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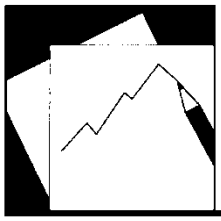

IMF Working Paper

How Expensive is Norway?
New International Relative Price Measures

Volodymyr Tulin and Kornélia Krajnyák

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European Department

How Expensive is Norway? New International Relative Price Measures

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Abstract

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The views expressed in this Working Paper are those of the author(s) and do not necessarily represent those of the IMF or IMF policy. Working Papers describe research in progress by the author(s) and are published to elicit comments and to further debate.

In this paper, we derive two new measures of international relative prices for Norway. Developments in these new measures follow rather closely movements in the CPI-based real effective exchange rate through the 1990s, but diverge after 2000—suggesting that the costs of living in Norway relative to its trading partners have risen in the recent years more than the real effective exchange rate would indicate.

JEL Classification Numbers: F14, F31, F37

Keywords: Norway, real effective exchange rate, Penn World Tables

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[1] This paper has benefited from comments by our colleagues in the European Departments of the IMF. Errors and omissions are the authors' sole responsibility.

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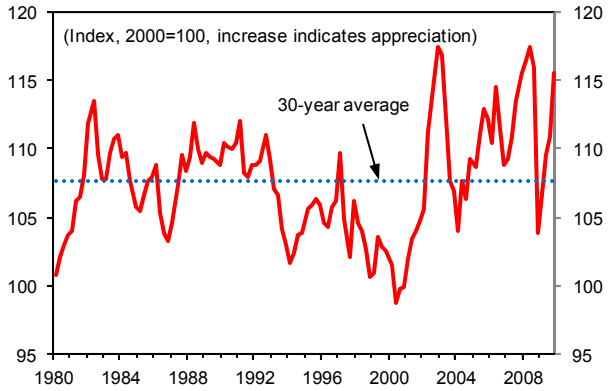
I. INTRODUCTION

The Norwegian real effective exchange rate (CPI-based) has been broadly stable over the last 30 years (Figure 1), even though the most recent decade brought a modest appreciation trend. By the end of 2009, the real value of the krone was about 7 percent above its 30-year average. One might, therefore, conclude that Norway's price level has changed relatively little compared to the price levels of its trading partners. This paper develops several alternative international relative price measures that suggest that the appreciation has been larger.

Figure 1. Norway's Real Effective Exchange Rate



Source: IMF Information Notice System.

CPI-based real effective exchange rates (REER) are practical measures of average relative price changes because they are computationally easy and timely, but they do not take account of some potentially important factors. Namely, they do not provide any information about the relative price levels between the partners, and they rely on comparing price indices for different consumption baskets. As the paper documents, the extent of dispersion of bilateral relative price levels among trading partners, as well as cross-country differences in consumption patterns, are both substantial.

We construct new measures for Norwegian international relative prices that do take into account these factors. First, these measures of the economy's international relative prices are not index numbers, rather, they are relative price levels. It turns out that accounting for dispersion in the underlying bilateral relative price levels allows for a new source of dynamics in trade-weighted relative price measures. Norway's price level relative to its partners rises as the composition of trade shifts away from relatively expensive partners towards developing economies.

Second, the proposed measures improve on commonly used CPI-based real exchange rate indices by accounting for cross-country differences in baskets—both in the composition of national consumer price indexes and in the composition of actual individual consumption. This includes, for example, recognizing that the weight of services in Norway's CPI is relatively small, due to public provision of services such as healthcare and education. As the costs of services relative to the prices of traded goods rise, the CPI-based bilateral real exchange rate will understate the increase in the cost of individual consumption in Norway vis-à-vis a partner with a larger share of personal expenditure on.

The new measures indicate that Norway's relative price level appreciated more in recent years than suggested by the REER. Our results suggest that the traditional CPI-based REER may understate the extent of Norway's relative price appreciation by about 7-15 percentage points during 2000–2008. About half of the difference can be attributed to increased trade with low-cost developing economies. The other half stems from taking proper account of the low measured share of services in Norway compared to other advanced economies.

II. ALTERNATIVES TO THE CPI-BASED REER

A. Why REER Mismeasures Changes in International Relative Prices

1. Accounting for greater trade with developing economies

Norway is one of the most expensive countries in the world. It has been repeatedly placed at the top of the Big Mac Index ranking popularized by the Economist, and Oslo has climbed to the rank of the world's most expensive city in various cost of living surveys (e.g. UBS, the Economist). Estimates of purchasing power parities (PPP) conducted under the International Comparison Program in 2005 suggest that Norway is about four times as expensive as emerging market countries such as China and Russia, and nearly 40 percent more expensive than the average OECD economy (World Bank, 2008). However, such surveys essentially provide either a comprehensive spatial or limited time-series comparison of Norway's price level to other countries. The PPP surveys under the International Comparison Program are only conducted every six years and are available with a two year lag[2], and more frequent international cost of living surveys, such as the Big Mac index, feature a more limited coverage of actual consumption baskets.

The idea of the REER, on the other hand, is to aggregate changes in consumer price indices across trading partners into an index number measured relative to the base year. Traditionally, REER computations have relied on fixed trade weights, which makes them less than ideal for a world of changing directions of trade. Allowing time-varying trade weights helps the REER capture shifts in the trade composition better. But even so, shifts towards low-cost producers is largely understated or missed. For instance, when bilateral real exchange rates do not change, then the REER will not record any changes just on account of updated trade weights, even though the change in trade patterns may be a significant source of relative price dynamics.

Example 1: Assume that country N's trade weights amount to 90 percent with country A (Advanced) and 10 percent with country E (Emerging). Its bilateral relative price level equals

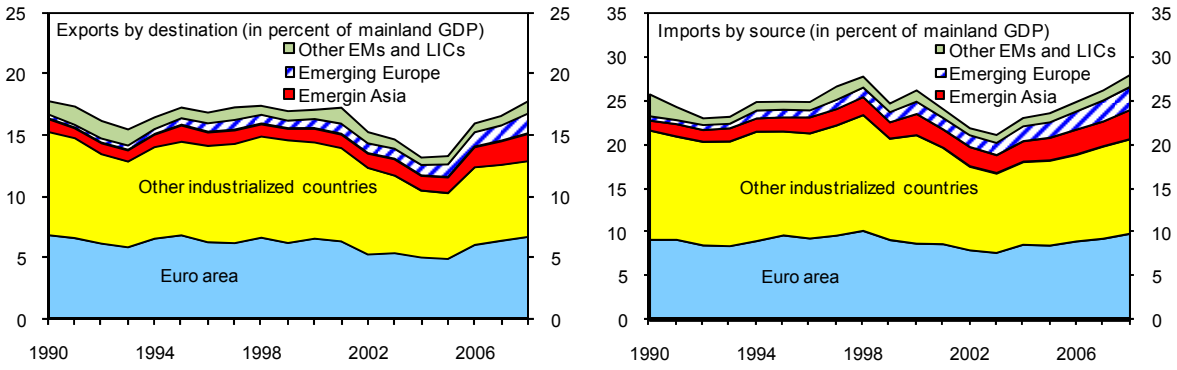
[2] The OECD-Eurostat PPP program is conducted every 3 years but does not include some major emerging markets.

1 vis-à-vis country A and 4 vis-à-vis country E. Assume that bilateral price levels do not change, but country A trade share falls to 80 percent and country E trade share rises to 20 percent. Such a change in the direction of trade would have no effect on the REER, as none of the bilateral prices have changed. However, when one accounts for the interaction between the shift in trade and the difference between A's and E's relative price levels, the trade-weighted price level rises by nearly 14 percent.

Indeed, Norway's non-oil trade has been changing fast in the past two decades. Since 2000, the share of trade with developing countries has nearly doubled to over one quarter of mainland GDP. As the simple example in the previous paragraph illustrates, compositional shifts in the direction of trade of such magnitude towards countries with significantly lower price levels could translate into a double-digit increase in Norway's trade-weighted relative price level.

The share of non-energy exports destined to developing countries has increased from 10 percent of total non-energy exports to nearly 25 percent from 1990 to 2008, which roughly equaled the decline in exports destined to non-euro area advanced economies, notably Sweden and the United Kingdom (Figure 2). Most of this adjustment has occurred since 1999. Similarly, imports from developing countries have increased from about 10 percent of total imports to nearly 25 percent from 1990 to 2008, as a share of non-euro area advanced economies decreased.

Figure 2. Geographical Composition of Norway's Non-Energy (Traditional Goods) Exports and Imports



Source: UN COMTRADE Database; Haver Analytics; and IMF staff calculations.

2. Incomparability of the underlying Consumer Price Indexes

The first shortcoming of the standard REER stems from how dispersion in overall price levels across countries interacts with changing trade weights. The second issue, discussed in this section, derives from differences in composition of consumer price indexes used to construct changes in bilateral real exchange rates. There are two main reasons why CPI-based real exchange rates tend to misspecify changes in the relative costs of living. First,

composition of CPIs often differs from composition of actual individual consumption within a particular country. Second, actual consumption patterns differ across countries.

In simple terms, the goal of cost of living indices, such as the CPI, is to measure the percentage by which consumers would have to increase their spending to be as well off after the change in prices as they were with the old prices. The main reasons for the dispersion in CPI expenditure weights across countries are differences in underlying preferences, differences in relative prices, and the implicit aggregate level of consumer satisfaction. They generally ignore the impact of government goods on household welfare[3]. There are also methodological differences due to, for example, the treatment of rural households or rents for owner occupied housing. Alternative to CPIs are Personal Consumption Expenditure (PCE) deflators which track actual individual consumption expenditure by households from quarter to quarter. PCEs are broader in scope and usually include some (but far from all) of the spending on behalf of consumers by employers and government agencies. Because of tracking actual expenditure they include substitution effects due to changes in relative prices.

Actual Individual Consumption (AIC) consists of goods and services paid for by individuals as well as services paid for by governments for the purpose of individual consumption, mostly education and health services. AIC is preferred to household consumption in international comparisons because the amount of individual services provided by government varies across countries. Because both CPI and PCE deflator measure out-of-pocket consumption expenditures by households, they exclude the costs of actual individual consumption borne by the government. Norway, as well as other Scandinavian countries, provide a significantly larger share of government-financed goods and services than many other industrialized economies. Reflecting this, the cumulative CPI weight on healthcare and education amounts to only 3% in Norway, compared with 9% in Italy, 10% in the United States, and 15% in Switzerland.

Housing rents are another important component of household expenditures. While most of Norway's trading partners account for both out-of-pocket expenditures of households on rents and imputed rents of owner–occupied housing[4], methodologies for imputing costs of owner–occupied housing vary greatly. Christensen et al (2005) suggests that while the effects of inclusion or exclusion of owner occupied housing on long-term average CPI measures are relatively modest, the short term effects turn out to be large and highly dependent on the

[3] There are, of course, a number of other limitations in the ability of CPIs to reflect changes in the domestic cost of living. They ignore the fact that consumer preferences extend to the choice between labor and leisure, they also abstract from intertemporal choices by assuming that all consumption takes place in a single period.

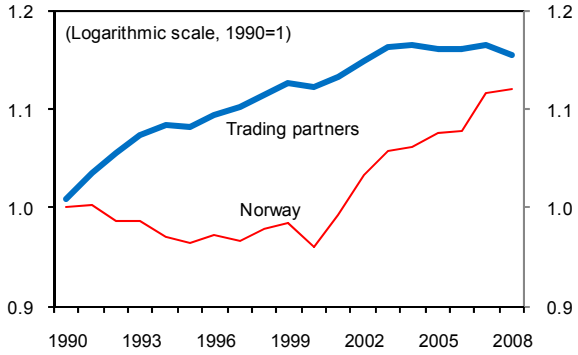
[4] Notable exceptions are France, Italy, and Korea. Eurostat's Harmonized Index of Consumer Prices (HICP) excludes owner-occupied housing from its scope. Eurostat argues that imputed rents are the opportunity costs of homeownership rather than reflection of actual prices faced by them as consumers (Johannessen, 2004).

underlying imputation methodology. On the other hand, for the purposes of National Accounts, owner-occupiers are considered as renters of their own homes. The reason for this is to avoid a situation in which the value of the gross domestic product could be affected by the switch in the proportion of tenants and owner-occupiers even if there is no change in the housing stock.

So why are these differences so important? The main reason is that they drive a wedge between the share of non-traded goods recorded in the CPI and the actual share in individual consumption.

Example 2: Assume that the shares of goods and services each equal to 50 percent of actual individual consumption in both country N and country A. However, due to differences in the extent of public service provision, shares of goods and services in the CPIs differ. Specifically, the weight on goods is 60 percent in the CPI of country N and 40 percent in country A. If prices of goods rise by 10 percent and prices of services by 30 percent in both countries, CPI would rise by 18 percent in country N and 22 percent in country A, while the cost of total individual consumption would rise by 20 percent in both countries.

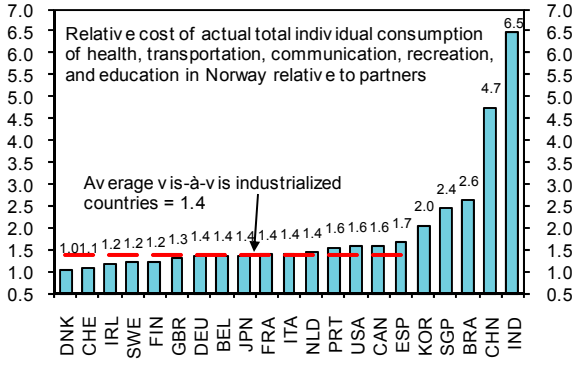
Figure 3. Prices of Services Relative to Prices of Goods in Norway and Trading Partners, 1990-2008



Source: IMF staff calculations.

According to the Balassa-Samuelson effect, because productivity in the tradable sector grows faster than in the nontradables sector, wage equalization between the two sectors leads to faster growth of prices of non-tradables. Figure 3 shows the growth in the relative prices of private services relative to goods in Norway and in its trading partners. Since 2000, the growth in the relative costs of services in Norway has been far larger than in its partners. Also, the relative prices of non-traded goods are normally higher in richer countries as they are relatively more productive in the traded goods than in non-traded goods[5]. Moreover, as Figure 4 suggests, the average cost of services is not only 1.4 times

Figure 4. Cost of Norwegian Consumption of Non-Traded Goods Relative to its Trading Partners, 2005

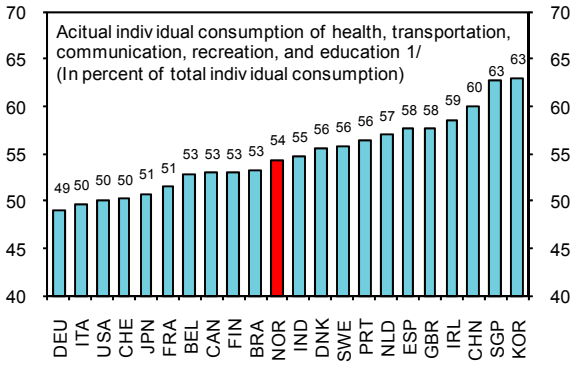


Source: International Price Comparison Survey, 2005.

[5] Therefore, the growth in partners differential is somewhat overstated by not accounting for increased trade with developing countries where services are relatively cheaper.

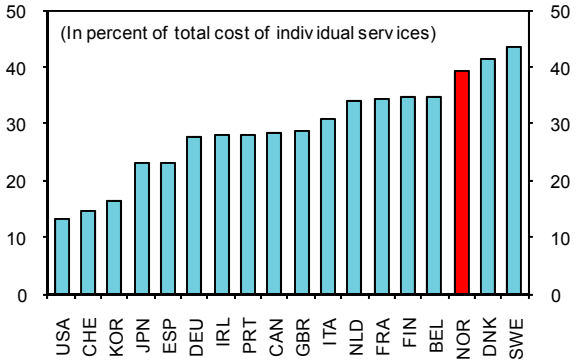
higher in Norway than in the average of its industrialized partners, it is also higher than in any single one of them. Yet, as a share of actual individual consumption (Figure 5), services account for slightly over 50 percent – and are about the average of its partners. In Norway, as well as in other Nordics, the general government accounts for nearly 40 percent of actual individual consumption of services (Figure 6). As costs of services rise relative to prices of goods, personal cost indices understate the total costs of personal consumption.

Figure 5. Actual Individual Consumption of Services in Norway Relative to its Trading Partners, 2005



Source: International Price Comparison Survey, 2005.
1/ Includes individual consumption expenditure by government.

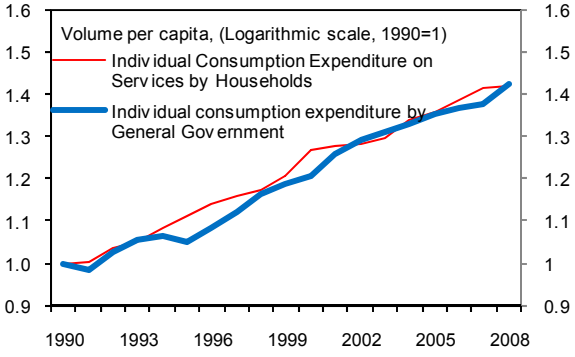
Figure 6. Government Provided Share of Individual Consumption of Services, 2005



Source: International Price Comparison Survey, 2005.

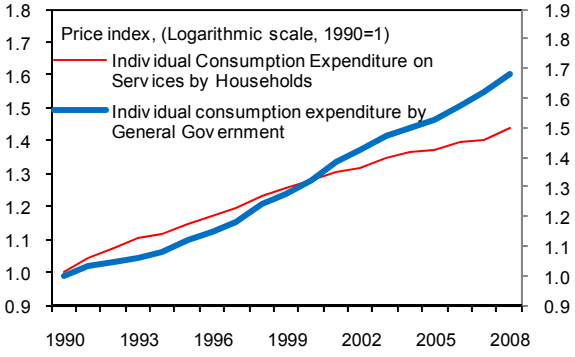
In Norway, consumption of privately and publicly provided individual services grew at a similar pace throughout the last two decades (Figure 7). However, the growth in the costs of publicly provided individual services appears to have outpaced the growth in the costs of private services by a total of 20 percent since 2000 (Figure 8). Therefore, compared to other countries, the Norwegian CPI is likely to even further understate the rise in the total costs of individual consumption.

Figure 7. Individual Consumption Volume by Households and by the Government, 1990-2008



Sources: Statistics Norway; and IMF staff calculations.

Figure 8. Individual Consumption Cost by Households and by the Government, 1990-2008



Sources: Statistics Norway; and IMF staff calculations.

B. Alternative Measures

We propose two measures of international relative prices that mitigate the shortcomings of the REER discussed above. Our methodology closely resembles the approach of Thomas, Marquez, and Fahle (2008) to measure U.S. World Average Relative Prices (WARP). Both approaches rely on Purchasing Power Parity comparisons, but there are important methodological and implementation distinctions.

Thomas, Marquez and Fahle define the bilateral relative price as the ratio of purchasing power parities over total GDP based on the Penn World Tables. The PPP for country i is defined as the ratio of its nominal GDP in local currency over its GDP expressed in international dollars:

$$PPP^i = \frac{\sum p^i \cdot y^i}{\sum p^{int} \cdot y^i} \tag{1}$$

Construction of PPPs in the Penn World Tables relies on the Geary-Khamis (GK) aggregation method[6]. The prices in each country are compared with those of an imaginary composite country, constructed from averaging all countries included. The PPP index for any country as a whole, as in equation (1), or for a specific expenditure category is computed as a Paasche index that compares domestic prices (p^i) with the world prices (p^{int}), which is then obtained from a solution to a world quantity-weighted average of the prices for each good across all countries.

The reliance on the "world" prices for each good ensures that each country's aggregate GDP is valued at the same "world" prices. This aggregation advantage makes the GK algorithm practical for comparing PPP-valued GDPs. However, it has disadvantages that make it far less useful in application to comparing international prices. First, the resulting structure of relative prices does not ensure that the aggregated national price indexes are consistent with the assumption of identical homothetic preferences across the countries[7]. This means, for example, that the PPP-implied aggregate relative price index between Norway and Denmark does not reflect optimal expenditure choices of an identical consumer under different relative price structures in the two countries. Second, it uses a single set of international relative prices to value the consumption of every country. In constructing the world average price for any good, the GK method will assign higher weight to actual prices of countries with higher consumption volumes of this good. Such prices are, therefore, likely to resemble prices of relatively richer countries (Nuxol, 1994). On the other hand, prices of non-traded services in

[6] Identification of the Geary-Khamis system requires specification of the numeraire currency. The notion of the international dollar implies the same purchasing power over the U.S. GDP as the U.S. dollar.

[7] An example of a consumer theory consistent aggregation method is Neary's (2004) GAIA system.

poor countries are significantly below the world average prices. When these world prices are then used to aggregate the value of total consumption in poor countries, they tend to value consumption of these services very highly, and will inflate the value of consumption of poor countries measured in international prices[8].

When it comes to international comparisons, cross-country differences between, say, Norway and France clearly tend to be larger than differences within Norway and France over one year. And the larger dissimilarities in the expenditure composition of the countries compared, the less reliable the PPP-based relative price level will be. The use of aggregated PPPs, for the reasons mentioned in the previous paragraph, is clearly not able to transform prices of different countries into a bilateral price index that would reflect utility maximizing behavior. Moreover, as the key idea of the WARP relies on interaction of international price level dispersion and increased trade with developing countries, the reliability of bilateral relative price measures vis-à-vis developing countries is essential. As emerging markets gain significance in global trade, trade-weighted relative price measures will increasingly suffer from misspecification of comparator baskets.

To alleviate these problems, we propose two alternative measures of international relative prices. The first measure evaluates the relative price of the Norwegian consumption basket in Norway compared to the "average" partner country. We denote this as *import average relative price*. It is obtained by aggregating over Norway's trading partners (using geographic composition of import trade volumes) the following bilateral relative prices:

$$Q^M = \frac{\sum p^N \cdot y^N}{\sum p^P \cdot y^N} \cdot E \tag{2}$$

The superscripts N and P denote Norway and its trading partner, y and p are vectors denoting the real expenditure basket and the associated local currency prices, and E is the nominal exchange rate expressed in krone per foreign currency units. Q^M thus measures the cost of the Norwegian consumption basket in Norway relative to an import source country.

The second measure evaluates the relative price of foreign consumption basket. We label this measure the *export average relative price*. It is obtained by aggregating over Norway's trading partners (using geographic weights of non-energy export volumes) the following bilateral relative prices:

$$Q^X = \frac{\sum p^N \cdot y^P}{\sum p^P \cdot y^P} \cdot E \tag{3}$$

[8] This is the so-called Gershenkron effect.

The only difference between the two bilateral measures is the choice of the consumption basket. Intuitively, if two countries are sufficiently similar in their consumption patterns, there should be little or no difference between the two measures of bilateral relative prices. However, different baskets drive a wedge between Q^M and Q^X. The relationship between them can be interpreted taking into account the sensitivities of consumption decisions to prices. Note that bilateral relative prices are not cost-of-living indices in the sense of welfare optimality. However, if one assumes that each country's domestic basket represents an optimal choice under this country's prices, then this same basket would not be optimal under a different set of prices. It is easy to notice that $Q^M \leq Q^X$ simply because the former includes an optimal basket in the denominator and the latter in the nominator. If the prices of tradable goods were perfectly equalized across the world, then Q^M and Q^X would deviate from unity only to the extent of divergence in the prices of non-traded goods. Thus the rise in Q^M and Q^X would be associated with rising costs of non-traded goods in the domestic economy relative to the foreign economy. If non-traded goods serve as inputs in a production of traded goods produced for exports, rising relative prices may be also associated with the loss of competitiveness[9].

Another way to look at these bilateral relative prices in equation (2) and (3) as standard Laspeyres and Paasche price indexes. Consequently, a natural extension to these would be a Fisher price index calculated as a geometric average of the two.

C. How to Construct Import and Export Relative Prices

Our implementation strategy relies on calculating bilateral relative price levels for a benchmark year, and extending it using a measurable decomposition of changes in bilateral relative prices.

The key data source for calculating the benchmark relative prices is the International Comparison Program (ICP) 2005 survey. The ICP is by far the most comprehensive statistical survey in the world. It is the principal input for Purchasing Power Parities estimates. The ICP collects two types of data: prices of comparable and representative items and expenditure weights. The latest 2005 survey covers nearly 150 countries while the number of surveyed items may vary from 800 to 2,500 depending on a country. Two types of ICP data are required to compute benchmark relative prices: real individual expenditure per capita and price level indices. Real per capita expenditure is expressed in international dollars and can be used to compute expenditure weights. We limit the disaggregation level to twelve personal consumption expenditure categories. While the ICP would allow for finer

[9] Thomas et al (2008) offer a theoretical model to illustrate such mechanism.

disaggregation in constructing benchmark relative prices, evaluating the changes in both real expenditure and prices with greater disaggregation would be highly cumbersome.[10]

We make one important adjustment to the ICP data. A choice of the numeraire country, for which nominal expenditure equals real expenditure, is necessary to close the GK system. As the price indices for the United States are defined relative to the world average, we rebase ICP price indices relative to the United States. This ensures consistency between the product of real expenditures and price index with actual nominal expenditures.

To construct relative prices beyond the benchmark years we recursively (backward and forward) calculate the log-differentiated form of equations (1) and (2):

$$\frac{\Delta Q^M}{Q^M} = \frac{\sum \Delta\left(p^N \cdot y^N\right)}{\sum p^N \cdot y^N} - \frac{\sum \Delta\left(p^P \cdot y^N\right)}{\sum p^P \cdot y^N} + \frac{\Delta E}{E} \tag{4}$$

$$\frac{\Delta Q^X}{Q^X} = \frac{\sum \Delta\left(p^N \cdot y^P\right)}{\sum p^N \cdot y^P} - \frac{\sum \Delta\left(p^P \cdot y^P\right)}{\sum p^P \cdot y^P} + \frac{\Delta E}{E} \tag{5}$$

The first term in equation (4) and the second term in equation (5) correspond to growth in Norway's and the partner's nominal personal consumption expenditure, respectively. The last term in both equations is the bilateral nominal depreciation of the krone. The remaining two terms are calculated recursively by combining growth in real personal expenditure and prices for each of the twelve personal expenditure categories[11] according to the Classification of Individual Consumption by Purpose (COICOP. The starting point for calculating these terms is the ICP's benchmark year (2005), for which real expenditure weights and relative prices are used as weights for calculating the growth rates in the adjacent years. These weights are then updated recursively and applied in the next round of calculation.

We construct bilateral import and export relative prices for Norway's 23 major trading partners (see Table A1 for the list) that make up approximately 80 percent of total non-petroleum exports and 80 percent of total imports. We make no attempt to incorporate results of the previous ICP benchmark surveys or the Eurostat and OECD PPP programs into our calculations. To obtain world average relative import and export relative prices we aggregate corresponding bilateral relative prices using volume-based import and export trade weights.

[10] To the extent that a greater degree of expenditure disaggregation would entail comparison of more harmonized products, it may result in relative prices that would be closer to unity.

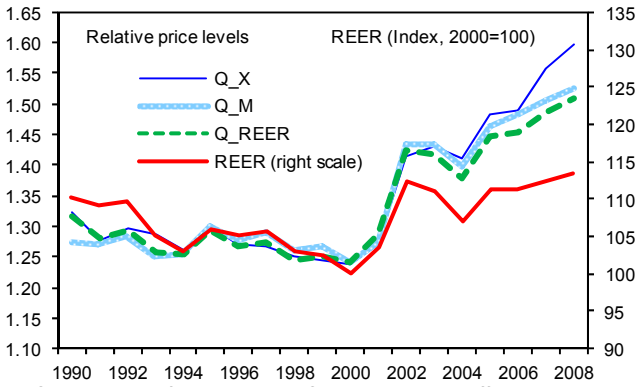
[11] As relative prices for benchmark years are calculated over total individual consumption, this approximation assumes same growth rates of personal and public components of individual consumption.

To provide further insight into the sources of aggregate relative prices changes we construct an additional measure (Q^{REER}) which more closely resembles the WARP measure as presented in Thomas et al (2008). We use PPP-implied bilateral relative prices from the 2005 ICP survey and extended them backward and forward using developments in CPI-based bilateral real exchange rates. Then we aggregate these bilateral relative price levels using Norway's total non-energy trade weights. Unlike the other two measures but like the REER, Q^{REER} compares price levels for different baskets. But, like the two measures and unlike the REER, Q^{REER} takes into account that different price levels prevail in the various trading partners—essentially isolating the effects of the interaction between relative price levels and the trade weights that is not captured by the CPI-based REER.

D. Relative Price Estimates

Figure 9 compares the evolution of import and export relative prices to the IMF real effective exchange rate index. From year to year, the indicators move quite closely over the last two decades, which confirms that changes in the REER provide a good indication of relative price developments. However, after 2001, the appreciation of the REER is smaller than the rise of our relative price measures. The cumulative appreciation since 2000 amounts to 26 percent for Q^X and 20 percent for Q^M, compared with 12 percent for the REER[12]. The difference is substantial and can be attributed to the continuing shift towards low-cost partners. Indeed Q^{REER} has increased by about 7 percentage points relative to the REER over the same period.

Figure 9. International Relative Prices vs. Real Effective Exchange Rate Index



Sources: IMF Information Notice System; and IMF staff calculations.

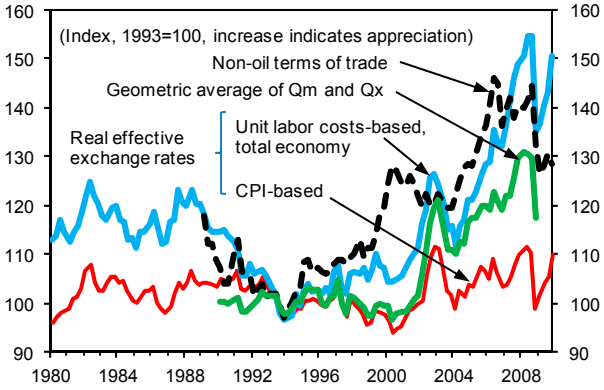
Our constructed trade-weighted relative prices may still somewhat understate the effect of increased trade with developing countries. The cumulative weight of emerging markets in our sample is about 15 percent in 2008, while actual trade shares appear to be in the mid 20s[13]. Given the evolution in trade since 2000, this could mean that some 5 to 15 percentage point rise in the international relative prices remain unaccounted for.

[12] At year average nominal exchange rates.

[13] The coverage of emerging markets was limited due to the lack of data.

Our trade-weighted relative price measures also help to close some of the gap between the unit-labor costs and CPI-based real effective exchange rates that has widened significantly in the recent years (Figure 10). Marked improvement in Norway's non-oil terms of trade has supported a sizable rise in relative labor costs, unmatched by consumer prices. This in part is due to the higher share of services in our relative price measures, the costs and prices of which have risen relatively more than for traded goods. This must also be due to strong demand from developing countries for Norwegian commodities and high tech investment goods, but also due to their ability to export relatively cheap consumer goods.

Figure 10. Norway's International Relative Price Indices



Sources: Haver Analytics; IMF Information Notice System; OECD; and IMF staff calculations.

Our international relative price measures also provide an improved account of actual developments in relative prices than traditional real effective exchange rates. Regressing our relative price measures on the set of equilibrium real exchange rate determinants we find a much better fit in our measures compared to traditional REER (see Appendix 2 for details).

As Tables 1 and 2 suggest that increased trade with China is the major source of world average relative price changes. Import relative price changes over the last two decades mostly happened after 2000. During the 1990s, the strengthening was broadly neutral, as increased trade with emerging markets offset generally declining bilateral prices as the krone depreciated in nominal terms. It is also apparent in the larger decline in the REER during this period. After 2000, however, shifting trade was accompanied by generally rising Norwegian relative prices. Norway has become more expensive compared to most of its industrialized partners, particularly Sweden, the United States and Japan. At the same time, the volume of imports from these countries has contributed negatively, as import shares of emerging markets increased. Also, the contribution of increased import volumes from Korea has disappeared after 2000, likely as China strengthened its presence in the global markets.

Table 1. Contribution to Changes in Average Import Relative Price
(In relative price units)

	1991–2000			2001–2008			1990	2000	2008
		Contribution of			Contribution of		Trade weights		
	Total	Price	Weight	Total	Price	Weight			
Total	-0.03	-0.09	0.08	0.28	0.18	0.11			
China	0.06	-0.01	0.07	0.19	0.03	0.15	0.8	3.3	8.5
India	0.01	0.00	0.01	0.01	0.00	0.00	0.2	0.4	0.4
Korea	0.04	0.00	0.05	-0.01	0.01	-0.02	0.6	3.2	1.7
Denmark	-0.01	0.00	-0.01	0.01	0.00	0.00	8.1	6.8	7.3
Finland	0.01	0.01	0.00	0.00	0.00	0.01	3.9	4.1	4.4
Sweden	0.00	0.02	-0.02	0.02	0.03	-0.01	18.4	16.5	15.6
Canada	0.01	0.00	0.01	0.00	0.01	-0.01	2.7	3.7	3.2
UK	-0.06	-0.04	-0.01	0.00	0.02	-0.02	9.8	8.5	6.8
USA	-0.03	-0.03	0.00	0.00	0.04	-0.03	10.0	10.2	7.1
Japan	-0.01	-0.03	0.02	-0.01	0.03	-0.03	5.5	6.7	3.2
Germany	-0.04	0.00	-0.04	0.05	0.00	0.05	17.4	14.4	18.1
Others	0.00	0.00	0.00	0.02	0.00	0.02	22.5	22.3	23.5

Source: IMF staff calculations.

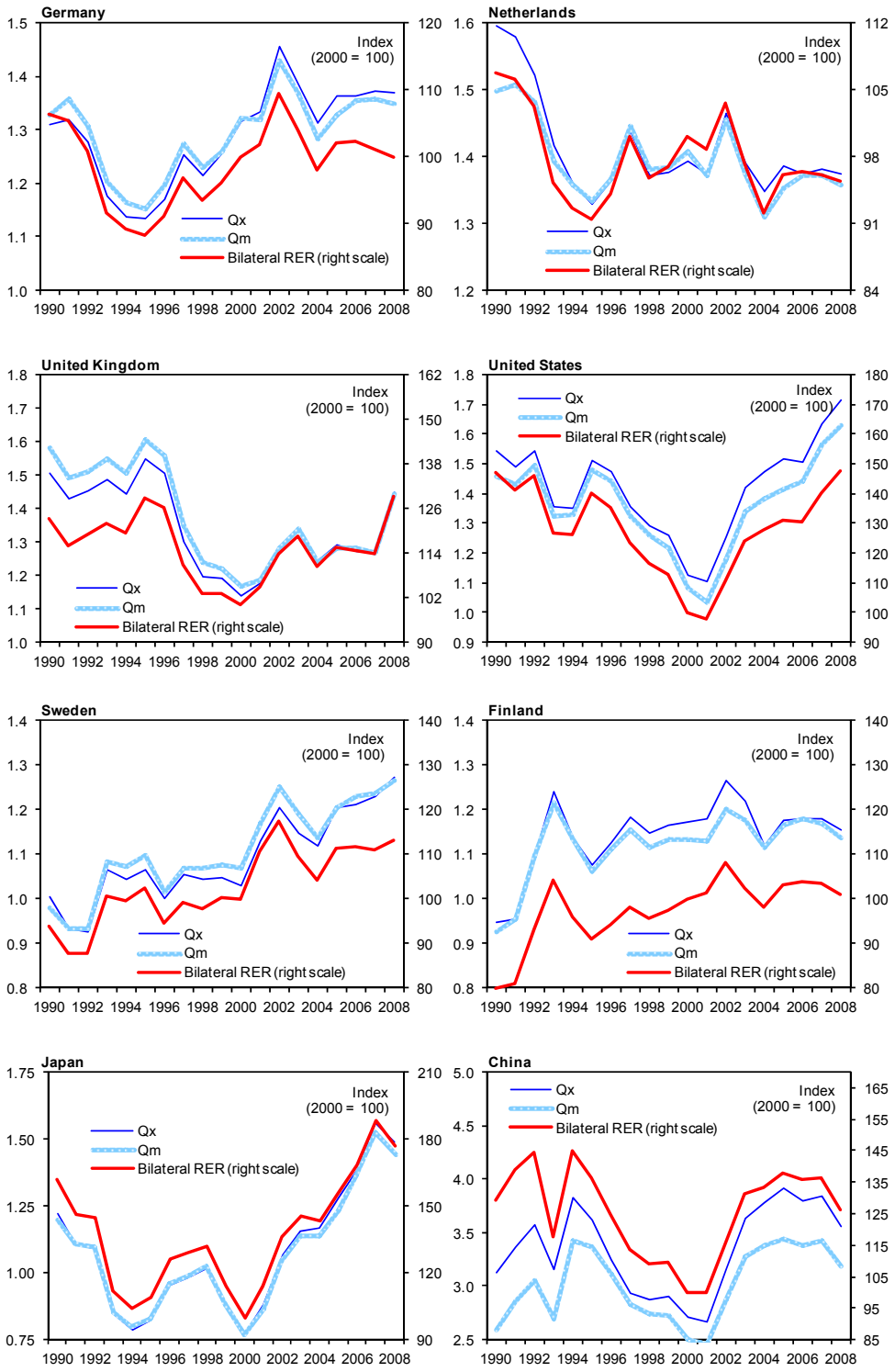
Export relative price developments are also driven by increased exports to the emerging markets, mostly in the last decade. Again, Norway's bilateral prices have appreciated strongly vis-à-vis most of its partners, particularly against United States, Sweden, and the United Kingdom. Figure 11 depicts developments in the bilateral relative prices vis-à-vis major partners over the last 20 years.

Table 2. Contribution to Changes in Average Export Relative Price
(In relative price units)

	1991–2000			2001–2008			1990	2000	2008
		Contribution of			Contribution of		Trade weights		
	Total	Price	Weight	Total	Price	Weight			
Total	-0.09	-0.11	0.03	0.36	0.21	0.15			
China	0.02	0.00	0.02	0.14	0.01	0.12	0.6	1.3	4.8
India	0.01	0.00	0.01	0.06	0.01	0.05	0.2	0.4	1.3
Korea	0.01	-0.01	0.02	0.08	0.02	0.06	0.5	1.5	4.7
Denmark	0.00	0.00	0.00	0.00	0.00	0.00	7.6	7.6	7.2
Finland	0.00	0.01	-0.01	0.00	0.00	0.00	3.8	3.0	3.0
Sweden	-0.01	0.00	-0.01	0.00	0.04	-0.03	17.2	15.4	12.5
Canada	0.00	0.00	0.00	0.00	0.00	-0.01	0.9	1.0	0.7
UK	-0.07	-0.05	-0.02	-0.01	0.03	-0.05	13.3	11.8	8.3
USA	-0.02	-0.03	0.02	0.03	0.05	-0.03	8.3	9.5	7.7
Japan	-0.01	-0.02	0.02	0.01	0.04	-0.03	3.9	5.5	3.4
Germany	-0.02	0.00	-0.01	-0.01	0.01	-0.01	15.3	14.0	12.8
Netherlands	-0.03	-0.01	-0.01	0.05	0.00	0.05	6.6	5.6	9.5
Spain	0.02	0.00	0.02	0.00	-0.01	0.01	2.0	3.2	3.8
Others	0.00	0.00	-0.01	0.02	0.00	0.01	19.7	20.2	20.3

Source: IMF staff calculations.

Figure 11. Selected Bilateral Relative Prices



Source: IMF staff calculations.

III. SUMMARY

In this paper, we derived two new measures of international relative prices for Norway. Developments in these new measures follow rather closely movements in the CPI-based real effective exchange rate through the 1990s, but diverge after 2000—suggesting that the costs of living in Norway relative to its trading partners have risen in the recent years more than the real effective exchange rate would indicate.

Development of the new measures was motivated by the possibility that the CPI-based real effective exchange rate may measure developments in Norway's international relative prices with considerable error. The results confirm this—at least for recent years—and suggest that both factors considered as the potential source of mismeasurement contributed. The factor with the larger effect is the rapidly rising share of developing countries among Norway's trade partners. The other factor also contributes: inconsistent definition of consumption baskets that use across partner economies makes the real effective exchange rate understate Norway's appreciation when service prices are rising fast. As large part of Norway's individual services are provided by the government, Norwegian consumers have generally fewer service items to cover out of their pocket, which get reflected in the consumer price index.

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Appendix 1

Table 1. Norway's major trading partners
(In percent of total volume)

	Non-energy exports		Non-energy imports	
	1990	2008	1990	2008
Belgium	1.6	2.3	2.3	1.7
Finland	2.9	2.4	3.3	3.7
France	5.5	4.5	3.8	3.8
Germany	11.8	10.1	14.4	14.9
Ireland	0.3	0.7	0.9	1.1
Italy	4.1	2.9	3.4	3.5
Netherlands	5.1	7.5	4.0	4.1
Portugal	1.2	1.2	1.1	0.3
Spain	1.5	3.0	1.1	2.2
Canada	0.7	0.5	2.3	2.7
Denmark	5.9	5.7	6.7	6.1
Japan	3.0	2.7	4.6	2.6
Korea, Rep.	0.4	3.7	0.5	1.4
Singapore	1.1	2.6	0.5	0.4
Sweden	13.3	9.9	15.2	12.9
Switzerland	1.3	0.7	1.6	1.2
United Kingdom	10.3	6.5	8.1	5.6
United States	6.4	6.1	8.2	5.9
India	0.1	1.1	0.2	0.4
China	0.4	3.8	0.7	7.0
Brazil	0.5	1.1	0.5	1.2
Total	77.6	78.9	83.1	82.6

Source: IMF Direction of Trade Statistics; and IMF Staff calcualtions.

Appendix 2

EXPLAINING INTERNATIONAL RELATIVE PRICES

As the rationale behind our relative price measures and the REER is similar, it seems natural to investigate the behavior of Norway's international relative prices with respect to established equilibrium exchange rates fundamentals. There is a large set of literature devoted to both theoretical and empirical analysis of equilibrium real exchange rate determinants. We regress our trade weighted relative price estimates on the set of variables commonly used to explain equilibrium real effective exchange rates. Our annual measures have been converted into quarterly series by incorporating CPI-based bilateral real exchange rate quarterly dynamics. The data are expressed in logarithms and cover the period from

1990 to 2008. Based on existing studies for Norway (e.g. Akram, 2003, Bjørnland et al., 2002) we consider the following determinants:

- *Productivity differentials*. Measured as the difference between relative prices of non-traded goods (services) and traded goods. According to the Balassa-Samuelson effect, if the productivity in the tradables sector grows faster than in the nontradables sector, than higher wages in the tradables sector will put upward pressure on the wages in the tradables sector resulting in higher relative prices of nontradables. It is measured thus as Norwegian differential relative to foreign differential. Note, that trade-weighted foreign differential aggregates changes in relative prices.
- *Real oil price*. Measured as the index of U.S. dollar *brent* price relative to the U.S. CPI. Higher oil prices improve Norway's terms of trade and can lead to appreciation through wealth effects. To the extent that high oil prices raise the permanent value of the oil reserves, they should affect the present value of Norway's net foreign assets.
- *Norway's net foreign asset (NFA) position*. Measured as a share of mainland GDP. Higher NFA allows countries to afford more appreciated currency and the associated trade balances. In the case of Norway, large positive NFA position reflects national wealth generated by the accumulation of oil export revenues.
- *Relative cost of public services*. Measured as the differential between the costs of publicly and privately provided individual services. Higher growth of public costs would not affect relative prices directly as the PCE deflator were used. It, however, could have affected relative price measures through its effect on the nominal exchange rate.
- *Interest differential*. Nominal interest rate differential between Norway and its key industrialized partners on short term money market instruments.

The estimated equation can be written as:

$$Q = \alpha_1 + \alpha_2\left(\left(P_{NT} - P_T\right) - \left(P^*_{NT} - P^*_T\right)\right) + \alpha_3 Poil + \alpha_4 NFA + \alpha_5\left(i - i^*\right) + \varepsilon \qquad (6)$$

Table 3 reports results of the OLS estimation of equation (6). In contrast to previous studies, interest rate differential is found to be insignificant. One potential reason is that we used short-term rates, and not the long term rates used in other studies (Akram, 2003). The specifications vary significantly in the magnitude of the productivity differential coefficient. The value on the coefficient in the REER equation is slightly above the 0.23 estimate obtained for Norway or 0.19 found for cross-country studies. However, there appears an apparent ranking in the magnitudes among the specifications, with the largest value in the Qx equation. NFA coefficients suggest that a rise in NFA of 10 percent of mainland GDP is associated with a 1 percent increase in relative prices. At the same time, the doubling of real oil prices would lead to a 5 percent rise in the relative prices. However, as we change the sample period to exclude 2007 and/or 2008, the significance of oil price variable disappears. It is thus consistent with more dated studies that have not utilized these data. The significance of other variables remains unchanged. The last column of table 3 includes the relative price measure that equals the geometric average of the export and import relative price. If

preference where homothetic and identical across the partners, this measure would account for substitution effects under different set of relative prices. Our measures provide a better fit for developments in these equilibrium real exchange rate fundamentals. The R squared for both Q^M and Q^X equations are substantially higher than for the REER.

Table 3. Determinants of Norway's International Relative Prices

Dependent Variable:	**Qx**	**Qm**	**REER**	**Sqrt(Qx*Qm)**
Productivity differential	0.581 ***	0.289 *	0.298 **	0.434 ***
	(0.135)	(0.148)	(0.127)	(0.14)
Oil price	0.047 ***	0.041 **	0.042 **	0.045 **
	(0.017)	(0.018)	(0.016)	(0.017)
Net foreign assets position	0.113 ***	0.109 ***	0.062 **	0.110 ***
	(0.031)	(0.032)	(0.028)	(0.031)
Relative cost of public services	0.218	0.227	-0.113	0.228
	(0.266)	(0.282)	(0.247)	(0.271)
Interest differential	0.036	0.071	0.478	0.052
	(0.239)	(0.256)	(0.223)	(0.245)
Constant	-0.106	-0.124	4.524	-0.123
	(0.272)	(0.285)	(0.251)	(0.275)
R^2	0.862	0.805	0.655	0.838
Sample: 1990Q1-2008Q4				

Source: IMF staff calculations.
Notes: *,**, and *** indicate 10, 5, and 1 percent statistical significane respectively.