment banks and pension funds, in commodity-based securities and the emergence of mutual funds focused on commodities that allowed investors to buy into commodity markets in a more diversified way than buying individual contracts. Substantial sums were invested in instruments such as commodity futures contracts, and there was debate about how much speculators were to blame for the run-up in food prices. Most recently, money has flowed out of these markets as many investors have sought only the safest investments and as some of these financial firms have sold whatever they could to improve their liquidity position. Although these trades either way can and do move prices temporarily, they do not represent final demand for the consumption of the food product (or crude oil). Because they can influence prices for a time, such trading can change incentives, especially for inventory holdings of the various commodities, but they cannot influence a long-term trend in price.

What about the supply side?

Data clearly tell us that over the five years since 2003, the supply produced of the major food crops has risen (see Johnson 2008).[5] The crop year 2004/2005 saw a particularly sharp rise in production and in subsequent years, output was about flat. Even in spring 2008, while prices were rising rapidly, expectation was for a further increase in supply. Several negative factors affecting supply have been at work. Drought in Australia resulted in a large reduction in wheat production in 2006/2007, and output there has not really recovered yet. Diversion of resources away from growing food and into the production of biofuels has been controversial and been pointed to by many as a major reason for higher food prices. In the United States, the issue is the use of corn for ethanol production. Elsewhere, it is the use of vegetable oil crops, including soybeans, for the production of biodiesel. US corn production has risen significantly over the past five years, but 25 percent of US production is now devoted to ethanol (Faiola 2008, A13). Almost all of the increase in total corn production over the recent past has been used for ethanol and not food and feed. However, the supply of corn available for food and feed for animals has been maintained since 2003: this supply has not declined as a result of biofuel activity (OECD and FAO 2008, 40). No change in biofuel policy has been part of the recent downward pressure on corn prices. Moreover, the supply of rice has risen in recent years, rice is not a crop used in biofuel production, yet the price of rice at one point had risen the most dramatically; and rice was the focus of some of the greatest public concern during spring 2008.

Available world land for agricultural production has been stable since 1990, and the scope for increasing the total amount of land under cultivation seems to be limited, especially in light of pressures on land use to expand urban and suburban development.

[4] Data on CPI weights are from national sources.

[5] Data on global food production can be found in the database provided by the US Department of Agriculture.

However, yields on the various acres under cultivation differ markedly. According to officials at the OECD, one third of harvested land lies within the countries that are its members, essentially the advanced countries, with two thirds in the developing world. Yields per hectare within the OECD are 4.5 tons, with yields in the United States even higher at 6.5 tons. But yields in developing countries average only 2.4 tons (OECD and FAO 2008, 39). There would seem to be substantial potential for raising world food production by improving yields in many countries up to those reached in OECD member countries. There are challenges in achieving this. Costly crude oil and natural gas can raise the costs to farmers of fertilizer, an input into raising yields. In addition, higher fuel prices raise transportation costs, and infrastructure bottlenecks pose major problems in many developing countries. Overall, many of these factors impeding greater supply are transitory.

Food prices are primarily driven by demand

We know from data on crop inventories that despite the overall increase in supply during the past five years, inventories have fallen (Wolf 2008). Thus in the five years through mid-2008 demand for food rose more than did supply, inventories were allowed to fall, and yet prices still rose. Stocks of the major crops are now significantly lower than they were in the 1990s, a development that increases the volatility of price in the face of demand surprises. With supply being maintained or rising for the major food crops and yet inventories falling, it appears that the strength of demand was the major, but not only, determinant of high and rising food prices. More recently, the very abrupt collapse in the growth of world overall demand and the sharp drop in food prices confirm the central role of demand as the driving force behind changes in global food prices.

Since 2003, the world has evolved from a condition of chronic excess supply of the major global food crops, with price subject to various policies largely intended to provide support to farmers while limiting the costs of storing the excess supply, to one in which demand fluctuations play a dominant role in moving food prices. The heightened role of demand in influencing price reflects the growing importance of emerging market economies in overall world output growth and the feedback onto the sensitivity of price to demand coming from reduced world inventories. The result has been an extended period of food price inflation followed by deflation. Fluctuation in food prices, in turn, has contributed to sharp acceleration and then deceleration of broad consumer price indexes in many countries.

Clearly, world demand will be driven for some time by the current global recession. Accordingly, food price inflation is likely to remain subdued. But when global economic growth recovers, the emerging world will once again exert significant influence on overall activity, and the trend in the relative price of food could again become positive. We need to recognize the demand-driven market nature of the movement in food prices and to design policies that use price to create appropriate incentives to guide food demand and production decisions. Policies that work by controlling food prices are now more unwise than ever.

Monetary policy responses

At present, most central banks see food and energy price inflation as restraining overall inflation, and monetary policy decisions are focused on returning resource utilization closer to potential. Over a longer horizon, however, food and energy price inflation raise two important issues for monetary policy. One is the potential for food and energy price inflation to influence inflation expectations. Ensuring that inflation expectations remain anchored is an important element of controlling inflation, as a rise in these expectations quickly adds to the cost of controlling inflation. With households shopping in food markets very frequently and thereby updating their information about food prices, a return to a positive trend in the relative price of food has the potential to feed back onto inflation expectations and then to upward pressure on nominal wages. Once a wage/price spiral begins, it is very costly to end. So over time, central banks need to pay close attention to the links between food and energy price inflation and inflation expectations.

The second issue concerns the tactic of the Federal Reserve and some other central banks to focus not on headline inflation but on core inflation, that is headline inflation less food and energy prices. This approach has been used for some time for pragmatic reasons, as core inflation gave a clearer view of inflation pressures going forward than did headline inflation because of the volatility of food and fuel prices. But if the fundamentals moving food prices

have changed, as this paper argues, and are now more closely a reflection of overall demand in the global economy, then the risk of focusing on core inflation has increased. Core inflation omits precisely the price elements whose behavior has changed. Although the central bank may want to seek some other way to smooth some of the very short-term volatility in headline inflation that owes to food and energy price inflation, it should move away from relying on core inflation as a primary signal.

Agricultural policy

With respect to agricultural policy, we need to recognize that the chronic surpluses in several of the most important food crops were the core of humanitarian food aid and drove the decision process with respect to agricultural policy. We now need to rethink. From 2003–2008, supply failed to keep up with demand. We need policies that are designed to let price have a positive impact on supply.

Price controls should be avoided as they send negative signals to producers and blunt the incentives the rise in global prices is trying to create. In addition, price controls on particular foods are essentially arbitrary and distort the decisions made both by consumers and producers about buying or growing one food rather than another. Given the complex linkages across the globe in food production, it is essential that we use the price mechanism to direct markets to the true trade-offs on both production and consumption of food and related issues with respect to the use of scarce water and scarce energy. There are still calls for providing subsidies to agricultural production and, to some extent, consumption. Those policies that work through income mechanisms rather than price mechanisms at least avoid distorting the market signals that are working to encourage more and more efficient production. Policies that directly reduce supply by holding some acreage fallow were adopted as a way of reducing the cost of managing the surpluses. The United States still has millions of acres enrolled in such programs. Those policies must be reconsidered in a world in which inventories have dwindled and critical food shortages can emerge and go unmet, as they did last year.

Policy efforts to raise yield, particularly in the world's poorest regions, would be helpful, especially if they can be done in a way that does not distort choices by farmers. Efforts to improve the infrastructure so that seeds and fertilizer can get to farmers and crops can get to markets are an appropriate use of public resources and could be very helpful.

As the food crisis unfolded in 2008, many countries responded with changes to their trade policies with respect to agricultural products. In some cases, import restrictions or tariffs were lowered or removed so as to allow for additional food to reach the country. Steps in this direction should help global markets respond to the pressures on price. But some countries responded by placing limits on exports, in an effort to retain more food for their population. These actions introduce new distortions, create gaps between domestic and world prices, and lessen the incentives for farmers in the country imposing the restriction to increase their production. Trade in agricultural products has been manipulated by the industrial and the developing countries for decades, driven by artificially elevated prices in advanced countries and the desire of world producers to have access to markets. With the fundamentals of food demand and supply now changing, and prices responding more sharply to demand shifts, it should be possible to do away with the old distortions and find ways to let food be produced efficiently and traded globally. Unfortunately, the Doha Round of trade negotiations, which had agricultural trade as a major element of its agenda, ran aground. At present, there is little likelihood that trade liberalization in the agricultural sector will happen anytime soon. Policy officials need to find a way to address again mutually beneficial moves that could contribute to the efficiency of world food production, benefit some of the world's poorest people, and lessen the risks of another episode of a spike in food price inflation.

Conclusion

The basic economics of supply and demand are at the root of the acceleration in global food prices in the five years through mid-2008 and the subsequent sharp decline. The rapid moves recorded in food price inflation in the past several quarters confirm the pronounced role of demand fluctuations in moving food prices. Going forward, we need to make the overall supply of global food crops more responsive to price. The financial crisis will overshadow any other global economic event for some time and are

likely to restrain prices, thus limiting inflation. But the UN World Food Program still perceives a global food crisis in many poor countries. The forces moving to increase demand for food faster than global food production and hence food prices are likely to return and to persist over the long run. We need to reconsider the policies I have highlighted once the present crisis subsides; particularly those policies that distort price and so hinder incentives that would lead to a better balance between future demand and supply.

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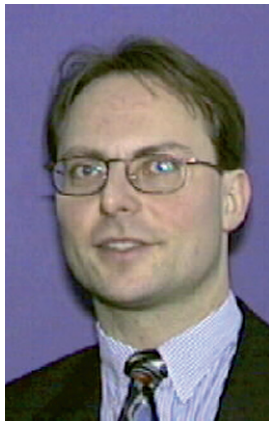
Energy, Commodity and Food Price Volatility: What Policy Responses?



Ernest Gnan*

Introduction: Energy and food price volatility as a source of macroeconomic instability

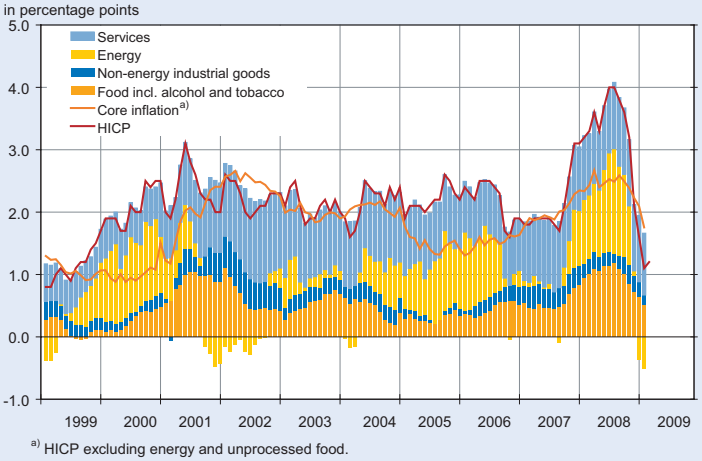
The oil price roughly doubled both in USD and in EUR terms between early-2007 and mid-2008 to record highs of around USD 140 or more than EUR 80. In tandem, raw material and food prices soared, leading the IMF to diagnose the *"broadest and most buoyant commodity price boom since the early 1970s"* (IMF 2008a). As a result, headline inflation surged considerably above common definitions or perceptions of price stability. This development prompted a debate about the "return of inflation" and the "end of the Great Moderation". Also in the euro area, after having been at low levels of around 2 percent over the past decade, inflation rose above 3 percent (indeed to considerably higher levels in some individual euro area countries) in 2008. Most of the sudden increase in inflation was due to a sharp hike in energy, raw material and food prices. But also core inflation gradually nudged upwards, as higher energy prices filtered through the production chain and into wages.

The surge in inflation triggered a debate about appropriate policy responses. The policy measures considered and/or actually taken at the time should be seen against the knowledge about the state of the economy, and expectations of the further path of growth and inflation, prevailing at the time:

- The financial "turbulences", as they used to be called back in 2007 and early 2008, were considered to be limited to certain regions and financial market segments.
- Economic growth was expected to slow in response to the combination of the oil and food-price induced cost-push shock and some tightening of financing conditions due to increased risk premiums, but the slowdown was widely expected to be gradual, from very robust levels and with output close to or even above potential.
- As late as September 2008, oil, raw material and food prices were still generally expected to remain high over the medium run (for oil this meant a price level of around USD 100), as a result of continuing robust world demand, limited short-term supply responses and, in the case of oil, a growing awareness of a nearing depletion of natural resources.
- Therefore, regarding inflation, there were serious worries of a more lasting rise, going beyond the mere level shift in the energy price component of the consumer price basket, for at least three reasons. *First*, increased oil prices were filtering through the production chain into non-energy industrial goods and energy-intensive services,

Figure 1

Components of the HICP: Contribution to Annual Increase



a) HICP excluding energy and unprocessed food.

Source: Eurostat.

* Oesterreichische Nationalbank, Vienna. The views expressed in this article are those of the author alone and need not reflect the views of the Oesterreichische Nationalbank or the Eurosystem. I appreciate research assistance by Elisabeth Augustin, Wolfgang Harrer, Andreas Nader and Beate Resch as well as hints on relevant literature by Beat Weber and Jürgen Janger.

such as transport and tourism, thus generating "indirect inflation effects". *Second*, there were increasing concerns about second-round inflationary effects through higher wage settlements, aimed at compensating workers for the energy-induced loss in purchasing power and also reflecting robust employment growth and low unemployment rates. *Third*, as a result and also because of media-induced high public awareness of the surge in headline inflation, some indicators of inflation expectations pointed to the risk of a "de-anchoring" of inflation expectations (see e.g. IMF 2008b).

– The media, the general public and the body politic in many EU countries were at the time highly concerned about adverse consequences of the inflation surge for workers' and pensioners' real income, particularly for the poor. Governments replied with anti-inflation programs, while public dissatisfaction with the Eurosystem's perceived failure to contain (headline) inflation was mounting.

Meanwhile, as part of the sharp deterioration of the world economic outlook, oil prices – and with some lag – other energy prices have returned to low levels of somewhat above USD 40 even more abruptly than they had risen. While this may in principle be regarded as a welcome positive supply shock for energy importing countries in the current economic downturn, it also poses problems in other areas: *first*, the sharp downward pressure may, combined with the cyclical downturn, temporarily lead to negative inflation rates by mid-2009 in a number of euro area countries, exacerbating fears of deflation in the midst of a deep recession, creating the risk of a "downward de-anchoring of inflation expectations"; *second*, the return of energy prices to fairly low levels may act as a drag on longer-term, structural measures against climate change and energy saving measures; *third*, energy exporting countries such as Russia need to readjust to the sudden loss of income, deepening the effects of the global economic crisis. So, it was not only the strong increase in energy, commodity and food prices that caused headaches for policy makers, but also their extreme volatility, both upwards and downwards.

Against this background, this article discusses policy measures taken in response to the recent oil and food price shocks. Section 2 sets the frame by proposing two alternative or complementary readings on the sources of the current economic crisis, one focusing on a supply cost-pull shock story, another emphasising a global demand-triggered bubble which also extended to energy and commodity prices. Sections 3 and 4 analyse policy measures taken by central banks and EU governments to contain inflationary – and, more recently, disinflationary – pressures and/or to mitigate their consequences. Section 5 draws some tentative first conclusions.

Sources of the crisis: Cost-push shock or endogenous consequence of a global demand bubble?

There is a vivid ongoing debate about causes of the current economic crisis, reaching from too lax monetary policies over regulatory and incentive failures to globalisation, excessive financial market liberalisation and capitalism proper (to mention but a few). For the purpose of this article, two further aspects may be noteworthy. First, the current economic crisis may have been triggered or aggravated by the initial upward energy and food supply shock. Second, the ultimate causes of this supply shock may, however, in turn have been rooted deeper in a global overheating of aggregate demand.

Energy and commodity prices may have triggered the current crisis through a number of channels. *First*, the marked terms of trade deterioration in industrialized, oil and commodity-importing countries affected conditions for production and dampened private household purchasing power and demand, leading to a downward revision of economic prospects. *Second*, against the background of sharply rising headline inflation rates, signs of indirect price effects on other sectors of the economy and incipient second-round effects on wages, central banks had to tighten monetary policy in order to avoid wage-price spirals and an upward de-anchoring of inflation expectations. This contributed to, or accelerated, a bursting of various asset price bubbles which had been building up since the turn of the millennium. This reading of events is supported by the fact that the peak of price developments in various asset markets had been passed already before the start of the financial turbulences in mid-2007.

So, as is argued here, the oil and commodity price shock may – directly through the supply shock and indirectly through the induced hikes in policy interest rates – have triggered the bursting of various bubbles and the current recession. But what caused

the hike in oil and raw material prices in the first place? Three basic factors are generally discussed in this context: supply, demand and price distortions due to speculation in commodity markets.

On the *supply* side, the slow response of production capacities, especially for oil, be it for technical reasons, be it for uncertainty about the profitability of such investments, resulted in a steep supply curve, making prices highly sensitive to changes in demand.[1]

Against the background of inelastic supply, the *second* explanatory factor, demand, seems thus to have played a crucial role for price fluctuations. Energy consumption is closely correlated with economic growth. Both, the strong catching up of emerging market economies as well as the robust growth in the industrialised world, contributed to the surge in world energy prices. The move towards bio-fuel acted as a spill-over channel from energy to food prices, but other factors such as changes in eating habits and a rising world population played a role as well in the surge in agricultural prices. With the benefit of hindsight, at least part of the vigorous world growth performance over the past years was a reflection of credit-led overheating that was triggered by low risk-free interest rates and an under-pricing of risk (see e.g. BIS 2008). The view of oil price shocks being the endogenous result of overly expansionary macroeconomic policies was already raised for the first and second oil price shocks of 1973–74 and 1979–80 by Barsky and Kilian (2001).

This leads to the third factor, *speculation*. Despite widespread public allegations that commodity prices were substantially driven by speculation, empirical econometric research only found rather limited evidence that the financialization of commodity markets may have distorted spot prices (see e.g. European Commission 2008; IMF 2008b; Heath 2008). Interestingly, this is at odds with market practitioners' own assessment of market dynamics (see e.g. Gnan and Gudmundsson 2008). Furthermore, even if commodity prices had not been driven by "market dynamics" in a narrow sense, this need not rule out that a global, demand-driven bubble economy may – through expectations on the future path of the world economy – also have driven commodity prices. In other words, for a commodity price bubble to develop there is no need for underlying commodity futures markets to have malfunctioned.

The sharp decline in current and expected world GDP growth setting in after the Lehman Brothers crisis in September 2008 was accompanied by an abrupt reversal in world oil and energy prices. The bursting of the "energy bubble" in principle constitutes a positive supply shock for energy importing countries. However, as the economic outlook has meanwhile deteriorated sharply with no recovery in sight in the short term, lower commodity prices may provide little stimulus for investment and consumption, primarily contributing to an increase in private savings. Instead, the commodity-price driven sharp fall in inflation may in the current circumstances be destabilising for expectations. For energy-exporting countries, in turn, the bursting of the energy bubble constitutes a sharp terms of trade deterioration, adding yet another adverse shock to the negative demand-side effects of the world economic downturn. Thus, sharp energy and commodity price fluctuations may not only have triggered the current crisis but may also aggravate its further process.

Monetary policy facing multiple adverse shocks and a rapidly changing inflation outlook

From the second half of 2007 onwards, central banks in industrialized countries faced an unpleasant combination of adverse shocks. *First*, rising energy and food prices boosted headline inflation considerably above declared inflation targets or definitions of price stability. Central banks were not so much worried by a temporary rise in headline inflation (as evidenced e.g. by the Eurosystem's medium-term focus in the definition of price stability) but by actual or possible indirect and second round effects as well as effects on inflation expectations.

Second, the financial turbulences which started in mid-2007, required exceptional measures in terms of liquidity provision to the banking and financial system. In the Eurosystem, the "separation principle" emphasized the difference between "liquidity policy" and the "monetary stance" aimed at providing a level of interest rates adequate to maintain price stability. In line with this separation principle, the Eurosystem provided the banking system with the required central bank money to ensure its functioning, while the monetary stance was kept on hold for about a year (with the main refinancing rate at 4 per-

[1] In addition, given the geopolitical location of major parts of world oil resources, political uncertainties also repeatedly contributed to market nervousness and price volatility.

cent) between mid-2007 and mid-2008. In July 2008, the main refinancing rate was slightly tightened by 25 basis points to 4.25 percent – with the Lehman Brothers crisis still not in the picture – in view of mounting inflationary pressure.

The *third* shock came from aggregate demand. As was to be expected, the negative cost shock of energy, raw material and food prices dampened actual and expected growth – and potential growth. In addition, there was a sharp correction in asset (in particular stock and housing) prices worldwide, and restrictions on credit, sharply rising risk premiums and/or reduced availability of credit in a number of European countries dampened consumption through wealth effects and investment.

The unfolding of these various shocks is illustrated by dramatic forecast revisions since mid-2007. While in mid-2007 growth in the euro area was expected to hover around potential in 2008, the actual turnout has been below + 1 percent. Consensus Economics forecasts for 2009 swung by a full 4 percentage points within little more than a year, from + 2 percent in January 2008 to – 2 percent in February 2009, with further downward revisions in the pipeline. Due to various lags, *inter alia* in price formation of various non-oil energy sources such as natural gas, and in the broader transmission of energy and commodity prices in the pricing chain, the cyclical downturn initially brought little relief on the inflation front. On the contrary, inflation remained at high levels well into the autumn of 2008. Only the sharp fall in energy prices, gathering pace in late 2008, finally pushed inflation rates abruptly downwards.

The current prospects for inflation are in a way a mirror image of developments a year ago. This time, a supply shock depresses inflation sharply. Downward pressure from the demand side is for the time being more muted (for a discussion of flat Phillips curves – see e.g. Rumler et al. 2008; Gnan et al. 2006). This is reflected in core inflation moving down more smoothly.

Against this complex – and extremely rapidly changing – background, central banks worldwide had to switch priorities from initially containing inflationary pressures and inflation expectations (up to the first half of 2008), over providing liquidity to "frozen" money markets and fragile financial institutions (from mid-2007 onwards), towards safeguarding macroeconomic and financial system stability in an environment of rapidly falling growth and headline inflation, amidst the poor transmission of expansionary monetary impulses through credit markets.

It is interesting to note that energy and raw material prices, whose extreme surge initially posed a major challenge for monetary policy in containing inflation expectations, also in most recent months, due to their even more abrupt collapse, again probe central banks' ability to guide expectations.

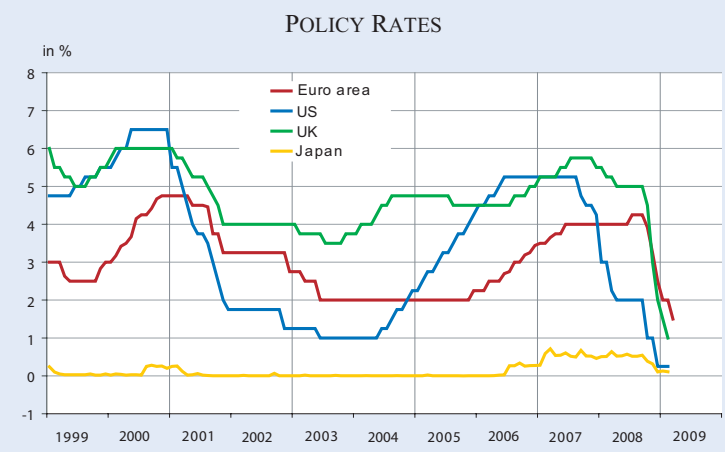
Table 1

Evolution of GDP and inflation forecasts over time

	GDP				Inflation			
	2007	2008	2009	2010	2007	2008	2009	2010
06.2007	2.7	2.3			2.0	2.0		
07.2007	2.7	2.3			2.0	2.0		
08.2007	2.7	2.3			2.0	2.0		
09.2007	2.6	2.2			2.0	2.0		
10.2007	2.6	2.0			2.0	2.0		
11.2007	2.6	2.0			2.0	2.1		
12.2007	2.6	1.9			2.1	2.3		
01.2008	2.6	1.8	2.0		2.1	2.4	1.9	
02.2008	2.6	1.6	1.9		2.1	2.5	2.0	
03.2008		1.5	1.8			2.7	2.0	
04.2008		1.5	1.7			2.9	2.1	
05.2008		1.5	1.6			3.1	2.1	
06.2008		1.7	1.4			3.3	2.3	
07.2008		1.6	1.2			3.6	2.4	
08.2008		1.5	1.1			3.6	2.5	
09.2008		1.3	0.9			3.5	2.4	
10.2008		1.2	0.5			3.4	2.2	
11.2008		1.0	-0.2			3.4	1.8	
12.2008		1.0	-0.9			3.3	1.4	
01.2009		0.9	-1.4	0.8		3.3	1.0	1.7
02.2009		0.8	-2.0	0.7		3.3	0.8	1.6

Source: Consensus Economics Inc.

Figure 2



Source: Thomson Reuters.

Anti-inflation measures by governments: Addressing "causes" and "symptoms"

The public discussion about policy measures against the inflationary impact of commodity price increases focused on energy and food prices, since these two items are directly included in the consumer price basket and make up a substantial part of the basket. By contrast, other commodity prices, such as various ores or steel, attracted much less attention, despite equally large price movements. Measures taken by governments may be categorized along various (overlapping) dimensions:

- *"market-based"* (e.g. enhancing competition, abolition of previous supply restrictions etc.) versus *"interventionist"* (e.g. price regulation, tax reductions aimed at compensating for market price increases) measures;
- measures influencing the *causes* of price developments (e.g. energy supply and consumption, market malfunctioning) versus measures ameliorating their *consequences* (e.g. income subsidies, tax relief measures for certain sectors of the economy, freezing of public fees and administrative prices);
- measures aiming to influence *supply, demand,* or the *functioning of the market* in a certain product;
- measures targeted to bring *immediate relief* versus *long-term solutions.*

In the European Union, all of the above approaches were pursued in parallel, with both the Community and individual Member States playing active roles. The general thrust of the EU's reply to high energy prices was in principle to allow the increase in the relative price of energy and energy intensive products to show its effect in terms of a reallocation of resources. The need for efficient market adjustment was taken as yet another rationale for the Lisbon Agenda to be implemented vigorously. The energy price boom was also seen as yet another motivation to rapidly adopt measures to increase energy efficiency, which had been part of EU packages against climate change. Concrete measures at the EU level focused on, *first*, facilitating investment by households and industry in energy efficiency and use of renewable energy sources and a more environment-friendly use of fossil fuels, thus curbing energy demand and reducing energy dependency; *second*, improving the functioning of energy markets, with the aim of improving market matching and curbing profit margins in the energy sector; third, stabilizing energy supply (through diversification among suppliers and energy transport routes) and making supply more responsive to energy demand, *inter alia* by promoting investment in exploration, production, refining capacity and alternative energy sources. The role of international "energy diplomacy" received prominence during the "gas crisis" (non-delivery of gas by Russia for two weeks) following a dispute between Russia and Ukraine in January 2009 (see Council of the European Communities 2008; European Commission 2008a; Euractiv 2009a and 2009b).

Regarding food prices, immediate responses at the EU level aimed, *first*, at increasing supply by reducing or abandoning supply restrictions emanating from the Common Agricultural Policy. The measures included in particular the sale of intervention stocks, the reduction of export refunds, the removal of the set-aside requirements for 2008, the increase in milk quotas, and the suspension of import duties on cereals. *Second*, market functioning was envisaged to be enhanced by a closer monitoring of competition in the retail sector by the European Commission. *Third*, regarding the demand for agricultural products, the role of first-generation bio-fuels was reconsidered, with future emphasis being shifted to second-generation bio-fuels made from by-products. *Finally*, jointly with other international organisations, measures were taken to alleviate the humani-

tarian consequences of high food prices and to foster food production in developing countries (see Council of the European Union 2008; European Commission 2008b).

Measures of individual EU Member States were in principle embedded in a general understanding that measures could be considered to alleviate the impact of higher oil, gas and food prices on the poorer strata of the population but that they should remain temporary and targeted. *"Distortionary fiscal and other policy interventions should be avoided as they prevent the necessary adjustment by economic agents"* (Council of the European Union 2008). More specifically, it was stated that support for the poor should be designed in a way as not to delay necessary structural adjustments towards reduced energy consumption. Income compensation should therefore be disconnected from energy consumption; direct income transfers should e.g. be preferred over fuel vouchers. Similarly, oil-related taxes should not be reduced, since this would send misleading signals to energy producers and markets that the public purse would offset higher energy prices. Competition in the oil producing, processing and distribution industry should be enhanced. Taxes and subsidies as well as R&D policies should be geared towards a more efficient use of energy and the exploration and use of renewable sources of energy (see European Commission 2008a; Brook et al 2004; IMF 2008a).

In practice, EU Member States took a broad range of measures aimed at absorbing some of the negative income impact on (particularly but not exclusively poorer) households, and to help specific economic sectors. It is not possible to give a detailed account of the various measures in individual EU countries here. A rough overview, however, yields the following picture. Several countries reduced excise duties or VAT on energy or food. Almost all countries adopted measures to support vulnerable households. Several Member States adopted measures to help specific sectors. Only a small minority of countries seem to have taken no measures at all. So, in sum, the conclusion is that the "strict" principles outlined above were not fully adhered to in practice. Measures at the national level had a focus on supporting household income, be it through tax reductions or by means of various forms of income subsidies. Admittedly, some of the measures marketed under the label of "anti-inflation packages" may have had different motivations. Still, the fact that most member countries found it necessary and appropriate to take steps against the consequences of higher inflation illustrates how serious the inflation threat was considered at the time the measures were taken.

Conclusions: Using the crisis as a motivation for longer-term reforms

The commodity and energy price boom between 2007 and 2008 represented a major supply cost shock to the world economy (which may, in turn, as has been argued here, have been the endogenous result of a global demand bubble). The resulting strong increase in inflation rates prompted central banks to tighten monetary policies, given the risk of a de-anchoring of inflation expectations and second-round effects. Governments took multiple measures, both of a structural nature in order to rebalance supply and demand for commodities and to improve the functioning of commodity markets, and measures aiming to alleviate short-term adjustment problems for people or sectors affected most.

The unexpectedly large and rapid global economic downturn since autumn 2008 has sharply altered policy priorities. Commodity prices collapsed even faster than they had previously risen, bringing headline inflation to very low levels, with the prospect of – temporarily – negative headline inflation rates in many countries around mid-2009. Central banks worldwide have responded with unprecedented cuts in official rates, accompanied by "non-standard" measures aimed at countering credit constraints and mounting risk premiums.

Governments responded with large banking support and economic stimulus packages. Interestingly, many of the previous government measures aimed at countering the surge in food and energy prices or alleviating their consequences, now – more by chance than by design – turn out to fit also in the current global recession. Both the demand-side measures such as income subsidies for the poor and specific sectors most affected by the price surges, and the supply-side oriented measures involving public and private investments in energy conservation and the development of alternative sources of energy now turn out to form useful elements of larger expansionary fiscal programs. As a result, governments did not have to rescind any of these measures but rather can build on them now.

The positive supply shock from falling commodity and energy prices, while in principle favourable in the current economic situation, may be less beneficial than the previous price increase had been detrimental, since the effects from oil price shocks are not symmetrical for price increases and decreases. Well-known reasons include *"adjustment costs associated with sectoral reallocations, the implications of uncertainties for spending on consumer durables and investment, and nominal wage rigidities"* (see Schneider 2004). In addition, in the current situation of a sharp drop in aggregate demand and confidence, the expansionary effect on both production and income from lower prices may affect spending behaviour less than under normal circumstances. Moreover, the commodity and energy price-induced sharp decline of inflation may trigger perceptions of deflation, with various negative connotations attached. It will be important for central banks to explain the sources of the sharp decline in inflation as being primarily driven by energy costs and less by output gaps.

What lessons can be learnt? *First*, in a globalised economy, the usual distinction between supply shocks and demand phenomena may become blurred. As a result, standard textbook policy prescriptions may become inadequate. *Second*, global phenomena such as commodity price bubbles may need global policy responses. *Third*, if bubble phenomena also extend to commodity markets, monetary policy may in the future also need to pay closer attention to emerging imbalances in these markets; at the same time, much the same as for asset price bubbles, the limitations of what monetary policy can achieve should be borne in mind. *Fourth*, if – despite the evidence so far – the financialization of commodities markets were to be found to contribute to overshooting and volatility of prices, appropriate regulatory frameworks might be called for. *Fifth*, it is not so much high commodity prices as their excessive volatility which causes problems. Also, the recent sharp decline adds to global macroeconomic uncertainty and may destabilize expectations.

The current economic crisis should be taken as an opportunity to look beyond immediate emergency financial sector and economic stimulus packages: public expenditure programs and tax cuts should be embedded in a longer-term strategy that addresses structural issues including increasing energy efficiency and cutting carbon emissions (see e.g. the European Commission's Second Strategic Energy Review – European Commission 2008c). The currently rather low energy prices cannot be taken for granted over the medium and long run. It is wise to invest now into reducing Europe's dependency on oil and gas, as a short-term spending measure, as a medium-term measure to reduce macroeconomic volatility, and as a long-term measure to enhance sustainability.

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Econometric Models for Oil Price Forecasting: A Critical Survey

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Introduction

In the last two years the price of oil and its fluctuations have reached levels never recorded in the history of international oil markets. In 2007, the West Texas Intermediate (WTI) oil price, one of the most important benchmarks for crude oil prices, averaged around 72 $/b, while in 2008 the WTI price was around 100 $/b, with an increase of nearly 38 percent over the previous year. Within the past six months, WTI daily spot prices ranged from almost 150 $/b in early July to about 30 $/b towards the end of 2008.

The determinants of past, current, and future levels of the price of oil and its fluctuations have been the subject of analysis by academics and energy experts, given the relevance of crude oil in the worldwide economy. Although the share of liquid fuels in marketed world energy consumption is expected to decline from 37 percent in 2005 to 33 percent in 2030, and projected high oil prices will induce many consumers to switch from liquid fuels when feasible, oil will remain the most important source of energy, and liquid fuel consumption is expected to increase at an average annual rate of 1.2 percent from 2005 to 2030 (EIA 2008).

The crucial question of whether oil prices will rise in the future or will decline again is timely. According to EIA (2009), for example, under current economic and world crude oil supply assumptions, WTI prices are expected to average 43 $/b in 2009 and 55 $/b in 2010. The possibility of a milder recession or a faster economic recovery, lower non-OPEC production in response to current low oil prices and financial market constraints, and more aggressive action to lower production by OPEC countries could result in a faster and stronger recovery in oil prices. Consequently, it is extremely important for economists to provide accurate answers to the complex problem of forecasting oil prices.

This study aims at investigating the existing econometric literature on forecasting oil prices. In particular, we (i) develop a taxonomy of econometric models for oil price forecasting; (ii) provide a critical interpretation of the different methodologies; and (iii) offer a comprehensive interpretation and justification of the heterogeneous empirical findings in published oil price forecasts. The paper is structured as follows: we first introduce the historical framework which is necessary to understand oil price dynamics. The following section discusses and critically evaluates the different econometric models for oil price forecasting proposed in the literature. Finally we comment on alternative criteria for evaluating and comparing different forecasting models for oil prices.

International oil markets: A historical framework

The history of oil consumption and prices goes back to the second half of the 19th century. The introduction of oil distillation in 1853 gave rise to the use of kerosene for home lighting. Not until the end of the century did oil gain a much more relevant role, due to its use for the generation of electricity. At that time, the United States was the principal consumer and its North-Eastern region was the main source of

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oil supply. The increasing consumption and the subsequent depletion of US North-Eastern reserves soon caused oil prices to rise, and Standard Oil, the oil company with a monopoly position at that time, was not able to control them. By the beginning of the 20th century, oil production was extended to Texas, generating over-supply and price reductions. In the meanwhile, oil consumption spread to Europe and oil reserves were also discovered in Iraq and Saudi Arabia, but the United States still remained the main consumer and maintained its dominance over the world oil market.

One of the major economic agents in the world oil market in that period was the Texas Railroad Commission (TRC) that was founded in 1891 as a regulatory agency aimed at preventing discrimination in railroad charges, later also controlled petroleum production, natural gas utilities as well as motor carriers. Given its dominant position in the US market, TRC was able to set oil prices by effectively fixing production quotas, at least until the formation of the Organization of Petroleum Exporting Countries (OPEC). The other major actors in the world oil markets were the so-called "seven sisters", five of which were American companies (Standard Oil of New Jersey (Esso), Standard Oil of California (Chevron), Standard Oil of New York (Mobil), Gulf Oil and TEXACO), together with Royal Dutch Shell and the Anglo Persian Oil Company (BP). The seven sisters started to operate after the break-up of Standard Oil by the US government. Their fairly complete monopoly and ability to work as a cartel allowed them to take control over oil prices for about fifty years.

World War II definitely marked the predominance of oil as an energy source. The excess of oil due to the cooperation between the United States and Saudi Arabia offered America and its allies a privileged access to this crucial resource. During the 1950s, new oil reserves were discovered in the Middle East, and new producers entered the market, making it difficult to limit oil production for the sake of controlling oil prices. In 1960 the Middle Eastern countries formed the OPEC, a cartel meant to avoid competition among its members and to prevent unsought price reductions. In 1970, for the first time, the growing US economy was not able to feed its increasing need of oil from domestic sources and became an importing country. The effects of this dependency became visible very soon after the Yom Kippur War in 1973, when the United States and many other Western countries supported Israel, catalyzing the reaction of the Arab exporting countries which declared an embargo. As a result, within six months the price of oil increased by 400 percent. Since 1973, the stability of oil prices has vanished, starting a period of large price fluctuations.

A second phase of uncertainty affected world oil prices in 1979 and 1980, when the Iranian Revolution and the Iraq-Iran War pushed oil prices to double. This period also revealed the inability of OPEC to act as a cartel. Saudi Arabia's warning that high prices would reduce consumption remained unheeded and prices kept on rising, while oil demand decreased. Furthermore, non-OPEC countries, attracted by the possibility of large gains at the high price level, increased their oil production and, consequently, helped match oil supply and demand. Later, between 1982 and 1985, OPEC policy was devoted to stabilize prices by setting production quotas below their previous levels. Unfortunately, this strategy was often hampered by the behaviour of some members, that kept on producing above their quotas. During this period, Saudi Arabia played the "swing producer" role, adjusting its production to demand in order to prevent price falls until 1986. Yet, burdened by this role, this country changed its strategy thereafter and increased its oil production, causing an abrupt price decrease.

Prices kept on falling until the Gulf War of 1990. The invasion of Kuwait in this year created a sudden price reversal, which was only normalized after 1993, when Kuwaiti exports outran their pre-war levels. In the early 1990s oil consumption started to rise again, aided by the growth of the Asian economies. The increasing rate of production by OPEC to meet the demand was then the origin of the drastic price reduction that occurred between 1997 and 1998, when the Asian growth slowed due to the financial and economic crises, and OPEC was faced by a massive oversupply at the same time. In 1999 the prices rose again, supported by the OPEC's strategy of reducing quotas, which was successful in spite of the increase in non-OPEC production, at least until the terrorist attack of September 11, 2001. During the years between 2002 and 2005, the majority of oil producer countries continued to adopt the policy of fixing low production quotas. This strategy, together with the inadequate response of non-OPEC countries to the increase in the oil demand, led to an increase in oil prices, which have kept on rising until

the second half of 2008, when the monthly average price of WTI fell from 133 $/b in July 2008 to 41 $/b in December 2008 and January 2009.

Econometric models for oil price forecasting

In the existing empirical literature on oil price forecasting one can distinguish among three categories of econometric models:

- time series models exploiting the statistical properties of the data, namely autocorrelation and non-stationarity;
- financial models based on the relationship between spot and future prices; and
- structural models describing how specific economic factors and the behaviour of economic agents affect the future values of oil prices.

The following subsections will illustrate the main features of each class of econometric models for oil price forecasting, as well as the most relevant contributions which can be classified according to our proposed taxonomy.

(a) Time series models

Time series models aim at predicting future oil prices by exploiting relevant characteristics of historical data. In this respect, a wide range of models have been proposed which can be divided into three main groups, depending on their assumptions about the data-generation process: martingale sequences, autoregressive models and mean-reverting specifications. Given their simplicity, time series models have often been used as a benchmark for the forecasting performance of financial and structural models. In particular, the random walk model (a particular case of martingale sequence) is generally used to assess whether more complex and expensive models are indeed justified by an improvement in their forecasting performance.

A martingale sequence for the oil spot price S is a stochastic process such that the expected value of S at time t+1 conditional on all available information I up to time t is equal to the actual value of the oil spot price at time t:

(1)

$$E(S_{t+1} \mid I(t)) = S_t$$

Its applications in finance go back to the introduction of the "efficient market hypothesis (EMH)", often credited to Fama (1965), which states that, in the presence of complete information and a large number of rational agents, actual prices reflect all available information and expectations for the future. In other words, current prices are the best predictor of tomorrow's prices. A widely used form of the martingale process is the random walk specification:

(2)

$$S_{t+1} = S_t + \varepsilon_t$$

where ε_t is an uncorrelated error term with zero mean and constant variance. According to this model, prices deviate from their current level only because of casual fluctuations. The random walk with drift represents a simple extension of this formula, which introduces a linear trend in the data generation process:

(3)

$$S_{t+1} = \delta + S_t + \varepsilon_t$$

In this case prices are assumed to constantly increase (decrease) from their previous level, except for stochastic deviations.

Oil prices can follow an autoregressive (AR) process:

(4)

$$S_t = \phi_1 S_{t-1} + \ldots + \phi_q S_{t-p} + \varepsilon_t = \phi_p(L) S_t + \varepsilon_t$$

where p is the order of the AR(p) process, $\phi_p(L)$ is the polynomial in the lag operator L of order p, and ε_t is a white noise error term. Notice that this process can either be explosive or stable depending on whether the roots of the characteristic equation associated with $\phi_p(z) = 0$ are outside or inside the unit circle. In the case of autoregressive processes, prices are not driven by random fluctuations, instead they are predictable from their history.

Oil prices can also be driven by a mean reverting process. This assumption comes from the evidence that prices in financial markets tend to go back to their average level after a shock. According to this approach, prices can neither be explained by the ran-

dom walk assumption nor simply inferred from their past values. Given a long-run equilibrium level S^*_t of the oil spot price and a mean reversion rate α, mean reverting models can be described as:

(5)
$$S_{t+1} - S_t = \alpha(S_t^* - S_t) + \varepsilon_t$$

According to equation (5), future price variations depend on the disparity between actual and long-run price levels, where the latter can be specified to be a function of a set of exogenous variables.

More generally, error correction models (ECM) are designed to capture movements towards an equilibrium level. Given two variables, X and Y, and an equilibrium level between the two variables, $Y=\alpha X$, variable Y tends to adjust to deviations from this equilibrium according to the following scheme:

(6)
$$Y_t = \alpha + \lambda_1(Y_{t-1} - \alpha X_{t-1}) + \varepsilon_t$$

where $Y_t^* = \hat{\alpha} X_t$ is the estimated equilibrium value for Y (see e.g. Engle and Granger 1987; Stock and Watson 1993).

In the empirical literature on oil price modelling and forecasting, several contributions provide empirical evidence that is supportive of the EMH. For instance, Morana (2001) notices that, during the period between January 4, 1982 and January 21, 1999, oil prices appeared to be characterized by a stochastic trend and exhibited alternating periods of high and low volatility. Since these features can be a symptom of underlying dependencies in the behaviour of oil prices, Morana (2001) suggests to use a martingale process to describe oil price dynamics. The reliability of a random walk model is also assessed by Chernenko et al. (2004) with an application to the crude oil future market.

Abosedra (2005) observes that the behaviour of the WTI spot price, S, during the period from January 1991 to December 2001 can be approximated by a random walk process with no drift. Consequently, the author proposes to forecast the one-month-ahead price of crude oil for every day using the previous trading day's spot price and to use the monthly average of these daily forecasts to obtain a monthly predictor of the future oil price X. To assess the statistical properties of this univariate forecast, the author suggests estimating the following relationship:

(7)
$$S_t = \alpha + \beta X_{t-1} + \varepsilon_t$$

and to test the null hypothesis $\alpha = 0$ and $\beta = 1$, that is to test for the unbiasedness of X. However, since cointegration between S and X can lead to biased estimates of α and β in equation (7), the author follows Phillips and Loretan (1991) and suggests a nonlinear estimation of and α and β:

(8)
$$S_t = \alpha + \beta X_{t-1} + \sum_{i=1}^{n} \rho_i (S_{t-1} - \alpha - \beta X_{t-i-1}) + \sum_{j=-m}^{m} \phi_j \Delta X_{t-j} + \varepsilon_t$$

Both single and joint tests of the null hypotheses $\alpha = 0$ and $\beta = 1$, suggest that X is an unbiased predictor for future oil prices. Furthermore, the absence of autocorrelation in the residuals confirms the efficiency of the proposed forecast method.

The empirical evidence on autoregressive specifications is much more controversial. Bopp and Lady (1991) use an autoregressive specification to describe monthly heating oil prices from the New York Mercantile Exchange (NYMEX). Their analysis covers the period between December 1980 and October 1988, and confirms the good performance of the autoregressive model. An autoregressive representation is used by Lalonde et al. (2003) to analyze the behaviour of WTI crude oil prices. The authors show that this model has a very poor forecasting ability. Ye et al. (2005) verify the performance of an autoregressive specification with seasonal effects in predicting monthly oil prices in the period from January 2000 to January 2003. Their model takes into account the consequences of the reduction of OPEC production from 1999, using a leverage variable and a dummy variable capturing the effects of the twin towers terrorist attack, of which impact is supposed to extend from October 2001 to March 2002:

(9)
$$S_t = \alpha + \beta_1 S_{t-1} + \beta_2 S_{t-12} + \sum_{j=0}^{5} \gamma_j D01_j + S99 + \varepsilon_t$$

A dynamic forecasting exercise shows the poor performance of this model, which is not able to capture oil price variations.

Pindyck (1999) analyzes the stochastic dynamics of crude oil, coal and natural gas prices using a large data set covering 127 years, and tries to assess whether time series models are helpful in forecasting long horizons. The analysis ranges from 1870 to 1996, considering nominal oil prices deflated by wholesale prices *(p)* (expressed in 1967 USD). The author proposes a model which accounts for fluctuations in both the level and the slope of a deterministic time trend:

(10)

$$\begin{cases} p_t = \rho p_{t-1} + \beta_1 + \beta_2 t + \beta_3 t^2 + \phi_{1t} + \phi_{2t} t + \varepsilon_t \\ \phi_{1t} = \alpha_1 \phi_{1,t-1} + \upsilon_{1t} \\ \phi_{2t} = \alpha_2 \phi_{2,t-1} + \upsilon_{2t} \end{cases}$$

where ϕ_{1t} and ϕ_{2t} are unobservable state variables. Assuming normally distributed and uncorrelated error terms, Pindyck computes a Kalman filter to estimate model (10). This procedure is a recursive estimate that calculates parameters via Maximum Likelihood, along with optimal estimates of the state variables. The initial values are usually estimated using OLS and assuming that the state variables are constant parameters. The author concentrates on three sub-samples (1870–1970, 1970–1980, 1870–1981) and the full dataset to compare the forecasting ability of the proposed model with respect to a model with mean reversion to a deterministic linear trend:

(11)

$$p_t = \rho p_{t-1} + \beta_1 + \beta_2 t + \varepsilon_t$$

Results show that the deterministic trend model performs better in forecasting oil prices. Nevertheless equation (10) provides a more accurate explanation of oil prices fluctuations.

Radchenko (2005) proposes a univariate shifting-trends model for the long-term forecasting of energy prices:

(12)

$$\begin{cases} p_t = \alpha p_{t-1} + \beta_1 + \phi_{1,t} + \phi_{2,t} t + \varepsilon_t \\ \phi_{1t} = \gamma_1 \phi_{1,t-1} + \mu_{1,t} \\ \phi_{2t} = \gamma_2 \phi_{2,t-1} + \mu_{2,t} \\ \varepsilon_t = \psi \varepsilon_{t-1} + \upsilon_t \end{cases}$$

which is a modified version of Pindyck (1999), where the error term ε is assumed to be an autocorrelated process, rather than a simple white noise. In particular, the author exploits the same dataset used by Pindyck (1999) and considers four different forecasting horizons: 1986–2011, 1981–2011, 1976–2011, 1971–2011. Radchenko (2005) suggests embedding equation (12) into a Bayesian framework and obtains results similar to Pindyck (1999), except for the autoregressive parameters α, γ_1 and γ_2 which appear less persistent. However, the author notices that forecasts from shifting-trend models cannot account for OPEC cooperation, thus predicting unreasonable oil price declines. As a solution, he suggests combining model (12) with an autoregressive model and a random walk model, which can be considered a proxy for future cooperation. Results confirm that forecasts can be improved by a combination of different models.

A comprehensive comparison of the different time-series models proposed is offered by Zeng and Swanson (1998), who analyze four futures markets – gold, crude oil, Treasury bonds and S&P500. The authors compare the performance of a random walk specification with an autoregressive model and an error correction model, where the deviation from the equilibrium level *(ECT)* is assumed to be equal to the difference between the future price for tomorrow and the futures for today's price, which is generally called the price spread:

(13)

$$F_t = \alpha + \beta_1 ECT_{t-1} + \sum_{i=1}^{n} \rho_i (F_{t-i}) + \varepsilon_t$$

Daily data from April 1, 1990 to October 31, 1995, with a rolling out-of-sample forecast over the period between April 1, 1991 and October 31, 1995, shows that ECM are preferable when short forecast horizons are considered.

Prices may revert to a non-constant and uncertain value, which can evolve stochastically through time. Factor models are the direct translation of this assumption, as they are meant to infer from the data the nature of the stochastic unobservable factors that drive a given phenomenon. Schwartz and Smith (2000) provide an interesting example of a factor model, where the spot price of a general commodity is decomposed into two factors, one capturing the equilibrium value (χ_t), the other the short-run depar-

tures from equilibrium (ξ_t). The short-run component ξ_t is assumed to follow an Ornstein-Uhlenbeck process reverting to a zero mean:

(14)

$$d\xi_t = -k\xi_t d_t + \sigma_\xi dz_\xi$$

while the long-run level χ_t is modelled according to a Brownian motion:

(15)

$$d\chi_t = \mu_\chi d_t + \sigma_\chi dz_\chi$$

with dz_ξ and dz_χ indicating the correlated increments of standard Brownian motion processes. Clearly, the Ornstein-Uhlenbeck process and the Brownian motion represent the extension in continuous time of the mean reverting process and the random walk process, respectively. Model shown in equations (14) and (15) can be generalized by including another stochastic factor, as the three factors model proposed by Schwartz (1997), where a stochastic interest rate is added as the determinant of spot prices and it is modelled as a mean-reverting process.

(b) Financial models

The relationship between spot (S) and futures (F) prices can be represented as:

(16)

$$F(t,T) = S(t)e^{r(T-t)}$$

where $F(t,T)$ is the futures price at time t for maturity T, r is the interest rate, $S(t)$ is the asset price at time t. The underlying assumption is that it is possible to replicate the payoff from a forward sale of an asset by borrowing money, purchasing the asset, "carrying" the asset until maturity and then selling the asset. This kind of arbitrage is known as the "cost-of-carry arbitrage". Referring to commodities (e.g. oil), relationship shown in equation (16) is no longer valid, unless it is modified to include the costs of storage (w):

(17)

$$F(t,T) = S(t)e^{(r+w)(T-t)}$$

However, the activity of storing oil can provide some benefits, which are generally indicated with the term "convenience yield" (δ). Consequently, in the commodities market, the future-spot relationship becomes:

(18)

$$F(t,T) = S(t)e^{(r+w-\delta)(T-t)}$$

From equation (18) the market can be either in *contango* (future price exceeds spot price) or in backwardation (spot price exceeds future price), according to the relative size of w and δ.

Financial econometric models generally assume that futures and forward prices can be unbiased predictors for the future values of the spot price:

(19)

$$F_t = E(S_{t+1})$$

In order to test for unbiasedness, the following model can be specified:

(20)

$$S_{t+1} = \beta_0 + \beta_1 F_t + \varepsilon_{t+1}$$

In equation (20), F_t is an unbiased predictor of S_{t+1} if the joint hypothesis $\beta_0 = 0$ and $\beta_1 = 1$ is not rejected *(unbiasedness hypothesis)*, and it is also an efficient predictor if no autocorrelation is found in the error terms *(efficiency hypothesis)*. It is worth noticing that a violation of the unbiasedness hypothesis is generally interpreted as the presence of a risk premium.

Fama and French (1987) propose a detailed comparison between storage costs and risk premia applied to commodity markets. Although their study does not include crude oil prices, it clearly shows that empirical evidence in favour of storage costs is easier to detect than the existence of risk premia. Following this seminal paper, a significant part of the empirical literature has focused on risk premium models, although the findings on the existence of a risk premium are mixed. An attempt to model the cost of storage relationship has been proposed by Bopp and Lady (1991), who include in the regression a proxy which measures the number of months until expiration of the contracts corresponding to the futures price. Using monthly data on NYMEX heating oil from December 1980 to

October 1988, they confirm the statistical adequacy of this relationship. However, they also propose a simple random walk specification and a regression model of spot prices on futures prices, which seem to perform equally well. Samii (1992) estimates the WTI futures oil price (three and six months) as a function of the WTI spot price and an interest rate, using daily data for the years 1991–1992 and monthly data over the period 1984–1992. In particular, the author shows that oil storage should influence spot prices in the intermediate run, while in the long run prices should be led by a premium. Unfortunately, Samii (1992) does not find any robust evidence for either of the two hypotheses of cost storage and risk premium. The conclusion is that the interest rate does not play a relevant role, whereas spot and futures prices are highly correlated, although it is not possible to identify the causal direction of the relationship between spot and futures prices.

Gulen (1998) extends model shown in equation (20) by incorporating the effects of posted price *(C)*, i.e. the price at which oil is actually bought or sold by an oil company. The author proposes posted prices as an alternative predictor to futures prices and states that, if futures prices are the best predictor, then posted prices should have no explanatory power in the following regression model:

(21)

$$S_{t+1} = \beta_0 + \beta_1 F_t + \beta_2 C_t + \varepsilon_{t+1}$$

Gulen (1998) analyzes monthly data of WTI spot and futures prices for one-, three- and six-month ahead, computed as a simple mean of daily data and covering the period between March 1983 and October 1995. He shows that futures prices outperform the posted price and that futures prices are an efficient predictor of spot prices. However, the posted price seems to have a predictive content, although limited to the short run.

Zeng and Swanson (1998) use an ECM to forecast oil prices over the period 1991–1995. The specification of the long-run equilibrium refers to the cost-of-storage approach specified in equation (18), as the ECT is defined as:

(22)

$$ECT_{t-1} = F_{t-1} - e^{(r+\omega-\delta)cl} S_{t-1}$$

where cl denotes the number of days for the delivery cycle. As described in the previous section, Zeng and Swanson (1998) estimate also a random walk, an autoregressive model and an ECM, where the ECT is given by the price spread. The empirical evidence is supportive of the ECM. Chernenko et al. (2004) focus on the spreads between spot price and futures as well as forward prices by estimating the following modification of model (20):

(23)

$$S_t - S_{T-t} = \beta_0 + \beta_1 (F_{t|T-t} - S_{T-t}) + \varepsilon_t$$

In particular, the authors' strategy is to test for the absence of risk premia and, if the null is rejected, to investigate whether risk premia are time-varying or constant by testing for $\beta_1 = 1$. Results show that futures and forward prices do not generally outperform the random walk model and cannot be considered as rational expectations for the spot price. Furthermore, when the oil market is analyzed, risk premium does not seem to be a relevant factor, while the empirical performance of futures prices is very close to the random walk specification.

Chin et al. (2005) examine how accurate futures prices are in forecasting spot prices. They analyze the relationship between three-, six- and twelve-month ahead futures prices and the current spot price for crude oil (WTI), gasoline (Gulf Coast), heating oil (No.2 Gulf Coast) and natural gas (Henry Hub). Assuming that the spot price follows a random walk with drift and rational expectations, the authors estimate a logarithmic version of equation (23) with OLS and robust standard errors. For the period from January 1999 to October 2004, the authors show that futures prices at different maturities are unbiased predictors of spot oil prices, and they find empirical evidence in favour of the efficient market hypothesis.

The two hypotheses of storage costs and risk premium are tested by Green and Mork (1991) for the oil market during the period 1978–1985. They concentrate on Mideast Light and African Light/North Sea monthly prices using Generalized Method of Moments (GMM) estimates. The most interesting result is that in the years 1978–1985 there is no evidence of unbiasedness/efficiency, while the subperiod 1981–1985 seems to support the hypothesis of efficiency in the oil financial market. Serletis (1991) analyzes daily spot and futures prices of NYMEX

heating oil and crude oil over the period between July 1, 1983 and August 31, 1988, as well as daily spot and futures prices of unleaded gasoline over the period between March 14, 1985 and August 31, 1988. The aim of his contribution is to measure the forecast information contained in futures prices and the time-varying risk premium. The empirical findings suggest that variations in the premium worsen the forecasting performance of futures prices.

Moosa and Al-Loughani (1994) use monthly data from January 1986 to July 1990 on WTI spot, three- and six-month futures prices to test unbiasedness and efficiency. Given the presence of cointegration between spot and futures prices, they extend equation (20) in an error correction form:

(24)

$$\Delta S_{t+1} = \alpha_0 + \alpha_1(S_t - \beta_1 F_{t-1}) + \alpha_2 \Delta F_{t-1} + \sum_{i=1}^{n} \gamma_i \Delta S_{t-i} + \sum_{i=1}^{n} \delta_i \Delta F_{t-j} + \varepsilon_t$$

In this case, unbiasedness corresponds to the null hypothesis $\alpha_0 = 0$, $\alpha_1 = -1$, $\alpha_2 = 1$, $\gamma_i = \delta_i = 0$, $\forall i$. Results show that futures prices are neither unbiased nor efficient. Assuming rational expectations and using a GARCH-in-mean specification to take into account non-constant volatility, the authors analyze the structure of the risk premium, which turns out to be time-varying.

Morana (2001) shows that one-month ahead forward prices are a poor predictor of futures spot prices, since in more than 50 percent of the cases they fail to predict the sign of oil price changes. The author compares the forecasting ability of the Brent forward price with the accuracy of a simple random walk model, using daily data from November 2, 1982 to January 21, 1999 and considering a long forecasting horizon (May 2, 1985–January 21, 1999) and a short forecasting period (November 21, 1988–January 21, 1999). The decomposition of the mean squared forecast error (MSFE) and the sign tests show that forecasting with forward prices or with a random walk does not yield significantly different results. Specifically, over a short time horizon both methods are biased, while, when a longer time period is considered, they do produce unbiased forecasts, although their performance resembles that of a random guess. Nevertheless, Morana (2001) points out that an appropriate use of forward prices can be promising, as they are reliable predictors when oil price volatility is small. Following Barone-Adesi et al. (1998) and Efron (1979), the author uses bootstrap methods to approximate the oil price density function, which is characterized by time-varying volatility. The resulting confidence intervals for oil price forecasts confirm that forecasting with forward prices future values of the price of oil is less reliable, as the confidence intervals tend to widen as volatility increases. Cortazar and Schwartz (2003) use a three factor model to explain the relationship between spot and futures prices. Daily data from the NYMEX over the period 1991–2001 confirm the accuracy of the model. The authors propose a minimization procedure as an alternative to the standard Kalman filter approach, which seems to produce more reliable results.

Another interesting evaluation of financial models is carried out by Abosedra (2005), who compares the performance of futures prices *(F)* with a simple univariate forecast *(X)*. As already mentioned, Abosedra (2005) assumes a random walk process with no drift for spot crude oil prices *(S)*, and suggests using the previous trading day spot price to forecast the one-month ahead price of crude oil for every trading day. The monthly forecast is set equal to the simple average of the daily forecasts. Using the approach described in the section related to time series models, the author establishes that the forward price and the simple univariate forecast are unbiased and efficient predictors for the future value of the spot price of oil. A more formal comparison of the two predictors is based on testing whether the forecast error related to each forecast can be improved by the information contained in the other forecast. This comparison corresponds to a test of the null hypothesis $\alpha_1 = 0$ and $\beta_1 = 0$, $i = 1,...,$ n, in models:

(25)

$$S_T - F_{T-1} = \alpha_0 + \sum_{i=1}^{n} \alpha_i (S_{T-i} - X_{T-i-1}) + \varepsilon_t$$

(26)

$$S_T - X_{T-1} = \beta_0 + \sum_{i=1}^{n} \beta_i (S_{T-i} - F_{T-i-1}) + \varepsilon_t$$

Results show that futures prices can reduce the univariate forecast error, while the converse is not true.

These findings lead to conclude that futures prices are semi-strongly efficient.

Murat and Tokat (2009) analyze the relationship between crude oil prices and the crack spread futures. In the oil industry the crack spread is defined as the difference between the price of crude oil and the price of its products. In other words, the crack spread represents the profit margin that can be obtained from the oil refining process. An ECM is specified to assess the direction of the causal relationship between crude oil price and crack spread, as well as to predict the price of oil from the crack spread futures, using weekly data from the NYMEX over the period from January 2000 to February 2008. The empirical evidence suggests that the crack spread helps to predict oil prices. When its performance is compared with a random walk model and a regression of the spot price on futures oil prices, the authors find out that both crack spread and crude oil futures are preferable to the random walk specification, although futures prices are slightly more accurate than the crack spread futures.

(c) Structural models

Structural models relate the oil price behaviour to a set of fundamental economic variables. The variables that are typically used as the economic drivers of the spot price of oil can be grouped into two main categories: variables that describe the role played by OPEC in the international oil market, and variables that measure current and future physical oil availability. In this context researchers have generally considered measures of OPEC behaviour, such as production quotas, overproduction, capacity utilisation and spare capacity. It is well known that OPEC periodically establishes the quantity of oil to be produced by its members *(OQ)* in order to pursue oil market stability. It is also well acknowledged that, on several occasions, some OPEC countries have decided to produce more than their fixed production quotas. This overproduction *(OV)* is computed as the difference between OPEC production *(OP)* and quotas. Another relevant factor is production capacity. This variable is introduced in structural models in two different ways. On the one hand, some authors have used capacity utilization *(CU)*, computed as 100 times the ratio between production and productive capacity *(PC)*. On the other hand, some authors have proposed spare capacity *(SC)*, defined as the difference between production and productive capacity.

Besides the impact of OPEC, many authors have also recognized the importance of the current and future availability of physical oil. According to this view, the most crucial variable is represented by the level of inventories. Stocks are the link between oil demand and production and, consequently, they are a good measure of price variation. Most authors have considered two kinds of stocks, namely government *(GS)* and industrial *(IS)*. Due to their strategic nature, government inventories are not generated by a supply-demand mechanism and are generally constant in the short run. This explains the decision of many researchers to introduce in their models industrial stocks that vary in the short run and are able to account for oil price dynamics. When industrial inventories are considered, they are generally expressed in terms of the deviation from their normal level *(ISN)*, which is defined as the relative inventory level *(RIS)*. Operationally, *RIS* is calculated as:

(27)

$$RIS_t = IS_t - ISN_t$$

In equation (27), ISN_t indicates the de-seasonalized and de-trended industrial stock level, i.e.

(28)

$$ISN_t = \alpha_0 + \beta_1 t + \sum_{i=2}^{12} \beta_i D_i$$

where t is a linear trend and D_i is a set of monthly dummies, used to detect seasonal variations. Since government stocks are not subject to seasonality, their relative level *(RGS)* is specified as follows:

(29)

$$RGS_t = GS_t - GSN_t$$

being GSN_t the de-trended government stock level, defined as:

(30)

$$GSN_t = \alpha_0 + \beta_1 t$$

Zamani (2004) presents a short-term quarterly forecasting model of the real WTI price *(W)* that accounts for both the role of OPEC and the physical oil availability. Besides the significance of both kinds

of relative inventory levels, the author includes in his model OPEC quotas, overproduction and non-OECD demand *(DN)* as explanatory variables. In particular, Zamani (2004) proposes an ECM, estimated using the two-step approach by Engle and Granger (1987), where the long-run equilibrium is specified as:

(31)

$$S_t = \alpha_1 + \alpha_2 OQ_t + \alpha_3 OV_t + \alpha_4 RIS_t + \alpha_5 RGS_t + \alpha_6 DN_t + \alpha_7 D90_t + \varepsilon_t$$

and the short-run dynamics is described by:

(32)

$$\Delta S_t = \beta_0 + \sum_{i=1}^{m} \beta_{1i} \Delta OQ_{t-i} + \sum_{i=1}^{m} \beta_{2i} \Delta OV_{t-i} + \sum_{i=1}^{m} \beta_{3i} \Delta RIS_{t-i} + \sum_{i=1}^{m} \beta_{4i} \Delta RGS_{t-i} + \sum_{i=1}^{m} \beta_{5i} \Delta DN_{t-i} + \beta_6 D90_t + \lambda \varepsilon_{t-1} + \mu_t$$

In equations (31) and (32), *D*90 is a dummy variable for the Iraqi War in the third and fourth quarter of 1990. Using data for the period 1988–2004, Zamani (2004) shows that an increase in all the explanatory variables generates a reduction of the price of oil, while the dummy variable and the non-OECD demand positively affect the real WTI price. It is worth noticing that the in-sample dynamic forecasts computed on the basis of this model are quite accurate, according to standard forecast evaluation criteria.

Ye et al. (2002, 2005 and 2006) use relative oil inventory levels to forecast oil prices. Ye et al. (2002) describe oil prices as a function of RIS and of a variable accounting for a lower-than-normal level of inventories. The specification is empirically tested using a monthly dataset which covers the period from January 1992 to February 2001. This model is generalized by Ye et al. (2005), who use monthly data from 1992 to 2003 to analyze the relationship between WTI spot price and oil stocks. Defining relative industrial inventories as described in equations (27) and (28), they suggest modeling the WTI spot price as:

(33)

$$S_t = \alpha_0 + \sum_{i=0}^{3} \beta_i RIS_{t-i} + \sum_{j=0}^{5} \gamma_j D01_j + S99 + \alpha_1 S_{t-1} + \varepsilon_t$$

where *D*01 is a dummy variable for the period between October 2001 and March 2002, which takes into consideration the consequences of the terrorist attack on 11 September 2001, and *S*99 is a leverage variable which captures the impact on the oil market of a structural change in the OPEC's behaviour. The evaluation of this model is conducted through a comparison with a pure time series model and the following regression:

(34)

$$S_t = \alpha_0 + \alpha_1 S_{t-1} + \sum_{j=0}^{5} \gamma_j D01_j + \beta_0 S99_t + \beta_1 IS_{t-1} + \beta_2 (IS_t - IS_{t-12}) + \varepsilon_t$$

where relative inventories are substituted by industrial inventories, which are assumed to affect oil prices with a one-month lag and to depend on the deviation from their previous year level. One-, two-, three- and six-month ahead forecasts over the period from January 2000 to January 2003 show that equation (33) outperforms the other two specifications. When considering the three-month ahead forecasts, equation (34) produces more satisfactory results in the presence of a price trough, while equation (33) is more accurate in the presence of price peaks. More recently, Ye et al. (2006) extend the work by Ye et al. (2005), allowing for asymmetric transmission of inventory changes to oil price. The authors claim that the response of the oil price should be different, depending on the level of the relative stocks:

(35)

$$\begin{cases} LIS_t = RIS_t + \sigma_{IS} & if \quad RIS_t < -\sigma_{IS} \\ LIS_t = 0 & otherwise \end{cases}$$

(36)

$$\begin{cases} HIS_t = RIS_t - \sigma_{IS} & if \quad RIS_t > \sigma_{IS} \\ HIS_t = 0 & otherwise \end{cases}$$

where *LIS* is the low inventory level, *HIS* is the high level of inventories, and σ_{IS} is the standard deviation

of *IS* for the entire period. The specification proposed for the forecasting model introduces both linear and non-linear terms, according to the following scheme:

(37)

$$S_t = \alpha_0 + \alpha_1 S_{t-1} + \sum_{j=0}^{5} \gamma_j D01_j + S99 + \sum_{i=0}^{k} \beta_i RIS_{t-i} + \sum_{i=0}^{k} (\gamma_i LIS_{t-i} + \delta_i LIS_{t-i}^2) + \sum_{i=0}^{k} (\phi_i HIS_{t-i} + \psi_i HIS_{t-i}^2) + \varepsilon_t$$

Results show that the use of asymmetric behavior helps to predict oil prices and that the forecasting ability of equation (37) is stronger than the simple linear specification.

Kaufmann (1995) outlines a model for the world oil market that accounts for changes in the economic, geological and political environment. This model is divided into three blocks: demand, supply and real oil import prices *(PCO)*, analyzed over the period 1954–1989. Due to the presence of two dominant oil producers in the period under scrutiny, the author models oil prices as a function of the behaviour of both agents:

(38)

$$\frac{PCO_t - PCO_{t-1}}{PCO_{t-1}} = \alpha_0 CU_{TRC_t}^2 + \alpha_1 CU_t^2 + \alpha_2 \frac{PC_t - PC_{t-1}}{PC_{t-1}} CU_t \frac{OP_t}{WD_t} + \alpha_3 (DOPEC_t - DOPEC_{t-1}) + \alpha_4 S74_t + \alpha_5 PCO_{t-1} + \alpha_6 (SOECD_t \frac{OP_t}{WD_t}) + \varepsilon_t$$

where *WD* is the world oil demand, *DOPEC* is a dummy variable for the strategic behaviour of OPEC, *S*74 is a step dummy for the 1974 oil shock, and *SOECD* is the level of OECD stocks. Equation (38) appears to have a good explanatory power in detecting oil price variations. It is interesting to note that the key factor in OPEC's behaviour is OPEC capacity.

Focusing on the recent history of oil prices, Kaufmann et al. (2004 and 2006) modify equation (38) by excluding the role of the TRC. The new specification places much more emphasis on OPEC's behaviour, since it accounts for OPEC overproduction besides OPEC quota and capacity utilization. Furthermore, the modified model outlines the impact of a new variable – the number of days of forward consumption *(DAYS)* proxied by the ratio of OECD oil stocks to OECD oil demand. Their analysis is centered on the following equation:

(39)

$$PCO_t = \alpha_0 + \alpha_1 DAYS_t + \alpha_2 OQ_t + \alpha_3 OV_t + \alpha_4 CU_t + \sum_{i=1}^{3} \beta_i DS_i + \beta_4 D90_t + \varepsilon_t$$

where *DS* are seasonal dummies and *D*90 is a dummy variable for the Persian Gulf War in the third and fourth quarters of 1990. The two studies carried out based on quarterly data differ with respect to the time period considered, which is 1986–2000 in Kaufmann et al. (2004), while Kaufmann et al. (2006) refer to the time interval 1984–2000. An error correction representation of equation (39) is estimated via the Dynamic OLS (DOLS) approach proposed by Stock and Watson (1993) and using Full Information Maximum Likelihood (FIML). Results indicate that OPEC quotas, production and capacity utilization are important in affecting oil prices. In-sample dynamic forecasts from the first quarter of 1995 to the third quarter of 2000 suggest that the performance of the model depends on the considered time period, although the proposed specification is able to capture the consequences of various exogenous shocks on the oil price level.

Merino and Ortiz (2005), extending the various works of Ye et al. (2002, 2005 and 2006), investigate whether some explanatory variables can account for the fraction of oil price variations that is not explained by oil inventories. The authors acknowledge as possible sources of variation: the difference between spot and futures prices; speculation defined as the long-run positions held by non-commercials of oil, gasoline and heating oil in the NYMEX futures market; OPEC spare capacity along with the relative level of US commercial stocks; different long-run and short-run interest rates. Exploiting causality and cointegration tests, the authors identify the importance of the speculation variable which, among oth-

ers, appears to add systematic information to the model. Given the presence of cointegration, the authors eventually propose an error correction model, where oil prices are function of the percentage of relative inventories on the total current level of inventories and of speculation *(SPEC)*:

(40)

$$\Delta W_t = \alpha_0 + \alpha_1 \Delta \frac{RIS_t}{IS_t} + \alpha_2 \frac{RIS_{t-1}}{IS_{t-1}} + \alpha_3 \Delta SPEC_t + \alpha_4 SPEC_{t-1} + \alpha_5 W_{t-1} + \varepsilon_t$$

Data from January 1992 to June 2004 show that speculation helps predicting prices throughout the whole sample, except for the period 2000–2001.

A different approach in forecasting oil prices is proposed by Lalonde et al. (2003), who test the impact of the world output gap and of the real US dollar effective exchange rate gap on WTI prices. A comparison with a random walk and with an AR(1) specification suggests that both variables play an important role in explaining oil price dynamics. In Dees et al. (2007) oil prices are driven by OPEC quotas and capacity utilization, which are shown to be statistically relevant over the period 1984–2002. Sanders et al. (2009) investigate the empirical performance of the EIA model for oil price forecasting at different time horizons. This model is a mixture of structural and time series specifications, which includes supply and demand as the main factors driving oil prices, and takes into account the impact of past forecasts. The authors find that EIA three-quarter ahead oil price forecasts are particularly accurate.

Evaluation and comparison of oil price forecast models

In this study we have described three broad classes of econometric models that have been proposed to forecast oil prices. We have also presented the different and often controversial empirical results in the relevant literature. Any attempt to compare alternative oil price forecasts should be based on a comprehensive evaluation of the underlying econometric approach and model specification.

There are a number of statistical issues which should be accounted for in the development of an econometric model. Heteroskedasticity (both unconditional and conditional) as well as autocorrelation in the errors of a regression model are common problems, which, if unsolved, lead to misleading statistical inference. Another issue that comes up frequently when dealing with financial data is non-stationarity, as it is acknowledged that prices are often integrated of order one, or even two. Granger and Newbold (1974) warn that spurious regressions may arise in the presence of non-stationary variables. However, when non-stationary prices are cointegrated, it is then possible to overcome the spurious regression problem and to embed in the forecasts the information provided by the existence of one (or more than one) long-run equilibrium.

Out of the 26 papers we have reviewed, 20 provide a test for autocorrelation, 15 for heteroskedasticity and 20 account for non-stationarity and cointegration (see Table 1). Needless to say, the absence of explicit references to the use of heteroskedasticity and error autocorrelation tests as well as to a systematic check for the presence of unit roots in the analyzed series does not imply that those issues have not been accounted for, and, above all, it cannot be interpreted as evidence for the presence of heteroskedasticity, autocorrelation or non-stationarities in the analyzed data. Rather, it denotes that some authors consider it unimportant to test the statistical adequacy of their models.

The frequency of the data influences the statistical characteristics of the series, as low frequencies tend to smooth volatility. As a consequence, the choice of the data frequency can produce significant effects on the performance of a forecasting model. In general, if daily data are more volatile than their weekly, monthly and yearly averages, low-frequency oil prices can be more easily predicted than their high-frequency counterparts. The data frequencies used by the contributions reviewed in our survey are not homogeneous. Yet monthly data are most widely employed by each of the three classes of models, while weekly data are used just twice.

In addition, the literature surveyed in our paper can help to answer another question: what is the gain, if any, from using a large set of control variables in a forecasting model? In other words, why don't we simply follow the idea that all relevant information to forecast the oil price is embedded in the price itself? Random walks, martingale processes and simple autoregressive models root their justification on this idea. In this respect, random walk and martin-

Table 1

Diagnostic checking and time series properties of the data

Year	Authors	Serial correlation	Heteroskedasticity	Non stationarity and cointegration
1991	Bopp and Lady	X		
1991	Green and Mork	X	X	X
1991	Serletis	X	X	X
1992	Samii	X		
1994	Moosa and Al-Loughani	X	X	X
1995	Kaufmann	X	X	
1998	Gulen			X
1999	Pindyck	X	X	X
2000	Schwartz and Smith	X		X
2001	Morana	X	X	X
2002	Ye et al.	X		
2002	Zeng and Swanson	X		X
2003	Cortazar and Schwartz	X	X	
2003	Lalonde et al.		X	X
2004	Chernenko et al.	X	X	
2004	Zamani			X
2005	Abosedra	X		X
2005	Chin et al.	X	X	X
2005	Kaufmann et al.	X	X	X
2005	Merino and Ortiz			X
2005	Radchenko	X	X	X
2005	Ye et al.	X	X	X
2006	Kaufmann et al.	X	X	X
2006	Ye et al.	X	X	X
2007	Dees et al			X
2009	Murat and Tokat			X

Notes: X indicates the the authors have checked for serial correlation and/or heteroskedasticity and/or nonstationarity and cointegration.

gale models exploit the actual value of the price to forecast its future values, while autoregressive specifications evaluate also the lagged price values. These models have been used in many papers as benchmarks to check the forecasting performance of more complex specifications. Specifically, 9 papers out of 26 use the random walk model as a benchmark, while 4 papers compare the forecasting results of their econometric models with simple autoregressive specifications. It is important to notice that the random walk and the autoregressive model never outperform the more general specifications.

Structural models are generally considered to be an extension of autoregressive specifications that integrate the information embedded in the price history using proxies for particular relevant aspects of the oil market and the world economy. Among the surveyed papers belonging to this category, two (Lalonde et al. 2003; Ye et al. 2005) use a benchmark model as a comparison. Of these two contributions, only Ye et al. (2005) show that structural models outperform time series specifications. Financial models are based on different assumptions, as they arise either from the arbitrage theory or from the REH. Out of 13 papers in this group, 6 formally compare their models with a benchmark, either a random walk or an autoregressive specification.

The comparison with specifications which could differ from the standard benchmark models is systematically used in the papers we have reviewed as a general strategy to assess the accuracy of oil price forecasts. In Tables 2 to 4 we report the criteria proposed by the reviewed literature to evaluate the forecasting accuracy of a model, and also demonstrate that model comparison is common practice for virtually all of the structural, financial and time series models considered in this survey. Some authors (e.g. Radchenko 2005) suggest that, rather than selecting among different forecasts produced by different models, a good strategy is to combine the forecasting performance of different specifications. By combining the forecasted values obtained from an autoregressive, a random walk and a shifting trend model, it is possible to obtain significant increases in the accuracy of the forecasts.

The type of econometric model used in forecasting the price of oil seems to affect the type of forecasts that is produced. As Tables 2 to 4 clearly show, the majority of time series and structural specifications mainly use dynamic forecasts to assess the perfor-

Table 2

Criteria for comparing in-sample and out-of-sample forecasts: time series models

In-sample forecasts											
Year	Authors	Type of forecast		Graphical evaluation	Model comparison		Forecast evaluation				
		Static	Dynamic		Formal	Informal	RMSE	MAPE	MAE	Theil	Others
2005	Abosedra	X			X						X
2005	Ye et al.		X	X	X		X	X	X	X	X
Out-of-sample forecasts											
1991	Bopp and Lady		X		X		X	X	X		X
1999	Pindyck		X	X	X						
2000	Schwartz and Smith		X	X	X						X
2001	Morana		X	X	X		X			X	X
2002	Zeng and Swanson		X		X		X	X	X		X
2003	Lalonde et al.		X	X	X		X				X
2004	Chernenko et al.	X			X				X		
2005	Ye et al.		X	X	X		X	X	X	X	X
2005	Radchenko		X	X	X		X				

Notes: X indicates the presence of a specific criterium; RMSE = root mean squared error; MAPE = mean absolute percentage error; MAE = mean absolute error

mance of the analyzed model, while in the class of financial models static and dynamic forecasts have been equally employed. Given the well-known difference between static and dynamic forecasts, the latter seem to be more reasonable in the present context. Graphical evaluation of the forecasting performance of a given econometric specification has been widely used for structural models and, though in a limited number of cases, for time series models as well. Conversely, graphical methods are rarely considered in financial models. Finally, it is worthy to note that the measures of forecast errors commonly used by the surveyed articles are the root mean squared error (RMSE), the mean absolute percentage error (MAPE), the mean average error (MAE) and the Theil inequality coefficient (Theil) (see also Tables 2 to 4). Those criteria have been taken into account mainly by time series as well as structural models, and only in few cases by financial models. Despite the relatively large number of criteria, which are available to evaluate the forecasting performance of each proposed model, it is not possible to identify which class of models outperforms the others in terms of forecasting accuracy.

Table 3

Criteria for comparing in-sample and out-of-sample forecasts: financial models

In sample forecasts											
Year	Authors	Type of forecast		Graphical evaluation	Model comparison		Forecast evaluation				
		Static	Dynamic		Formal	Informal	RMSE	MAPE	MAE	Theil	Others
1992	Samii			X							
1998	Gulen					X					
2004	Chernenko et al.	X			X				X		
2005	Chin et al.		X	X	X		X		X		
1994	Moosa and Al-Loughani	X									X
2005	Abosedra	X			X						X
Out of sample forecasts											
1991	Bopp and Lady		X		X		X	X	X		X
2001	Morana		X	X	X		X			X	X
2002	Zeng and Swanson		X		X		X	X	X		X
2003	Contazar And Schwartz		X	X	X		X		X		X
2009	Murat and Tokat		X		X		X	X	X		X

Notes: X indicates the presence of a specific criterium; RMSE = root mean squared error; MAPE = mean absolute percentage error; MAE = mean absolute error

Table 4

Criteria for comparing in-sample and out-of-sample forecasts: structural models

In sample forecasts											
Year	Authors	Type of forecast		Graphical evaluation	Model comparison		Forecast evaluation				
		Static	Dynamic		Formal	Informal	RMSE	MAPE	MAE	Theil	Others
2002	Ye et al.		X								
2004	Zamani		X	X							
2005	Merino and Ortiz	X		X	X						
2005	Ye et al.		X	X	X		X	X	X	X	X
2007	Dees et al.	X	X	X	X		X				
2006	Ye et al.	X	X	X	X		X	X	X	X	X
2006	Kaufmann et al.	X	X	X			X				
Out of sample forecasts											
2003	Lalonde et al.		X	X	X		X				X
2005	Ye et al.		X	X	X		X	X	X	X	X
2006	Ye et al.	X	X	X	X		X	X	X	X	X

Notes: X indicates the presence of a specific criterium; RMSE = root mean squared error; MAPE = mean absolute percentage error; MAE = mean absolute error.

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Does Environmental Protection Hurt Low-Income Families?

Don Fullerton*

Policies for environmental protection affect the lives of all US citizens by regulating pollution, imposing costs and influencing economic decisions. Common examples range from municipal trash disposal to federally mandated Corporate Average Fuel Economy (CAFE) standards for automobile fuel efficiency. Other notable environmental policies include the Environmental Protection Agency's Acid Rain Program to reduce sulfur dioxide (SO_2) emissions from domestic power plants, and the much-discussed but not-yet-enacted idea of a program to reduce greenhouse gas (GHG) emissions. While the United States is not a member of the Kyoto Protocol to reduce global GHG totals, adopted by the United Nations Framework Convention on Climate Change (UNFCC) in December 1997, President Obama promised to achieve substantial GHG reductions in the form of a cap-and-trade policy. The proposed policy has an ambitious reduction target, and if such a policy were to be passed by Congress it would have profound impacts on the entire country. Here, we look at various implications of a GHG regulatory regime for residents of the nation and the state of Illinois, including the possibility of different effects on each income group.

As pollution becomes an increasing concern at the municipal, state, national and international level, policy makers continue to enact environmental policies to manage environmental problems. Pollution is a negative "externality", to the extent that the costs of pollution are not included in the price of the goods produced and sold. Generally, an externality is defined as the impact of a market transaction on individuals not involved in that transaction. A firm that tries to maximize profits would not voluntarily incur costs to cut emissions. Similarly, consumers do not ration their use of goods that are produced in a polluting process, because they do not face the higher prices that would result if producers were required to pay for pollution. In such circumstances, it is incumbent upon the government to enact appropriate policies to deal with the negative externalities of pollution. However, the optimal level of pollution is not zero. Given current technology, some pollution is necessary to produce the vast majority of goods and services demanded by consumers.

Policy makers have a large menu of choices at their disposal to control pollution levels. Below are three categories of policy types:[1]

- *Command-and-control (CAC) policies* can include either a "performance standard" that merely restricts pollution of each firm or a "technology mandate" that may require particular choices. For instance, an electricity plant may be required to use a particular type of fuel or to install a scrubber. These requirements generally make goods more expensive.
- *Pollution taxes* set a tax per unit of pollution. This tax may induce the firm to reduce pollution per unit of output, and it may raise the price of output in a way that induces consumers to buy less output. A problem is that taxes are usually collected on receipts from market transactions, while many emissions are not so easily measured.
- *Permit trading schemes* are also known by the name cap-and-trade. Government creates a market for pollution by issuing a number of permits that matches the maximum target amount of pollution. In order to pollute legally, a firm would have to hold a number of permits equal to their own quantity of pollution. Firms can buy and sell these permits on the open market. Firms that can reduce pollution at a lower cost than the prevailing permit price can sell their permits, and firms with higher abatement costs can buy permits. A key policy choice in any permit trading scheme is the initial allocation of permits. In the case of a GHG cap-and-trade program, the US Congressional Research Service (CRS) estimates that the total

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[1] For a further discussion of policy options, see Fullerton (2001).

value of permits could be 100 billion US dollars per year by 2020 under proposed legislation.[2] If permits are given away (or grandfathered) to firms, then firms receive profits equal to the total value of the permits. Alternatively, the government could auction the permits and use the resulting revenue to reduce other taxes, to reduce the deficit, or for necessary spending.

Importantly, all three policy choices would be likely to raise product prices. Goods produced using the most pollution would tend to experience the largest increases in price on a percentage basis. Particularly hard hit would be items such as electricity and gasoline. However, consumers are not all identical, as some use more electricity or gasoline than others. In this regard, a key distinction is between absolute consumption levels and consumption as a percentage of each household's budget. To calculate the burden of such policies as a fraction of each household's budget, we need to know the household's expenditure on these goods as a fraction of total expenditures.

Government must balance various and often conflicting goals when selecting an environmental policy, including economic efficiency, administrative costs, distributional objectives and political feasibility. This note focuses on distributional effects of environmental policy, or the question of how to consider the impacts on different segments of society when formulating a policy. A particular concern is that low-income individuals might shoulder an undue burden from environmental policy.

Distribution of burdens

The federal income tax system is designed to be a "progressive" policy, since the tax is a low fraction of income for low-income workers and a higher fraction of income for those with more income. Conversely, a regressive policy is one with burdens that are a high fraction of income for low-income families and a lower fraction of income for a high-income family. Concerns regarding environmental policy impacts across the income distribution are an important part of policy making, but are not well studied or understood. A particular concern is that environmental policies might generally be regressive. We now discuss six pathways that might contribute to environmental policies being regressive, and how these pathways apply to some or all of the types of policies listed above.[3]

(1) Increased product prices: Environmental policy is likely to raise the price of goods and services that are produced or used in a pollution intensive manner. Under the tradable permit requirements of the Acid Rain Program, for example, electricity producers incur additional costs to buy low-sulfur coal, to buy scrubbers, or to buy SO_2 pollution permits. These extra costs raise electricity prices. Similar effects on automobile prices arise from CAFE standards that raise fuel efficiency, or from pollution surcharges such as garbage collection fees. In the case of a GHG reduction program, the products most affected would be those produced using a lot of fossil-fuels, whether manufactured goods, electricity, gasoline, or heating fuel. However, expenditures on goods such as electricity and gasoline generally constitute a high fraction of budgets for low-income households (Metcalf 1999). As a result, low-income households may be disproportionately harmed by the resulting price increases (West 2004).

(2) Decreased real net wages: Pollution abatement technologies might be capital-intensive, and thus environmental policies can raise the capital-to-labor ratio used in production. If so, in equilibrium, the wage rate paid to labor may fall relative to the return on capital. This effect may also have a regressive impact if low-income households derive the majority of income from wages, while high-income households earn higher returns from the increased demand for capital. That is, in real terms, the budgets of low-income households shrink relative to the budgets of high-income households.

(3) Scarcity rents: As discussed above, the handout of initial permits can create profits for firms, and high-income households may have relatively high levels of wealth held in the form of corporate stocks. If so, then this environmental policy may create corporate profits that are received by rich shareholders (Parry 2004).

(4) Differential valuation: Low-income households may not derive the same benefits as high-income households from decreases in pollution. Low-income households do benefit from a decrease in pollution, but those benefits may be low if those households

[2] The proposed legislation cited is S. 2191 (Lieberman-Warner). The CRS states, "using the lower allowance prices in the EPA/ADAGE-TECH case, total auction revenues start in the tens of billions of dollars (2005$) and increase to over $100 billion before 2030. Using higher allowance prices, such as the MIT/EPPA case, total auction revenues exceed $100 billion before 2020" (Parker and Yacobucci 2008, 40).

[3] For a complete discussion, see Fullerton (2008).

would rather spend the same resources on the basic necessities of adequate food, clothing and shelter. In contrast, high-income households can better enjoy the luxury of environmental benefits if they already have all the required necessities. If environmental protection provides greater value to high-income households, then, in this way also, environmental policies can be regressive.

(5) Capitalization effects: When environmental policy cleans up the air in a particular area, property prices usually increase, because, all else equal, people are willing to pay more for a house in a cleaner area. Often the property is already owned by high-income households, while low-income households rent. Thus, the capitalization effect increases the wealth of landlords and the costs to renters. It thus constitutes an additional regressive pathway of environmental policy. If so, it may represent a redistribution of wealth from the poor to the rich.

(6) Transitional effects: Environmental policies to reduce pollution almost surely decrease production by affected firms and may cause layoffs. However, individuals with higher levels of education often have better outcomes in the labor market when looking for a job. To the extent that low-income individuals have lower education levels, these individuals may bear a disproportionate cost from employment transition periods between jobs.

Despite these pathways, which can make environmental policy regressive, an overall policy package can be designed to offset these effects. For example, if permits in a cap-and-trade policy are auctioned, then the resulting government revenue can be used to provide assistance to low-income families who must pay more for electricity and heating fuel. While the policy would encourage conservation of pollution-intensive goods by raising these product prices for everyone, the assistance to low-income families could help offset the effects of those price increases on their overall welfare.

Empirical evidence

Next we turn to some numbers to illustrate the first regressive pathway; that is, the increased price of pollution-intensive goods. Again, any serious environmental policy must raise prices, affecting all consumers in some manner. President Obama has promised a GHG emission reduction policy to be instituted at the federal level that results in at least an 80 percent decrease from 1990 GHG levels by 2050. Importantly, he supports the auctioning of initial permit allocations to industry instead of giving away the initial permits to industry. Under such a policy, does the first regressive pathway affect all regions of the country identically? In terms of regressive effects, would Illinois be harmed to a greater extent compared to other states?

Data for this analysis are provided by the Consumer Expenditure Survey (CEX) administered annually by the Bureau of Labor Statistics (BLS). For a sample of about 119,000 households in the 2006 edition, the CEX provides information on their income, all expenditures, and their demographic characteristics. The survey provides reliable household representation at the regional level, and states are aggregated into four regions: East, West, South and Midwest.[4] Since the states in the Midwest have similar economies, and all make relatively high use of natural gas rather than other fossil fuels, the data for the Midwest region provide an appropriate picture for residents of Illinois.

Additionally, the CEX reports aggregate data by region for the seven household income classes arrayed across the bottom of each figure below. For example, the fifth group has pre-tax reported income between 40,000 and 49,999 US dollars. The 2006 edition of the CEX sampled 2,607 households in this group in the Midwest region, with an average household size of 2.4 people, an average annual consumption expenditure of 37,906 US dollars, and average yearly expenditure on electricity of 1,006 US dollars. We apply "equivalence factors" to household aggregate statistics to help account for differences in average household size and composition, and to allow for more accurate comparisons of welfare across household groups.[5]

Any one year's income may fluctuate and thus may not provide a meaningful measure of that family's long-run well being. Instead, we use total consumption expenditure as a measure of income that is relatively constant, since households make consumption choices based on past income and expected future

[4] In the CEX definition, the Midwest region includes: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.
[5] Equivalence factors adjust for increasing or decreasing returns to scale for households of different size and composition. The equivalence factor formula applied to this study is from Citro and Michael (1995).

Figure 1

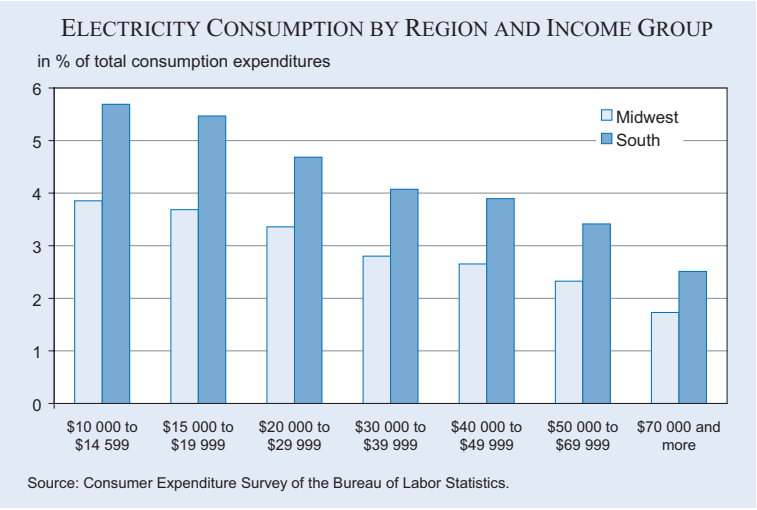
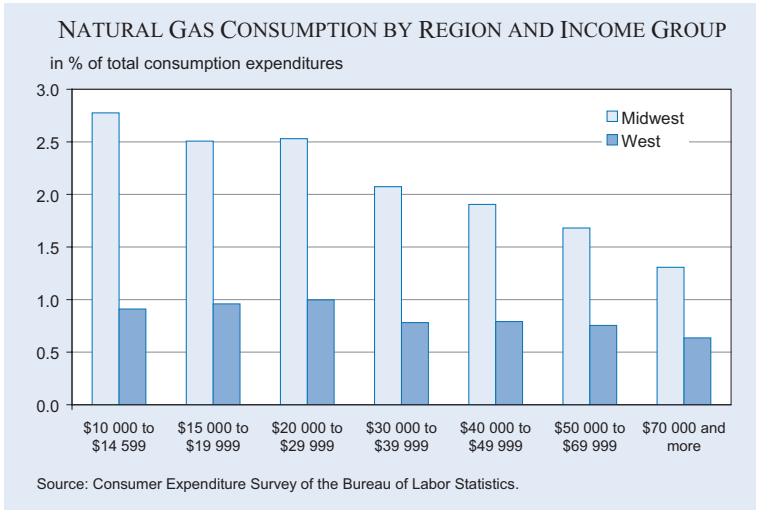


Figure 2



earnings. In this way, consumption expenditure is a reliable measure of "permanent" income.[6]

Conveniently, the CEX tracks energy expenditures including purchases of electricity, natural gas and heating oil. Expenditure proportions by income class on these three energy sources help demonstrate this regressive pathway, because the burning of carbon-based fossil fuel releases carbon dioxide (CO_2) emissions that constitute a vast majority of domestic GHG emissions. By calculating the household budget expenditure fractions on these three energy expenditure categories for different income groups, we show the possible regressive impact of environmental policy from the potential increase in prices.

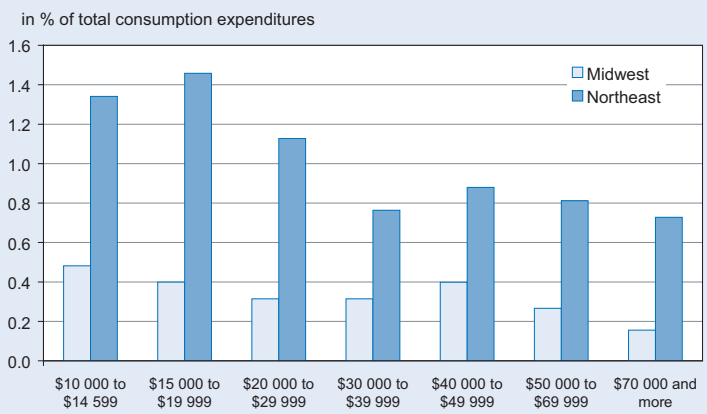
Figure 1 compares the percentage of consumption expenditures on electricity for the Midwest and South regions by income class. The clear downward sloping trend for both regions demonstrates the first regressive pathway of environmental policy. That is, the percentage of consumption expenditures on electricity falls as income increases. Among all regions, Southern states have the highest fractions of budget expenditures on electricity, due to air-conditioning use. If the GHG emissions from electricity generation are similar in the Midwest and South, then the impact of a GHG reduction regime through electricity prices would be greater in the South. Thus, comparing environmental regulation only on electricity generation, Illinois would have a smaller regressive distributional impact than in the typical southern state.

Figure 2 compares the percentage of consumption expenditures on natural gas for the Midwest and West regions by income class. Here, the downward sloping trend is more pronounced for the Midwest region, but still applies to the West region. In the Midwest, natural gas is widely used for home heating, but the West has mild weather. However, natural gas has a low carbon content per unit of energy, compared to other fossil fuels, which mitigates the effects of a GHG reduction regime on Illinois consumers.

By contrast, Figure 3 compares the percentage of consumption expenditures on fuel oil for the Midwest and Northeast regions, by income class. In many ways, Figure 3 is the opposite of Figure 2. Many homes in the Northeast region are heated using fuel oil, while Figure 2 showed that the Midwest region uses more natural gas for home heating. Unfortunately, the carbon content per unit of energy for fuel oil is much higher than for natural gas. Thus a GHG reduction policy would tend to have a heavier welfare burden on the

[6] After applying the equivalence factor formula and using total consumption as a proxy for income in the budget, electricity accounts for 2.65 percent of a standardized household budget with reported income between 40,000 and 49,999 US dollars. We use total consumption for the denominator of these spending percentages, but the CEX still defines income categories by annual income. Ideally, the household aggregate groups would also be sorted by consumption.

Figure 3



Northeastern states relative to a Midwestern state like Illinois.

Conclusion

Environmental policies increasingly affect every aspect of society, and it seems inevitable that more stringent pollution control regulations are soon to be enacted. However, politicians and citizens need to be aware of the potentially regressive effects of environmental policy. Environmental policy is not necessarily regressive, however, if the distributional impacts are understood and taken into account. The data analysis provided here demonstrates one possible regressive pathway of environmental policy via increased product prices. It also therefore demonstrates the magnitude of assistance to low-income families that would be needed to offset the effect of higher energy prices. Revenue to provide the assistance could come from the auctioning of initial permits, a policy position supported by President Obama. Five other possible regressive pathways are also discussed. If these pathways are not considered carefully, well-meaning environmental policies can inadvertently hurt the poorest members of our communities.

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EU Climate and Energy Policies – Which Path Ahead?

Herbert Reul*

Energy is a central part of our daily life. Our heating is done with electricity, gas, oil or some other form of energy, all production processes depend on energy. Our entire way of life is built on the abundant availability of affordable energy. After the vast destructions caused during the Word War II, energy policy has been at the heart of European integration in the early 1950s. The European Community for Coal and Steel was the first of the three European Communities to be set up. The European Atomic Energy Community followed in 1957 together with the European Economic Community at a time of high expectations for nuclear energy. However, true European energy policy in the framework of the European Economic Community can only be discerned from the 1990s onwards even though most instruments existed long before. In analysing European energy policy in the early 1990s, Padgett came to the conclusion that "there is a general agreement that energy policy must be ranked as one of the Community's major failures" (Padgett 1992, 55). Does this analysis still hold today?

The focus of energy policy in the European Union today is threefold. First the completion of the internal market for energy, especially for gas and electricity, lies at the centre of the third liberalisation package presented by the European Commission in September 2007. The second pillar of the current energy policy builds on the competence of the EU in the field of environment. Here, the major legislative package was the climate and energy package of 2008. The third pillar concerns security of supply and has come back into focus when the gas dispute between Ukraine and Russia resulted in the closing down of the Bratstvo Gas Pipeline, the main transit pipeline for Russian gas to Central and Western Europe. Only a month before the escalation of this dispute, the Commission published several documents on security of supply, *inter alia* the second strategic energy review.

These three large packages cover to a large extent the three main goals of energy policy: security of supply, sustainability and competitiveness. These goals must be treated equally at any time in order to achieve a truly sustainable energy policy. This article critically evaluates the most recent developments in European energy policy and explores ways to consolidate the three basic objectives.

The internal market for energy

The establishment of a common market is the key objective set out by Art. 2 of the Treaty Establishing the European Community. Art. 3c then follows the lead by giving the European Community the assignment to set up "an internal market characterised by the abolition (...) of obstacles to the free movement of goods, persons, services and capital". Only later, in the Treaty of Maastricht, Art. 3u was added, inserting the word "energy". However, this insertion was mainly meant as a clarification. Thus, the objective of creating an internal market did also encompass the market for energy – and the same is true for the instruments set up by the Treaty, especially for Art. 28, 29, 30, 82, 86 and 100. Thus, as Grunwald, a former member of the Commission rightly observes, "only an explicit mandate for a common energy policy was missing" (Grunwald 2003, 18).

Despite this often forgotten fact, the first concrete measures were only adopted from 1988 onwards in three important sectors. The first concerned price transparency (European Council 1990), the second the transit of energy through large networks (European Council 1991) and the third access to resources (European Parliament and European Council). This first step, however, did prove insufficient to eliminate the many structural market barriers that existed in the energy sectors of all Member

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States. Roger Fauroux, the then French Minister for Industry, summarised the situation in 1989 by deploring that France was exporting electricity to Switzerland, Italy and the United Kingdom, but not to Germany – and this despite an export potential worth around DM 2 billion and another twelve nuclear power plants still under construction.[1] This explains why France was initially such an ardent supporter of liberalisation. Today the situation has changed profoundly. Not only is France often seen as a chock block when it comes to liberalisation in the energy market, it also exported an impressive 16 billion KW/h of electricity to Germany in 2005. The root of this change was the liberalisation process on European energy markets.

In 1992 the European Commission proposed two parallel directives on common rules for the internal market in electricity and gas (European Commission 1992a; European Commission 1992b). The central topic of the discussions at the time was the issue of grid access. As with railways, electricity and gas grids represent natural monopolies. Thus non-discriminatory access to the existing infrastructure is of central importance for the development of competition. A compromise was reached in 1996 and 1998, respectively. Third party access (TPA) to the grids was to be granted either on a negotiated or a regulated basis, with the decision on which principle to adopt left to each Member State. Moreover, several unbundling provisions for vertically integrated companies were set up in order to further increase transparency.

It soon became clear, however, that these provisions were insufficient once again. A study carried out for the European Commission found that markets remained very much closed and that TPA had remained problematic, especially in France and Germany (DRI-WEFA 2001). Thus the Commission presented two parallel acceleration directives in 2001 (European Commission 2001). The double purpose of these directives was to open markets to full competition and to harmonise national regulation. Both directives were adopted in 2003.

As a principle, the acceleration directives provided for a regulated TPA to the grid of transmission system operators (TSO). Distribution system operators (DSO) remained outside of the scope of the directives. Furthermore, for gas storage negotiated access was still allowed. Exemptions could further be granted for major new investments such as interconnectors between Member States, liquefied natural gas (LNG) facilities or gas storage sites. TSOs were further to be granted access to the grids of TSOs by Member States. One of the most important steps, however, was the creation of independent regulatory bodies in all Member States. Furthermore, transparency was to be increased by more rigorous unbundling provisions that encompassed legal, operational and informational unbundling.

These complex provisions took several years to be transposed into national law. In Germany, for example, the directives were only transposed in 2005, and thus in the same year in which the Commission started a further inquiry into the energy markets. The Commission's finding of continued market concentration was therefore hardly surprising. Marietje Nauschütz already warned in 2005 that the Commission would not be satisfied with the acceleration directives and could go even further by demanding full ownership unbundling of vertically integrated companies (Nauschütz 2005, 292). Indeed, ownership unbundling was by far the most important and controversial topic of the third liberalisation package that is to be adopted in the summer of 2009. Already, the impact assessment presented by the European Commission raised more questions than answers. Despite the many open questions and the fact that nobody could possibly expect liberalisation to come into effect within a few years, negotiations have continued.

In its first reading, the European Parliament opted for different approaches for gas, for which the so-called third option was introduced into the proposal, and electricity, for which the two Commission alternatives, full ownership unbundling and Independent System Operator were not complemented. The situation in the Council was different, however: a blocking minority around France and Germany was able to insert a third option for both sectors. This very detailed third option, the efficient unbundling of transmission system operators, foresaw very strict unbundling provisions stopping short of ownership unbundling in order to ensure the independence of the grid operators. The outcome of the negotiations remains to be seen. All relevant actors are united in their commitment to reach a compromise by April 2009 at the latest in order to adopt the act before the next European elections.

The main purpose, it is worth recalling, of the entire third liberalisation package is to foster competition

[1] See *Frankfurter Allemeine Zeitung* of 20 May 1989.

and through competition to lower energy prices for consumers. This purpose was entirely lost sight in the course of the negotiations. In the German gas market, for example, only 4.4 percent of the final price for consumers is due to fees paid to TSOs for grid access. Half the costs cover the purchase of gas itself and nearly another 25 percent are accounted by taxes. About 20 percent cover the costs of the distribution system operators (DSO) themselves. The figures for electricity are similar.

Thus, the argument of the Commission that by strengthening competition prices would automatically come down, must be questioned. No data can be found which clearly shows a correlation between ownership unbundling and lower energy prices. Furthermore, the Commission itself announced in a staff working document that "the objective of ownership unbundling is not necessarily to bring prices down but to achieve a price setting which reflects the real cost of efficient operation and which gives the right signals for the future investments needs, for example in renewable energy" (European Commission 2007, 37).

This seems to be the most honest statement on the true objectives pursued by the Commission. What is more, security of supply, even though it is mentioned in the justification of the directives, never played a role in the debate. The impact of full ownership unbundling on security of supply is still unclear, but the first experiences in Britain suggest that negative effects of liberalisation might also exist. Gas storage capacity in that country is one of the lowest in the EU, for example.

From this experience with the liberalisation trilogy the following can be deduced. First, we should accept the fact that changes to structures that have grown over decades cannot be made within a few years. Second, we have to realise that the Commission, once it has been given an incentive to regulate, will never stop to pursue even further goals at ever shorter intervals. And third, the European Parliament must finally stand up to its role as legislator and subject Commission proposals to in-depth scrutiny.

Environmental policy and its impact on energy policy

With the Single European Act (SEA) new competencies on environmental policy were introduced into the EC Treaty. While Member States had often used environmental policies to set up national barriers to free trade and thus to safeguard their own markets against foreign competition, the first harmonisation measures at Community level were, as Klaus Eckrich rightly points out, "rather aimed at restoring free trade – and not necessarily to safeguard the environment" (Eckrich 1994, 5).

The central modification that led to a surge in environmental legislation came only with the Treaty of Amsterdam, in which the co-decision procedure was extended to the field of environment. However, a few exceptions remain even today, e.g. for provisions primarily of a fiscal nature and measures significantly affecting a Member State's choice between different sources and the general structure of its energy supply.

Thus it was surprising that the Commission based its legislative proposals within the climate and energy package on Art. 175 I EC but not on Art. 175 II EC. Defining specific targets for renewable energies, for example, clearly affects the choice between different sources and the general structure of the energy supply of the Member States. At the same time, the proposal altered the existing emissions trading system (ETS) of the EU in such a way that it arguably imposes a tax on CO_2 emissions. Here again, European Parliament and European Council failed to apply the necessary scrutiny. As it turned out during the negotiations, only the least controversial part of the package, the one setting up common rules for carbon capture and storage (CCS) for the demonstration plants, would clearly fall under Art. 175 I EC.

Given the complexity of the matter and limited space, only the ETS will be dealt with in more detail here. The proposals were to serve a threefold aim: to reduce emissions by 20 percent, to help improve energy efficiency by 20 percent and to raise the share of renewable energies to 20 percent by the year 2020. With the ETS, a price tag is introduced for carbon emissions. Thus the main idea is that the worst polluters should pay the highest prices. The Commission proposal draws a distinction between electricity generation and CO_2 intensive industries. Electricity generators were to be subjected to full auctioning from 2013 onwards. Industry, however, was to be given more time to adjust through a phasing in – starting at 20 percent auctioning in 2013 and resulting in full auctioning in 2020.

However, the proposal does not in any way account for the enormous differences in the energy mix of the now 27 Member States. Poland, for example, generates close to 80 percent of its electricity using solid fuels. France, on the other hand, uses close to 80 percent CO_2 free nuclear energy. As a result of this approach, the largest French energy company, EdF, is likely to make additional profits in the range of 50 billion euros between 2013 and 2020 compared to German power producers, simply by selling its cheap electricity on the German market – at market prices determined by the oldest German coal power plant. Thus, full auctioning in the power sector leads to severe distortions of competition.

This example demonstrates once more how schizophrenic current EU energy policy is. On the one hand, liberalisation is supposed to foster competition and thus to lower prices for consumers and, on the other hand, EU environmental policy leads to massive price increases. The Institute of Energy Economics at the University of Cologne came to the conclusion that the Commission proposal on ETS would lead to a 50 percent increase in electricity prices in Germany by 2020.

From here it does not take much to calculate the amount of purchasing power that will be quashed. Much more difficult to calculate, however, are the indirect costs caused by higher electricity prices. Electricity is the fundamental basis of all production processes. Thus, a sharp increase in prices will inevitably lead to higher product prices. Transport and industrial companies will try to pass their addition costs on to the consumers. A real impact assessment, taking into account those indirect costs, has never been published. One central reason for this omission was the enormous time pressure that bore on both Parliament and Council. This self-imposed pressure served those in the Commission, Parliament and the Council who wanted the fundamental characteristics of the Commission proposal to remain unchanged. A large minority favoured a different approach that would not have endangered the main political goals of reducing emissions by 20 percent but would save consumers across the EU billions of euros each year.

Their idea was to introduce a benchmark system that would have rewarded the most efficient installations. Hence, both electricity producers and the remaining industry sectors covered by the directive would have been issued free certificates up to an ambitious and dynamic benchmark. Should the monitored installation fall short of the benchmark, the remaining certificates would have had to be purchased on the market. In order to avoid windfall profits, unused certificates would have had to be returned. Such a system would have given strong investment incentives while minimising costs. Minimising costs it would, however, have reduced revenues for the Member States. It is precisely this reasoning that unmasks the fiscal nature of the Commission proposal. By increasing the number of certificates to be purchased to 100 percent, the measure takes on the character of a CO_2 tax.

In order to speed up negotiations, Parliament even agreed to a proper co-decision procedure. This was done through a relatively recent invention: the trialogue. In a *joint declaration on practical arrangements for the co-decision procedure* (European Parliament, Council, Commission 2007), the institutions agree to cooperate in good faith with a view to reconciling their positions in order to reach a first reading agreement whenever possible. The EP *code of conduct for negotiating codecision files* (European Parliament 2008) clearly states that the decision to enter into trialogue must be politically justified, for example, on grounds of the uncontroversial or technical nature of the proposal or because of an urgent situation. Even though the file was surely to be qualified as a political priority, it is questionable whether the conditions set out by the code of conduct were met in this case.

Neither was the file uncontroversial, as the large number of amendments demonstrated, nor was it merely of a technical nature. Only the European Council was able to reach a compromise at the end of December 2008. This compromise allowed many exceptions to the general rules for different groups of countries and industries and foresaw a phasing-in for power producers in the new Member States.

This course of action resulted in Parliament being able to negotiate about exceptions for hospitals with the French Presidency but not about the main controversies of the file. These were left to the Heads of State. Parliament was thus only able to accept or to reject the compromise reached by the Presidency. After having struggled for more power over many decades, the co-decision procedure was unhinged by a trialogue procedure that so far not even appears in the rules of procedure of Parliament. This result is to be deplored, not only for democratic reasons.

The power of the European Commission is extremely large. Once it had suggested full auctioning, it was hardly possible to introduce an alternative that would have saved consumers around 70 billion euros every year. Parliament should not light-heartedly engage in trialogue procedures on highly controversial files, as it will only lose power to the Council. A proper first reading would further have enabled Parliament to present the Council with a position carried by the entire house – instead of entering into negotiations with the position of just one Committee. But ideology once more prevailed over rationality when it came to environmental files.

Security of supply

The winter of 2008/2009 demonstrated again the overwhelming importance of supply security. For the fourth time already, a gas dispute between Russia and Ukraine caused disruptions of gas supplies to the EU. With 80 percent of Russian gas exports to the West transiting Ukraine, the consequences of blocking the pipeline were felt almost immediately in many Member States. Bulgaria closed more than 50 schools due to gas shortages, Romania declared a state of emergency, Poland, Slovakia, Hungary, Germany and France reported sharp drops of supply, as Russian gas could only be transported through Belarus and demand was soaring due to temperatures well below zero in most parts of Europe.

Only in November 2008 had the Commission presented its Second Strategic Energy Review (European Commission 2008). This communication focuses on five major points: (1) infrastructure needs and the diversification of energy supplies, (2) external energy relations, (3) oil and gas stocks and crisis response mechanisms, (4) energy efficiency and (5) making the best use of indigenous sources of energy.

Despite gains in efficiency, energy demand and especially the demand for gas will increase in the future. The share of gas in gross domestic consumption has already increased from 17.9 percent in 1990 to 24.6 percent in 2005. Thereafter it is presumed to increase to 25.7 percent in 2020. At the same time, the share of solid fuels is predicted to decline further to less than 17 percent in 2030. According to the European Commission (2007b), declining indigenous gas and oil production in the EU means that import dependency will continue to rise, reaching 84 percent for gas in 2030 (from 46 percent in 1990) and even 95 percent for oil (up from 80 percent in 1990). These figures do not yet reflect the shift in primary energy demand that will be caused by the ETS reform.

Diversification of transport routes is the traditional answer that was already promoted by Winston Churchill before World War I: "safety and certainty in oil lie in variety and variety alone". Therefore it is of paramount importance to define priority infrastructure projects and to actively promote their realisation. Two of these priority projects that figure dominantly in the list of projects of European interest within the framework of Trans European Energy Networks (TEN-E), are the North Stream Pipeline through the Baltic Sea and the Nabucco pipeline linking the Caspian Sea to South Eastern Europe (European Parliament and European Council 2006).

It is unclear how such projects can successfully be promoted by the EU with a budget of just 25 million euros a year for TEN-E priority projects that not only cover gas but also electricity. Even though it is evident that those multi-billion euro investments have to be accomplished by private investors, at least the political support must be strong. But even this support is lacking.

The North Stream Pipeline with a total length of close to 1200 kms will cost over 7.4 billion euros and was supposed to carry 24 to 27.5 billion m^3 of gas to the EU each year starting from 2010. The doubling of the pipeline would then later have allowed the import of up to 55 billion m^3 of gas each year. By comparison, Britain produced just 80 billion m^3 of gas in 2006. The feasibility studies were carried out from 1997 to 1999, thus ten years ago. But still the pipeline does not exist. Mainly Poland and the Baltic countries, but also Finland and Sweden have at one point or the other in the process slowed down negotiations due to security concerns. Only now, with the renewed gas dispute, the perception is finally changing.

A central part of the strategy of diversification will also be the extension and upgrading of the "internal" pipeline system of the EU in order to allow reverse flows. Furthermore, LNG facilities have to be promoted even more vigorously in order to diversify supply routes. Qatar is already preparing itself for the surge in demand, for example, by designing new LNG tankers of Q-Flex and Q-Max size that are able to carry around 80 percent more

gas than current tankers which, in turn, will considerably help reduce costs.

The stronger promotion of LNG will not fail to affect gas markets. As in oil markets, new traders will emerge, spot markets are likely to appear and thus the hitherto regional gas markets around the world will at least in part develop into global markets. This will have consequences for future gas flows. Whereas the EU is currently geographically well located to import gas through pipelines that take years or decades to amortise and thus guarantee supply over long periods of time, tying both parties together, LNG offers more flexibility for both suppliers and buyers. As this is a new situation that Europe will have to face in coming decades, we need clear and open discussions and, even more importantly, decisions in order to prepare ourselves.

The EU will not start building pipelines or LNG facilities itself and will not act as a contract partner of foreign oil or gas companies. However, it can help. For example, through the INOGATE programme the EU conducted many studies on the existing energy infrastructure in Central Asia. It has further helped to train personnel and to finance gas metering stations that were able to enhance mutual confidence in those states.

Nonetheless, the vital question of the status of the Caspian Sea has yet to be resolved. The EU could have acted as a mediator in the conflict or at least put pressure on the parties to find a compromise. Until today this conflict has prevented the construction of a pipeline through the Caspian Sea for over a decade. Instead of exporting gas from Turkmenistan, which holds the second largest gas reserves in the CIS after Russia, towards the West, pipelines are now being planned to run eastwards to China. Turkmen gas, however, would have been of central importance to fill the Nabucco pipeline. Thus the hesitant attitude of the EU now endangers one of its top priority projects.

Not only supply routes but also a wide energy mix is of vital importance for securing energy supply. Such an energy mix must include safe nuclear energy as well as coal, since both provide not only cheap energy, but these primary sources of energy are imported from stable export countries and at relatively stable prices. Indeed, coal prices have seen the largest stability over decades compared to oil and gas prices. Furthermore, even as uranium prices have seen a considerable increase in recent years, price effects remain minimal since fuel prices only account for a small fraction of the operating costs of nuclear power plants.

Renewable energies were most strongly promoted in past decades. The decision to raise the share of renewable energies to 20 percent will lead to further improvement of energy security. However, the main problem with renewable energies consists in the efficient allocation of subsidies. It does not make much sense to pay the highest subsidies to solar energy in Germany, when solar panels operate much more efficiently in Southern Europe. The directive on renewable energies, which was just adopted last December, did nothing to improve such inefficiencies, despite the imminent financial crisis. On the contrary, it protected national systems, most of which are based on national guaranteed feed-in tariffs. This inefficiency only raises costs for all consumers and might also reduce the acceptance of renewable energies if costs become too high.

Energy efficiency is yet another topic in the context of security of supply. The Spring 2007 European Council decided to raise overall energy efficiency within the EU by 20 percent by 2020 (European Council 2007). Ever since, the Commission has presented a whole bunch of proposals on how to attain this target, including the ban of the old light bulb. More bans and further regulation, for example on energy use during stand- by and on energy related products, will soon follow.

It is doubtful, however, whether regulation is indeed the best way to foster efficiency. Car manufacturers would have stepped up their development of low consumption engines and flexy-fuel or hybrid cars even without the penalties that have also been decided last December. The main driver for innovation in this respect was soaring oil prices that led to a change in consumer demand around the world, not the prospect of penalties.

What lessons may be learnt from the past? First of all, security of supply has to be taken seriously both in the internal and the external policies of the European Union. There is no need to discuss energy efficiency and sustainability when no energy can be produced in the first place. The most recent gas dispute showed clearly once more that concrete actions have finally to be taken. Second, we must find a way to allocate our capital much more effi-

ciently in order to ensure a broad energy mix. And third, even though energy efficiency is of central importance to reduce growth in demand, we have to rethink the mechanisms that will ultimately achieve the goal.

Quo vadis?

Energy policy has gained considerable importance over the last two decades. This is due in part to a shift towards greater liberalisation of energy markets in the United States and in Britain in the 1980s, but also to technological developments and to the break-up of the Soviet Union and the enlargement process of the EU itself.

Our world is changing constantly. But one fact remains true for the past centuries if not even millennia: we do need energy. And our need for energy has been growing at an alarming pace ever since the invention of the steam engine and the industrial revolution. Furthermore, the earth's population has risen rapidly in the last 150 years and the United Nations predict a further rise in the next decades. At the same time, countries like China and India are witnessing their own industrial revolutions as they enter a new era. Each one of these developments further increases global demand for energy.

Therefore, energy policy cannot be successful if it is short-sighted. If we want to retain our way of life and to continue being at the forefront of science and production, then we must by all means develop a sustainable energy policy that balances security of supply, sustainability and competitiveness. The EU is moving along a good path but it will be necessary to avoid contradictions like those we have witnessed in recent years. Maybe the restructuring of the European Commission currently under discussion will help develop a more consistent European energy policy in the future.

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Are Older People Responsible for High Healthcare Costs?

Constantina Safiliou-Rothschild*

The cost of public healthcare is continuously rising and 15 percent of the European population aged 65 and over consumes 60 percent of healthcare resources. In OECD countries, the over 65 age group accounts for 40 to 50 percent of healthcare spending and their per capita healthcare costs are three to five times higher than those under 65. Projections for Europe forecast that the population over 65 years old will increase from around 16 in 2000 to 23 in 2025 and to 30 percent in 2050, and, that healthcare costs are likely to grow at an average annual rate of 5 to 6 percent, most of this cost attributed to increasing ageing. Public expenditures on healthcare are projected to increase by 1 to 2 percent of GDP due to ageing in most OECD member states between now and 2050 – a relatively small amount in comparison to the total increases since 1950. In addition, if it becomes possible to maintain the proportion of a lifetime spent in good health as overall life expectancy increases, these additional costs could be halved (Liddle and Lerais 2007).

Table 1 is representative of the type of data responsible for propagating the belief that the increased numbers of older people are responsible for enormous (occasionally termed "catastrophic") increases in healthcare costs. There is no question that the number of old people will increase as long as life expectancy increases. Yet economic analyses have shown that the expected increase in per person health expenditure caused by greater longevity will be less than expected because of the concentration of expenditures at the end of life rather than during extra years of a relatively healthy life (Yang, Norton and Stearns 2003). Other researchers have shown that while both age and proximity to death have significant effects on quarterly hospital costs, age effects are small compared with the tripling of quarterly costs that occurs with approaching death in the last year of life. The 5 percent of patients in the last year of life generated approximately half of the hospital expenditures for those aged 65 and over (Seshamani and Gray 2002). Of course, the cost of nursing homecare increases with age but because

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Table 1

National healthcare costs in 1994 and projections for 2015 by age and healthcare sector for the Netherlands

	Age group				Total		Annual growth rate %
	0–64		>65				
	million euros	%	million euros	%	million euros	%	
1994							
Acute care	4,560	54.9	3,742	45.1	8,302	100	
Long-term care	3,129	38.3	5,501	61.7	8,180	100	
Total	7,689	46.7	8,793	53.3	16,482	100	
2015-I							
Acute care	5,105	49.4	5,232	50.6	10,337	100	1.1
Long-term care	3,298	31.5	7,175	68.5	10,473	100	1.2
Total	8,402	40.4	12,408	59.6	20,810	100	1.1
2015-II							
Acute care	6,101	40.5	8,977	59.5	15,078	100	2.9
Long-term care	7,058	51.2	6,724	48.8	13,781	100	2.5
Total	13,158	45.6	15,701	54.4	28,859	100	2.7

Note: 2015-I = demographic projection; 2015-II = demographic projection + age-specific trends.

Source: Polder, Bonneux, Meerding and Van der Maas (2002).

Table 2

Share of population and hospital expenditures by age group, 2002 and 2026, England

	0–4	5–15	16–44	45–64	65–74	75–84	85+
% of population							
2002	5.8	14.0	40.9	23.8	8.1	5.5	2.0
2026	5.4	11.9	36.0	26.2	10.4	7.3	2.7
%-point change	– 0.4	– 2.1	– 4.9	+ 2.4	+ 2.3	+ 1.8	+ 0.7
% of decedents							
2002	0.2	0.2	3.5	13.1	18.7	33.7	30.7
2026	0.1	0.1	2.5	12.0	17.1	32.9	35.2
%-point change	– 0.1	– 0.1	– 1.0	– 1.1	– 1.8	– 0.8	+ 4.5
% of expenditures							
2002	7.9	3.4	24.9	20.1	13.1	18.4	12.5
2026	7.3	2.8	21.3	21.9	13.7	19.0	14.0
%-point change	– 0.6	– 0.6	– 3.6	+ 1.8	+ 0.6	+ 0.6	+ 1.5

Source: Seshamani and Gray (2002).

Table 3

Share of population and hospital expenditures attributable to people in their last year of life, 2002 and 2026, England

Age group	2002		2026	
	Share of age group in last year of life (%)	Share of expenditures (%)	Share of age group in last year of life (%)	Share of expenditures (%)
0–4	0.03	1.54	0.02	1.02
5–15	0.01	0.65	0.01	0.44
16–44	0.09	3.83	0.07	3.10
45–64	0.56	18.97	0.47	16.48
65–74	2.35	43.06	1.68	36.81
75–84	6.24	55.94	4.63	51.44
85+	15.90	64.63	13.47	63.04
All ages	1.02	28.98	1.02	27.98

Source: Seshamani and Gray (2002).

Table 4

Average number of hospital days per year according to status, Germany

Age group	Survivors	Persons in their 3rd last year of life	Persons in their 2nd last year of life	Persons in their last year of life
–24	0.8	9.3	11.2	24.2
25–34	0.9	13.4	12.0	28.6
35–44	1.1	13.7	22.5	34.7
45–54	1.9	11.0	15.5	39.2
55–64	2.3	6.9	12.4	40.6
65–74	3.0	9.0	12.4	36.4
75–84	4.8	8.5	11.4	31.8
85+	5.4	5.1	6.3	23.2

Source: Busse, Krauth and Schwartz (2002).

hospital costs predominate in total health expenditures, the related research still finds a concentration of costs towards the end of life. A number of empirical studies confirm the findings of high levels of healthcare resources mainly occurring in the 12–18 months before an individual's death (Brockmann 2002; Dixon et al. 2004).

Individually older patients actually consume fewer healthcare resources than younger patients since, mainly because of age discrimination, they are less likely to receive intensive care or to undergo surgery or complex interventions. In fact, the most expensive patients are the ones who die young. If only the last year of life is counted, the 45–64 year olds have the highest number of hospital days; and if the last three years are taken into account, the 35–44 year olds use the most hospital days (Busse, Krauth and Schwartz 2002). Overall, it seems that *the negative image of* the "expensive older patient" may be a myth that needs to be dispelled (Zwifel, Felder and Meiers 1999; Jacobzone 2002).

Table 5

Share of persons admitted to hospital at least once a year according to status (%), Germany

Age group	Survivors	Persons in their 3rd last year of life	Persons in their 2nd last year of life	Persons in their last year of life
–24	7.7	17.9	32.1	56.0
25–34	7.5	25.0	28.6	50.0
35–44	7.7	34.1	30.6	59.6
45–54	10.2	24.5	38.0	74.6
55–64	12.5	28.3	35.2	80.2
65–74	14.9	30.6	39.3	81.2
75–84	20.2	34.0	37.5	82.4
85+	20.6	21.6	27.6	70.2

Source: Busse, Krauth and Schwartz (2002).

If, however, the population is not simply getting older, as assumed in the Eurostat demographic projections, but also getting healthier, there will be improvement in life expectancy in terms of years lived in good health and health costs will be squeezed within the very few last years of life ("compressed" morbidity). Also New Zealand calculations suggest that even plausible modest improvements in older persons' health could offset about one-third of the extra healthcare costs imposed by population aging (Bryant and Sorenson 2006). This highlights the importance of investing in population health as a means of mitigating future economic impacts of ageing populations (Suhrcke et al. 2005).

It must be pointed out that the examination of healthcare costs as well as projections about such costs are primarily focused on widely available hospitalization costs. The calculation of healthcare costs, however, cannot be separately examined from social care costs, especially when dealing with aging-related costs. Wanless (2002) correctly argues that any future reviews of aging and health costs should fully integrate modeling and analysis of health and social care. Indeed, even underestimated available data from Britain show that the ageing of the population is a more important cost pressure for social care than for healthcare.

While there is considerable agreement that health costs are increasing in Europe as well as in North America, the contention that this increase is primarily due to increasing population aging is less solid. Other important factors besides aging play very important roles in increasing the cost of healthcare. These other factors can be grouped in four distinct categories: (a) unhealthy lifestyles: smoking, obesity and overweight and lack of exercise; (b) poor quality of healthcare: lack of primary and secondary prevention, adverse drug reactions and other preventable medical injuries, and age and gender discrimination in healthcare delivery; (c) lack of adequate rehabilitation care and social care; and (d) a number of non demographic expenditure drivers, such as higher wages for health professionals, rising administrative costs, new treatments because of new medical technology and new drugs and better coverage of the population (Bryant and Sorenson 2006). We shall examine all these additional factors in some detail.

Unhealthy lifestyles

There is considerable evidence that unhealthy lifestyles such as smoking, lack of physical activity and obesity can have a major impact on the required level of healthcare resources (Wanless 2002). The calculations healthcare costs caused by smoking in Germany

Table 6

Number of hospital days per year of persons admitted to hospital at least once according to status, Germany

Age group	Survivors	Persons in their 3rd last year of life	Persons in their 2nd last year of life	Persons in their last year of life
–24	10.8	52.1	34.8	56.0
25–34	12.4	53.7	41.9	50.0
35–44	14.5	40.3	30.6	59.6
45–54	18.3	45.0	38.0	74.6
55–64	18.3	24.4	35.2	80.2
65–74	20.3	29.4	39.3	81.2
75–84	23.8	25.1	37.5	82.4
85+	26.2	23.4	27.6	70.2

Source: Busse, Krauth and Schwartz (2002).

Table 7

Costs of smoking in Germany in 1993 (in million euros)*

Smoking attributable costs	Neoplasms	Cardiovascular diseases	Respiratory diseases	Total costs
Direct costs				
Prescribed drugs	7.7	784.3	316.5	1,108.0
Outpatient care	56.2	756.7	329.3	1,193.9
Acute hospitalization	303.7	1,361.1	498.0	2,162.8
Rehabilitation	50.1	177.9	96.1	324.2
Total	417.7	3,079.5	1,239.9	4,737.1
Indirect costs				
Mortality	2,013.5	1,816.1	237.2	4,173.7
Morbidity	1,194.4	4,196.7	2,972.1	8,363.2
Work lost days	161.1	1,290.0	2,006.8	3,457.9
Early retirement	1,033.3	2,906.7	965.3	4,905.3
Total	3,208.4	6,012.8	3,208.9	12,537.4
Total costs	3,626.1	9,092.3	4,449.3	17,274.5

* Calculated by stratifying smoking prevalence in nine age groups.

Source: Welte, König and Leidl (2000).

show high direct and indirect costs involved for all age groups (Welte, Konig and Leidl 2000).

There is also evidence that obesity has roughly the same association with chronic health conditions as does twenty years' aging from 30 to 50, this association being mirrored in healthcare utilization. Namely, obesity is associated with a 36 percent increase in inpatient and outpatient spending and a 77 percent increase in medications. In the case of current smokers, the increase in inpatient and outpatient costs is 21 percent and 28 percent the increase of medications costs (Sturm 2002). An American study also concluded that while in all age groups obesity increased direct healthcare costs by 54 percent, in the age group 65–74 the increase amounts to 104 percent (Thompson 2008).

It has been estimated that the present value of the expenditure savings for the Australian government would provide savings of about 2 US dollar for every 1 US dollar of expenditure in public health programmes to reduce tobacco consumption (Suhrcke et al. 2005). In Europe, there have been relatively few economic evaluations of preventive activities, such as the cost effectiveness of the smoking cessation programmes in Britain: the average cost per life saved was 684 British pounds and the estimate of cost-effectiveness rose to 2693 British pounds (Godfrey et al. 2005).

Poor quality of healthcare

While adverse drug reactions (ADR) have negative health consequences for all ages, they occur much more often among older persons who more frequently take many types of medicines than do younger persons. It has been shown that the risk of ADR is related to the number of medicines taken and that nursing home patients appear to be particularly vulnerable to ADR. In addition, around 7 percent of all hospital admissions are related to ADR, although as many as 80 percent of these reactions are preventable as they are due to a drug treatment procedure inconsistent with present-day knowledge of good medical practice. However, in the case of older patients the knowledge of pharmacological principles and the way that ageing affects drug kinetics and response is also necessary. Furthermore, dose-related failure of existing therapy to manage the condition adequately (because of age discriminatory healthcare) may be one of the most important reasons for hospitalization of older people (Routledge, O' Mahony and Woodhouse 2003). While the majority of patients hospitalized with ADR recover, they may need hospitalization of several days and from 1.5 to 3 percent of them die. ADR leading to hospitalization represents a cost up to 466 million British pounds annually for the British National Health System that can be significantly reduced with better healthcare delivery (Pirmohamed et al. 2004).

Other preventable medical injuries are iatrogenic injuries and include hospital-acquired nosocomial infections, pressure sores and surgical and peri-operative complications. Older patients are much more vulnerable to all these medical injuries partly due to the aging process and partly to inadequate care provided. These injuries are usually responsible not only

for older patients' deteriorating health but also for increasing the cost of required healthcare in terms of hospitalization and medical interventions. Considerable cost reductions appear to be possible if principles of error prevention and geriatric research are applied in all care settings (Rothschild, Bates and Leape 2000).

Older patients suffering more often with chronic illnesses (e.g. heart failure) than younger persons require expensive re-hospitalizations because there is no comprehensive discharge planning with post-discharge support. European and North American studies have shown that expensive re-hospitalizations can be reduced if patients are well informed about their illness and about self-management, and are provided with the follow-ups that facilitate their transition to home care. While the mean cost of such interventions is low, the mean annual reduction in overall costs (because of the reduction of re-hospitalization rate) appears to be rather considerable (Phillips et al. 2004).

In Britain more than 30 percent of people over 65 years old living in the community fall every year, often more than once, and the risk of falling and of fatality increases with age (Jensen et al. 2002). While only 3 to 10 percent of these falls results in serious injury, even for those who do not sustain any major physical injury as a result of a fall, the psychological trauma or fear of falling itself may lead to self-imposed reduction in physical activity (Close 2001). Because of the frequency of falls and their serious health and mobility consequences for older people, resulting health and social care costs are significant. Tables 8 and 9 present the costs of such falls in Britain.

There is considerable evidence provided by medical research according to which, in the case of several life-threatening conditions (such as acute myocardial infarction, heart failure, or cancer), older patients are significantly less often provided with appropriate and effective medical treatment than younger patients suffering from the same conditions. In Sweden, for example, only a quarter of all heart failure patients are treated with ACE inhibitors – few of them being older patients, despite the fact that they constitute the most effective as well as cost-effective treatment of the condition (Ryden-Bergsten and Andersson 1999). The situation is, however, perpetuated for several reasons. First, older people are underrepresented in randomized, controlled treatment trials and in this way there is no evidence whether or not invasive medical interventions and particular drugs are effective for older people (Shah, 2004). Second, in the absence of clear evidence of effectiveness in the case of treating older people, physicians tend to avoid undertaking possibly risky medical interventions, while medical insurance companies attempt to save extra expenses caused by such supposedly risky treatments. Because of the combination of all these factors, age discrimination in older persons' access to effective healthcare continues (Safiliou-Rothschild 2007).

There has recently been considerable debate in Europe and the United States as to whether or not it is ethical to ration medical treatment and healthcare on the basis of age and cost benefit considerations (Williams 1997; Robinson 2002). The prevailing themes have been the perception of lesser cost-effectiveness of older people's healthcare and the preference for greater investment in younger people. Such age rationing seemed to take place more often when healthcare modalities, such as dialysis or transplantation, were scarce or were perceived to be scarce (Killner 1988; Rothenberg 2005). The scarcity issue was defended because it was argued that the healthcare needs of younger people have priority over those of old people since the use of medical care by younger people is more effective in preserving life and in maintaining normal function than when used by old people. However, there is no guarantee that

Table 8

Costs of accidental falls per 10,000 people in thousand British pounds*

Age group	Fall on same level from slip/trip/stumble	Fall on or from stairs or steps	Fall from one level to another	Unspecified fall	Total
60–64	65.4	30.9	80.9	101.9	279.2
65–69	173.1	74.5	20.8	319.0	587.4
70–74	163.8	63.3	23.5	180.9	431.5
= or >75	468.5	60.5	138.1	838.9	1,496.1
Mean	248.2	57.2	77.2	427.4	810.0

* Incidence data are from 1999 and costs are expressed in 2000 British pounds.

Source: Scuffham, Chaplin and Legood (2003).

Table 9

Breakdown of costs of accidental falls by resource use (in % of total costs for each age group)*

	60–64	65–69	70–74	= or >75	Total
Ambulance journey	5.2	2.6	4.5	3.4	3.5
Accident and emergency attendance	6.4	3.2	5.6	4.1	4.3
Hospital inpatient					
Outpatient attendance	71.8	58.6	61.2	42.6	49.4
General practice consultations	4.4	2.2	3.0	1.2	1.8
Long-term care	0.3	0.2	0.2	0.2	0.2
Total	12.0	33.2	25.5	48.5	40.8
	100.0	100.0	100.0	100.0	100.0

* Incidence data are from 1999 and costs are expressed in 2000 British pounds.

Source: Scuffham, Chaplin and Legood (2003).

the denial of appropriate medical care to older people will be tied directly to redistribution of this care to afflicted younger age groups (Battin 1987).

While at present, clear-cut discussions of rationing of expensive medical treatment of older persons have become less frequent, the concept and the practice have not disappeared; they have often gone underground. Thus, the analysis of data from German hospitals suggests that healthcare is informally rationed according to the age and sex of the patient (Brockmann 2002) and a similar type of rationing has been reported regarding the treatment of angina in Scotland (Murphy et al. 2006). Similarly in Italy, the age and sex rationing was evident in lesser hospital expenditure for women than for men and for older patients-over 65 than for younger ones (Gabriele et al. 2006).[1]

Inadequate rehabilitation and social care services

In general older patients have less easy access to rehabilitation services (Cottin et al. 2004) and to long-term care. In the Czech Republic, for example, while there is an abundance of acute-care hospital beds, there are few beds for rehabilitation and the long-term care. The main problem of care for old and chronically ill people is not only the absence of geriatric departments in most hospitals but also the lack of capacities for rehabilitation and continuing care. After old people are discharged from hospitals and go home, they are still in an unstable condition and need long-term care that is not available. For this reason, they soon end up back in hospital (Holmerova 2004).

The French experience seems to be similar – old people who lose their autonomy have great difficulty finding nursing services and assistance at home that allow them to continue living at home but always can find place in hospitals when they need treatment for an acute phase of their illness (Doucet, 2002). Furthermore, Arfeux-Vaucher et al. (2006) suggest that older people (and especially those over 80 years old) resort to emergency and/or to hospitalization because available social services are not able to take care of them so they can stay at home or because there is no place for them in rehabilitation or geriatric units. In this way, health statistics show high numbers of older people without acute health problems in emergency services and in hospitals and doctors hurry to discharge them in order to "free beds".

Non-demographic expenditure drivers

Economic analyses undertaken in New Zealand concluded that non-demographic (rather than demographic) factors dominate the expenditure growth in healthcare (Bryant and Sorenson 2006). Firstly, when a country's economy is doing well, governments may be willing to spend more on health and there is considerable pressure for the wages of health professionals to increase. Secondly, different types of new medical technology that can either help decrease or increase healthcare costs. They can decrease healthcare costs when they provide more effective screening, diagnosis and treatment of diseases; or when they help decrease disability and the need to use expensive medical treatments and pharmaceuticals. On the other hand, new medical innovation can increase healthcare costs by increasing

[1] Widespread age rationing has been reported, for example, (a) in the use of statins for the secondary prevention of coronary heart disease; (b) in the revascularization of older hospital patients with ischaemic heart disease where an age-related selection bias leads to fewer referrals for exercise tolerance testing and cardiac catheterization and angiography despite indications that such interventions are equally beneficial for them as for younger patients; (c) in the treatment of cancer; (d) in the exclusion of older people from dialysis; and (e) in the low percentage of patients over 60 years having access to renal transplantation despite the fact that such transplantation can be performed safely and successfully in patients with end-stage renal disease who are 60 years and older.

the life expectancy of people with different chronic or multiple health conditions that require long-term treatment and medication; or by propagating a more expensive technology that does not offer advantages over the less expensive existing technology (European Commission 2007). Thirdly, healthcare costs for people over 65 years increase because of the introduction of new and more expensive drugs and shifts in dosages within each therapeutic class. In Canada these shifts were found to be responsible for a 90 percent increase in per capita healthcare costs between 1985 and 1999 (Evans et al. 2001). Fourth, electronic health records and information-sharing technologies, which can greatly boost productivity, are inadequately used. There is little doubt that widespread computerization could greatly cut healthcare cost by reducing the paperwork burden of health personnel and hospitals, by heading off medication errors (and adverse drug reactions), and by reducing the costly repetition of diagnostic tests as patients change doctors (New York Times Editorial 2007). It has been calculated that potential financial benefits of the widespread adoption of electronic medical record systems could eventually save more than 80 million US dollars annually. Furthermore, health information technology that enables prevention and management of chronic disease could eventually double these savings while increasing health and other social benefits (Hillestad et al. 2005).

Conclusion

In conclusion, it seems that attributing increasing healthcare costs to increased aging of the population is an easy scapegoat solution. Rising healthcare costs have many other significant expenditure drivers. Furthermore, healthcare costs cannot be measured only by health costs. It is necessary to examine different types of social care costs together with direct healthcare costs.

There is considerable evidence pointing to other important factors responsible for high health costs that are also responsible for older persons' relatively poor quality of healthcare. The examined evidence also suggests that the key to lowering future healthcare costs lies in the improvement of healthcare system in general and particularly the improvement of older persons' healthcare.

Despite the existence of some hard data concerning the expected reduction of healthcare costs through the improvement of lifestyles, the improvement of healthcare system and its organization and implementation style, there are no overall economic analyses and projections taking all of these possible reductions into consideration when projecting future healthcare costs. And social costs incurred in the care of older persons are not integrated in these projections.

Of course, there are good reasons for this lack of systematic economic analysis and projections. Relevant data are not always complete or available for many countries and there are many ever-changing dynamic factors that can alter thoroughly these calculations. For instance, biotechnologies are revolutionizing the ageing experience by offering early diagnoses, new treatments such as regenerative and genetic interventions and ultimately disease prevention.

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World Economic Prospects for 2009 and 2010

According to the IMF's latest forecast,[1] world growth will fall to 1/2 percent in 2009, its lowest rate since World War II. Output in the advanced economies will contract by 2 percent in 2009, while growth in emerging and developing economies will slow from 6 1/4 percent in 2008 to 3 1/4 percent in 2009, under the drag of falling export demand, lower commodity prices and much tighter external financing constraints. Continued efforts to ease credit strains as well as expansionary fiscal and monetary policies are prerequisites for a gradual recovery of the global economy in 2010, with growth reaching around 3 percent (Table 1). However, the outlook is highly uncertain.

The major reason for the pessimistic projection is that despite various policy actions to provide additional capital and reduce credit risks, financial strains remain acute, badly affecting the real economy. Since end-October 2008 in advanced economies, spreads in funding markets have only gradually narrowed despite government guarantees, and those in many credit markets remain close to their peaks. In emerging economies, despite some recent moderation, sovereign and corporate

[1] International Monetary Fund (IMF, 2009), World Economic Outlook Update, January 28, 2009, Washington DC.

Table 1

IMF's World Economic Forecasts for 2009 and 2010

			Projections	
	2007	2008	2009	2010
World output	5.2	3.4	0.5	3.0
Advanced economies	2.7	1.0	– 2.0	1.1
United States	2.0	1.1	– 1.6	1.6
Euro area	2.6	1.0	– 2.0	0.2
Japan	2.4	– 0.3	– 2.6	0.6
Newly industrialized Asian economies	5.6	2.1	– 3.9	3.1
Emerging and developing economies	8.3	6.3	3.3	5.0
Africa	6.2	5.2	3.4	4.9
Central and eastern Europe	5.4	3.2	– 0.4	2.5
Commonwealth of Independent States	8.6	6.0	– 0.4	2.2
Developing Asia	10.6	7.8	5.5	6.9
Middle East	6.4	6.1	3.9	4.7
World trade volume (goods and services)	7.2	4.1	– 2.8	3.2
Imports				
Advanced economies	4.5	1.5	– 3.1	1.9
Emerging and developing economies	14.5	10.4	– 2.2	5.8
Exports				
Advanced economies	5.9	3.1	– 3.7	2.1
Emerging and developing economies	9.6	5.6	– 0.8	5.4
Commodity prices (US dollars)				
Oil*	10.7	36.4	– 48.5	20
Nonfuel (average based on world commodity export weights)	14.1	7.4	– 29.1	7.3
Consumer prices				
Advanced economies	2.1	3.5	0.3	0.8
Emerging and developing economies	6.4	9.2	5.8	5.0

* Simple average prices of UK Brent, Dubai and West Texas Intermediate crude oil. The average price of oil in US dollars a barrel was $97.03 in 2008; the assumed price based on future markets is $50.00 in 2009 and $60.00 in 2010.

Source: IMF.

spreads are still elevated. As economic prospects have deteriorated, equity markets in both advanced and emerging economies have made hardly any gains. Currency markets have been volatile. The continuation of the financial crisis, as policies failed to dispel uncertainty, has caused asset values to fall sharply across advanced and emerging economies, decreasing household wealth and thereby putting downward pressure on consumer demand. In addition, the associated high level of uncertainty has prompted households and businesses to postpone expenditures, reducing demand for consumer and capital goods. At the same time, widespread disruptions in credit are constraining household spending and curtailing production and trade.

The sudden decrease in global demand has led to a rapid fall of commodity prices. Despite production cutbacks and geopolitical tensions, oil prices have declined by over 60 percent since their peak in July 2008: the IMF projects 50 $/b for 2009 and 60 $/b for 2010. Metals and food prices have also been marked down in line with recent developments. These price declines have dampened growth prospects for many commodity-exporting economies. Sluggish real sector activity accompanied by lower commodity prices has reduced inflation pressure. In the advanced economies, headline inflation will decline from 3 1/2 percent in 2008 to a record low of 1/4 percent in 2009, before edging up to 3/4 percent in 2010. In emerging and developing economies, inflation is also expected to subside to 5 3/4 percent in 2009 and 5 percent in 2010, down from 9 1/2 percent in 2008.

Faced with a rapidly deteriorating outlook and subsiding inflation pressures, central banks in the advanced economies have taken actions to cut policy rates and improve credit provision. Policy interest rates have been brought down substantially in recent months, especially as inflation pressures subsided, although falling inflation expectations are mitigating the impact on real interest rates. Central banks in emerging economies are also moving to ease their policy stance and improve market liquidity. At the same time, many governments have announced fiscal packages to boost their economies. Specifically, fiscal stimulus in G-20 countries in 2009 is projected to be 1.5 percent of GDP. Deficits are also expected to be boosted by the operation of automatic stabilizers and the impact on revenues of sharp asset price declines as well as the costs of financial sector rescues. Consequently the fiscal balance in advanced economies will deteriorate by 3 1/4 percentage points to minus 7 percent of GDP in 2009.

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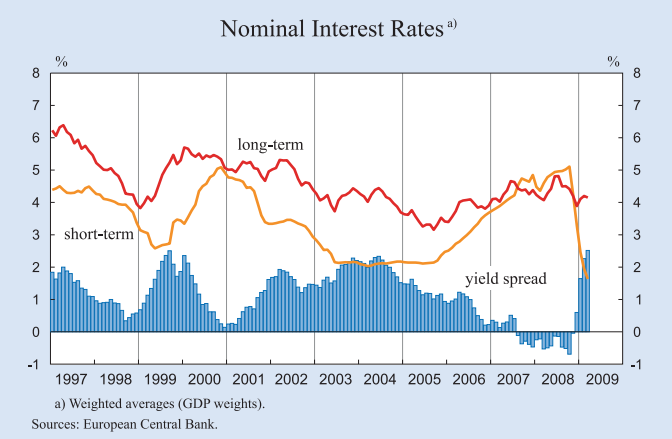
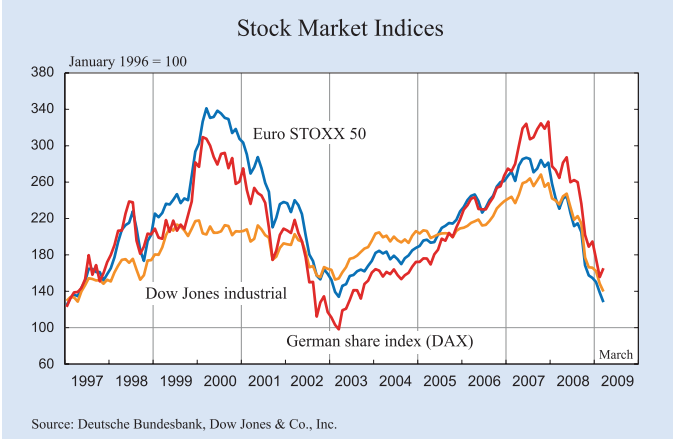
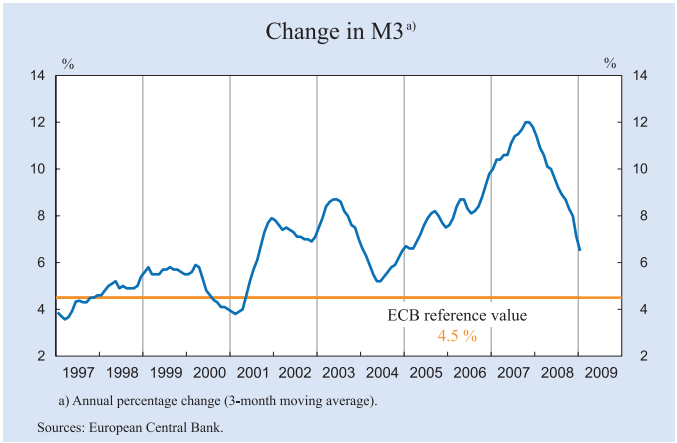
FINANCIAL CONDITIONS IN THE EURO AREA

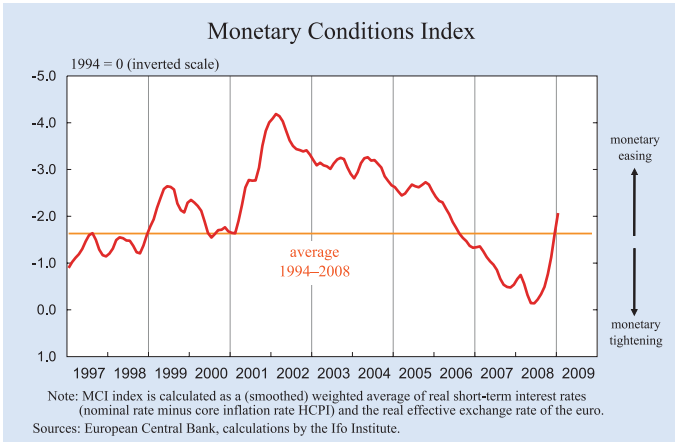




In the three-month period from January to March 2009 short-term interest rates declined. The three-month EURIBOR rate decreased from an average 2.46% in January to 1.64% in March. Yet, the ten-year bond yields slightly grew from 4.11% in January to 4.15% in February. In the same period of time the yield spread increased from 1.65% (January) to 2.51% (March).

The German stock index DAX declined in March 2009, averaging 4,085 points compared to 4,338 points in January. The Euro STOXX also fell from 2,340 in January to 1,994 in March. The Dow Jones International also declined, averaging 7,235 points in March compared to 8,396 points in January and 7,690 points in February.





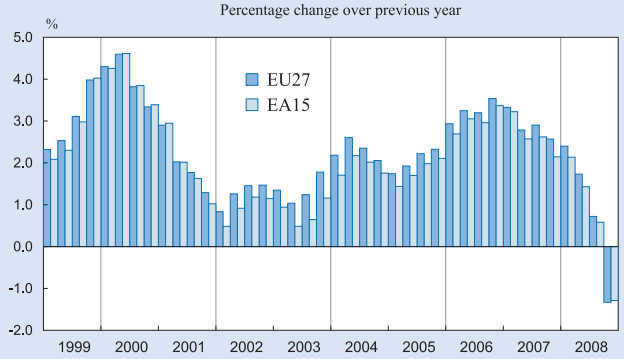
The annual rate of growth of M3 stood at 5.9% in February 2009, compared to 6.0% in January. The three-month average of the annual growth rate of M3 over the period from December 2008 to January 2009 declined to 6.5%, from 7.1% in the period November 2008 to January 2009.

In January 2009 the monetary conditions index continued its rapid growth that had started in mid-2008, signalling greater monetary easing. In particular, this is the result of decreasing real short-term interest rates.

EU SURVEY RESULTS

Gross Domestic Product in Constant 2000 Prices

Percentage change over previous year

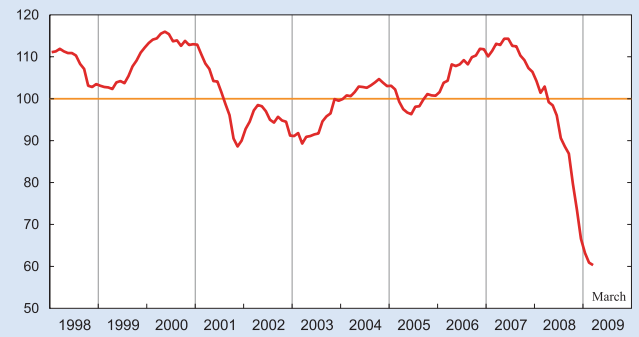


Source: Eurostat.

According to the first Eurostat estimates, GDP fell by 1.5% in both the euro area (EU15) and the EU27 during the fourth quarter of 2008, compared to the previous quarter. In the third quarter of 2008 the growth rate had amounted to – 0.2% for the euro area and – 0.3% for the EU27. Compared to the fourth quarter of 2007, i.e. year over year, seasonally adjusted GDP declined by 1.3% in both the euro area and the EU27.

EU27 Economic Sentiment Indicator

Index 2000 = 100, seasonally adjusted

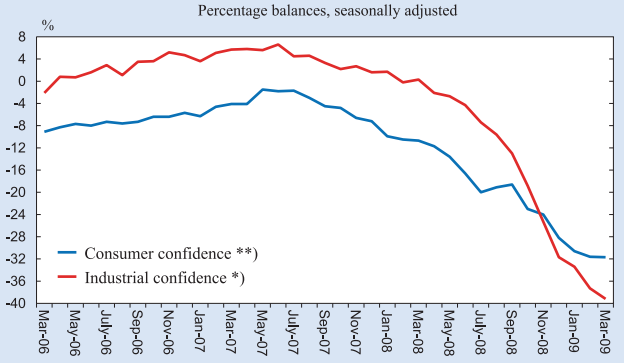


Source: European Commission.

In March 2009, the EU Economic Sentiment Indicator (ESI) fell by 0.6 points in the EU27 and decreased by 0.7 points in the euro area, to 60.3 and 64.6 respectively. The indicators for both regions now stand at their lowest level since January 1985. Confidence deteriorated most markedly in Italy (– 4.5), followed by France and Poland (– 1.0), Germany (– 0.8) and the UK (– 0.4).

EU27 Industrial and Consumer Confidence Indicators

Percentage balances, seasonally adjusted

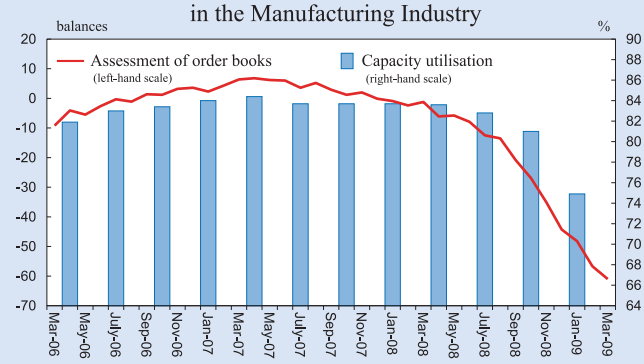


Source: European Commission.

* The industrial confidence indicator is an average of responses (balances) to the questions on production expectations, order-books and stocks (the latter with inverted sign).
** New consumer confidence indicators, calculated as an arithmetic average of the following questions: financial and general economic situation (over the next 12 months), unemployment expectations (over the next 12 months) and savings (over the next 12 months). Seasonally adjusted data.

In March 2009, the *industrial confidence indicator* fell by the same amount (-2 points) in both the EU27 and the euro area. The indicator has been on a downward path since its peak in May 2007 and currently stands below its long-term average in both areas. The *consumer confidence indicator* remained unchanged in the EU27 but fell by 1 point in the euro area in March, and also currently stands below its long-term average in both areas.

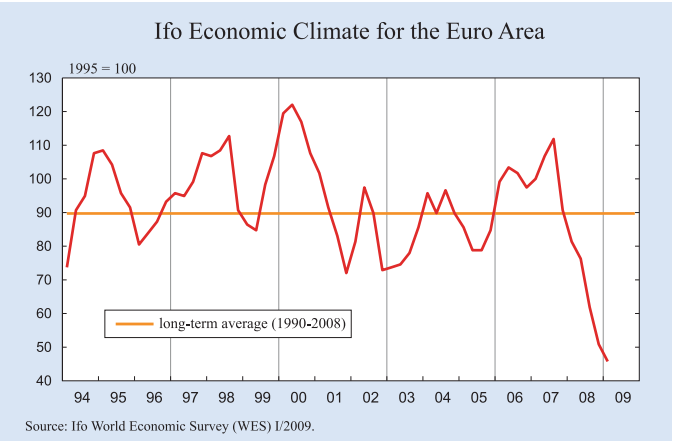
EU27 Capacity Utilisation and Order Books in the Manufacturing Industry



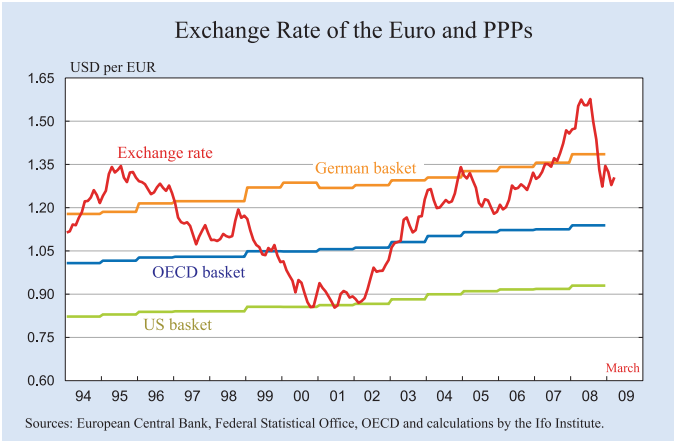
Source: European Commission.

Industry Managers' assessment of *order books* deteriorated from – 48.2 in January to – 61.0 in March 2009. In December 2008 the indicator had reached – 44.3. *Capacity utilisation* declined to 74.9 in the first quarter of 2009 from 81.0 in the previous quarter.

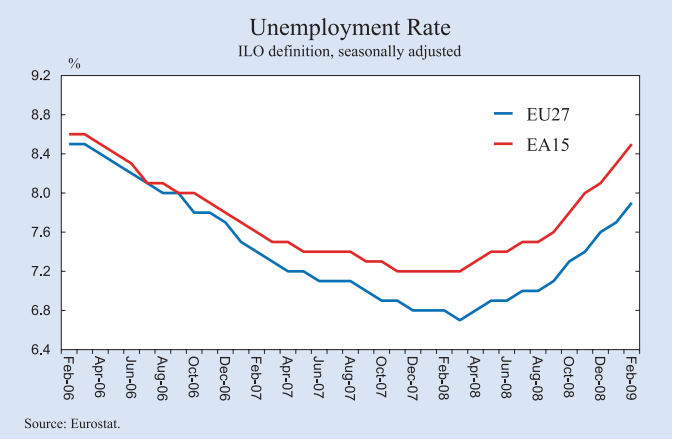
EURO AREA INDICATORS



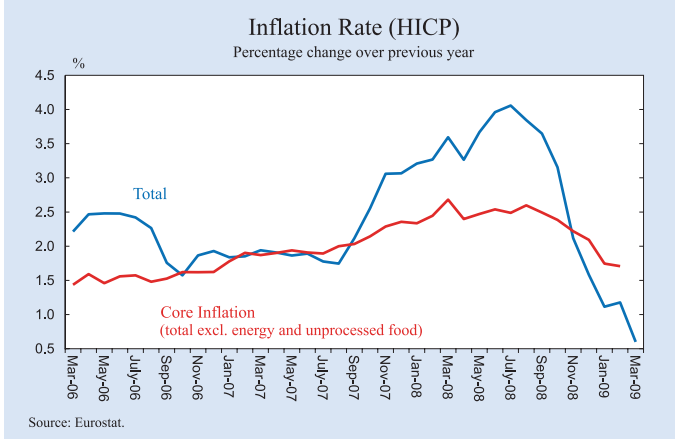
The Ifo indicator of the economic climate in the euro area (EU15) has worsened again in the first quarter of 2009 for the sixth time in succession, falling to its lowest level in five years. Its decline is the sole result of less positive assessments of the current economic situation: the expectations for the coming six months improved somewhat but are still in strongly cloudy territory.



The exchange rate of the euro against the US dollar averaged 1.31 $/€ in March 2009, a decrease from 1.32 $/€ in January. (In December 2008 the rate had amounted to 1.34 $/€.)



Euro area (EU15) unemployment (seasonally adjusted) amounted to 8.5% in February 2009, compared to 8.3% in January. It was 7.2% in February 2008. EU27 unemployment stood at 7.9% in February 2009, compared to 7.7% in January. The rate was 6.8% in February 2008. Among the EU Member States the lowest rate was registered in the Netherlands (2.7%). Unemployment rates were highest in Spain (15.5%), Latvia (14.4%) and Lithuania (13.7%).



Euro area annual inflation (HICP) was 1.2% in February 2009, compared to 1.1% in January. This is quite a decrease from a year earlier, when the rate had been 3.3%. The EU27 annual inflation rate reached 1.7% in February, down from 1.8% in January. A year earlier the rate had amounted to 3.5%. An EU-wide HICP comparison shows that in February 2009 the lowest annual rates were observed in Ireland and Portugal (both 0.1%) and Cyprus (0.6%), and the highest rates in Latvia (14.1%), Bulgaria and Lithuania (both 10.8%). Year-on-year EU15 core inflation (excluding energy and unprocessed foods) slightly fell to 1.8% in February from 1.7% in January.

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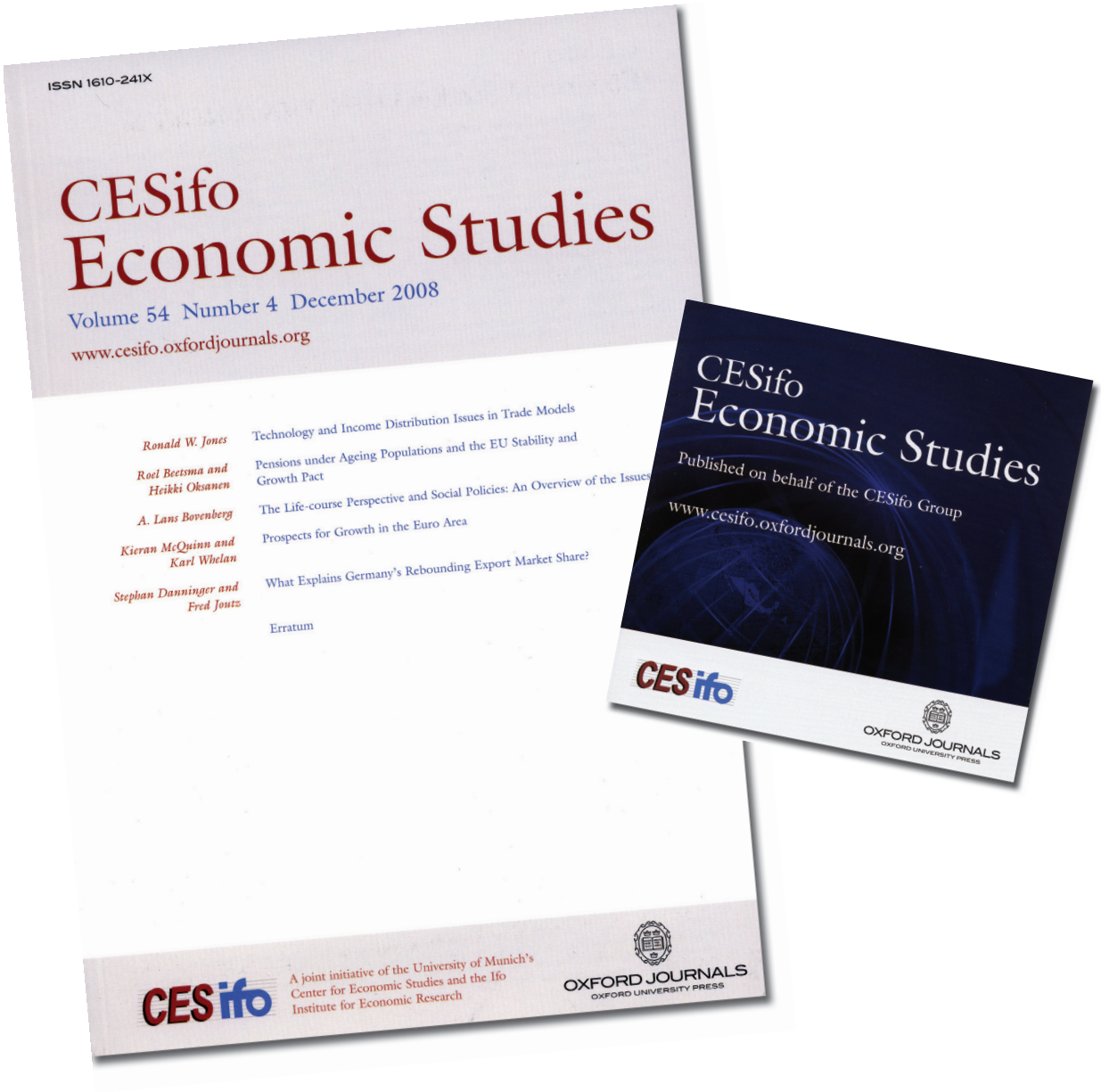

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