

5. THE DIRECT IMPACT OF HIGHER OIL AND GAS PRICES ON COUNTRIES' GDP

19. Estimates of the direct impact of oil and gas price increases on Ukraine can provide great insight into structural and macroeconomic difficulties Ukraine faces over the next few years. But of course there are a number of other factors (beyond energy prices) affecting GDP changes, including momentum from past years, World growth trends, progress on institutional and structural reform, and financial discipline.

20. Beyond direct effects of energy price increases, there can be important indirect effects which can both help and hurt a particular country. The net affect is usually negative for a net energy importing country. However, without the use of a world general equilibrium model, it is difficult to estimate these effects with confidence. A couple of examples from Ukraine are illustrative. Increased World oil prices may hurt Ukrainian producers through their costs, but help them in terms of sales due to increased import demand for their products by now more wealthy Russian trading partners. At the same time, establishment of the oil stabilization fund in Russia introduces a stability factor, which over the foreseeable future, will tend to moderate the potential growth in export demand from Russia. Also, increasing World oil prices are also expected to hit the car industry very hard, yet the trends toward new production in Eastern Europe and Western Ukraine may well quicken in such a cost-crunch environment, and the momentum and potential capacity in Ukraine for growth in this sector are tremendous. Also, increased World oil prices are expected to weaken World economic growth, which could have a relatively negative impact on Ukraine, through less foreign investment and demand for Ukrainian goods (in the oil-importing countries).

21. To keep things relatively simple, several assumptions are made in this paper which can be debated. However, the results are indicative of the range of effect that Ukraine may experience, and interested researchers may adjust the assumptions to test the robustness of the results presented below, in light of their own priors about the energy environment Ukraine is likely to face over the coming few years.

5.1 Simple Net Import Model

22. In order to estimate the direct effect of price increases, a simple net import model can be used.¹² It is based on the observation that terms-of-trade changes for energy products will affect the wealth of countries positively or negatively, depending on whether they are net importers or exporters of these products. Ukraine is a net importer of oil and gas, but is potentially a net exporter of coal and electricity. The simplest version of the model (most relevant for a country significantly poorer than Ukraine) assumes that in case of a terms-of-trade deterioration, the country will not be able to raise additional external financing, nor will it have excess reserves to spend. Thus, the entire value of the higher costs will be reflected by a reduction in GDP. The model recognizes, however, that elasticity of demand for energy products is not zero – that is, as prices go up, producers and consumers substitute away from energy, or between energy products.

¹² See for example, “The Impact of Higher Oil Prices on Low-Income Countries and on the Poor”, March 2005. -UNDP/ESMAP.

Therefore, in order to estimate the net impact on GDP, we need additionally to calculate these demand elasticities from cross country estimates, which can be segmented by level of development of the countries in question.

23. Using the net import model, the equation of impact on GDP is as follows:

$$\% \Delta GDP = \% \Delta TT * (1 - E) * \frac{-NI}{GDP},$$

where:

$\% \Delta GDP$ = the percentage change in GDP,

$\% \Delta TT$ = the percentage change in price of energy imported,

$\frac{NI}{GDP}$ = net import of energy, and

E = price elasticity (written in absolute value).

24. This equation can be interpreted as follows. The change of GDP from a terms of trade shock in energy (a price increase) is a function of the size of its net imports as a ratio to GDP (if it is a net importer, this is a negative factor on GDP) and the price elasticity of energy demand (the more inelastic its energy demand, the more a price increase reduces GDP).

25. Our analysis is limited to a 2-year horizon. The starting point (year 0) is 2005 where the estimated average price of Urals oil is assumed to be US\$52¹³. This implies a 50.5% increase of average price comparing with 2004. The average price of Russian gas is US\$50 per 1000 cubic meters in 2005, while Turkmenistan's gas price is US\$60 at Ukraine's border after Russian transport costs are included.

26. We assume that all gas price increases are permanent,¹⁴ and only 50% increases of oil price are permanent (this assumption is supported by the empirical evidence). Beyond year 2 (2007), we make no estimates; this is convenient given uncertainties about World energy prices. But the implications for other years are obvious from the estimate results below. In our estimates of oil price increases, it is assumed that there is no impact on coal, hydro and gas (or that these secondary effects are insignificant). Likewise, gas is determined by a separate negotiation, which does not then affect oil and other primary energy supplies. This has the added benefit of building some conservatism into the assumptions. Given lags in adjustment of the energy prices facing Ukraine, these secondary effects would tend to become more important out of sample (beyond the second year forecasting horizon).

27. Price elasticity estimates are taken from the literature.¹⁵ The elasticities are drawn in relation to oil price changes. Fuel switching, energy efficiency and switching away to

¹³ During 9 months of 2005, the oil price increased by about 65% since 2004 to US\$55. We assume price of Urals oil does not change in the last quarter of 2005.

¹⁴ Of course, this assumption will no longer be applicable if Ukraine and Russia eventually reach European-parity prices.

¹⁵ As these elasticities are drawn from country estimates in response to a US\$10 per barrel increase in the price of oil, they are more applicable to marginal price increases than dramatic price shocks..

less energy intensive activities explains these elasticities, with the latter requiring more time, investment, innovation, and thus the whole range of institutional strengths that characterize well diversified economies. Research shows that elasticities in the second year (it is much harder to switch in the first year) are positively correlated with the *ex ante* level of development of the economy in question.

28. Table 5 shows estimate results for OECD and other developing countries in year 1 and year 2. They are higher in year 2, as the economies have more time to shift away from the higher priced energy imports. Ukraine has the capacity to export both coal and electricity, and it is a country with access to international financial markets, which potentially can help it to adjust more quickly away from high cost energy inputs while softening the negative GDP impact in the meantime. Thus, OECD elasticities for our estimates would seem more appropriate. However, in the scenarios below, both oil and gas prices are moving up, which means there are less alternative uses for energy switching, as compared to the studies from which the elasticities were drawn (these studies looked at only oil price shocks). We therefore use the average OECD’s elasticity estimates in our calculations for partial (oil or gas alone) estimates. In case both prices change, we assume joint price elasticity to be lower than partial elasticity for the second year (0.25 versus 0.4), since there are fewer alternatives for energy switching when both oil and gas prices are moving up from separate (albeit related) external shocks. These elasticity estimates are summarized in Table 5.

	OECD (oil)	Developing World (oil)	Ukraine (gas or oil)	Ukraine (jointly gas and oil)
Year 1	0.055	0.055	0.055	0.055
Year 2	0.3-0.5	0.2	0.4	0.25

5.2 Scenarios

29. Throughout the scenarios below we make the following specific assumptions:

- The shares of gas imported from Russian and Turkmenistan do not change.
- The transit fee will move to a cash basis. The change in the transit fee for Russian gas through Ukraine is proportionally equal to the increase in the price of Russian gas supply (and Turkmen gas through Russia). This means that the cash generated from transit will be sufficient for Ukraine to import from Russia the quantity of gas that it currently receives as payment for transport. However, the net impact on Ukraine will be felt due to the extra gas imports Ukraine will need to purchase from Russia (this is the gas Ukraine currently imports from Turkmenistan).
- The import share for the simulations below is calculated differently for oil and gas. Net imports of oil is used, since Ukraine is operating in almost market conditions on

¹⁶ These price elasticities are reflected in absolute value. A figure of 0.5 would mean that if the price increases by 100%, the quantity demanded would decline by 50%.

both import and export sides, so the price change will have the same effect, and the net imports of oil is really what matters for the economy. However, we use gross imports of natural gas, because Ukraine gets under-priced imports while exporting the gas on market terms. Therefore, price adjustment will affect gross imports while exports will not change.

30. Our specific price assumptions per scenario are as follows (each number reflects the scenario number):

Oil 1-3, 5: Average price per barrel facing Ukraine in 2006 (year 1) is US\$57. Using our assumption on the permanent price impact, this implies an average price of US\$54 per barrel for 2007 (year 2).

Oil 4: The price of oil increases by 50% to US\$78 per barrel in 2006 and goes back to US\$65 in 2007.

Gas 1: Naftogaz/GazProm negotiations result in no change of prices.

Gas 2, 4: As a result of the Naftogaz/GazProm negotiations, a price of US\$80 per 1000 m³ in cash results (a 60% increase). We assume the same increase (60%) in the price of Turkmen gas to US\$96 per 1000 m³ (with transit costs included).

Gas 3: Prices of Russian and Turkmen gas goes up by 110% (to US\$105 and US\$126 respectively).

Gas 5: Russia and Turkmenistan both raise the cost of gas by 220% (to US\$160 per 1000 m³ and \$192 per 1000 m³ respectively).

Table 6: Scenarios description

	2005	Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 5	
		Year 1	Year 2*	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
Urals oil price, US\$ per barrel	52	57	54	57	54	57	54	78	65	57	54
Russian gas price, US\$ per 1000 m ³	50	50	50	80	80	105	105	80	80	160	160
Turkmen gas price, US\$ per 1000 m ³	60	60	60	96	96	126	126	96	96	192	192

Source: authors' calculations

5.3 Scenario Results

31. Table 7 presents the results of the simulations, divided into two blocks. In each block, the shock column shows the change in the price of oil and gas in each scenario. The next two columns demonstrate the resulting estimated change in GDP in years 1 and 2 relative to the baseline path, which, by default, implies no changes in prices for oil and gas. Firstly, we show the effect of a “pure” price shock, that is change in the price of oil and gas without any changes to the transit fee. Then we show the effect of an “effective”

price shock, correcting for the same proportional change in the transit fee, as described in the assumptions. Actually, the range between the two estimates provides an insight into the costs of the bargaining power in the negotiations. For all scenarios, we show both estimates of the partial effects (when the increase in oil price occurs without any change in gas price and vice versa) and, most importantly, the composite effect, which reflects the joint impact of both gas and oil price changes. The composite effect is higher than the sum of partial effects because the joint elasticity is assumed to be lower than partial elasticities due to there being fewer alternatives for energy switching when both oil and gas prices are moving up at the same time.¹⁷

32. Depending on the scenario, the estimated impact on the economy would be in range of 0.4-8.6% GDP “loss” relative to the baseline for the first year after the shock, and a range of 0.2-6% GDP “loss” relative to the baseline for the second year. For example, in scenario 2, the GDP would be 2.2% lower relative to baseline in Year 1, and 1.6% lower in Year 2.

Table 7: Estimation of the Price Changes' Impact on GDP

	Imports, % GDP (2004)	Price Shock	ln % of GDP		Effective Price Shock	ln % of GDP	
			1 year	2 year		1 year	2 year
		Scenario 1					
Partial impact							
oil and oil products (net)	-4.7%	10%	-0.4%	-0.1%	10%	-0.4%	-0.1%
natural gas (gross)	-5.5%	0%	0.0%	0.0%	0%	0.0%	0.0%
Composite (joint) impact			-0.4%	-0.2%		-0.4%	-0.2%
		Scenario 2					
Partial impact							
oil and oil products (net)	-4.7%	10%	-0.4%	-0.1%	10%	-0.4%	-0.1%
natural gas (gross)	-5.5%	60%	-3.1%	-2.0%	33%	-1.8%	-1.1%
Composite (joint) impact			-3.6%	-2.7%		-2.2%	-1.6%
		Scenario 3					
Partial impact							
oil and oil products (net)	-4.7%	10%	-0.4%	-0.1%	10%	-0.4%	-0.1%
natural gas (gross)	-5.5%	110%	-5.8%	-3.7%	61%	-3.2%	-2.0%
Composite (joint) impact			-6.2%	-4.7%		-3.7%	-2.7%
		Scenario 4					
Partial impact							
oil and oil products (net)	-4.7%	50%	-2.2%	-0.7%	50%	-2.2%	-0.7%
natural gas (gross)	-5.5%	60%	-3.1%	-2.0%	33%	-1.8%	-1.1%

¹⁷ It is important to remember that, as we have clarified above, natural gas import prices in Ukraine are not determined by the oil equivalent value of natural gas btu's.

Composite (joint) impact		-5.4%	-3.4%	-4.0%	-2.3%		
Partial impact		Scenario 5					
oil and oil products (net)	-4.7%	50%	-2.2%	-0.7%	50%	-2.2%	-0.7%
natural gas (gross)	-5.5%	220%	11.5%	-7.3%	123%	-6.4%	-4.1%
Composite (joint) impact		-	-	13.7%	10.0%	-8.6%	-6.0%
Memo: Price elasticities							
Partial		0.055	0.4	0.055	0.4		
Joint		0.055	0.25	0.055	0.25		

Source: authors calculations

33. While these estimates provide a useful gauge of the importance of energy prices to Ukraine's economy, they should be considered with caution. First, some good news. As Ukraine's economy is highly energy dependent, hard budget constraints and full cost energy tariffs toward market prices should encourage a more rapid modernization of Ukraine's production techniques and an adjustment toward Ukraine's true comparative advantages in production and services. This is of course provided that macroeconomic stability and access to finance are maintained through responsible stewardship of the economy during the transition period. The bad news, however, is that the analysis does not take into consideration potential non-linearities following from micro-considerations in Ukraine's largest export sectors. These are discussed briefly below.

5.4 Non-Linearity

34. The impact of increased oil and gas prices on the Ukraine's economy may be non-linear. The Ukrainian economy grew rapidly since 2000 despite substantial increase in oil prices. In the context of strong world growth and better financial discipline at home, Ukrainian producers brought industrial capacity back on line, while being helped by the fact that export commodity prices were rising, such as metals, chemicals and agricultural products.

35. Ukraine has continued to operate with cheap inputs of gas. Focusing on the exporting sector, we can assume that the world market prices for goods produced by Ukraine can be taken as given. If the price of gas increases, industrial enterprises can be expected to dramatically reduce production in a step-wise manner since they are unable to change output prices. Further, at some level of gas prices, many plants and many sectors would likely all be affected at once, complicating matters, and due to multiplier

effects, potentially making the resulting fall in GDP steep and larger than the estimates provided above.¹⁸

36. That said, according to estimates of the IMF, Ukraine accumulated terms of trade gains during 2000-04 amounting to about 24 percent--correspondingly roughly to a positive current account impact of 12 percent of GDP. Most of the positive terms of trade gains have accrued to the corporate sector, although some of the gains have been experienced by households (via wages) and the public sector (via tax revenue increases). An increase of gas prices to US\$200 per 1000 cubic meters would only amount to a terms of trade loss of about 7 percent and a negative CA impact of 3.5 percent of GDP. Thus, Ukraine is relatively well positioned to digest a terms of trade loss of this size - it would reverse only a fraction of recent terms of trade gains. What is of potentially more concern, is a concurrent large drop in the price of Ukraine's exports, especially metals.¹⁹

5.5 Potential Impact on Inflation

37. Beyond GDP, the increase in energy prices will also have both direct and indirect effects on inflation. Increases in oil and gas prices can directly lead to higher overall inflation indexes as petroleum products and gas are consumed by households. Indirect impacts come as producers pass through some part of higher oil and gas costs to the prices of final goods. Induced macroeconomic effects follow also. For example, higher goods prices can lead to higher wage costs that result in further prices growth. The role of expectations, the composition and size of the public budget, and monetary policy all play interlinking roles. It is also important whether the increases in gas and oil prices are expected to be temporary or sustained. If consumers and producers perceive the increases as permanent, the impact of higher oil and gas prices on inflation will be larger.

38. The direct impact of oil and gas prices increases on inflation depend on the share of petroleum products and gas in the consumption basket and the ability of consumers to substitute toward produces with less energy content and or which use cheaper energy sources. The direct impact of the gas price increase on CPI would also depend on the policy of Naftogaz towards passing through the price increase to households and/or the industrial sector.

39. Among other things, the magnitude of the indirect impact of higher gas and oil (petroleum products) prices on inflation is influenced by dependence of producers on these energy products, ability to switch to cheaper energy sources, and the extent to

¹⁸ In 2005, Ukraine's metallurgical enterprises have encountered decline in world prices of their products, increase in transportation costs and real appreciation of hryvnia, which made downward pressure on their profits. However, they still have been benefiting from the substantial increase in metals prices during last years. For more details see *Ukraine Trade Policy Study, World Bank, 2004*. Enterprise managers of metal and coal companies have reported prices of gas at which they would have to significantly cut back production, ranging from a price of US\$100 per 1000 cubic meters to US\$160. However, given the very public nature of these declarations, and in light of the dramatic terms of trade increases they have experienced, these figures can only be considered indicative of the non-linear supply response to price increases.

¹⁹ For more on this, see IMF Article IV, Selected Issues, "Ukraine: External Risks and Opportunities".

which prices of other energy sources prices rise in response to oil and gas prices increase. These factors are implicitly included in our analysis above with respect to GDP estimates.

40. The duration and strength of the inflation increase depends on the economic policy response. Subsidies to producers and consumers can mitigate shocks of oil and gas prices increases. However, attempts to keep energy prices stable at the internal market would lead to an increase in the fiscal burden and make such practice unsustainable in the long run. Moreover, such policy may lead to accumulation of inflationary pressures and worsen the impact of higher prices in the long run, while blocking adjustment of the economy that otherwise would be the upside of the energy price pressures. Price controls have already proved unsustainable in Ukraine. In April-May 2005, the government attempted to fix gasoline prices, but this policy lead to deficit of gasoline supply and the government had to abolish price controls.

6. POLICY RECOMMENDATIONS

41. It is clear that Ukraine is both vulnerable to oil and natural gas price increases, and that upward price pressures are going to be a fact of life for the coming few years. Oil price pressures are driven by World market trends that are essentially beyond the influence of policy makers in Ukraine. With regard to natural gas prices, the pace and magnitude of increases will be affected by Ukraine's use of diplomacy and finesse in its international negotiations. At the same time, moving to a cash basis will be an important step toward governance improvements in Ukraine while helping to bring transparency to the sector. Beyond prices and transparency, Ukraine has in its hands the task of reducing its vulnerability. The following recommendations provide a broad roadmap for policy makers in Ukraine in this regard. More detailed recommendations can be found in a number of studies produced by the World Bank and other organizations over the past few years. The bibliography below is intended as a resource for policy makers who would focus on this issue in more depth. "Taking the Next Steps in Energy Sector Reform" (WB Jan. 2005) and "Ukraine: Challenges Facing the Gas Sector" (Sept. 2003) are good starting places for such analysis.

- Seek a step by step and gradual reduction of gas price increases from main suppliers, in return for a credible commitment by Ukraine as a high quality and dependable manager of the transit system.
- Maintain hard budget constraints on energy producers, intermediate energy suppliers and consumers to encourage them to improve efficiency, modernize capital, and reduce energy dependency. This will be particularly important as Naftogaz and GazProm enter into a cash-only arrangement.
- Eliminate cross subsidization of energy tariffs and bring them to full cost recovery, including needed investment costs.
- Implement the Law on Debt Restructuring of the Energy Sector and adopt a strategic plan for further restructuring, ownership transformation and private sector participation in the energy sector.