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Abstract

This paper compiles alternative estimates of underground economies in twenty five transition countries during the transition decade and finds a disturbing lack of convergence between them, calling into question the reliability of GDP figures (which in varying degrees now include non-transparent imputations for the "non-observed economy") as well as the macro model estimates of the unrecorded economy. A corollary of this finding is that substantive results from many studies examining the consequences of the radical transition from planned to market economies must be viewed with considerable skepticism. Underground (unobserved, non-observed, unrecorded) economic activities play a major role in transition economies. Evaluations of the success and failure of the transition experience should be based on estimates of total economic activity (TEA) namely, recorded plus unrecorded economic activity. We examine the conceptual and empirical relationships between new National Income and Product Accounts (NIPA) methods for obtaining "exhaustive" measures of total economic activity and the two most popular macro-model approaches (electric consumption and currency ratio models) for estimating the size and growth of the unrecorded sector. Our updated empirical results detailing the size and trajectory of unrecorded activities obtained from different estimation methods reveal a disturbing lack of convergence. Until these important differences are resolved, investigations of the relationship between economic reforms and economic outcomes during the transition decade must be viewed with considerable caution. Given the shortcomings of conventional macro model estimates of the underground economy and the lack of transparency and consistency of NOE estimates, it is high time that the profession acknowledges how little we really know about underground economies and their causes and consequences.

Key words: Underground, unrecorded, unobserved, non-observed, NOE, hidden, informal, shadow, GDP, national accounts, transition economies.
JEL: E26, E01, O17, P24, H26, O11.

Measuring Underground (Unobserved, Non-Observed, Unrecorded) Economies in Transition Countries: Can We Trust GDP?

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This paper compiles alternative estimates of underground activities in twenty five transition countries during the transition decade and finds a disturbing lack of convergence between them, calling into question both the reliability of GDP, (which now includes non-transparent imputations for the "non-observed economy") and of the estimates obtained by conventional macro models. A corollary of this finding is that substantive results from many studies examining the consequences of the radical transition from planned to market economies and the causes and consequences of underground economies must be viewed with considerable skepticism.

Underground, unobserved and unrecorded economic activities are widely recognized as playing a major role in transition economies. Evaluations of the success and failure of the transition decade must be based on reliable measures of total economic activity [TEA], namely, the sum of recorded and unrecorded economic activities. Our study suggests that to date, estimates of the unrecorded sector are not sufficiently reliable to use in substantive studies of the transition decade.

We begin by examining new National Income and Product Accounts (NIPA) procedures for obtaining "exhaustive" measures of GDP which include imputations of the NOE. We clarify the conceptual relationship between NOE and other measures of "unrecorded" and "unobserved" income obtained from widely used macro models employed to estimate the underground economy. Given this conceptual structure, we then present and compare alternative newly updated measures of unobserved income in transition countries for the period 1990-2001 in order to examine the extent to which different comparable estimates converge. Our disturbing finding of a lack of

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convergence raises doubts about both the reliability of new GDP estimates, and of conventional macro methods employed to estimate underground economies.

Substantive conclusions concerning the transition process have either relied exclusively on recorded measures of GDP or have employed estimates of unrecorded income based on variants of the electric consumption method [ECM]. Feige and Urban (2003) have demonstrated that ECM methods of estimating unrecorded income are highly sensitive to initial conditions, and when updated, produce seemingly anomalous negative estimates of unrecorded income for a number of transition countries. We reexamine those results in light of new information concerning the extent of NIPA imputations for NOE in transition countries. We also present new estimates of unobserved income from simple monetary models. While these estimates are also highly sensitive to various specifying assumptions, they do offer additional information on the controversial question of both the extent and inter-temporal development of unobserved activities during the transition.[1]

Since each approach to estimation has its strengths and weaknesses, we hope that a compendium of comparable results will indicate both the range of available estimates and the extent to which they do or do not converge. As will be developed below, the reliability of the macro model estimates are themselves partially dependent on the reliability of the new imputations for non-observed activities, since these imputations are themselves included in the official GDP statistics on which macro model estimates rely.

[1] We have consciously refrained from including MIMIC estimates of the "shadow economy" as presented by Friedrich Schneider and several of his co-authors. Not only is the "shadow economy" poorly defined, but a careful econometric review (Breusch, 2005) demonstrates that "The literature applying this model to the underground economy abounds with alarming Procrustean tendencies. Various sliding and scaling of the results are carried out in the name of 'benchmarking', although these operations are not always clearly documented. The data are typically transformed in ways that are not only undeclared but have the unfortunate effect of making the results of the study sensitive to the units in which the variables are measured. The complexity of the estimation procedure, together with its deficient documentation, leaves the reader unaware of how the results have been stretched or shortened to fit the bed of prior belief." He concludes that "the MIMIC model is unfit for the purpose" of estimating the size of the underground economy. Breusch (2006) also reviews a book edited by Bajada and Schneider (2005) and comments on a chapter written by the editors which purports to show the size of the shadow economy in 145 countries. Breusch concludes that "it is impossible to reconstruct these results from the documentation that is provided here or in other Schneider papers on which this chapter is based. Neither the data nor the model details were forthcoming from Schneider when I asked for them". The authors of this paper have had similar experiences in various attempts to obtain data and model specifications from Schneider in order to attempt to replicate his results. We therefore concur with Breusch's (2005) assessment that "There are many other results in circulation for various countries, for which the data cannot be identified and which are given no more documentation than 'own calculations by MIMIC method.' Readers are advised to adjust their valuation of these estimates accordingly."

Acknowledging the difficulty of attempting to measure a phenomenon that is not directly observable, and recognizing the strengths, weaknesses and interdependencies of alternative empirical approaches, we argue that researchers and policy makers will only gain confidence in the accuracy of measures of total economic activity when alternative estimates of unobserved economic activity begin to converge. To anticipate our findings, such convergence has yet to be established.

Conceptual Background and Definitions

Decades ago, (Feige, 1980) urged the economics profession to "entertain a fundamental distinction, between the "observed" and the "unobserved" sectors of the economic system." A consortium of national and international agencies has finally risen to the challenge and produced an extensive handbook for measuring the "non-observed economy" [NOE] (OECD, 2002) presenting a "systematic strategy for achieving exhaustive estimates of gross national product" taking specific account of "activities that are missing from the basic data used to compile the national accounts because they are underground, illegal, informal, household production for final use, or due to deficiencies in the basic data collection system." We shall employ the term "imputed unobserved income" (Y^{IUI}) to describe the (NOE) estimate that national accountants now impute and then include in the published national income and product (NIPA) accounts. The amount of Y^{IUI} in many transition economies is already a sizable fraction of measured output. The relationships between recorded, unrecorded, observed and unobserved income are described below.[2]

Let:

Y = total economic activity (TEA) [The sought after exhaustive measure of all productive economic activity].

Y^{R} = recorded economic activity (measured output; GDP)

Y^{RO} = recorded observed economic activity

Y^{IUI} = recorded unobserved economic activity [measured (imputed) NOE]

Y^{UR} = unrecorded activity

[2] We avoid such vague terms as shadow, hidden, gray, black, clandestine, second, parallel that have been all too widely used in the literature. We retain the more useful notions of underground, illegal, informal, and household production for own final use as described in Feige (1990). These latter concepts are essentially retained in the "Handbook" (OECD, 2000) which seeks to "identify and promote international best practice."

Given the foregoing definitions, (Y^R), the official recorded measure of economic activity, that is, published GDP now consists of an observed and imputed unobserved component:

1) $Y^R = Y^{RO} + Y^{IUI}$

The observed component, (Y^{RO}) represents the amount of economic activity (income) that is actually reported to the statistical authority, namely all the productive activities that are captured in the basic data sources used for national accounts compilation. The unobserved component, (Y^{IUI}) is what the "Handbook" describes as "non-observed economic activity" (NOE) which is not captured in the basic data sources and must therefore be imputed. The Handbook identifies five groups of activities that are most likely to be unobserved because they are "underground, illegal, informal, or undertaken by households for their own use" and those that represent "deficiencies in the basic data collection program". These unobserved activities require imputations for distinct components identified by national income accountants as comprising unobserved activity.[3]

Since the imputation of the unobserved sector is at best an art form, we can not be assured that all unobserved income is finally captured in (Y^{IUI}). We therefore require a final category, namely unrecorded income (Y^{UR}) which represents the difference between total (exhaustive) economic activity (Y) and the amount of income actually recorded (Y^R) that is, official GDP. As will be developed below, macro models have been employed to obtain estimates of (Y^{UR}). When these estimates of (Y^{UR}) converge to zero, we can be increasingly confident that NIPA measures of total economic activity are truly exhaustive.

The relationship between total economic activity and its recorded and unrecorded components is as follows:

2) $Y = Y^R + Y^{UR} = Y^{RO} + Y^{IUI} + Y^{UR}$

We define the unobserved economy (Y^U) as the sum of unrecorded and recorded unobserved income,

3) $Y^U = Y^{UR} + Y^{IUI}$,

and the observed economy (Y^O) as identical to observed recorded income (Y^{RO}).

[3] The measurement of NOE includes imputations that were unrecorded 1) for statistical reasons, including, lack of response, registers not kept up to date, subjects not registered; 2) for economic reasons including underreporting and unregistered subjects; 3) the informal sector; 4) illegal activities and 5) other forms of non-exhaustiveness of GDP.

Given these conceptual distinctions we now turn to the empirical issue of how to measure the size and growth of the unobserved sector of economic activity. Our inquiry will focus attention on several specific questions dealing with the measurement of the unobserved sector.

What do we currently know about the size and trajectory of the unobserved economy as estimated by the new national accounting methods and how do these new NIPA (NOE) estimates effect macro model estimates?

How do updated estimates of the unrecorded economy obtained from modified ECM models compare to estimates of the unobserved economy based on the currency/deposit ratio method?

How do the new imputation measures of the unobserved economy obtained by national accounting agencies compare to estimates from macro-models?

Finally, given alternative measures of total economic activity, to what extent to they converge and what do they tell us about how different countries have fared after a decade of transition?

Empirical Estimates of Unobserved Economic Activity

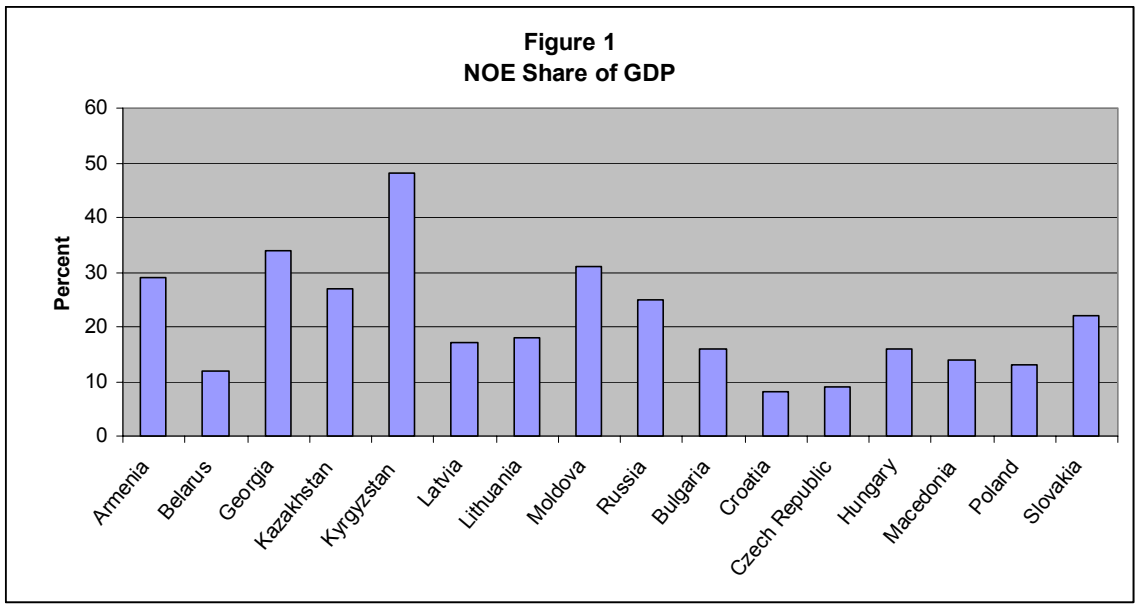
NIPA Estimates of Unobserved Activity

The United Nations Economic Commission for Europe (United Nations, 2003) recently conducted a survey of national practices for imputing the non-observed economy in national accounts. The 256 page UN report reveals distinct differences not only in the size of the imputations for the non-observed economy for different countries but also in the methods used to make the imputations. Figure 1 presents the results of the NOE imputations for the period 1998-2000 the FSU and CEE countries included in the UN survey. The estimates range from 8 percent for Croatia to 48 percent for Kyrgyzstan. The difficulty of interpreting the estimates as being strictly comparable is indicated by the warning note accompanying the UN's table: "the information in the table including the percentages of GDP should be regarded only as indicative…. and may not necessarily accord with the countries individual assessments." [4]

One of the problematic aspects of the UN report is that NOE estimates are presented for a short time span and often for only a single year. Nowhere does the

[4] Among the problems of comparability cited, the report suggests that "not all countries measure the same kinds of underground or informal activity" and not every country will necessarily have the same view of what constitutes a particular type" of NOE activity.

report address the issue of inter-temporal consistency, namely, when did the imputations begin to be included in the official GDP statistics, and how were historical GDP growth rates adjusted to reflect the impact of the inclusion of the NOE imputations?



Source: United Nations (2003) Table 1 (p.13)

Given the short time span of NOE imputations covered in the UN report and difficulty of interpreting the comparability of the results, we attempted to directly contact each of the national statistical agencies of the FSU and CEE countries in order to gather more information on the timing and amount of non-observed income already included in the official NIPA estimates of GDP. On the basis of responses to our inquiry, and additional referenced sources, we compiled Table 1 as an update to the UN survey. Table 1 reports the amount of imputed non-observed income (Y^{IUI}) as a percent of official GDP from the responses we obtained from our inquiries.[5] Table 1 reveals that countries apparently imputed Y^{IUI} for many more years than were noted in the UN survey. Moreover, our own investigation yielded estimates that are at times quite different from those contained in the UN survey. The most dramatic example is that for Kyrgyzstan, where the UN survey reports a figure of 48 percent of NOE imputed in GDP for the year 2000, compared to our figure, reported in Kudabaev (2004, Table 1) of 13.1 percent for the same year.

[5] Given the lack of uniformity in the procedures used by the statistical agencies and the remaining gaps in the data, we present this preliminary table in the hope that it will bring forth further responses from both the national statistical agencies the international agencies responsible for maintaining consistency in the NOE adjustments so that consumers of NIPA information will have a better understanding of the extent, timing, nature and implications of the adjustments.

Table 1

	Period Average	Imputed Unobserved (NOE) Income $Y^{IUI}/(GDP)*100$											
		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
FSU													
Armenia[6]	29.4					27.0	31.6	34.3	28.9	25.6	29.0	30.2	28.2
Belarus[7]	10.4	5.7	6.0	10.7	11.3	10.1	11.9	13.2	10.9	11.0	11.7	11.1	10.6
Estonia[8]	9.4				9.8	9.3	10.6	11.4	10.4	8.8	8.7	7.9	7.4
Georgia[9]	29.8							26.9	27.4	30.3	30.3	30.4	33.5
Kazakhstan[10]	28.8								37.9	30.2	27.4	24.7	23.9
Kyrgyzstan[11]	11.5						8.4	9.4	10.3	11.9	13.2	13.1	14.4
Latvia[12]	16.4								16.0	16.8			
Lithuania[13]	19.2			20.1	19.0	20.7	19.1	20.0	21.0	17.9	17.7	18.0	18.3
Moldova[14]	30.5				32.6	29.6	26.2	24.2	31.4	30.1	34.4	34.6	31.6
Russia[15]	12.1				5.3	8.5	10.4	11.7	11.9	11.9		24.8	
Ukraine[16]	20.0											20.0	
Uzbekistan[17]	31.0									31.0			
CEE													
Albania[18]	31.4							30.2	28.9	30.7	32.8	34.2	
Bulgaria[19]	19.3							27.8	31.2	12.3	12.0	16.3	16.4
Croatia[20]	8.5									8.9	8.1		
Czech R.[21]	8.9									8.9	9.3	9.1	8.4
Hungary[22]	16.0			16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Macedonia[23]	14.8								14.4	16.2	13.7		
Poland[24]	15.5					17.2	16.6	15.9	15.2	15.3	14.5	14.6	14.3
Romania[25]	16.4			6.7	8.9	12.6	16.6	18.4	18.6	23.3	21.1	21.1	
Slovakia[26]	14.2						11.9	14.4	13.5	14.7	15.0	15.6	14.5
Slovenia[27]	6.3						6.4	6.3	6.5	6.1	5.8	6.6	6.7

[6] Personal Correspondence: Stepan Mnatsakanyan, National Statistical Service, Republic of Armenia.
[7] Personal Correspondence: Ministry of Statistics, Belarus
[8] Personal Correspondence: Andres Lauba, Statistical Office of Estonia, Acting Deputy Head of Macroeconomic Statistics Division
[9] Personal Correspondence: Revaz Tsakadze, Head of National Accounts Division, State Department for Statistics of Georgia
[10] Personal Correspondence: Isakova, Statbase, Kazakhstan.
[11] Kudabaev (2004) and personal correspondence: Akylbek Masydykov, National Bank of Kyrgyzstan.
[12] OECD (2002)
[13] Personal Correspondence: G. Juskiene, Deputy Head, National Accounts Division, Statistics Lithuania.
[14] Personal correspondence: V. Gidilica, Head of General Direction of National Accounts and Synthesis.

Table 1 also reveals that there remain significant data gaps for size of NOE imputations, particularly, for the early years of the transition. If no such imputations were made in the early transition years, published GDP growth rates would have been significantly affected in the year that the imputations were first included.

Electric Consumption Estimates of Unrecorded Income

Feige and Urban (2003) attempted to replicate and update earlier estimates (Dobozi and Pohl, 1995; Kaufmann and Kaliberda, 1996; Johnson et al., 1997; Johnson et al., 1998; Friedman et al., 2000) of unrecorded income based on simple electric consumption models (ECM) and examined the sensitivity of the results to alternative specifying assumptions. They found that simple ECM estimates were highly sensitive to alternative initial conditions (Alexeev and Pyle, 2003) concerning the pre-transition size of the unrecorded sector and produced seemingly anomalous negative shares of unrecorded income for a number of transition countries. They also modified the simple ECM to allow for changes in electricity prices and changes in the share of the private and industrial sectors as suggested by Eilat and Zinnes, (2002) and Lacko, (1999). These modifications affected the estimated size and trajectory of unrecorded incomes, and eliminated some, but not all of the negative values of the share of unrecorded activities.

Figure A1 in Appendix A displays the share of the unrecorded income in total economic activity (Y^{UR}/Y) as estimated by the modified electric consumption method (MEC) based on the temporal cross-section estimates reported in Feige and Urban (2003). Overall, the trajectory of the estimates labeled [Y^{UR}/Y MEC] display an inverted U shaped pattern. It appears that the unrecorded sector's share of total economic activity grew during the early years of the transition and eventually

[15] Masakova (2001)
[16] V.Golovko, State Statistics Committee of Ukraine "Experience of Ukraine in measuring of non-observed economy"
[17] Rogoznikova (2004)
[18] Personal Interviews at INSTAT, Tirana, Albania and OECD (2004) which concludes "NOE's actual contribution to GDP is probably closer to 50-60% of GDP" p.86.
[19] Personal Correspondence: T.Yalamov, Center for the Study of Democracy
[20] United Nations (2003).
[21] Personal Correspondence: N. Holikova, National Accounts Department.
[22] Personal Correspondence: I. Bedekovics, Deputy Head of National Accounts Department.
[23] United Nations (2003)
[24] Personal Correspondence: R. Popiński, Central Statistical Office of Poland.
[25] Ciupagea (2001)
[26] Personal Correspondence: V. Cicmanec and P.Baláž, National Accounts Slovakia.
[27] Personal Correspondence: A. Flajs, Statistical Office of the Republic of Slovenia.

declined during the second half of the transition decade. However this observed temporal pattern is directly effected by the extent to which official GDP has been adjusted with imputations for the non-observed sector. The temporal pattern of the NOE imputations as a fraction of estimated total economic activity is also displayed as the series (Y^{IUI}/Y MEC). For most countries and most time periods, the estimated share of unrecorded income is positive. The most notable exceptions are the negative shares of unrecorded income for Poland, Romania and the Slovakia during the period 1997-2001.

It must be recalled that the MEC estimates of the unreported economy are derived as the difference between total economic activity as predicted by the adjusted electric consumption proxy and the actual recorded level of GDP. As such, if the proxied value of TEA is approximately correct and if recorded GDP (which includes imputed NOE [Y^{IUI}]) reflects an accurate exhaustive measure of total economic activity, the expected value of the MEC estimate of unrecorded income would be zero. Positive estimates of unrecorded income are indicative of either an overestimated value of TEA (due to either a failure of the electric consumption proxy, or an overestimate of the initial value for the pre-transition underground) or an underestimated value of the imputation for non-observed income. Conversely, negative estimates of unrecorded income are indicative of either an underestimated prediction of TEA or an overestimated imputation for non-observed income. Since there is insufficient information to determine which of these possible explanations accounts for our observed estimates of unrecorded income, it is helpful to develop an alternative independent estimate of the size of the unrecorded income. To this end we turn to simple currency deposit ratio estimates of the unrecorded economy.

Currency Deposit Ratio Model Estimates of Unobserved Income

It is widely believed that currency plays a major role in the unobserved economy, as economic actors seek to hide their activities from public authorities by using a medium of exchange that does not leave a paper trail. However, many transition economies are highly dollarized [Feige, 2003], as economic agents engage in currency substitution to avoid the costs of inflation and exchange rate depreciation that accompanied the transition process. As such, estimation of unobserved activities by monetary models ideally requires estimates not only of local currency in circulation (LCC), but also of foreign currency in circulation (FCC).

There is a growing body of evidence (Feige 1994, 1996, 1997; Porter and Judson 1996) suggesting that between 40-60% of US cash is held abroad. The "official" estimate of overseas currency, published by the Bureau of Economic Analysis (BEA) and the Federal Reserve Board of Governors (FED) is based on a variant of a proxy measure proposed by Feige (1994). The official estimate indicates that in 2001, 50% of the $580 billion of US currency in circulation was held abroad. Similarly, studies by Seitz (1995), Stix (2001) and Doyle (2000) found that between 35-70% of Deutsch-Marks (DM) were held outside of Germany. These aggregate measures indicate that substantial fractions of key national currencies are held beyond their national borders, but they do not provide information on the exact location of these circulating international currencies.

During the transition period, US currency had a reputation as a stable currency, and was regarded as a reliable store of value. It was available in many countries, and was widely accepted as a medium of exchange, thought to protect foreign users against the threat of domestic bank failures, devaluation and inflation. Cash usage preserved anonymity because it left no paper trail of the transaction for which it served as the means of payment and was therefore a preferred medium of exchange for underground transactions. The problem is to estimate the approximate amounts of US and European legacy currencies in circulation in transition countries.

The United States Customs Service collects systematic information on cross border flows of US currency. The Currency and Foreign Transactions Reporting Act (also known as the "Bank Secrecy Act") requires persons or institutions importing or exporting currency or other monetary instruments in amounts exceeding $10,000 to file a Report of International Transportation of Currency or Monetary Instruments (CMIR). The information contained in the millions of accumulated confidential individual CMIR forms has been aggregated in order fully to preserve the confidentiality of individual filers' information. The aggregated data yield time series estimates of the gross inflows and outflows of US currency to and from different destinations. By cumulating the CMIR recorded net outflows of US dollars to all destinations, Feige (2003) obtained initial estimates of the amount of US currency held abroad as well as the location of US currency in various transition countries. Some transition countries are also known to have held European legacy currencies, particularly the DM. To reflect these added holdings we employed estimates of the amounts of Swiss Francs, Austrian Schillings, DM and dollars as obtained from

surveys undertaken by the Austrian Central Bank (Stix, 2001) from 1997-2001 for Croatia, Czech Republic, Hungary, Slovakia and Slovenia.

Table 2: Estimates of Per Capita Foreign Currency Holdings in Transition Countries

	Per Capita Holdings of FCC	Share of Total Currency held as FCC
Country	2001	2001
	$ Per Capita	Percent
Albania	46	14
Armenia	55	62
Azerbaijan	169	82
Belarus	17	34
Bulgaria	125	41
Croatia	117	35
Czech Republic	129	21
Estonia	414	59
Georgia	123	79
Hungary	25	6
Kazakhstan	1024	95
Kyrgyzstan	20	48
Latvia	1209	79
Lithuania	25	11
Macedonia	5	5
Moldova	NA	NA
Poland	93	27
Romania	61	55
Russia	903	87
Slovakia	123	28
Slovenia	329	54
Tajikistan	NA	NA
Turkmenistan	64	51
Ukraine	131	64
Uzbekistan	10	44

Source: Feige (2003)

The results of these calculations are reflected in Table 2 (Col 1), which reports the estimated per capita holdings of FCC in transition countries as well as the percentage (Col 2) of the total currency supply (LCC+FCC) held in the form of FCC. Table 2 reveals that many of the transition countries are heavily dollarized, with eight of the reported countries having more than fifty percent of their currency supply in the form of foreign currency. The countries exhibiting the highest degree of currency substitution are Kazakhstan, Russia, Azerbaijan, Georgia, Latvia and the Ukraine.

The estimates of FCC in transition countries were initially combined with the amount of local currency to determine the total currency supply in each country. We then employed estimates of the M2 money supply minus LCC to determine total deposits in each country. The ratio of total currency to total deposits was taken as our initial indicator variable to proxy the trajectory of unobserved income in each country.

The simple currency/deposit ratio method (CDM) described in Feige (1986; 1989) was used to estimate the ratio of unobserved to observed income. Currency is assumed to be the exclusive medium of exchange in unobserved activities and the income velocities in the observed and unobserved sectors are typically assumed equal to one another. This latter assumption is however particularly restrictive for transition countries that are highly dollarized and have poorly developed capital markets. With virtually no safe domestic savings alternatives, the large observed stocks of foreign currencies are more likely to function as stores of value rather than as media of exchange. In this case, the equal velocities assumption is likely to be violated, leading to overestimates of the size of unobserved sector. This conjecture was confirmed by preliminary estimates leading us to employ domestic currency holdings as the numerator of the currency deposit ratio for all but the EU border countries in our analysis.

The ratio of the size of unobserved economy, to the observed economy at any time t is then given by the equation:

4) $[Y^U/Y^O]_t = (C_t – K^O_t D_t)/[(K^O_t+1)D_t] = (C_t – C^O_t)/(C^O_t+D_t)$

where C_t represents total currency in circulation with the public; C^O_t is the currency used in the observed sector; D_t represents total deposits and K^O_t represents the C^O_t/D_t ratio that obtains in the observed sector. All estimates of the size of the unobserved economy require some benchmark value for calibration. In earlier applications of the simple currency/deposit ratio model Gutmann (1977) imposed the restrictive assumption that the unobserved sector was identically equal to zero in some initial base period T. Instead, we employ the modified electric consumption model estimate of Y^{UR} plus the NOE estimate of Y^{IUI} to establish the base period size of the unobserved sector (Y^U). Given the initial benchmark value of $[(Y^{UR} + Y^{IUI})/Y^{RO}]_T = [Y^U/Y^O]_T = \alpha_T$, we can solve for K^O_T as,

5) $K^O_T = (C_T – \alpha_T D_T)/[D_T(\alpha_T +1)]$

and our estimate of the share of unobserved income (Y^U) in observed income (Y^O) in period t is calculated as:

6) $(Y^U/ Y^O)^*_t = (C_t - K^O_T D_t)/[(K^O_T +1)D_t]$

It must be recalled that the CDM method yields an estimate of the unobserved economy Y^U whereas the MEC method produces an estimate of Y^{UR}. Prior to the NIPA efforts to impute NOE, both approaches essentially measured unrecorded income since $Y^{IUI} = 0$. In the presence of NOE imputations, the final CDM time series estimate of unrecorded income $(Y^{UR})_t$ is calculated as:

7) $(Y^{UR})_t = [Y^U/ Y^O]^*_t \text{ x } Y^{RO}_t - Y^{IUI}_t$,

where $[Y^U/ Y^O]^*_t$ represents the CDM estimate of the ratio of unobserved to observed income. In this formulation, the estimated value of unrecorded income has an expected value of zero if and only if the CDM model is a correct specification of the process generating the ratio of unobserved to observed income[28] and the NIPA imputations capture the full extent of the non-observed economy. If the CDM model produces an accurate estimate of unobserved income, then positive values of estimated unrecorded income suggest that Y^{IUI} is underestimated and conversely, negative estimates of unrecorded income would be indicative that Y^{IUI} has been overestimated. These inferences are however conditional on the conjecture that the CDM model is approximately accurate. Since other factors not included in the model are likely to affect both the level and temporal path of the CD ratio, all inferences concerning the accuracy of the NIPA imputations for unobserved income must be regarded as tentative and suggestive rather than conclusive.

Comparing Alternative Empirical Estimates

The Size of the Unrecorded Sector

Table 3 compares the average size of the unrecorded economy obtained by the MEC and CDM methods for the transition decade 1990-2001.[29] For a number of countries: Russia, Ukraine, Azerbaijan, Kyrgyzstan, Croatia, and Romania the average size differences are equal to or less than ten percent of one another. Where the MEC and CDM estimates diverge by more than ten percent, the CDM model

[28] Feige (1986, 1989) proposes a far less restrictive model to account for other variables that are likely to affect the ratio C^0/D over time, (particularly during a turbulent transition period) but this specification is beyond the scope of the present paper.

[29] All estimates of the MEC model have been recalculated using the latest revised data from the following sources: Total Net Electricity Consumption from Energy Information Administration, International Energy Annual 2005, Table 6.2; GDP growth and share of industry in GDP (%) from EBRD, 2007 Transition Report, Selected Economic Indicators; Private sector share in GDP (%) from EBRD, 2007 Transition Report , Structural and Institutional Change Indicators; Electricity tariffs from EBRD, 2003, Transition report, Structural and Institutional Change Indicators.

predicts a higher unrecorded sector for all countries except for Georgia, Turkmenistan, Hungary, Poland, Albania, and Bulgaria.[30]

Table 3

Average Size of Unrecorded Economy as Calculated by the MEC and CDM Methods 1990-2001

Percent of Total Economy [100*Y^{UR}/Y]

FSU	MEC	CDM
The Baltics		
Estonia	14.3	21.6
Latvia	19.4	31.6
Lithuania	19.7	29.0
MEAN FOR GROUP:	**17.8**	**27.4**
Western FSU		
Belarus	22.1	28.6
Moldova	44.9	53.8
Russia	28.0	25.3
Ukraine	40.0	41.1
MEAN FOR GROUP:	**33.7**	**37.2**
The Caucasus		
Armenia	24.0	51.5
Azerbaijan	43.8	39.8
Georgia	49.2	29.6
MEAN FOR GROUP:	**39.0**	**40.3**
Central Asia		
Kazakhstan	24.7	43.2
Kyrgyzstan	49.5	46.2
Tajikistan	54.2	64.8
Turkmenistan	19.0	0.2
Uzbekistan	25.8	32.5
MEAN FOR GROUP:	**34.6**	**37.4**
MEAN FOR FSU:	**31.9**	**35.9**

CEE	MEC	CDM
EU Border Countries		
Croatia	22.6	24.5
Czech Republic	14.2	16.1
Hungary	22.2	9.7
Poland	-3.5	5.5
Slovakia	5.6	11.1
Slovenia	20.4	23.9
MEAN FOR GROUP:	**13.6**	**15.1**
The Balkans		
Albania	49.6	16.3
Bulgaria	19.1	14.0
Macedonia	30.8	34.6
Romania	9.4	9.2
MEAN FOR GROUP:	**27.2**	**18.5**
MEAN FOR CEE:	**19.1**	**16.5**

[30] The temporal trajectory of the share of total economic activity made up of unrecorded income (Y^{UR}/Y) is displayed in the Appendix A (Figure A1) for alternative estimates as calculated by both the MEC the CDM methods. Figure A1 also displays the comparable NIPA estimates of the share of total economic activity made up of (NOE) imputed unobserved income.

Table 4 displays the average size of the unrecorded sector estimated by each of the macro model methods for the specific periods for which we also have an NIPA estimate of the imputed unobserved economy.

Table 4

Average Size of the Unrecorded Economy in Transition Countries for Comparable Years

Percent of Total Economy [100*Y^{UR}/Y]

		MEC	IUI-MEC	CDM	IUI-CDM
FSU	Period	Average Size Y^{UR}/Y	Average Size Y^{IUI}/Y	Average Size Y^{UR}/Y	Average Size Y^{IUI}/Y
The Baltics					
Estonia	1993-2001	10.6	8.2	20.3	7.4
Latvia	1997-1998	4.7	15.7	24.0	12.4
Lithuania	1992-2001	18.8	15.5	30.0	13.4
MEAN FOR GROUP:		**11.4**	**13.1**	**24.8**	**11.1**
Western FSU					
Belarus	1990-2001	22.1	8.1	28.6	7.4
Moldova	1993-2001	46.3	16.6	58.2	12.9
Russia	1993-2000	31.6	8.4	25.9	9.4
Ukraine	2000	41.2	11.8	35.5	12.9
MEAN FOR GROUP:		**35.3**	**11.2**	**37.0**	**10.6**
The Caucasus					
Armenia	1994-2001	15.9	24.7	54.1	13.3
Azerbaijan	NA	NA	NA	NA	NA
Georgia	1996-2001	46.8	15.8	7.7	27.9
MEAN FOR GROUP:		**31.4**	**20.3**	**30.9**	**20.6**
Central Asia					
Kazakhstan	1997-2001	7.9	26.3	40.2	17.1
Kyrgyzstan	1995-2001	51.7	5.7	46.0	6.4
Tajikistan	NA	NA	NA	NA	NA
Turkmenistan	2000	12.8	15.7	-51.1	27.2
Uzbekistan	1998	24.0	23.5	19.1	25.1
MEAN FOR GROUP:		**24.1**	**17.8**	**13.5**	**18.9**
MEAN FOR FSU:		**25.7**	**15.1**	**26.0**	**14.8**

Table 4 (Continued)

CEE	Period	MEC Average Size Y^{UR}/Y	IUI-MEC Average Size Y^{IUI}/Y	CDM Average Size Y^{UR}/Y	IUI-CDM Average Size Y^{IUI}/Y
EU Border Countries					
Croatia	1998-1999	23.1	6.5	18.3	6.9
Czech Republic	1998-2001	12.7	7.8	16.2	7.5
Hungary	1992-2001	20.9	12.7	6.3	15.0
Poland	1994-2001	-11.4	17.1	-1.7	15.7
Slovakia	1995-2001	0.0	14.3	9.1	12.9
Slovenia	1995-2000	18.0	5.2	22.8	4.9
MEAN FOR GROUP:		**10.6**	**10.6**	**11.8**	**10.5**
The Balkans					
Albania	1996-2001	56.7	13.9	-4.3	33.7
Bulgaria	1996-2001	20.6	15.0	11.5	18.1
Macedonia	1997-1998	36.9	9.7	31.6	10.5
Romania	1992-2000	8.5	15.2	5.4	16.1
MEAN FOR GROUP:		**30.7**	**13.4**	**11.1**	**19.6**
MEAN FOR CEE:		**18.6**	**11.7**	**11.5**	**14.1**

For those countries where the macro model estimates are highly inconsistent with one another, we infer a problem with at least one of the macro model estimates and as such are unwilling to make any inferences concerning the accuracy of the NIPA imputation.

For those countries where both the MEC and CDM estimates of unrecorded income are consistently large and positive, we have somewhat greater confidence in the inference that current NIPA imputations of the unobserved sector are likely to be understated and do not yet fully represent exhaustive estimates of total economic activity. This appears to be the case for many FSU countries. Conversely, where we find macro model estimates of unrecorded incomes that are consistently small and vary around zero, we have greater confidence in the inference that the NIPA imputations more accurately reflect exhaustive estimates of total economic activity. The negative estimates of unrecorded income (Figure A1) in the later years of the transition for Poland, Romania and the Slovakia suggest that NIPA NOE imputations may overstate the size of the unobserved sector during this period.

Recovery of Total Economic Activity During the Decade of Transition

A critical issue concerning the decade of transition is how well different economies responded to the initial transition shock and how quickly they recovered.

In particular, we are interested in determining which of the transition economies have failed to regain their pre-transition level of total economic activity (TEA) and which economies have succeeded in surpassing their pre-transition level of TEA.

Taking 1990 as the pre-transition base year in which the index of TEA=100 for all countries, Table 5 presents our estimates of the year 2001 index of TEA for each of the transition countries as determined by the three alternative estimates of TEA. The first column displays the value of the TEA index of official recorded income, that is, recorded GDP which includes the imputations for NOE as reported by the various national statistical agencies. The second column reports the corresponding 2001 TEA index as calculated by the MEC method and the final column reports the TEA index as calculated by the CDM model. Table 5 reveals that the convergence between different methods of estimating total economic activity still leaves much to be desired. The correlation coefficients between the recorded GDP index and the MEC and CDM indices of TEA are respectively .66 and .51, and the correlation between the MEC and CDM TEA measures is only .39. When the transition countries are ranked by their 2001 TEA index by each method we find the rank correlations between the recorded GDP index and the MEC and CDM indices to be respectively .72 and .56. The rank correlation between the MEC and CDM indices is .69.

Table 5.

Growth of Total Economic Activity (Recorded and Unrecorded 1990-2001 -1990 = 100

FSU	Recorded Income Index 2001	Total Economic Activity Index 2001 MEC	Total Economic Activity Index 2001 CDM
The Baltics			
Estonia	100.8	70.3	89.3
Latvia	71.7	57.1	80.9
Lithuania	78.0	62.7	79.1
MEAN FOR GROUP:	**83.5**	**63.4**	**83.1**
Western FSU			
Belarus	92.7	68.7	96.2
Moldova	36.8	35.7	55.0
Russia	70.5	73.0	87.2
Ukraine	46.3	54.4	70.2
MEAN FOR GROUP:	**61.6**	**57.9**	**77.2**

The Caucasus			
Armenia	74.3	49.8	97.8
Azerbaijan	66.7	71.2	74.9
Georgia	41.0	49.2	23.2
MEAN FOR GROUP:	**60.7**	**56.7**	**65.3**
Central Asia			
Kazakhstan	78.8	52.8	73.9
Kyrgyzstan	70.2	79.8	81.6
Tajikistan	52.8	75.7	139.9
Turkmenistan	91.6	58.3	49.9
Uzbekistan	100.4	79.2	98.7
MEAN FOR GROUP:	**78.7**	**69.2**	**88.8**
MEAN FOR FSU:	**71.5**	**62.5**	**79.8**

CEE	**Recorded Income Index 2001**	**Total Economic Activity Index 2001 MEC**	**Total Economic Activity Index 2001 CDM**
EU Border Countries			
Croatia	89.5	84.2	88.6
Czech Republic	105.3	112.3	115.2
Hungary	112.4	92.2	86.3
Poland	146.9	99.0	116.1
Slovakia	104.9	92.4	110.1
Slovenia	124.1	111.7	125.1
MEAN FOR GROUP:	**113.9**	**98.6**	**106.9**
The Balkans			
Albania	122.5	210.3	84.4
Bulgaria	84.3	74.2	79.8
Macedonia	86.9	90.8	112.3
Romania	89.0	67.5	83.2
MEAN FOR GROUP:	**95.7**	**110.7**	**89.9**
MEAN FOR CEE:	**106.6**	**103.5**	**100.1**

Only two countries appear to have unambiguously surpassed their pre-transition level of TEA after a decade as measured by all three approaches, namely the Czech Republic and Slovenia. According to official GDP estimates, Estonia, Uzbekistan, Hungary, Poland, Slovakia, and Albania also surpassed their pre-transition TEA by the year 2001, and this finding is confirmed by one of the other alternative estimation methods for each country except for Estonia, Uzbekistan and

Hungary. All three methods agree that Latvia, Lithuania, Belarus, Moldova, Russia, Ukraine, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Turkmenistan, Croatia, Bulgaria and Romania failed to achieve their pre-transition levels of total economic activity however; there is considerable variation between the methods in the estimate of the extent of the shortfall.

The Appendix (Figure A2) displays the temporal trajectory of TEA and each of its components: recorded observed income (Y^{RO}), recorded unobserved income (Y^{IUI}) and unrecorded income (Y^{UR}) as calculated by the MEC method and Figure A3 displays comparable estimates calculated by the CDM method.

In order to illustrate both central tendencies of our findings as well as the remaining range of uncertainty, Table 6 presents for the year 2001 an equally weighted average of the three TEA indices, along with its corresponding standard deviation. The countries are then ranked in descending order of their apparent "success" during the transition decade. The results suggest very different transition outcomes for different countries.

Table 6

Average 2001 TEA Index (1990=100) and Standard Deviation of Estimates

Country	Average TEA 2001 NIPA, ECM and CDM	Standard Deviation of TEA Estimates
Albania	139	53
Poland	121	20
Slovenia	120	6
Czech Republic	111	4
Slovak Republic	102	7
Hungary	97	11
Macedonia	97	11
Uzbekistan	93	10
Tajikistan	89	37
Croatia	87	2
Estonia	87	13
Belarus	86	12
Romania	80	9
Bulgaria	79	4
Kyrgyz Republic	77	5
Russian Federation	77	7
Armenia	74	20
Lithuania	73	7

Azerbaijan	71	3
Latvia	70	10
Kazakhstan	69	11
Turkmenistan	67	18
Ukraine	57	10
Moldova	43	9
Georgia	38	11

For example, Albania appears to have achieved a level of TEA in the year 2001 that was 39 per cent above its pre-transition 1990 level whereas Georgia's TEA in 2001 is estimated to have achieved only 38 percent of its 1990 level. However, as illustrated by the standard deviations that reflect the variation between different TEA estimates, we can not embrace these conclusions with any confidence.

For some countries, i.e. Croatia and the Czech Republic, the different methods produce quite similar results; however for most of the countries the range of estimates is so large as to preclude any confident judgments concerning the actual percentage of growth or decline during the transition decade.

Summary and Conclusions.

For social scientists who rely heavily on the laboratory of history to create interesting and dramatic experiments, the fall of communism and the radical transitions it induced is surely one of the most significant historic experiments of our century. Economists have flocked to the experiment in an effort to test alternative substantive hypotheses concerning the causes and consequences of transition success stories and failures. One danger of this rush to judgment is that the cart may be preceding the horse. The workhorse pulling most macroeconomic analysis is the NIPA that provides the richly detailed data documenting the economy's overall growth and the composition of its output and expenditure.

Unfortunately, traditional reliance on NIPA was undercut by two factors critically salient to the transition experience. First, the national accounts themselves were subject to a major upheaval in statistical practice, switching from the Material Product System of accounting to the SNA accounting standard. Second, it was widely recognized that the existence of large unobserved economies in transition countries limited the usefulness of official GDP since it could not be interpreted as an exhaustive measure of total economic activity. As such, total economic activity was substantially understated by official recorded income, and growth rate of TEA

remained largely indeterminate without a specific accounting of the temporal growth of the unobserved, unrecorded economy.

The profession's response to this dilemma has taken several forms. Many empirical studies (EBRD, 1999; 2001; World Bank, 2002; IMF, 2000; Berg, et.al., 1999; Sachs, et.al., 2001; Campos and Coricelli, 2002; Havrylyshyn, 2001, 2004) of the transition experience simply relied on published GDP growth rates while paying lip service to the acknowledged shortcomings of the data. Other scholars (Dobozi and Pohl, 1995; Kaufmann and Kaliberda, 1996; Johnson et al., 1997; Johnson et al., 1998; Lacko, 1999, 2000; Eilat and Zinnes, 2002; Alexeev and Pyle, 2003; Feige and Urban, 2003) turned their attention to finding means of measuring the unrecorded sector, primarily employing versions of the electric consumption model methodology. Most significantly, the national accounting community has developed new methods (OECD, 2002) for measuring the unobserved (NOE) economy with the aim of producing "exhaustive estimates of GDP". Many transition countries now include imputations for NOE in their published GDP statistics, but it is difficult to determine the exact nature, consistency and extent of these imputations for the transition decade.

The great advantage of the national income accounting approach to imputing unobserved income is that it is highly detailed, often preserving compositional aspects of the NIPA accounts as well as improving aggregates that purport to describe overall economic development. However, the detailed nature of adjustments for unobserved activities requires a variety of imputations employing diverse statistical and other inferential methods to model specific lacunae in the conventional data sources employed to estimate production, income, labor inputs and expenditures as well as their components.

Given the multitude, diversity and complexity of imputation methods, as well as their variation from country to country, activity to activity and over time, the national accounting community must be held to the highest standards of consistency and transparency. By consistency we mean that great care must be taken that every major revision in the published accounts must somehow be made comparable with earlier published data in order not to distort perceptions of changes in total output over time. In order to assure transparency, every national account aggregate should be accompanied by detailed information showing the fraction of each recorded component accounted for by Y^{IUI}. Every imputation must be fully documented and to the extent possible, confidence intervals should be established for each component

imputation. These confidence intervals must then be applied to key aggregate measures so that their reliability can be assessed. To date, national statistical agencies do not adhere to these suggested standards.

Without such stringent safeguards for consistency and transparency, national accountants risk, that by delving into the murky area of the unobserved economy in the interests of pursuing exhaustiveness, they may be confronted with growing skepticism that the accounts have become more subjective and opaque, and thereby more potentially vulnerable to political manipulation.[31] The transition countries are particularly vulnerable to unobserved activities arising from loosened state controls as well as tax and regulation incentives for firms and individuals to avoid registration (Gërxhani, 2004), or otherwise underreport income-producing activities.

This paper updates the available information on NOE imputations and develops a taxonomic framework that explains the conceptual and empirical linkages between recorded and unrecorded income and between the observed and unobserved economy. Our empirical work examines the relationship between NOE imputations and macro estimates of unrecorded income. In particular we examine the results of the modified electric consumption (MEC) model and the simple currency deposit ratio model (CDM) covering the period 1990-2001 for all twenty five transition countries.

The empirical results detailing the size and trajectory of the three alternative estimates of unrecorded activities unfortunately do not converge in a satisfactory manner. Indeed, the range of estimates obtained by the different methods is so large as to preclude confident judgments concerning the actual percentage growth or decline of total economic activity for most countries during the transition decade. The macro model approaches suggest that for some countries, NIPA imputations for NOE still fall far short of the goal of exhaustiveness, while for other countries; the NIPA estimates may actually overstate the size and growth of total economic activity. Noting the acknowledged strengths and weaknesses of the different approaches to measuring unobserved activities we strongly recommend that further efforts are needed to improve all three approaches in the hope that ultimately, more refined estimates from different approaches will converge to a far greater extent.

[31] Greece provides a glaring example. According to the International Herald Tribune (September 28, 2006, p.17) "Greece will revise upward its gross domestic product for the past six years by as much as 25 percent a quarter by including parts of its underground economy… The revision will help Greece meet the deficit standards set by the European Unions by shrinking its budget deficit as a percentage of GDP." A spokeswoman for the European Commission "said that Eurostat had not been consulted in advance."

The national accounting community, as reflected in the Handbook, has not exactly embraced macro-model methods, stating that they are discussed "not because they are considered useful in obtaining exhaustive estimates of GDP or in estimating underground production, but because they tend to produce spectacularly high measures, which attract much attention from politicians and newspapers." (p.187) Macroeconomic models are indeed not a substitute for detailed national accounting imputation procedures, since they are incapable of providing the rich compositional detail available from micro NIPA methods. Nevertheless, appropriately specified macroeconomic models can provide a complementary means of assessing both the aggregate size and the temporal trajectory of unobserved activity. Viewed as useful complements to NIPA methods, macro-modeling approaches have both the advantages and disadvantages of simplicity. While the macro-methods are rightly critiqued for requiring overly bold assumptions, their simplicity gives them the advantage of being transparent and thus readily subjected to sensitivity analysis, enabling researchers to readily establish plausible intervals for their estimates. This is much more difficult to accomplish for NIPA procedures because of their opacity and complexity.

Given our finding of non-convergence, it is all the more important that there be greater cooperation between national accounting professionals and macro economists to improve alternative methods of estimating underground activities and hence, of total economic activity. Statistical agencies will require greater resources to construct more consistent and transparent NIPA estimates. Econometricians must be encouraged not only to critique existing macro methods but to develop constructive alternative means of measurement. Assessing the current state of the arts, we conclude that the profession's rush to investigate the complex relationships between economic reforms[32] and economic outcomes is based on a fragile foundation of facts. It is time to acknowledge how little we really know about unobserved economies despite forty years of effort to measure their size and growth. Convergence among alternative improved measures of economic performance must be achieved before we can have any confidence in our judgments concerning the causes and consequences of underground economies and the successes and failures of the transition process.

[32] As measured by the European Bank for Reconstruction and Development reform indicators and the World Bank's new indicators of Governance.

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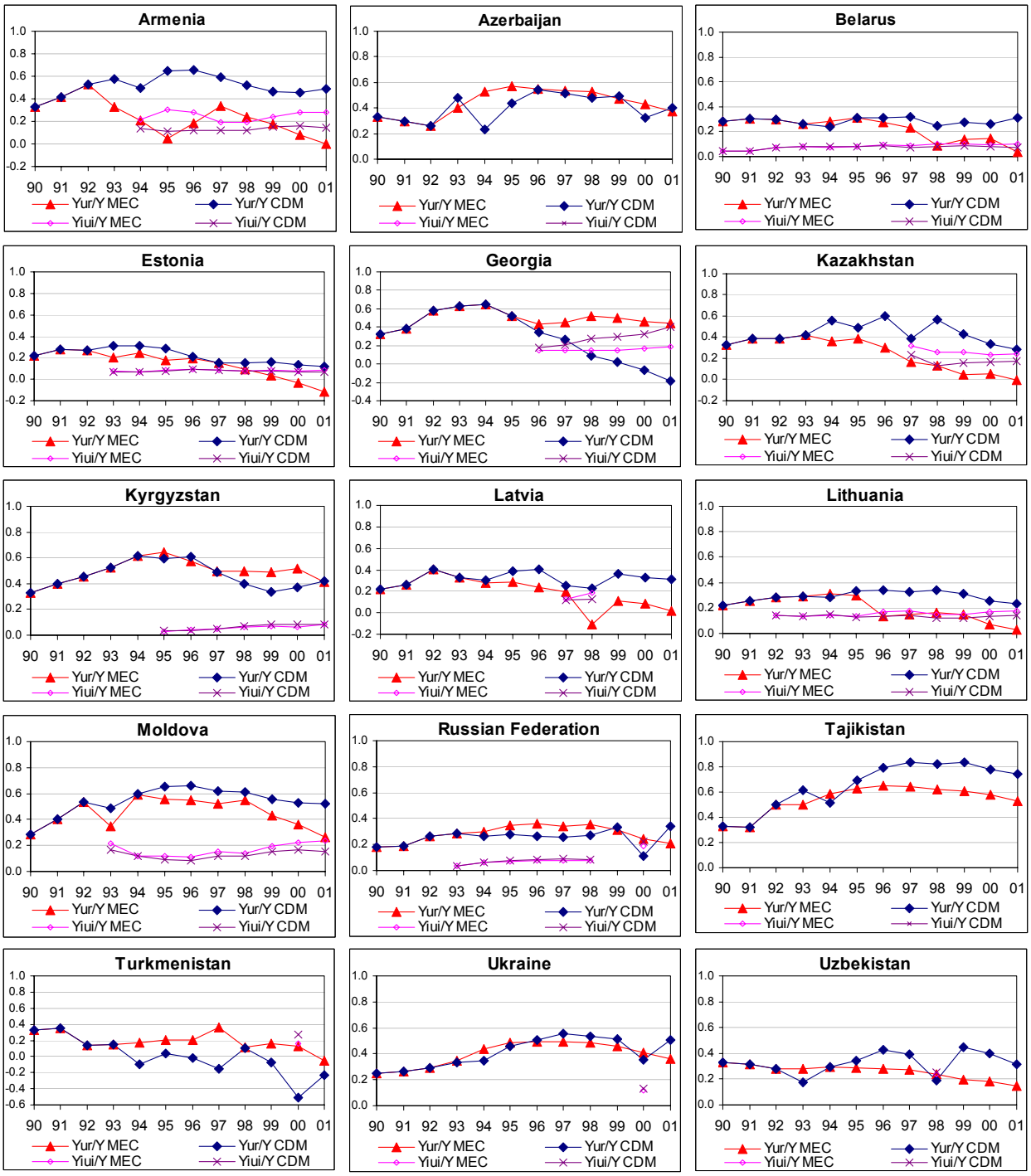
APPENDIX A

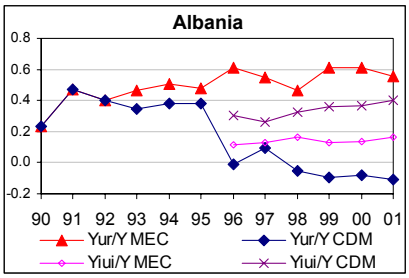
Figure A1

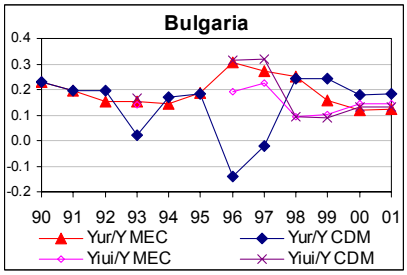
Share of Unreported and Imputed Income in Total Economic Activity

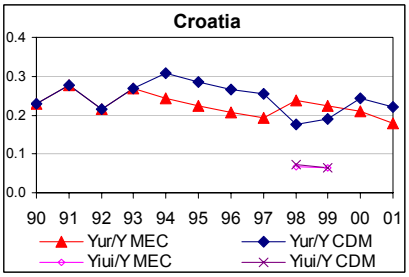
FSU Countries

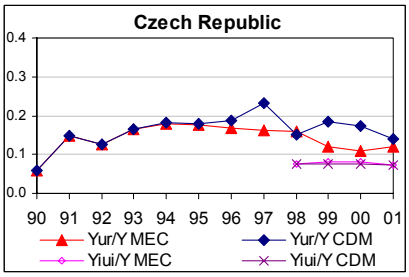


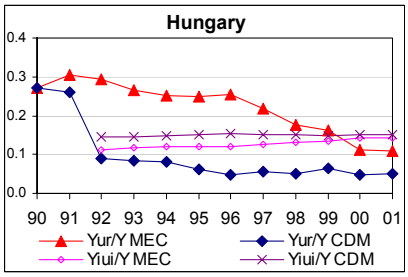
Share of Unreported and Imputed Income in Total Economic Activity
CEE Countries

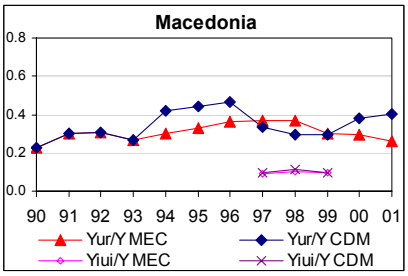


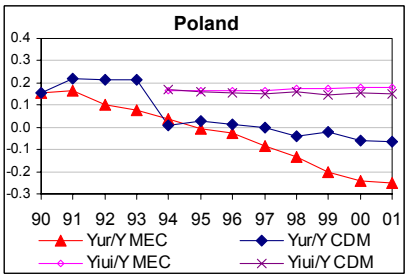


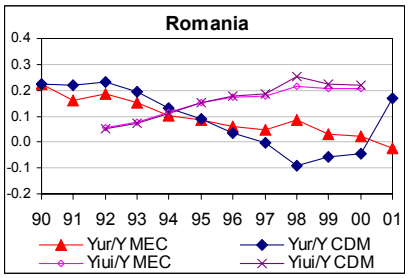


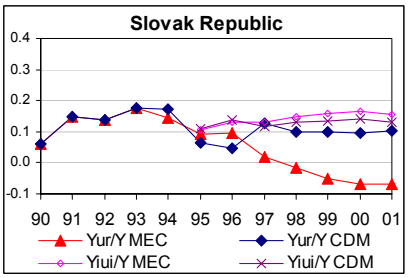












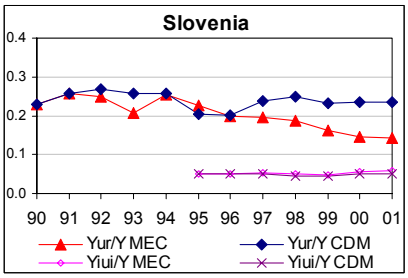


Figure A2
Evolution of Total Economic Activity -MEC Method
FSU Countries

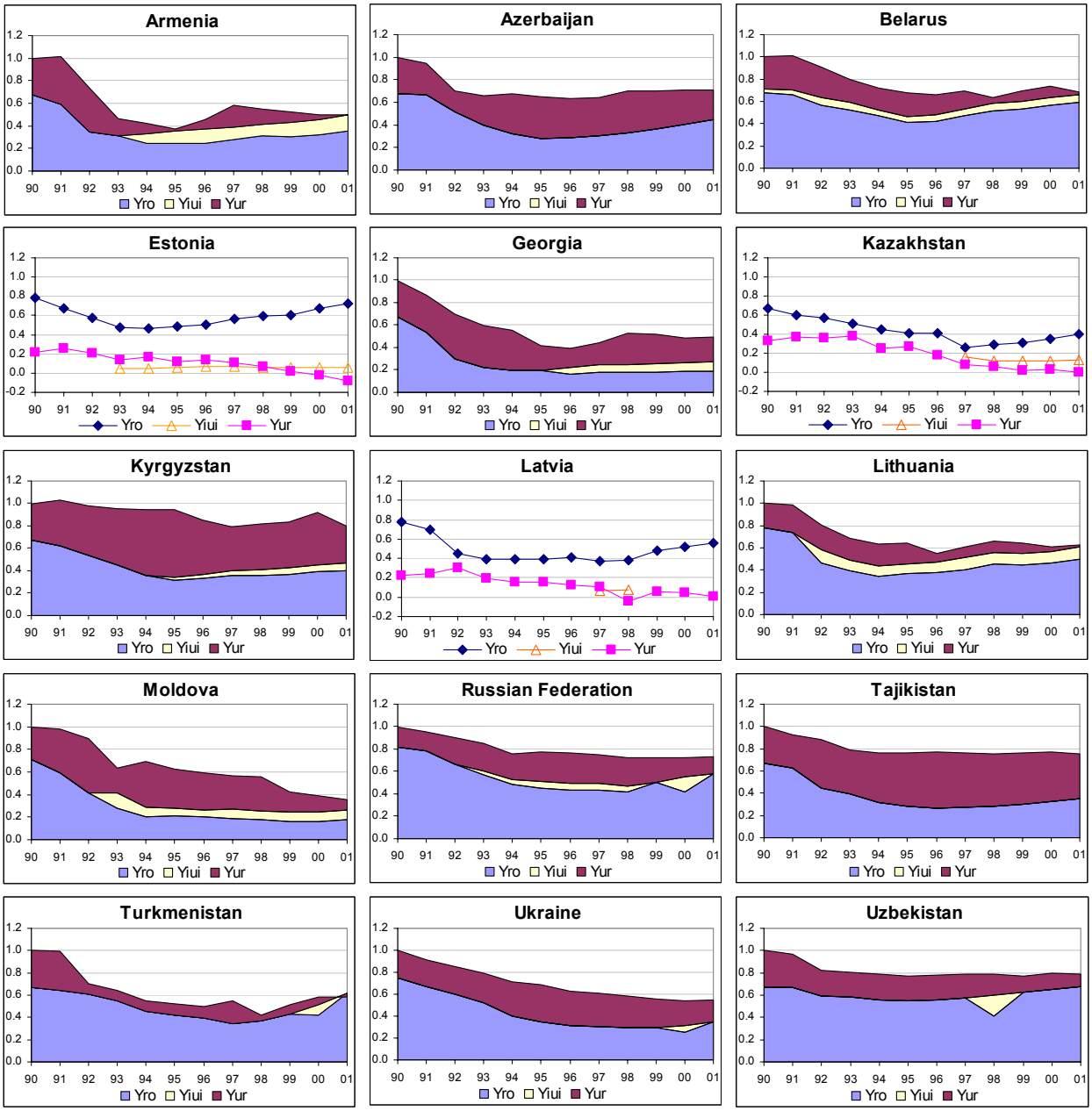


Figure A2
Evolution of Total Economic Activity -MEC Method
CEE Countries

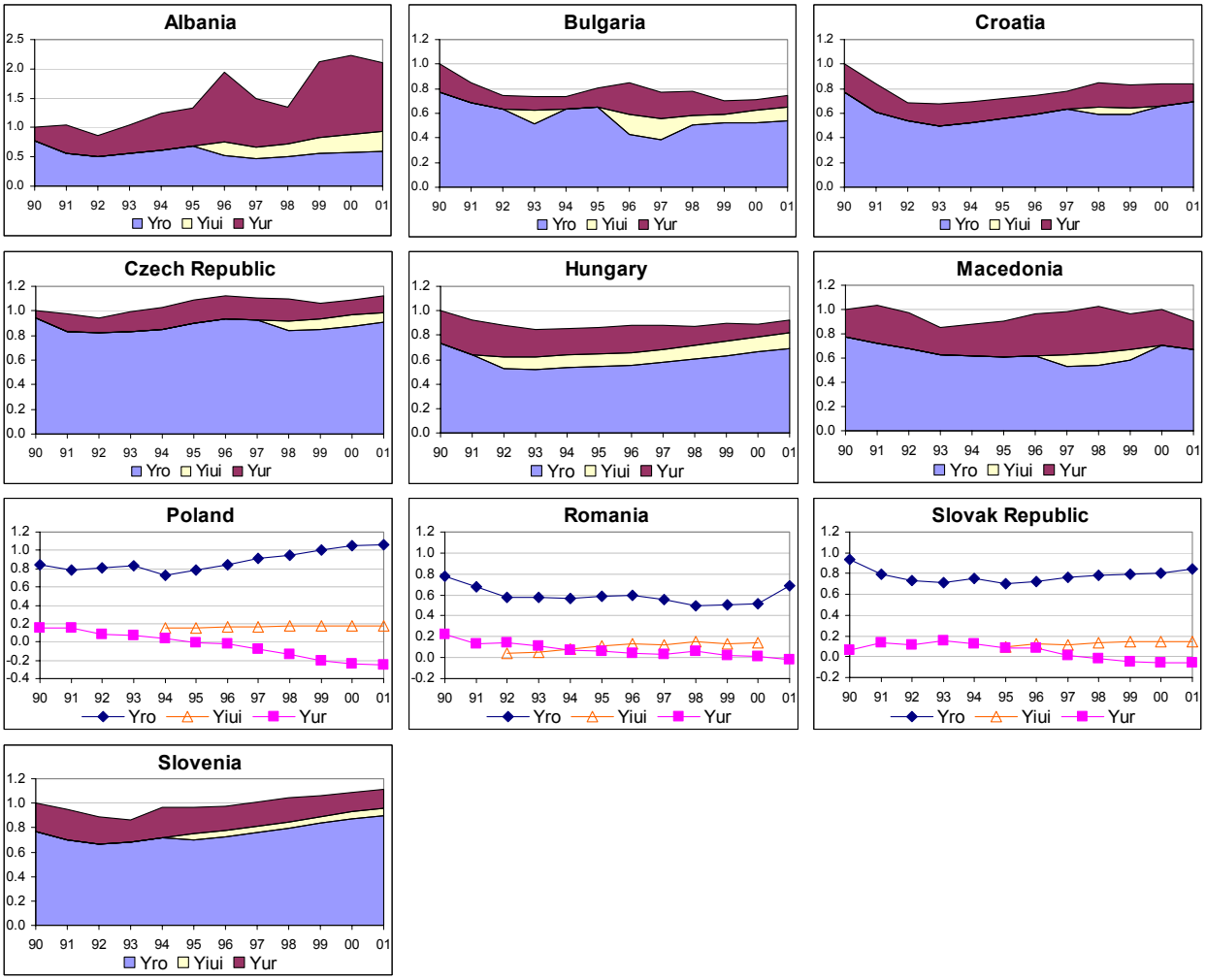


Figure A3
Evolution of Total Economic Activity -CDM Method
FSU Countries

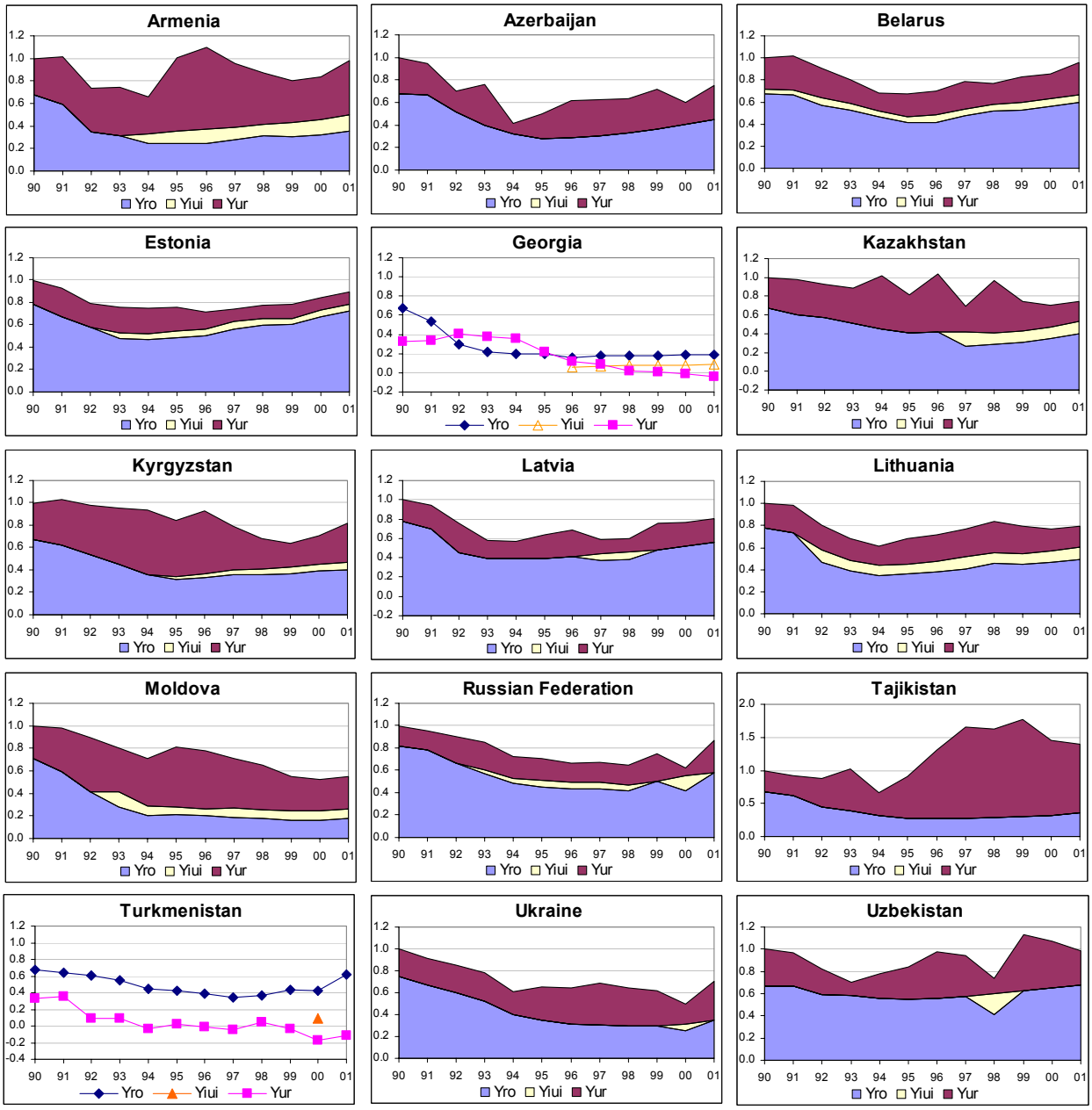


Figure A3
Evolution of Total Economic Activity -CDM Method
CEE Countries