

would directly and most heavily affect industrial production and households, while the direct effect of oil price increases will be the most noticeable in transport and agriculture.

7. Table 2 provides the data on energy imports to Ukraine for 2001 and 2004. Energy imports represented 16% of GDP in 2004, and they increased by 62% in US\$ terms in three years since 2001. Oil imports increased by nearly 130% during 2001-2004. While natural gas decreased as a share of energy imports, its value increased by 9% since 2001.

Table 2: Imports of Energy to Ukraine

	2001	2004
Energy imports, US\$ million	6253.5	10160.9
Energy imports / GDP, %	16.5	15.7
<i>Structure of imports, %</i>		
Imports	100.0	100.0
Mineral products	42.6	37.4
Energy	39.6	35.0
coal	1.8	3.1
Oil	13.3	16.7
natural gas	20.8	12.4
oil products*	3.6	2.9
<i>Index of value in US\$, 2001=100</i>		
Imports	100.0	183.8
Mineral products	100.0	161.3
Energy	100.0	162.5
coal	100.0	312.6
Oil	100.0	229.8
natural gas	100.0	109.2
oil products*	100.0	145.3

* Oil products import is calculated as a residual in the energy sub-group.

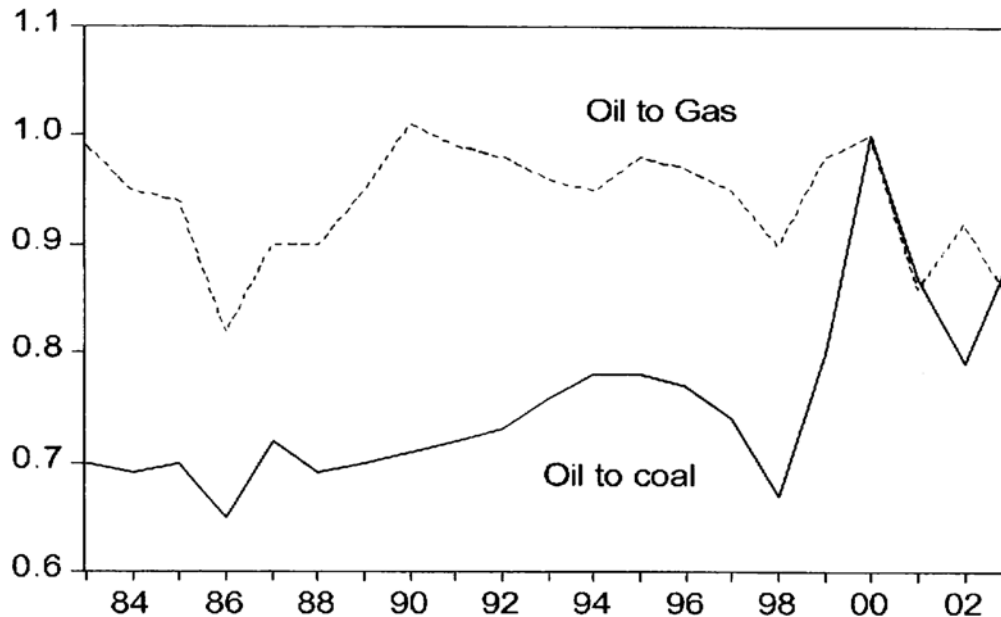
Source: State Statistics Committee of Ukraine.

3. PRICE TRENDS

8. Relative prices of energy sources are not stable in Ukraine. In theory, in a perfectly functioning market economy, the cross elasticity of substitution between energy sources approaches unity (that is, if the price of oil goes up by 10%, so does the price of coal, gas, and derivatives of these supplies – such as power). However, as Figure 1 reveals, there are large variations in energy supply prices even in OECD countries (i.e., the cross elasticities are not 1, and they appear to vary over time). Factors determining prices in Ukraine are especially complex, and while market forces are at play, they work in ways that are not obvious. The impact of oil price increases on coal, hydro and/or nuclear power prices will be closer to a market relationship than with gas. Gas price setting between Ukraine and its suppliers is affected by political factors, leverage and market factors combined (and they appear to have been dominated by political factors and leverage to date). Coal prices also appear to be heavily influenced by political

factors, budget allocations and leverage between suppliers and buyers, who tend to have varying linkages to policy setting at the state level.

Figure 1: Ratio of Oil to Coal and Oil to Gas Prices to End User in OECD



Source: The Impact of Higher Oil Prices on Low-Income Countries and on the Poor, March 2005 UNDP/ESMAP

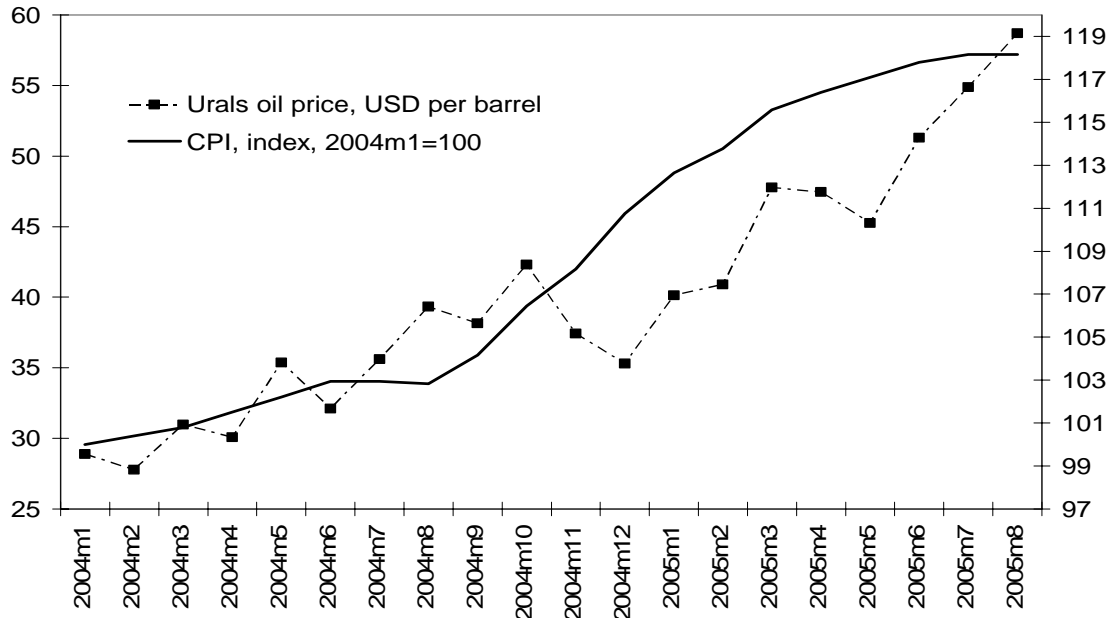
9. In Ukraine, oil prices are more dependent on the market mechanism than prices of natural gas. In order to make quantitative sense of these issues, the first step is to review World market oil and gas price trends as they apply to Ukraine. For oil, the relevant price of a barrel of oil is for Ural crude. Urals has risen from US\$29 per barrel at the end of 2003, to US\$35 at the end of 2004, and US\$59 in August 2005 (see Figure 2). In the absence of further unexpected supply shocks on the world market, we do not expect further price increases next year.

10. Oil price increases have influenced directly the cost of petroleum products (0.7% share in CPI) and city and road transportation services (1.8% share in CPI) for households. During 2004, the prices of petroleum products increased by 61.6% (accounting for some of the CPI growth in that year⁶), while during 9 months of 2005 it further grew by 32.9%. Cost of transportation services increased in 2004 by 11.8%, and during 9 months of 2005, by 20.3%. The impact of increased oil prices on cost of transportation services was mitigated due to subsidized transport tariffs by local authorities.⁷ The immediate contribution of these factors to CPI growth is relatively small given their share in the CPI market basket, but if one includes indirect and macroeconomic effects, their contributions can be substantial.

⁶ During 2004, CPI increased by 9%, while in Sep 2005, y/y growth of CPI was 13.9%.

⁷ For example, in Kyiv prices for public transportation services did not change for more than 5 years.

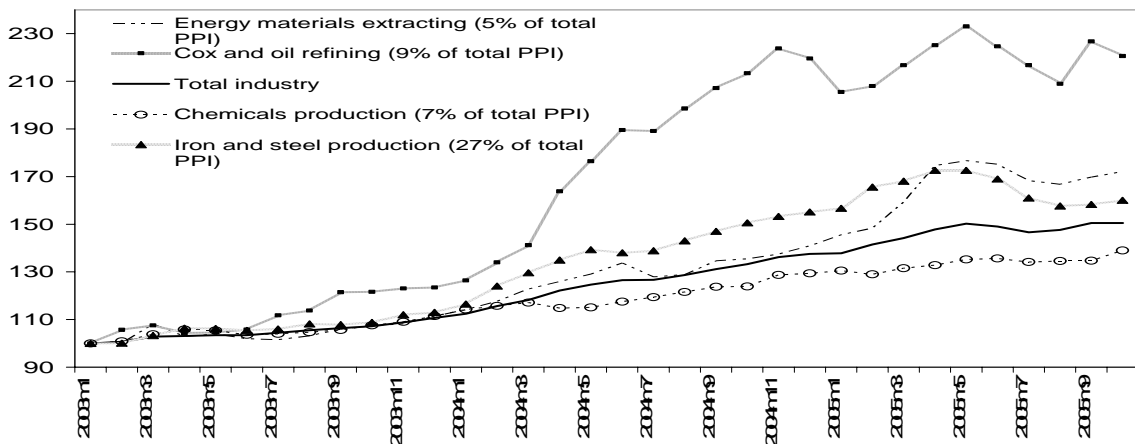
Figure 2: Urals crude oil prices and CPI



Source: State Statistics Committee of Ukraine, State Statistics Committee of Russian Federation

11. Oil price increases directly influenced Ukraine's PPI through prices in oil refining (their share in total industry PPI is about 9%) and energy material extraction (5%).⁸ In 2004, oil refining prices increased by 78% and the direct effect alone accounted for at least 7% of the total PPI growth.⁹ In the first 9 months of 2005 there has been much slower at 3.3%. Energy materials extraction prices increased by 26.4% in 2004 and 20.5% in the first 9 months of 2005.

Figure 4: Indices of PPI in different industries, 2003m1=100



Source: State Statistics Committee of Ukraine.

⁸ There are three main energy materials extracted in Ukraine: oil, natural gas and coal. Unfortunately, we do not have a disaggregated data to be able to take coal out of PPI in this industry.

⁹ In 2004, PPI increased by 24.1%, while in Sep 2005, y/y growth of PPI was 14.7%.

12. For natural gas, European prices have increased by 67% since 2003 (prices in the US are about proportional to that). European price parity for Ukraine could be as high as \$235 per 1000 cubic meters. However, gas prices in Ukraine are determined through bilateral negotiations with Russia and Turkmenistan. For several years, Russia has continued to provide gas to Ukraine at US\$50 per 1000 cubic meters. Earlier this year, Ukraine and Turkmenistan negotiated a cash-based gas price of US\$44 per 1000 cubic meters, which implies US\$60 at Ukraine's border after Russian transport costs are included. Negotiations are ongoing between Naftogaz and Gazprom on the future prices of Russian gas. While Ukraine may not see a significant increase in the cost of its gas supplies in 2006, there is concern about gas costs subsequently. Naftogaz has an arrangement with Gazprom covering payment in kind for gas transmission through 2013 that should provide 25 to 28 billion cubic meters per year at a deemed cost of about US\$50 per 1000 cubic meters. However, this arrangement has been put into question in recent months and pressure is clearly building on the Russia side for significant implicit price increases to be built into the arrangement. Ukraine has secured an arrangement with Turkmenistan for gas supplies in 2006. However, starting in January 2007, all of Turkmenistan's gas is effectively committed to Russia, and Ukraine will have to secure its purchased import volumes (about 30 to 35 billion cubic meters/year) from Russia, which would become the sole importer of all Central Asian gas after signing purchase and transit agreement between Gazprom and Turkmenistan, Kazakhstan and Uzbekistan.

13. Ukraine currently transits about 115 billion cubic meters of gas annually, and receives about 25 billion cubic meters worth of gas as payment for that transit. The transit fee used as a basis for this calculation is US\$1.09 per 1000 cubic meters per kilometer. The "European Parity" price of gas is about US\$235 and the parity transit fee is about \$2.6 per 1000 cubic meters per kilometer. Ukraine annually consumes additionally about 29 billion cubic meters of gas from Turkmenistan. Own production for domestic consumptions represents about 18 billion cubic meters.

14. The result of gas price negotiations is hard to predict. Russia can put pressure on Ukraine for payment in cash at "European prices", but this terminology is questionable for Ukraine which has leverage in negotiations. In addition to the pipeline, it has a valuable gas storage facility which is an important part of providing Westward gas flows consistent with demand. Ukraine must continue to focus on the long term goal of being the transit country of choice for Russia. In negotiations, it can increase transit fees along with the price increase proposed by Gazprom, and the gas pass-through is significantly larger than its own consumption, which gives it net leverage on this point. Yet, should gas supply break down with negotiations, even though the warehouse will provide some cushion, market reactions in Europe will likely lead to pressure on Ukraine from European partners to quickly settle the matter. Whatever the case, it will be crucial to come to a reasonable solution, presumably which moves the payment form to cash and which envisages a stepwise increase in gas prices for Ukraine, which is affordable to both Ukrainian and Russian industrial producers in Ukraine and preserves Ukraine consumers as a growing customer base for Russian suppliers in the future.

15. It is important to note that this paper is not about what factors realistically determine the framework of price negotiations, nor the eventual outcome. Political and specific economic variables interact in these negotiations in ways that yield outcomes which are difficult to predict analytically. This paper aims just to provide a reasonable sensitivity analysis of a range of outcomes of those discussions. It does not envelop the full range of potential outcomes, but rather provides a simple model that interested parties can use to test their own views on what outcome may take place, and a few scenario results to illustrate the potential impact. Further, we are not attempting to imply anything positive (about what would be the outcome) or normative (about what should be the outcome) of these discussions.

4. VULNERABILITY INDICATORS

16. Ukraine's energy vulnerability¹⁰ can be broken down into three complimentary indicators, derived from the ratio of net oil and gas imports to GDP:¹¹

$$\text{Oil vulnerability} = \frac{\text{net oil imports}}{\text{GDP}} = \frac{\text{net oil imports}}{\text{total oil use}} * \frac{\text{total oil use}}{\text{total energy use}} * \frac{\text{total energy use}}{\text{GDP}}$$

Equivalently,

$$\text{Gas vulnerability} = \frac{\text{net gas imports}}{\text{GDP}} = \frac{\text{net gas imports}}{\text{total gas use}} * \frac{\text{total gas use}}{\text{total energy use}} * \frac{\text{total energy use}}{\text{GDP}}$$

By component, we then have,

$$1 - \text{self sufficiency in oil/gas production} = \frac{\text{net oil/gas imports}}{\text{total oil/gas use}}$$

$$\text{Dependence on oil/gas as energy source} = \frac{\text{total oil/gas use}}{\text{total energy use}}$$

$$\text{Energy intensity} = \frac{\text{total energy use}}{\text{GDP}}$$

17. Using data for Ukraine and comparator countries yields the following results for Ukraine's relative vulnerability (see Table 3):

- Ukraine is the most energy-intensive in the region.
- Ukraine is less oil dependent and more oil self sufficient compared to other countries in the region, but the country's high energy intensity makes it much more oil vulnerable than the EU countries.

¹⁰ Energy vulnerability is measured here in ioe per US\$ GDP.

¹¹ The vulnerability analysis is based on "The Impact of Higher Oil Prices on Low-Income Countries and on the Poor", March 2005 UNDP/ESMAP.