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The Underground Economy: Estimation, and Economic and Policy Implications -- The Case of Pakistan

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Abstract

This paper estimates the size of the underground economy in Pakistan and analyzes its impact on Government fiscal position and the allocation of economic resources in the national economy. The results suggest that there is a mutual dependency between the size of the underground economy and fiscal deficits, and show a leakage from the national income-expenditure cycle in the formal economy to the underground economy via private investments. Finally, the paper proposes long- and short-run policies to reduce the size of the underground economy.

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1/ The paper was completed while the author was in the Middle Eastern Department.

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Contents

SUMMARY

This paper estimates the size of the underground economy (UE) in Pakistan and assess its economic impact during 1975-1991. It estimates the underground economy's GDP and its components -- the domestic sector which measures the underground overall domestic absorption and the export and import sectors -- providing insights into the dynamics of the UE. Furthermore, the estimated data were used to assess empirically the impact of the UE on the Government's fiscal position and on the investment-output relation.

The results confirm the existence of large UE in Pakistan. The UE's GDP averaged 22.6 percent of formal GDP during the study period, with a growth rate slightly higher than that of the formal GDP. The domestic component of the UE's GDP averaged 35.4 percent of the formal GDP and had grown at an average annual rate of 9 percent, a much higher rate than the formal domestic sector's growth rate of 5 percent. The size of the UE in the import sector relative to formal import sector, averaging some 35 percent of formal import sector, was the largest among the various components of UE's GDP. The data also show that the relative size of UE in the external sector had grown significantly relative to the domestic sector since the beginning of economic reforms in Pakistan in 1987, reflecting increased opportunities created by the opening of the economy.

Analyzing the relation between the UE and the fiscal position of the Government suggests a mutual dependency between the size of the UE and fiscal deficits. Continued fiscal deficits had contributed to the growth of the UE. In turn, the growth of UE was a significant factor in the continued problem of containing the fiscal deficits. The analyses of the role of the UE in the national income-expenditure cycle show a leakage of resources from the formal economy to the UE via private investments, with an overall net loss in economic efficiency.

Finally, the paper proposes long- and short-run policies, based on fiscal restrain and economic liberalization, to reduce the size of the UE.

I. Introduction

The purpose of this paper is to estimate the size of the underground economy (UE) in Pakistan and assess its economic impact. The literature has concentrated, for the most part, on estimating aggregate measures of underground output with little empirical analyses of the relation between the UE and the formal economy. This paper dose not only estimate the underground GDP but also its components -- the domestic sector which measures the underground overall absorption and the export and import sectors -- providing insights into the dynamics of the UE. Furthermore, estimated data were used to assess empirically the impact of the UE on Government's fiscal position and the allocation of economic resources between the UE and the formal economy through the investment-output relation.

Underground economic activities (UEA) reflect attempts by economic agents to evade taxes and regulations, illegal activities, and the activities of individuals and small units operating at the periphery outside the formal economy. The existence of a sizable UE has significant economic consequences stemming from the impact of information distortions, created by the existence of UE, on the conduct of economic policy and on the efficiency of resources allocation. A large and growing UE sends inaccurate signals about the economy to policy makers, rendering policy recommendations suboptimal. If, for example, output and employment in the UE are growing at a rate faster than that of the observed economy, then an expansionary policy designed to stimulate a perceived slow growth could be more inflationary than intended. A sizable UE presents also a particular problem for the Government's fiscal position. To the extent that the underground output would be taxable income, it is associated with a loss in tax revenues, while, at the same time, the UE benefits from Government services. The situation would be worse if the UE is growing at a rate faster than the observed economy. Government outlays will grow with the overall economy (formal and underground), but its revenues will grow at the slower rate of the formal economy from which the government collects taxes. A persistent deficit problem could arise, financing of which could have significant adverse economic consequences, particularly in a developing country with a weak tax base. The government would either monetize its deficit with significant adverse effects on financial stability or raise the tax rate and/or impose new taxes forcing more activities into the UE and causing a reallocation of resources from the formal economy to the UE.

The reallocation of resources from the formal economy to the UE could result in a net welfare loss since UEA are, in general, less productive than formal activities. In particular, the productivity decline is caused by the loss of resources spent evading the government, the inability of the UE to carry out large scale operation in fear of detection and, hence, losing the benefit of large scale activities, and the UE inability to have a substantive access to the formal financial markets.

The organization of the remaining parts of the paper is as follow: Sections II and III provide literature review of the monetary approach to

estimating the UE and the methodology used in this paper. The estimation results are presented in section IV. The empirical analyses of the relation between the UE and both the Government fiscal deficit and the private investment-output cycle are presented in sections V and VI.

II. Brief review of the monetary approach

A model based on the monetary approach is used in this paper to estimate the UE. The assumption that currency is the primary means of payment in the UE is the cornerstone of this approach. The various versions found in the literature differ in the assumptions they use as to the other determinants of currency demand (e.g., demand for bank deposits and output).

Gutmann (1977) assumed a stable relation between the ratio of currency to demand deposits and "legal activities" and argued that a rise in the ratio indicated an increase in UEA. The underground GNP was estimated by assuming that each dollar of currency used for UEA supports the same amount of activity as each dollar of money held in the formal sector. A particular criticism of Gutmann's approach is its inability to take into consideration the effect of financial innovations on the currency to demand deposits ratio.

Feige (1979) presented a new methodology based on Fisher's quantity theory of money. Given that money supply (defined as currency in circulation plus demand deposits) and its velocity (transaction velocity rather than income velocity) are known, and assuming a constant ratio of total transactions to nominal GNP, then, in the absence of UE, the derived GNP should equal the GNP as measured by the national accounts. Any difference between the two GNPs is assumed to estimate the underground GNP. As in the case of Gutmann's approach, Feige's approach was criticized for its reliance on ratios that are assumed constant over long periods.

Tanzi (1980, 1983) presented an original model that combined a demand for currency function (based on Cagan's 1958 analysis) and the income version of the equation of exchange. He assumed that the ratio of currency to money (M2) is a function of "legal" factors such as the relative cost of holding currency vis-a-vis other forms of money, the level of income and its composition since some forms of income are paid by checks only (e.g., dividends and interest) while other forms are paid, at least partially, by currency (e.g., wages and salaries) and "illegal" factors chief among them is tax evasion. The model's independent variables included estimates of tax burden (average or marginal tax rates), the ratio of wages and salaries to other forms of income (e.g., dividends and rent) and different measures of real income. Assuming that the underground income velocity is the same as the observed velocity in the formal sector, Tanzi derived a GNP estimate for

the underground economy in United States after estimating the demand for currency for both "legal" and "illegal" transactions.1/

III. Methodology

The paper will follow the methodology of Tanzi (1980) with two differences: (i) the specifications of the demand for currency model are modified to fit a less developed country, and (ii) in addition to estimating the underground GDP, the model is used to estimate the UEA in the domestic, exports, and imports sectors. The key assumptions are maintained, i.e., UEA are carried out mainly through the use of currency and the underground income velocity of money is the same as the observed velocity.

The methodology involves estimating the UE through estimating the demand for currency induced by UEA as follow: First, the coefficients of the determinants of currency in circulation (CC) to deposits (D) ratio are estimated. 2/ The CC/D ratio is assumed to be determined by the level of economic development, relative rates of return, the development and spread of banking services, and the UEA influenced by changes in the tax burden:

1. A higher level of economic development should lead to a decrease in CC/D as a result of increased demand for deposits. Per capita real GDP is used as a measure of economic development.

2. Bank deposits give an explicit rate of return in the form of interest paid on deposits. A higher real interest rate will increase the opportunity cost of holding currency and leads to a fall in its demand and a rise in the demand for deposits and, hence, a fall in CC/D. Real interest rate in this paper is defined as the difference between the money market interest rate and inflation rate (calculated using the GDP deflator index).

3. Improvement in banking services will lower the demand for currency for transaction purposes as more banking facilities become available leading to a fall in CC/D. The development level of banking services is measured by the per capita ratio of deposits to total number of bank accounts.

4. The tax burden has a positive effect on CC/D. An increase in the tax burden raises the relative price of taxable versus nontaxable economic activities. A rise in taxes will increase the nontaxable (underground) activities and, thus raise the demand for currency and CC/D will rise. Three different average taxes are used to estimate the size of UEA in

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1/ The assumption that the velocities of the underground and formal economies are the same is a strong assumption. There is no theoretical or empirical consensus, however, as to which velocity is higher if they differ.

2/ For the purpose of this paper it is more appropriate to use the currency to bank deposits ratio, rather than M2 as in Tanzi's model, since the model is attempting to capture the effects of the independent variables on the public's decision regarding their portfolio choice of currency vis-a-vis non-currency forms of money.

different sectors: Taxes on domestic activities proxied by the ratio of the sum of income and corporate taxes, excise duty, sales taxes on domestic products and other domestic taxes to the domestically produced and consumed income (GDP at factor cost minus exports).1/ Taxes on imports are estimated as the ratio of the sum of import duties and sales taxes on imports (deflated by GDP deflator index) to imports (deflated by import unit value index). Finally, taxes on exports are estimated as the ratio of export duties (deflated by GDP deflator index) to exports (deflated by export unit value index). All the ratios should have a positive effect on CC/D ratio.

Second, the following equation is estimated for the period from 1974/75 to 1990/91:

$$\left(\frac{CC}{D}\right)_t = \beta_1 + \beta_2 PCRY_t + \beta_3 RINT_t + \beta_4 BNKSRV_t + \beta_5 IMPTAX_t + \beta_6 EXPTAX_t + \beta_7 DOMTAX_t + e_t \qquad (1)$$

Where CC: Currency in circulation.
D: Bank deposits defined as M2 minus CC.
PCRY: Per capita real income.
RINT: Real interest rate.
BNKSRV: Per capita banking services.
IMPTAX: Average taxes on imports.
EXPTAX: Average taxes on exports.
DOMTAX: Average taxes on domestic economic activities.
e: Error term.

To improve the robustness of the equation, it is corrected for first order serial autocorrolation and first order moving average. The estimated equation is shown below:

$$\left(\frac{CC}{BH}\right)_t = \underset{(2.298)}{0.445} + \underset{(0.074)}{2.09E\text{-}06}\ PCRY_t - \underset{(-3.323)}{0.004}\ RINT_t - \underset{(-2.208)}{0.003}\ BNKSRV_t + \underset{(1.532)}{0.351}\ IMPTAX_t + \underset{(1.947)}{0.824}\ EXPTAX_t + \underset{(1.825)}{1.346}\ DOMTAX_t$$

$$AR(1) = \underset{(-2.339)}{-0.889}\ , \quad MA(1) = \underset{(12.964)}{0.940}\ , \quad R^2 = 0.934\ , \quad DW = 1.743$$

All variables have the expected signs and, with the exception of per capita real income, are statistically significant. The insignificance of income is not unexpected in a developing country with low per capita income

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1/ Taxes that are difficult to evade such as, surcharges, property and motor vehicle taxes were excluded.

and where significant number of transactions are still carried out on a cash basis. Starting from a low level of economic development, a rise in income will increase the demand for both deposits and currency with indeterminate effect on CC/D.

Third, the regression equation is used to estimate the underground GDP as follow: Estimates of total currency holdings of formal and UEA are generated for each year by multiplying the forecasted values of CC/D by D. Currency used for underground GDP transactions is then generated by solving the regression equation, assuming that all tax variables are zero while keeping the coefficients of the remaining explanatory variables unchanged, and subtracting the resulting currency level (which is used for formal GDP transactions) from total currency holdings generated in step one. Finally, assuming that the velocity of money for underground GDP transactions is the same as the velocity of money for formal GDP transactions, an estimate of underground GDP is obtained by multiplying the underground money by the velocity of money (derived by dividing formal GDP by the value of M1 minus currency held for underground transactions).

Incomes derived from domestic, export and import activities are estimated using similar procedure with the respective taxes assumed to be zero at each step. If the model captures all sources of UEA, then the estimated underground GDP should be equal to the sum of incomes from domestic and export UEA minus income from import UEA. Residuals (or "other" sector), on the other hand, should capture all underground activities not related to those specified in the above model.

IV. Empirical results

The underground GDP and its components are estimated for the period from 1974/75 to 1990/91, the results are reported in table 1. Table 2 shows the size of the underground GDP and its various components as a percentage of the formal GDP. The relative size of the underground sectors with respect to the formal sectors are reported in table 3.

Table 1. Size of underground sectors (in millions of RPs)

Year	GDP	Domestic	Exports	Imports	Residuals
1974/75	37519.25	59242.70	5921.06	16275.29	11369.21
1975/76	42758.51	66607.56	5352.90	9615.93	19586.02
1976/77	42228.11	66613.13	3217.49	16788.16	10814.34
1977/78	45459.02	71800.10	1497.03	15199.08	12639.03
1978/79	47854.10	71575.94	4554.16	18538.46	9737.53
1979/80	52489.75	82206.09	1434.81	16822.18	14328.96
1980/81	59763.82	87451.63	5348.34	21715.03	11321.12
1981/82	58059.57	89194.34	810.55	23299.60	8645.72
1982/83	73020.64	113325.14	3641.87	32848.21	11098.17
1983/84	68855.78	134205.91	986.19	27756.13	38580.18
1984/85	71286.48	129171.34	4299.52	31881.14	30303.23
1985/86	73720.00	135713.81	2978.91	30368.92	34603.80
1986/87	77364.98	131493.31	2196.79	39352.72	16972.40
1987/88	95177.41	144407.31	10136.93	41067.84	18298.99
1988/89	93895.73	129041.17	12940.67	39069.36	9016.74
1989/90	99245.00	122900.52	11015.40	42270.52	-7599.61
1990/91	91122.26	123228.30	7786.80	42267.32	-2374.49
Average	66460.03	103422.25	4948.20	27360.94	14549.49

Table 2. Ratio of the underground sectors to the formal GDP (in percent)

Year	GDP	Domestic	Exports	Imports	Residuals
1974/75	20.74	32.76	3.27	8.99	6.29
1975/76	22.92	35.70	2.87	5.15	10.50
1976/77	22.06	34.79	1.68	8.77	5.65
1977/78	22.01	34.77	0.72	7.36	6.12
1978/79	21.98	32.87	2.09	8.51	4.47
1979/80	22.53	35.28	0.62	7.22	6.15
1980/81	24.19	35.40	2.17	8.79	4.58
1981/82	21.91	33.66	0.31	8.79	3.26
1982/83	25.64	39.79	1.28	11.53	3.90
1983/84	23.13	45.09	0.33	9.33	12.96
1984/85	21.63	39.19	1.30	9.67	9.19
1985/86	21.55	39.68	0.87	8.88	10.12
1986/87	21.39	36.35	0.61	10.88	4.69
1987/88	24.73	37.53	2.63	10.67	4.76
1988/89	23.31	32.04	3.21	9.70	2.24
1989/90	23.56	29.18	2.62	10.04	-1.80
1990/91	20.46	27.66	1.75	9.49	-0.53
Average	22.57	35.40	1.67	9.05	5.44

Table 3. Ratio of the underground sectors to the formal sectors (in percent)

Year	GDP	Domestic	Exports	Imports
1974/75	20.74	29.70	26.23	33.98
1975/76	22.92	33.15	21.72	19.47
1976/77	22.06	32.03	15.26	32.55
1977/78	22.01	31.82	6.51	26.57
1978/79	21.98	29.63	18.92	25.75
1979/80	22.53	31.73	4.66	22.17
1980/81	24.19	32.24	14.69	30.49
1981/82	21.91	30.20	2.44	32.62
1982/83	25.64	36.08	9.03	43.26
1983/84	23.13	40.82	2.52	34.05
1984/85	21.63	35.02	11.32	35.51
1985/86	21.55	36.44	5.74	33.19
1986/87	21.39	34.41	3.68	43.82
1987/88	24.73	35.51	17.04	46.68
1988/89	23.31	30.03	19.39	40.55
1989/90	23.56	27.64	16.06	45.90
1990/91	20.46	26.70	8.93	46.95
Average	22.57	32.54	12.01	34.91

The results confirm the presence of a large UE in Pakistan. Underground GDP for the whole sample period averaged 22.6 percent of formal GDP. Domestic UEA averaged 35.4 percent of formal GDP and 32.5 percent of formal domestic sector. UEA in the export and import sectors averaged 1.7 percent and 9.1 percent of formal GDP respectively, and 12 percent and 34.9 percent of formal export and import sectors respectively. The UEA in the import sector relative to the formal import sector were the largest compared to the UEA in the domestic and export sectors indicating a strong UE in the import sector. UEA in the "other" sector were also relatively strong averaging 5.4 percent of formal GDP.

The underground GDP is estimated to have grown over the sample period by an average of 6.1 percent compared to an average of 5.8 percent for the formal GDP. The underground domestic sector grew by an average of 9 percent, significantly higher than the 5 percent growth rate of the formal domestic sector. Fluctuation in UEA were much stronger than those of the formal sector. The underground GDP variance of 85 was significantly higher than the 3.8 variance of the formal GDP. The higher instability of the UE could increase the overall economic instability and decrease in the efficiency of government's economic stabilization policies.

The underground GDP peaked in 1982/83 to 25.6 percent of formal GDP. The underground GDP was, also, high relative to GDP in 1980/81, 1983/84 and between 1987/88 and 1990/91. Domestic UEA were high relative to formal GDP in 1982/83 at 39.8 percent peaking to 45.1 percent in 1983/84. UEA in the

import sector reached a peak, relative to formal GDP, in 1982/83 at 11.5 percent and remained above the average till the end of the sample period, rising temporarily in 1986/87, 1987/88 and 1989/90. The "other" sector, which captures all other UEA, rose in 1975/76 to 10.2 percent of formal GDP, and peaked in 1983/84 to 12.2 percent, and remained high until 1986/87 when it started to decline significantly.

Some of the fluctuations in the UEA can be traced to particular political and economic events in Pakistan during the sample period. On the political scene, the decline in the of law and order associated with massive civil strife in 1975/76 was captured by a significant increase in the relative size of "other" UEA. The significant rise in the overall UEA, in general, and the "other" UEA, in particular, between 1983/84 and 1985/86 was associated with the escalation of the war in Afghanistan during that period.

The economic reforms that started in 1986/87 and the structural adjustment program adopted in 1988/89 have had significant impact on the UE. Although the underground GDP in the five years starting in 1986/87 averaged 22.7 percent of formal GDP compared to about the same average for the whole sample period, the data show a decline during the period and a change in the UE's GDP composition. The underground GDP rose in 1987/88 to 24.7 percent of formal GDP in response to the initiation of economic liberalization. As the process of liberalization continued, however, the UEA declined steadily in the following three years to 20.5 percent of formal GDP in 1990/91, the lowest in the sample period. As tables 2 and 3 show, the underground GDP between 1986/87 and 1990/91 was dominated by the rise in UEA in the external sectors, while UEA in the domestic and "other" sectors had declined substantially.

The domestic and "other" UEA declined from an average of 36.6 percent and 6.9 percent of formal GDP respectively in the pre 1986/87 period to an average of 32.6 percent and 1.9 percent of formal GDP respectively since 1986/87. UEA in the import and export sectors, however, rose to 10.2 percent and 2.2 percent of formal GDP since 1986/87 compared to 8.6 percent and 1.5 percent respectively before 1986/87. In particular, the UEA in the import sector as a percentage of formal imports soared to an average of 44.8 percent between 1986/87 and 1990/91 compared to a pre 1986/87 average of 30.8 percent. UEA in the export sector also rose slightly to an average of 13 percent of formal export in the same period compared to average of 11.6 percent during the pre 1986/87 period. The surge in the UEA in the foreign trade sector reflected the increased opportunities in this sector as a result of the liberalization of foreign trade.

Nevertheless, economic reforms had a dampening effect on the growth rate of the overall UEA as more transactions shifted to the formal economy. The underground GDP grew by an average of 6.1 percent over the whole sample period compared to 5.8 percent for formal GDP. In the years between 1986/87 and 1990/91, underground GDP growth rate declined to 4.8 percent compared to 5.4 percent growth rate for the formal GDP. The continuation of economic reforms, through the adoption of a structural adjustment program in 1988/89, further weakened the underground economy. The underground GDP declined in

1990/91 by 8.2 percent compared to a 5.7 percent growth for formal GDP. UEA in both the domestic and external sectors experienced similar declines.

The effect of the structural adjustment program and the end of the direct Soviet involvement in the war in Afghanistan on the "other" UEA was noticeable. The "other" UEA declined as a percentage of formal GDP to a record low of 0.63 for the period from 1988/89 to 1990/91 compared to 6.6 percent in the period before 1988/89. The decline in the "other" UEA points out to a significant shift within the UEA from the "other" sector to other UEA and/or to the formal economy.

V. Underground economy and government budget deficit

The divergence between the growth rates of the UE and the formal economy, especially between 1974/75 and 1985/86, implied an increasing economic cost of UEA in terms of allocating government resources. The UE had used an increasing share of government resources at the expense of the formal economy and had placed a higher demand on government services than the government had been able to finance from the slower growing formal sector, exacerbating an already difficult fiscal situation. By adopting measures such as raising the tax rates and imposing ad hoc taxes instead of expenditure cuts and/or widening the tax base, fiscal imbalances had, in turn, contributed to the growth of the UE.

This hypothesis is tested by examining the relation between the government budget deficit (GDf), defined as expenditures minus tax revenues and the difference (Dif) between the growth rate of the formal GDP and the growth rate on the underground GDP. In the following two sections the paper will examine the long-run relation between the two variables and the short-run dynamics.

1. The long-run relation between Dif and GDf

The long-run relation between GDf and Dif is examined using Engle-Granger cointegration test. The test will proceed as follow: First, the order of integration for Dif and GDf is determined using a unit root test on both series. The results, reported in table (4), show that Dif and GDf are both integrated of order one so that the cointegration test can be carried out on the levels of Dif and GDf.1/

1/ D-F t-statistic for Dif and GDf (both differenced once) are significant at 1 percent and 5 percent respectively.

Table 4. Unit root test
(D-F t-statistic)

Variable	GDf	Dif
Level	1.06	2.13
1st Difference	-4.12[a]	-3.61[b]

a. Significant at 99 percent level.
b. Significant at 95 percent level.

Second, the following cointegration equations are estimated by ordinary least squares (OLS):

$$GDf_t = \alpha_{21} + \alpha_{22} Dif_t + \mu_{2t} \quad (2)$$

$$Dif_t = \alpha_{11} + \alpha_{12} GDf_t + \mu_{1t} \quad (3)$$

Third, the residuals from the cointegration equations (μ_1, μ_2) are then checked for stationarity. If Dif and GDf series are I(1) and μ_1 is I(0), then: (Dif, GDf)~CI(1,1) or Dif series and GDf series are cointegrated. The estimated cointegration equations and the results of the unit root tests on the residuals are reported in tables (5) and (6).1/

Table 5. Cointegration equations

	Dependent Variable	
	GDf	Dif
Constant	28405.64	87705.53
GDf	...	-1.69
Df	-0.37	...
Trend	3299.56	10462.52
D-F t-statistic	-4.19[a]	-4.09[a]

a. Significant at 90 percent level.

1/ For complete review of the cointegration technique see Granger (1986).

Table 6. Unit root test of residuals

	Eq. 1	Eq. 2
	D(resid)	D(resid)
Resid(-1)	-1.11 (-4.19)	-1.13 (-4.09)
R^2	0.56	0.54
D-W	2.05	1.94

The results show that Dif and GDf are cointegrated using both equations. According to equation 2, the output growth differential has a long-run negative impact on the government budget, i.e., an increase in the size of the UE relative to the size of the formal economy (a decrease in Dif) increases the government budget deficit in the long-run. Equation 3 confirms the existence of the long-run relation detected in equation 2 and shows a feed back from the budget deficit to output growth differentials. The rising budget deficit lowers output differential in the long-run, i.e., raises the size of the UE relative to the size of the formal economy. This result is expected since an increase in the deficit will force the government, in the absence of expenditure reduction or rapid economic growth, to increase its revenues through higher taxes and hence raising the tax burden on the formal economy forcing more activities to go underground.

2. The short-run dynamics

The short-run dynamics are investigated using Granger's (1969) causality test in conjunction with Akaike's (1969, 1970) Final Prediction Error (FPE) criterion. 1/ According to Granger test, the GDf series is said to be caused by the Dif series if the future values of GDf can be better predicted when the information contained in Dif series is included than when that information is excluded. The test require the two series to be stationary, therefore, GDf and Dif were differenced once in the causality tests since both series are integrated of order one - see table (4). Granger (1988) pointed out that a simple causality test between two variables will be invalid if the two variables are cointegrated. Given that cointegration was detected between the two variable in the previous section, the simple causality model could capture the long-run relation instead of short-run causality. An Engle-Granger (1987) error correction causality model (EC) is more appropriate in this case. The error correction model adds the residual (lagged once) from the cointegration equation as an explanatory variable in the simple causality model as follow:

1/ Since the data in this paper is annual, the long term is defined to cover the whole sample period while short term is defined in limited number of years.

$$D(GDf)_t=\alpha_{10}+\sum_{j=1}^{M}\beta_{1j}D(GDf)_{t-j}+\sum_{i=0}^{N}\gamma_{1i}D(Dif)_{t-i}+\delta\mu_{1t-1}+\epsilon_{1t} \quad (4)$$

$$D(Dif)_t=\alpha_{21}+\sum_{j=1}^{M}\beta_{2j}D(Dif)_{t-j}+\sum_{i=0}^{N}\gamma_{2i}D(GDf)_{t-i}+\delta\mu_{2t-1}+\epsilon_{2t} \quad (5)$$

where D is the difference operator and μ_1 and μ_2 are the error terms from equations 2 and 3 respectively. the error variables should capture any long-run relation between GDf and Dif allowing the causality models to capture the short-run relation. 1/

The lag structures in the causality equations are determined, using Akaike's FPE criterion. 2/ The statistical significance of the causality

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1/ A statistically significant error term could be interpreted as an evidence of causality (Granger (1988, p.203)).

2/ as follow: First, each series is regressed on its own lagged values and for every lag structure the corresponding FPE is calculated using the following formula:

$$FPE_m=\frac{T+m+1}{T-m-1}\cdot\frac{Q_m}{T}, \quad (1)$$

where (T) is the number of observations, (m) is the order of lags varying from 1 to M, and Q_m is the associated sum of squared residuals. The value of m, such as m*, that minimizes FPE is the optimum number of lags for the variable. In the second step, each series is set as the controlled variable, with the order of lags set at m*, and the other series is treated as the manipulated variable, with the order of lags n varying from 0 to N. The corresponding two dimensional FPE is calculated for each lag structure:

$$FPE_{m,n}=\frac{T+m^*+n+2}{T-m^*-n-2}\cdot\frac{Q_{m^*,n}}{T}, \quad (2)$$

the number of lags of the second series is chosen at the value of n, such as n*, that minimizes FPE(m,n). If FPE(m*,n*)<FPE(m*) then causality is established.

results is tested using F test 1/ The results of the FPE and F tests are reported in table (7) and the causality equations in table (8). Table (7) reports the FPEs of the constrained equations, and the FPEs and F-statistics of the unconstrained equations where FPE(m^*,n^*) is minimized. In addition to the causality models that satisfied the FPE criterion, the table reports two additional lag structures for each causality model where the FPE(m^*,n^*) is less than FPE(n^*) and the F-statistic has a minimum of 90 percent significance. The sign of the sum of coefficients of the manipulated variables shows the direction of their combined short-run effects on the controlled variables.

Table 7. Optimum lags of controlled and manipulated variables in equations 4 and 5 and their FPEs

Controlled variable	Manipulated variable	Minimum FPE	F-statistic	Significance level
D(GDf) [1]	-	27582402	-	
D(GDf) [1]	D(Dif) [0]	12506552	21.00	99 percent
D(GDf) [1]	D(Dif) [2]	19133960	5.20	95 percent
D(GDf) [1]	D(Dif) [4]	19886196	3.75	90 percent
D(Dif) [1]	-	86651456	-	
D(Dif) [1]	D(GDf) [0]	62416972	9.17	99 percent
D(Dif) [1]	D(GDf) [1]	63534532	5.43	95 percent
D(Dif) [1]	D(GDf) [2]	84987312	2.90	90 percent

1/ The following F test is used to test the significance of causality results:

$$F=\frac{(SSE_C-SSE_U)/n}{SSE_U/(T-(m^*+n^*+2))} \qquad (1)$$

where SSEc is the sum of squared residuals in the constrained equation, and the SSEu is the sum of squared residuals in the unconstrained equation.

Table 8. Causality equations

Dependent Variable D(DGf)				Dependent Variable D(DIF)			
	FPE test	F test 95 %	F test 90 %		FPE test	F test 95 %	F test 90 %
Constant	1344.47	1178.55	6789.07	Constant	10196.07	8074.95	7525.72
	(0.81)	(0.31)	(1.37)		(2.31)	(1.72)	(0.96)
$D(GDf)_{t-1}$	0.17	0.25	0.26	$D(Dif)_{t-1}$	-0.02	0.17	0.21
	(0.72)	(0.60)	(0.58)		(-0.08)	(0.50)	(0.38)
$D(Dif)_t$	-0.22	-0.24	-0.25	$D(GDf)_t$	-1.58	-1.60	-1.63
	(-2.19)	(-1.77)	(-1.76)		(-2.98)	(-3.07)	(-2.53)
$D(Dif)_{t-1}$	...	0.002	0.06	$D(GDf)_{t-1}$	...	0.71	0.73
		(0.01)	(0.28)			(1.17)	(0.93)
$D(Dif)_{t-2}$	...	0.05	-0.02	$D(GDf)_{t-2}$	...	...	0.01
		(0.28)	(-0.11)				(0.01)
$D(Dif)_{t-3}$	...	...	-0.27	...	...	...	...
			(-1.44)				
$D(Dif)_{t-4}$	...	...	-0.19	...	...	...	...
			(-1.17)				
μ_{1t-1}	-1.23	-1.27	-1.44	μ_{2t-1}	-1.08	-1.45	-1.51
	(-4.07)	(-2.43)	(-2.85)		(-2.25)	(-2.55)	(-1.73)
R^2	0.69	0.68	0.85	R^2	0.69	0.52	0.48
D-W	1.88	1.81	2.15	D-W	1.88	2.04	2.07

The test results show the existence of strong short-run causality between government budget deficit and the relative size of the underground economy in both equations; the relation is similar to the one detected in the long-run test. For each causality equation, the FPE was minimized with one own lagged value and current value of the manipulated variable (in addition to the error term variable), each with highly significant F-statistics. Causality, however, was detected over longer periods. As table 7 shows, the manipulated variable has, with significant F-statistic, "caused" the controlled variable up to the forth lag in equation 4, and up to the second lag in equation 5. The sign of the sum of the elasticities of the dependent variable in each of the two causality equations was negative. Moreover, the size of the combined elasticities of the budget deficit variables in equation 5 was larger than the size of the combined elasticities of the output differential variables in equation 4.

These results have two important policy implications, (i) the budget deficit impact on output differential in the short-run is stronger than the impact of growing UE on the deficit; and (ii) the impact of UE on budget deficit lasts longer than the impact of budget deficit on UE. The policy implication of such short-run dynamics is significant. It could be argued that the starting point in breaking the deficit-UE cycle is fiscal discipline. A reduction in the budget deficit will, in the short-run, affect the growth of the UE faster than a reverse policy of fighting the UE

to improve the fiscal position. It is essential, however, that the method through which a deficit reduction is achieved dose not fuel the UE. A reduction in the budget deficit through higher tax rates will be counterproductive. Rather, a reduction in spending and/or high quality revenue measures, e.g., widening the tax base and reducing the number of exemptions in the existing tax structure, will be more appropriate. Furthermore, commitment to deficit reduction should be maintained for significant period of time (as long as five years in the case of Pakistan) to achieve a lasting effect on the UE.1/

VI. Underground economy and private investment

It is difficult to test empirically the misallocation of resources resulting from the existence of a large UE in a direct way. This paper explores one possible aspect of such misallocation by examining the investment-output relation. Investment and output are mutually dependent, at least in the long-run, on account of the multiplier, the increase in capital stock, and crowding-in effects. This section examines the long-run relation between private investment and both the formal and underground outputs. The private investment-formal output long-run mutually determined relation is part of the national income-expenditure cycle. The existence of a similar relation between formal private investment and the underground output represents a leakage from the formal economy to the UE.

The long-run relationships between private investment and outputs of the formal and underground economies are examined using cointegration test similar to the one used in the previous section. 2/

The cointegration equations for private investment (PI) and formal GDP (FGDP) are as follow:

$$FGDP_t = \alpha_{11} + \alpha_{12} PI_t + \nu_{1t} \quad (6)$$

$$PI_t = \alpha_{21} + \alpha_{22} FGDP_t + \nu_{2t} \quad (7)$$

For the relation between private investment and underground GDP (UGDP) the cointegration equations are:

1/ These conclusions pertain only to fiscal policy and UE relation and do not exclude other important measures such as liberalization and market oneness.

2/ No significant short term relations between private investment and either the formal output or the underground output were detected, therefore, the results of the tests on long term relations only are reported.

$$UGDP_t = \beta_{11} + \beta_{12} PI_t + \eta_{1t} \quad (8)$$

$$PI_t = \beta_{21} + \beta_{22} UGDP_t + \eta_{2t} \quad (9)$$

If there is a mutually determined relation between private investments and either outputs, then the two variables should be cointegrated using both equations in each model. A one way long-run dependency will be the case if the two variables are cointegrated in one of the two equations but not in the other.

A unit root test is performed on PI, FGDP and UGDP to determine their order of integration. The results are reported in table 9 and show that all variables are integrated of order one, therefore, the cointegration tests can be performed on the level of variables. The cointegration equations are reported in table 10 and the residual tests in table 11.

The test on private investment and formal GDP relation shows that the two variables are cointegrated only when formal GDP is the independent variable. In the long-run formal GDP has a positive impact on mobilizing private investment, the reverse, however, is not certain. The test did not show any long-run impact of private investment on formal GDP. This result is surprising since it shows a break in long-run national income-expenditure cycle. Equally surprising is the long-run relation between private investment and underground GDP which exhibited the opposite behavior. Private investment was found to be a long-run determinant of underground GDP but not affected by it. 1/

These results point to the existence of a significant misallocation of resources. While economic resources, public and private, go into fueling private investment, the formal economy dose not fully benefit in the long-run from the increase in private investment; rather part of formal private investments contributes to the growth of the UE. It might be argued that private investment is affecting the overall national output, formal and underground, with no substantial consequences on the economy as a whole. Given, however, that the underground output is characterized by higher volatility and less efficiency, as discussed earlier, the diversion of resources through private investments from the formal sector to the underground production constitutes a net loss of resources. The government could be forced to compensate by increasing public spending, exacerbating the negative effects of the UE on the government's fiscal position.

1/ These results could be a factor contributing to the anomalies detected in the private investment behavior in Pakistan.

Table 9. Unit root test
(D-F t-statistic)

Variable	PI	FGDP	UGDP
Level	1.16	2.65	0.93
1st Difference	-3.91[a]	-2.86[b]	5.26[c]

a. Significant at 95 percent level.
b. Significant at 90 percent level.
c. Significant at 99 percent level.

Table 10. Cointegration equations

	Dependent Variable			Dependent Variable	
	UGDP	PI		UGDP	PI
Constant	100347.63	1819.04	Constant	28035.63	10440.23
PI	3.41	...	PI	0.28	...
FGDP	...	0.07	UGDP	...	0.03
Trend	11514.56	486.20	Trend	3453.77	1550.07
D-F t-statistic	-2.03	-4.85[a]	D-F t-statisti	-4.75[a]	-3.87

a. Significant at 95 percent level.

Table 11. Unit root test of residuals

	Eq. 6	Eq. 7		Eq. 8	Eq. 9
	D(resid)	D(resid)		D(resid)	D(resid)
Resid(-1)	-0.56	-1.02	Resid(-1)	-3.30	-0.69
	(-2.03)	(-4.85)		(-4.75)	(-3.87)
D(Resid(-1))	...	0.59	D(Resid(-1))	1.92	-0.57
		(3.49)		(3.45)	(-2.97)
D(Resid(-2))	...	...	D(Resid(-2))	1.69	...
				(3.71)	
D(Resid(-1))	...	...	D(Resid(-1))	0.88	...
				(2.55)	
R^2	0.22	0.65	R^2	0.81	0.55
D-W	1.50	1.59	D-W	1.60	1.57

VII. Conclusion:

This paper has demonstrated the existence of large UE in Pakistan. The size of the UE and its rapid growth have had an adverse effect on development efforts in the country. The UE caused a significant loss of resources and contributed to the country's fiscal problems. While eliminating the underground economy totally is nearly impossible, efforts to reduce its size and growth rate are imperative. The results suggest that a long-run strategy based on sustained efforts at economic liberalization and fiscal discipline will be effective in achieving this objective. In the short-run, the government could achieve a relatively quick reduction in the growth rate of the UE by liberalizing the foreign trade sector which was, in recent years, a major contributor to the growth of the UE. Encouraging private investment by opening more investment opportunities in the formal sector would also be instrumental in stopping the leakage into the UE. Policies designed to stimulate private investment without opening such opportunities would only increase the possibility of similar leakage. Fiscal discipline and tax reform would help restrain the growth of UE and break the deficit-UE cycle. The expected decline in UE growth, resulting from economic liberalization and fiscal discipline, would transfer, as evident from the size of the UE, significant resources to the formal economy, reduce economic inefficiency, and advance the country's economic development.

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