# REDISTRIBUTIVE EFFECT OF PERSONAL INCOME TAXATION IN PAKISTAN

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**Abstract**. This paper studies the redistribution effect of personal income tax in Pakistan. We decompose the overall tax system in order to evaluate the contribution of rate, allowances, deductions, exemptions and credits. The structure given in Income Tax Ordinance, 2001, is applied to gross household incomes in 2002 (low growth year) and 2005 (high growth year). Our findings reveal that the reforms laid down in this Ordinance resulted in a greater redistribution of incomes. The redistributive effect increases as we move from 2002 to 2005 tax assessment. Deductions for salaried tax payers contribute the most towards progressivity. This is different from countries with advanced taxation systems relying mainly on allowances followed by tax rate and exemptions.

## I. INTRODUCTION

Personal income taxation is amongst the oldest and one of the commonly used instruments of fiscal policy. Besides partly fulfilling the government expenditure needs, income tax is also aimed at reducing the inequality gap in the society. They are transformed in to progressive structures so that principles of fairness are fully accomplished. Setting a just tax base is of

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critical importance in order to observe the ability-to-pay principle. The extent of redistribution in a tax system is not necessarily a static concept. Time period over which we measure income and wealth are likely to influence the measures of redistribution and progressivity (Creedy 1999).

The declining role of personal income taxes in developing countries is certainly not a new phenomenon. Most developing economies have inelastic tax structures with a narrow tax base, and high collection/administrative costs. Hence in many cases these taxes are easy to evade (Avi-Yonah *et al.*, 2006; Bird *et al.*, 2005). However the overall role of personal income taxation cannot be completely discarded. This is because apart from the distributional impact of these taxes, there are incentive effects as well, which can for example impact the tax payer's decision and manner of participating in the labour market (Blundell *et al.*, 2000).

In this paper we try to evaluate the progressivity in Pakistan's income tax structure using data from Household Income and Expenditure Survey 2001-02. We see the impact of Income Tax Ordinance for two separate years; 2002 (low growth year), and 2005 (high growth year). There is some previous research on the evaluation of tax progressivity in Pakistan. For example, *see* Ilyas (2004), Alauddin *et al.* (1981), Ahmed *et al.* (1986), Azfar (1972), Jeetun (1978), Malik *et al.* (1985, 1989). However, to our knowledge there is no decomposition analysis of personal income tax system. In the developing countries, this area of research has in the past received less importance, given that income tax constitutes relatively smaller portion of the overall revenue collections. *See* Sicat *et al.* (1988), Bird and Zolt (2005, 2008), Bird (2008) and Bernardi *et al.* (2006).

The next section briefly describes the personal income tax reform in Pakistan. Section III focuses on data and methodological issues and section IV then describes the components contributing to the progressivity of the tax system.

## **II. PERSONAL INCOME TAX STRUCTURE IN PAKISTAN**

In 1947, immediately after independence, Pakistan adopted the Income Tax Act 1922 of the pre-partition sub-continent. This Act was in fact introduced by the British in this region, who had a version called the general income tax introduced through Income Tax Act 1860. The Act of 1922 was based on the recommendations of All India Income Tax Committee which had been given the task of studying the income tax collections since the introduction of first general income tax in India. This general tax was only imposed for a period of 5 years in order to compensate for the mutiny of 1875. However, after the

great famine of 1876, this tax was revived the next year. The Act II of 1886 then gave a scheme for income tax levy that continued in later reforms.

As the new forms of incomes emerged, Pakistan had to adopt a new set of recommendations given by the then Central Board of Revenue<sup>1</sup> in the form of Income Tax Ordinance, 1979. The promulgation of this Ordinance widened the tax net and expanded the tax base. For details *see* Khan (1984). Similar need for revision was felt 21 years later when Income Tax Ordinance, 2001 was introduced which is still in operation subject to annual amendments through Finance Bill.

Under the present structure of income taxation, incomes are classified into: (*a*) salary, (*b*) income from property, (*c*) income from business, (*d*) capital gains, and (*e*) income from other sources. The salary category encompasses: (*a*) wages and remuneration, including any fringe benefits in money terms such as leave pay, commission, and gratuity/work condition supplements. Deduction is allowed if salary constitutes more than 50 percent of a person's overall earnings. Zakat is deducted from the tax base. Zakat is a mandatory tax on all Muslim citizens if they had any earnings during the year. It is charged at 2.5 percent on income (and specified asset holdings). *See* Zakat and Ushr Ordinance, 1980. Agricultural incomes have been exempt from taxation. This exemption is also applicable to any rent from agricultural land. However, more recently this type of exemption has become a controversial issue and has been debated on various occasions in the lower and upper houses of parliament.

Apart from the income tax there are four other types of direct taxes namely: wealth tax, capital value tax, worker's welfare fund, and corporate assets tax. The main income tax parameters have been derived from the Income Tax Ordinance, 2001. There are three different income categories general income, salaried income and agriculture income, each having five different bands where incomes are being taxed according to the prescribed schedule.

The income to be taxed is computed as below:<sup>2</sup>

TY = Y - Z - WPF - WWF

Where TY is the taxable income, Y is total income from all heads of income, Z is the Zakat payment by an individual, WPF is the amount paid towards

<sup>&</sup>lt;sup>1</sup>Now called: Federal Board of Revenue (FBR).

<sup>&</sup>lt;sup>2</sup>This definition is in line with the one given in Income Tax Ordinance, 2001-02, Central Board of Revenue, Islamabad.

workers participation fund under Companies Profit (Workers' Participation) Act, 1968. *WWF* is the amount paid to Workers' Welfare Fund under the Workers' Welfare Fund Ordinance, 1971.

In this paper, we will mainly analyze the personal income taxation as the other forms of direct taxation are harder to simulate and at times lead to excessive use of assumptions. Furthermore the other four types of direct taxes yielded Rs. 7,123 million in the year 2000-01, which was 5.7 per cent of the total collection from direct taxes (CBR Yearbook 2000-01).<sup>3</sup> In the 2002 tax system, allowance is kept at Rs. 80,000 with progressive rates applied until Rs. 700,000 after which the highest (slab) rate of 35 per cent is applied.

As explained earlier agricultural incomes in Pakistan are exempt from taxes. However if a person's agriculture income exceeds Rs. 80,000 and the person also has non-agriculture income then the tax rate will only apply to non-agricultural income of a taxpayer.

A special tax credit of 50 per cent of the tax payable is allowed to an individual if: (*a*) his age is 65 years or more on the first day of the relevant tax year, and (*b*) his taxable income is up to Rs. 300,000.<sup>4</sup> Other miscellaneous tax credits allowed by the government in the Ordinance include; foreign tax credit, tax credit for donations, tax credit for investment in shares, tax credit for payments towards retirement annuity scheme, and tax credit for mark-up on loans for house.

A low tax base, failure to curb evasion and delay in bringing new forms of incomes in the tax net, has resulted in an inelastic tax structure. These issues although were part of the overall objectives of Income Tax Ordinance, however, revenue collections have not been able to keep pace with the growth milieu. Figure 1 shows how income tax collections have performed vis-à-vis real GDP growth.

The income tax to GDP ratio remained stagnant between the years 2000 to 2006. However, during this time Pakistan witnessed one of the highest GDP growth rates in its history (reaching up to 9% percent in 2005). Between 2001 and 2005 the economic growth rate averaged 5.1 percent, however the income tax to GDP ratio remained under 3.5 percent. The share of income tax in total direct taxes and overall federal tax receipts also declined from 95.8 to 93.2 percent and 33.8 to 29.4 percent respectively.

<sup>&</sup>lt;sup>3</sup>http://www.cbr.gov.pk/YearBook/2000-01/default.htm.

<sup>&</sup>lt;sup>4</sup>Clause [1A] of Part-III of Second Schedule in the Income Tax Ordinance.



GDP Growth and Income Tax



## **III. METHODOLOGY AND DATA ISSUES**

The starting point is the identification of tax related components that are used while going from gross incomes (*I*) to net incomes (*NI*).<sup>5</sup> We calculate the tax free income (*F*), which in equation 1 is the sum of exemptions (*E*), allowances (*A*) and deductions (*D*). Then taxable income (*TI*) is calculated in equation 2 by subtracting tax free income from gross income.

$$F = A + D + E \tag{1}$$

$$TI = I - F 2$$

The residual income (*R*) is calculated in equation 3 by subtracting the tax liability (*T*) from taxable income and final residual income ( $R_f$ ) is obtained in equation 4 by adding residual income with tax credits (*C*).

$$R_f = R + C \tag{4}$$

If credits are subtracted from tax liability (in equation 5) we get final tax liability  $(T_f)$ , which if subtracted from gross income will give us the net income (equation 6).

<sup>&</sup>lt;sup>5</sup>For ease of reference notations are the same as used in Pfähler (1990).

$$T_f = T - C 5 5 6 6$$

The progressivity of tax liability can be expressed as the sum of four items namely rate effect, allowance effect, deductions effect, and tax credits effect. This is formalised below:<sup>6</sup>

$$\pi_N^K = \frac{t}{t-c} \left[ \pi_R^K + \frac{\alpha}{1-\alpha-\delta} \rho_A^K - \frac{\delta}{1-\alpha-\delta} \pi_D^K \right] + \frac{c}{t-c} \rho_C^K \qquad 7$$

Where  $\pi_N^K$  is Kakwani index of progressivity, *t* is average (gross) tax rate, *c* is average credit rate,  $\rho_c^K$  measures regressivity of credits,  $\pi_R^K$  gives the progressivity of rate,  $\rho_A^K$  measures regressiveness of allowances,  $\pi_D^K$  gives progressivity of deductions,  $\alpha$  and  $\delta$  indicate average allowance rate and average deduction rate respectively. This decomposition method developed in Pfähler (1990) is used in Decoster *et al.* (2002) and Wagstaff *et al.* (2001).

Our main data source is Pakistan's Household Income and Expenditure Survey (HIES) 2001-02. The survey description shows that a total of 16400 households were interviewed. The sample of household was drawn from 1150 primary sampling units out of which 500 are urban and 650 are rural. The data in survey only provided details on net incomes. This posed a challenge for our analysis as we required gross incomes which can be subjected to tax rules. Hence to obtain the net incomes we used the net-togross algorithm in XLsim microsimulation model for Pakistan (O' Donoghue and Ahmed 2004). This algorithm is explained at length in Immervoll and O' Donoghue (2001).

XLsim is a generic program designed to analyse tax-benefit policies and reforms. Due to the recent enormous growth in this field, tax-benefit microsimulation models are being developed in various languages such as C, Visual Basic, Gauss and SAS. However our inclination towards using XLsim is due to its user friendly excel-VB environment. The idea behind the actual design of XLsim came about as a need to demystify the large scale and heavily coded microsimulation systems. To construct a model using Gauss, for example would require considerable skill in programming and debugging. However for the case of XLsim, one requires intermediate level proficiency in MS-Excel to construct and run the model. The Xlsim model

<sup>&</sup>lt;sup>6</sup>For ease of reference the notations are the same as used in Wagstaff *et al.* (2001).

uses the household data and applies the taxation rules to individual gross incomes. The calculations are produced both at the family and household level, and the difference in the disposable income between the two runs is the net effect of the reform. For a review of microsimulation models *see* Klevmarken (1997) and O'Donoghue (2001). For country-specific applications *see* Lloyds (2003) and Wagenhals (2004).

A brief explanation is required here to highlight the tax-related definitions as used in our analysis and exhibited in Figure 2. We have treated allowance as that limit of income which is not taxed. Deduction is in fact reduction in tax liability allowed for salary earners. Exemptions include incomes from agricultural activities and credit includes the special provisions stated in Ordinance/tax rules (explained in section 2), Zakat, and Sadaqat.<sup>7</sup> Data on effective payment of Zakat at the household level does not match the amount assessed in FBR records. Hence, for accounting purpose we have treated Zakat as a component that directly reduces the amount of income tax paid. The assumption over here is that a tax payer essentially reduces his payable amount by showing the Zakat accrued to him, however we are not certain from the FBR data if the Zakat payment was in fact made.

#### FIGURE 2



Tax System for the Year 2002

<sup>7</sup>Charity money.

The tax system in 2002 and 2005 remained almost the same except for the change in allowance.<sup>8</sup> In Figure 3 we can see that the tax liability starts from Rs. 100,000 instead of Rs. 80,000 (in 2002). We can also observe the deduction component in the tax system where the liability of those tax payers, whose salary constitutes more than 50 percent of total income earned, is lesser than the general tax payers.

#### FIGURE 3

General Vs. Salary Tax Burden 2005



While going from 2002 to 2005 tax system we also uprate the incomerelated characteristics in the 2001-02 household survey. Adjustments to various income components are made in order to accurately project the changes in incomes between 2002 and 2005. Separate uprating factors can be applied for various income sources such as; wage income, self-employment income, rental income, and pensions. This method has been explained in Stirling and Lazutka (2006). The obvious advantage of this method is that changes in incomes are applied at disaggregate income levels. This to some extent preserves the heterogeneity of the survey observations.

<sup>&</sup>lt;sup>8</sup>There is also minor change in the manner of allowing deduction for salaried class.

# IV. RESULTS – DISTRIBUTIONAL IMPACT OF THE TAX SYSTEM

The overall personal income tax structure in Table 1 seems progressive for 2002 system (shown by a positive Kakwani) and redistributive (shown by a negative Reynolds-Smolensky). Applying the 2005 rates to the household incomes for the year 2002, we see an increase in progressivity, and if 2005 rates are applied to uprated incomes, then the results indicate a reduction in progressivity of about 1 percent (from 0.547 to 0.542). However, uprated 2005 system seems more redistributive as shown by the decline in R-S. The percentage change of Gini coefficient for net income over gross incomes shows a 3.7 percent decline compared to 3.2 in 2002 system (Table 2). This is also an indicator of over time redistribution of the Income Tax Ordinance, which is revised every year (through a Finance Bill) keeping in view the changes in incomes.

The low values of Reynolds-Smolensky (R-S) seem plausible as there is inequal redistribution shown by tax base and rate structure (Table 1). Only allowances and deductions have been responsible for contributing towards redistribution in overall personal income tax system. The role played by allowances and deductions also seems to be slightly declining overtime. Progressivity in both tax rate and base is declining over time.<sup>9</sup> This is seen in the overtime reduction in value of Kakwani for all sub-components namely; allowances, deduction, exemptions and credits. The highest change is in Kakwani measure for allowance falling by 2 percent (from 0.501 to 0.491). A closer look reveals that the progressivity pattern of tax base and allowance remained identical.

If one is to focus on only the role played by income tax reforms in reducing income inequality then we can observe in Table 2, first column, where the Gini coefficient of post-tax income declines by 3.2 percent as compared to pre-tax income. We can see the dominance of 2005 system over 2002 in terms of change in (greater) redistribution. The former shows a greater decline in all inequality indicators.

Generalised Entropy (GE) indicators are used in order to assess sensitivity towards inequality across the income distribution. *GE* measures satisfy five axioms which are desirable for a measure of inequality namely;

<sup>&</sup>lt;sup>9</sup>However, if the incomes are not uprated and 2005 system is applied to 2002 incomes then there is increase is progressivity.

TABLE	1
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Decomposing Personal Income Tax System

Tax Components	Kakwani	Reynolds- Smolensky
Overall Income Tax		
2002	0.547	-0.012
2005	0.564	-0.011
2005_u*	0.542	-0.015
Tax Rate Structure		
2002	0.602	0.018
2005	0.621	0.015
2005_u	0.595	0.021
Tax Base Structure		
2002	0.502	0.140
2005	0.532	0.115
2005_u	0.492	0.132
Allowance		
2002	0.501	-0.121
2005	0.531	-0.105
2005_u	0.491	-0.117
Deduction		
2002	0.621	-0.005
2005	0.640	-0.002
2005_u	0.613	-0.003
Tax Credits		
2002	0.588	0.005
2005	0.617	0.004
2005_u	0.586	0.006
Exemptions		
2002	0.590	0.026
2005	0.591	0.025
2005_u	0.577	0.028

\*2005\_u: 2005 tax system with incomes uprated from 2002 household data.

the transfer principle, scale independence, population independence anonymity and decomposability. *GE* ranges from zero (complete inequality) to infinity (*see* Cowell, 1995). An increase in *GE* parameter implies less sensitivity towards inequality at the lower end of the distribution. *GE(0)* is the mean log deviation, giving higher weight to income differences at the lower end of distribution. *GE(1)* is Theil index of inequality that gives equal weight to the entire income distribution. *GE(2)* is one half the squared coefficient of variations and gives more weight at the upper end. We can observe in Table 2 that the highest change (while comparing pre and post tax incomes) is in the case of *GE(2)*. This is because the upper tail of income distribution is most affected by the imposition of a progressive personal income tax and income earners falling in this upper tail end up paying a higher marginal rate.

#### TABLE 2

	2002_n/g	2005_u_n/g
Gini	-3.2	-3.7
GE(1)	-7.9	-9.6
GE(0)	-5.4	-6.4
GE(2)	-12.1	-15.0

Percentage Change in Net Income Over Gross Income

\*n/g: Percentage change in net income over gross income.

2005\_u: 2005 tax system with incomes uprated from 2002 data.

Table 3 exhibits the percentage contribution of various tax components (towards progressivity) under each of the three systems. The clearly stagnant contributions are observable between the 4 years (2002 to 2005). The percentage contribution of rate effect, allowances and deductions remains constant. The contribution of exemptions slightly decreases, while that of credits increase. The later's increase is plausible given that the increase in Zakat payable is directly related to increase in pre-tax incomes. Recall from previous section that for the purpose of tax accounting in household data we have treated Zakat payment as a tax credit.

TABLE	3
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Tax Components	2002	2005	2005_u
Rate effect	20.8	20.7	20.8
Allowance	17.3	17.7	17.2
Deductions	21.4	21.3	21.4
Exemptions	20.3	19.7	20.2
Credits	20.3	20.6	20.5
Total	100	100	100

Percentage Contribution Towards Progressivity

\*2005\_u: 2005 tax system with incomes uprated from 2002 data.

How do the component-wise contributions in Pakistan compare with other countries? We try to see from Verbist (2004) and Urban (2006) the percentage contribution towards progressivity in other developed and transition economies. Selected countries are grouped in Table 4. In this cross-country comparison we can observe that in pursuit of progressivity, countries with advanced taxation systems rely on allowances followed by rate and exemptions. Pakistan being a low-income country having a much narrower tax base relies on deductions followed by rate and exemptions. Recall that deduction here represents reduction in tax liability allowed for salary earners.

#### TABLE 4

Countries	Exem- ptions	Deduc- tions	Allow- ances	Rate	Credits	Overall	R-S
Austria	16.8	0.5	0.1	47.3	35.3	100	0.061
Ireland	34.5	-2.5	31.2	38.7	-1.9	100	0.055
Netherlands	8.1	-4.5	25.1	71.3	_	100	0.046
UK	55	-2.4	30.7	14.4	2.3	100	0.046
Croatia	_	_	85.8	14.3	-0.2	100	0.031
Pakistan	20.3	21.4	17.3	20.8	20.3	100	0.012

Cross-Country Comparison: Percentage Contribution Towards Progressivity

Source: For first four countries; Verbist (2004). For Croatia; Ivica Urban (2006). For Pakistan: Author's own calculation. Table 5 gives a comparison of post tax incomes for 2002 and 2005. The Gini coefficient for 2005 post tax uprated incomes increased by 1.4 percent compared to 2002. Even if the incomes are not uprated for 2005, still there is an increase of 0.18 percent in inequality. This implies that overtime changes in the tax system (resulting in higher redistribution from 2002 to 2005) are unable to reduce the already unequal pre-tax income gap. The rise in incomes around 2005 has favoured the higher income groups resulting in an increase in Gini coefficient.

## TABLE 5

	2005/2002	2005_u/2002
Gini	0.18	1.4
GE(1)	0.28	3.2
GE(0)	0.28	3.4
GE(2)	0.23	4.3

Percentage Change in Inequality Measures for 2005 over 2002

\*2005\_u: 2005 tax system with incomes uprated from 2002 data.

# **V. CONCLUSION**

Pakistan like other developing economies has a narrow tax base with high enforcement costs, making personal income taxation an unlikely cornerstone of a comprehensive inequality reduction agenda. However its role cannot be completely written-off given the potential contribution towards efficiency and equity objectives at the national level.

Our main findings are:

- Income Tax Ordinance resulted in greater redistribution. The redistributive effect increases as we move from 2002 to 2005 tax assessment.
- Deductions for salaried tax payers contribute the most towards progressivity. This is different from countries with advanced taxation systems relying mainly on allowances followed by tax rate and exemptions.
- Given the increasing pre-tax income gap, reforms in taxation cannot be entirely relied upon for a reduction in inequality in the society.<sup>10</sup>

<sup>&</sup>lt;sup>10</sup>The need for social protection policies and social safety nets remains.

#### • Progressivity pattern of tax base and allowance is identical.

There is a need to reform the present structure of exemptions. Income from agriculture (almost a quarter of GDP) is exempt from taxation. Agriculture taxation in Pakistan has been a matter of both parliamentary controversy and bureaucratic contention. For a very long time the presence of a dominant feudal class in the parliament implied that no headway could be made in this direction. However, on the insistence and continuous pressure from the multilateral donors and agencies a plan was chalked out to levy the tax on agriculture incomes subject to a consensus on a suitable tax base. However the actual imposition of such a tax is still not clearly defined to serve the macroeconomic purpose of broad basing the tax base and the microeconomic purpose of decreasing income inequalities (see World Bank, 1999; Chaudhry, 2001). The tax office has been unclear as to what will be a better instrument for agriculture taxation, *i.e.* should the tax be levied on agricultural produce, land value, value of agriculture inputs, value of output sold etc. In order to increase the tax to GDP ratio, indirect tax will remain the primary instrument in the medium term. There is a need to further study the distributional impact of bringing new services in to the tax net. The existing structure of sales tax also has the potential of being made a progressive tax. These issues require further research.

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# MOTIVATIONAL PREFERENCES OF PHARMACEUTICAL SALESFORCE Empirical Evidence from Pakistan

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**Abstract**. One of the biggest challenge that business world is facing today is how to motivate employees to dedicate persistent and intensified efforts to achieve the organizational goals (Watson, 1994). Accordingly, employees' attitude surveys have been used frequently to ascertain what sparks and sustains their desire to work harder. However, the motivation of the employees remained a complex puzzle since long (Wiley, 1997). It is generally accepted that motivated and committed salesforce is one of the critical factors in the growth and profitability of the organizations. Thus, the current study intends to address the complex issue of how to motivate pharmaceutical salesforce in Pakistan. Consequently, the study results will help practitioners in creating a work environment to fostering salesforce motivation leading to higher productivity and overall performance.

### I. INTRODUCTION

Insight into employees' perceptions regarding job content and context factors is usually considered important to aid in uplifting their morale. The study of motivation forms an integral part of industrial and vocational psychology in which the concepts of need, incentive and attitude are discussed extensively than the concepts of ability and skill (Vroom, 1995). Business world is faced with number one problem of how to motivate employees (Watson, 1994). Technological revolution, demographic changes in workplace and globalization stimulate the need of searching the novel ways to motivate

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workforce. Getting to know about employees' preferences of what motivates them could help improving productivity and building success story for the organizations. Consequently, organizations attain competitive edge whereby employees get valued rewards (Wiley, 1997). Performance of the employees is mostly determined by their abilities, motivation and positive job environment. The issues of lacking in abilities of employees and undesirable job environment can be effectively addressed by appropriate training and provision of favourable work conditions. However, if motivation is the underlying cause of performance problem, then its solution becomes more complex and challenging (Griffin, 1990).

Numerous definitions of motivation have been extended which mostly stick to the idea of promoting individual's willingness to invest more efforts to achieve specific objectives. However, motivation has not been uniformly defined in industrial and organizational psychology (Locke and Latham, 1990). One possible reason could be the invisible and hypothetical nature of motivation construct. The interplay of internal and external forces initiates work-related behaviors and ascertains the direction, intensity and duration of motivation (Pinder, 1998). Mullins (1992) defined motivation as the direction and persistence of actions. He has described that the driving force for motivation is to satisfy certain needs and expectations. Conroy (1994) has defined motivation as, "a person's active participation in and commitment to achieving the prescribed results." Wiley (1997) has noted that the following three assumptions of human motivation guided contemporary research: "(1) Motivation is inferred from a systematic analysis of how personal, task and environmental characteristics influence behaviour and job performance. (2) Motivation is not a fixed trait. It refers to a dynamic internal state resulting from the influence of personal and situational factors. As such, motivation may change with changes in personal, social or other factors. (3) Motivation affects behaviour, rather than performance (Nicholson, 1995). Initiatives designed to enhance job performance by increasing employee motivation may not be successful if there is a weak link between job performance and an employee's efforts." Locke (1976) has noted that motivation is determined by goal directedness, human willingness, and perceived needs and values to sustaining the actions of employees in relation to themselves and to their environment.

Attitude surveys have been used frequently in business to obtain the valuable information regarding job-related motivational preferences of the workforce to fostering their morale and performance. In this connection, a survey was conducted in 1946 on industrial employees by Labour Relations Institute of New York and reported in Foreman Facts (Hersey and Blanchard,

1969) to explore the importance of ten "job reward" factors. The employees placed highest importance on "appreciation" and least importance on "discipline" to motivate them in their work. Kovach (1980) investigated preferences of 200 employees regarding ten "job reward" factors. The results of the survey indicated that the respondents put "interesting work" at the top of the list and "tactful discipline" at the bottom of the list. In another similar survey, Kovach (1987) found changes in the motivational preferences of the industrial employees. He commented that substantial improvement in standard of living and quality of life of the Americans in the last 40 years probably justify why the respondents valued interesting work more than wages.

Charles and Marshall's (1992) conducted a survey to explore the motivational preferences of the job factors among 255 Caribbean hotel employees. The participants rated "good wages" to be the most important factor in motivating them to do their best work. The results of the survey by Simons and Enz (1995) were equally supportive. The hospitality employees in 12 hotels across United States of America and Canada perceived "good wages", "job security" and "opportunities for advancement and development" as the top rated motivators. The results also revealed that the employees from different functional departments differed regarding importance placed on job-related factors.

The results of a survey (Wiley, 1997) indicated that full-time and parttime employees from diversified industries such as retailing, services, manufacturing, insurance, utilities, health care and government agencies considered the following three job factors important in their motivation:

- 1. Good wages
- 2. Full appreciation for work done
- 3. Job security

Respondents rated "good wages" to be the top motivator while "sympathetic help" was perceived to have least importance in their motivation. The results of non-parametric test of significance and one-way ANOVA reflect that certain demographic subgroups were statistically different in their motivational preferences. Females placed more value on "appreciation for work done" and "good working conditions" whereas males placed more emphasis on "interesting work". "Good pay" was found to be the good motivator regardless of the age. Comparison of six occupational groups revealed that professionals, salespeople, clericals and managers perceived "interesting work" more important than did the plant employees. Lower-income groups placed more emphasis on "good working conditions" than did middle incomers.

Wong, Siu and Tsang (1999) conducted a survey questionnaire on Hong Kong hotel employees from nine different functional departments to ascertain the motivational importance of Kovach's ten job-related factors. "Opportunities for advancement and development", "loyalty to employees" and "good wages" were found to be top three motivators for the study participants. The results of one way-ANOVA revealed that demographic variables did not contribute significant variations in their perceptions of extrinsic job factors. However, respondents with different demographic characteristics such as female, un-married, employees with higher educational level and earning more than HK \$ 20,000 were found to have significantly different perceptions regarding intrinsic job factors than their counterparts.

Since decades, numerous researchers investigated employees' motivation preferences regarding job content and context factors in diversified cultures and occupations but none investigated pharmaceutical salesforce in Pakistan. Therefore, the current study attempts to explore the differences in motivational value of each job factor among pharmaceutical salesforce with different demographic backgrounds.

## **II. RESEARCH METHODOLOGY**

Following research methodology has been employed to explore the motivational preferences of pharmaceutical salesforce and to determine the significant differences in the value placed on each job factor across the demographic subgroups.

#### SAMPLE

Multistage stratified random sampling technique is employed to get a representative sample whereas the sampling frame is derived from Drug Index, 2007. The target population comprises of about 2,150 frontline salespersons. At the first stage, a total of 29 multinational and local pharmaceutical companies operating in Lahore are selected by using stratified random sampling technique. Of the 29 companies, 7 are selected from within a stratum of 25 multinational companies and 22 are chosen from another stratum of 152 local companies. At the second stage, a total of 100 out of 195 frontline salespersons are randomly selected from among the list of selected multinational pharmaceutical companies while a total of 250 out of 480 salespersons are randomly selected from among the list of selected local pharmaceutical companies.

## DATA

Of the 350 distributed questionnaires, overall usable response rate is about 71 percent. Local pharmaceutical companies returned 175 (70%) usable questionnaires whilst multinational companies returned 72 (72%) questionnaires to be used for analysis purpose.

#### SURVEY INSTRUMENT

Survey questionnaire contains the following two sections:

Section 1: Respondents are requested to give information regarding gender, age, academic qualification, marital status, company type, job position, and job experience.

Section 2: Participants are asked to rank the ten job content and context job factors according to how important each is in motivating them put their best efforts. The most important job factor is to be ranked number 1 and the least important job factor is to be ranked number 10. This part of the survey questionnaire is adapted from Kovach (1987) survey to obtain the information regarding the motivational preferences of frontline pharmaceutical salesforce in both multinational and local pharmaceutical companies.

## **III. ANALYSIS AND INTERPRETATION**

Descriptive statistics (means) are used to determine the relative rankings of job content and context factors for each demographic subgroup. Since study data are ranked ordered and violate the normality assumption, so alternative non- parametric tests such as Mann Whitney and Kruskal Walllis tests are employed to ascertain significant differences in value placed on each job factor across the demographic subgroups of pharmaceutical salesforce.

#### **CHARACTERISTICS OF RESPONDENTS**

Table 1 displays demographic characteristics of the frontline salespersons. Majority of the participants are male whereas females account for only 14 percent. About 29 percent of salesforce is employed in multinational companies and 79 percent in local pharmaceutical companies. Of the respondents, 21 percent are 20 to 25 years of age, 56 percent are 26 to 30 years of age and 23 percent belong to age group of 31 to 40 years. Married sales representatives are 58 percent and while the unmarried are 42 percent. About 84 percent salesforce hold graduation degree but only 16 percent possess master degree. About 46 percent of the respondents are working as sales promotion officer and 54 percent are senior sales promotion officer. Of the respondents, 17 percent have less than 2 years job experience, 40 percent

have 2 to 5 years experience, 32 percent have 6 to 10 years experience and only 11 percent worked more than 10 years in the present job.

Demographic Gre	oups	Frequency	%
Gender	Male	212	86
	Female	35	14
Company	Multinational	72	29
	Local	175	71
Education	Master	40	16
	Graduation	207	84
Marital Status	Married	143	58
	Single	104	42
Age	20-25 years	51	21
	26-30 years	138	56
	31-40 years	58	23
Job Experience	Less than 2 years	42	17
	2-5 years	98	40
	6-10 years	80	32
	More than 10 years	27	11
Job Position	Sales Promotion Officer (SPO)	114	46
	Senior Sales Promotion Officer (SSPO)	133	54

TABLE 1

Profile of the Pharmaceutical Salesforce (n = 247)

#### RESULTS

Table 2 displays the relative rankings of the ten job content and context factors. The analysis of the mean values of the factors reflects that pharmaceutical salesforce rate "pay and fringe benefits" as the most important motivator while "good working conditions" as the least important factor in their motivation. However, "good supervision" and "recognition for job done well" are placed in the middle of the list.

TABLE	2
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Relative Rankings of Job Content and Context Factors

Job-related Factors	Mean	Rank
Good pay and fringe benefits	3.35	1
Job security	4.18	2
Promotion opportunities	4.72	3
Personal growth and development	5.16	4
Good supervision	5.40	5
Recognition for job done well	5.89	6
Supportive co-workers	5.98	7
Interesting work	6.65	8
Good operating procedures	6.76	9
Good working conditions	6.91	10

The results of Mann-Whitney and Kruskal Wallis tests (Tables 3 and 4) indicate that demographic subgroups of salesforce differ from another in perceived importance of job content and context factors. The analyses reflect that male respondents place significantly higher value on the "supportive coworkers" than female counterparts. Salespersons in local pharmaceutical companies consider "job security" and "promotion opportunities" as more important motivators than those employed by multinational companies. However, multinational salesforce has placed significantly more importance on the "recognition for the job done well" than salesforce in local companies. Graduate degree holders have emphasized more on "promotion opportunities" than master degree holders. Married individuals have rated "job security" significantly higher while un-married consider "interesting work" more important than their counterparts. Respondents aged between 26-30 years value "pay and fringe benefits" more than those aged between 20-25 years. Salesforce having job experience between 6-10 years have rated "good working conditions" significantly higher than those with job experience more than 10 years. Salesforce senior in position have placed higher importance on "pay and fringe benefits" while junior salesforce valued "interesting work" more than their counterparts.

# TABLE 3

Ranking of Job Content and Context Factors
for Each Demographic Subgroup

Demographic	PFB	JS	РО	GD	GS	RW	SC	IW	GOP	GWC
Gender										
M	1	2	2	4	~	7	<b>C</b> *	0	0	10
Male	1	2	3	4	5	/	6*	8	9	10
Female	1	2	3	5	4	6	10	9	7	8
Company										
Multinational	1	2	4	5	6	3***	7	8	10	9
Local	1	2*	3*	4	5	7	6	9	8	10
Education										
Master	1	2	5	3	4	7	6	8	10	9
Graduate	1	2	3*	4	5	6	7	8	9	10
Marital Status										
Married	1	2 **	3	4	5	7	6	9	8	10
Single	1	2	3	4	5	6	8	7**	9	10
Job Position										
SSPO	1**	2	3	4	5	6	7	9	8	10
SPO	1	2	3	4	5	6	7	8**	10	9
Age										
20-25 years	1	2	3	4	5	7	6	8	9	10
26-30 years	1*	2	3	5	4	6	7	8	9	10
31-40 years	1	2	4	3	5	6	7	9	8	10
Job Experience										
< 2 Years	1	2	3	4	5	6	7	8	10	9
2-5 Years	1	2	3	5	4	6	7	8	9	10
6-10 Years	1	2	3	4	5	7	6	8	9	10*
>10 Years	1	4	2	5	3	6	9	8	7	10

\*Higher Significant Preference at 0.10 level, \*\*Higher Significant Preference at 0.05 level, \*\*\*Higher Significant Preference at 0.01 level

PFB = Good pay and fringe benefits, JS = Job security, PO = Promotion opportunities, GD = Personal Growth and development, GS = Good supervision, RW = Recognition for job done well, SC = Supportive co-workers, IW = Interesting work, GOP = Good operating procedures, GWC = Good working condition

# TABLE 4

Job-related Factors	Gender	Pharma- ceutical Company	Education	Marital Status	Age	Job Experience	Job Position
Good pay and fringe benefits					26-30 years*		SSPO**
Job security		Local*		Married**			
Promotion opportunities		Local*	Graduation*				
Personal growth and development							
Good supervision							
Recognition for job done well		Multi- national***					
Supportive co-workers	Male*						
Interesting work				Single**			SPO**
Good operating procedures							
Good working conditions						6-10 years*	

# Demographic Subgroups with Higher Significant Preference for Job Content and Context Factors

\*Higher Significant Preference at 0.10 level, \*\*Higher Significant Preference at 0.05 level, \*\*\*Higher Significant Preference at 0.01 level

# **IV. CONCLUSIONS**

The study results indicated that pharmaceutical salesforce identified the following three top motivators:

- 1. Pay and fringe benefits
- 2. Job security
- 3. Promotion opportunities

Pharmaceutical salesforce rated pay and fringe benefits as the most important motivating factor which is supported by the findings of other studies as well (Wiley, 1997; Dubinsky, Jolson, Michaels, Kotabe and Lim, 1993; Shipley and Kiely, 1988). In addition, results indicate that pay and fringe benefits is highly valued by the salesforce of all demographic backgrounds. Its possible explanation could be that pay and fringe benefits enable salespersons to fulfill their physiological as well as esteem needs. Thus, critical review of the current incentive schemes is required to make them more effective to cater to the needs of the salesforce in both multinational and local pharmaceutical companies.

All the demographic subgroups of the salesforce, except salespersons above 10 years job experience, emphasized job security as one of the top motivators. It could be probably due to widespread unemployment conditions in the country. Job insecurity can deteriorate economic and psychological well being of the salesforce. So, when downsizing is necessitated, appropriate initiates such as severance programmes, incentives for early retirement and outplacement techniques should to be taken to sustaining productive behaviours of the salespersons (Wiley, 1997). Pharmaceutical salespersons placed promotion opportunities among top three motivators. It is recommended that organization should ensure to communicate and implement the policy of promoting salesforce from within the company.

Results indicate significant differences in motivational potency of promotion opportunities, job security, interesting work and pay and fringe benefits among most of the demographic variables. Thus, it is recommended that decision makers should take into consideration individual differences while devising motivational programmes for the pharmaceutical salesforce.

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# DOES RURAL MICRO CREDIT IMPROVE WELL-BEING OF BORROWERS IN THE PUNJAB (PAKISTAN)?

## SEEMI WAHEED\*

Abstract. Rural micro credit is intended primarily for investment in rural productive activities to improve well-being of poor. However, its use to meet daily consumption needs is not prohibited. Nonetheless, credit increases income and consequently effects consumption. Punjab Rural Support Programme provides micro loans to rural poor who have regular source of income. The study uses six years (1999-2004) secondary data and primary data of 2005. Primary data, using stratified random sample technique of variables like credit, income, assets, education and family-size, was collected and applied to multiple regression model. It was concluded that micro credit was largely availed by the poor borrowers, however, non-poor also availed micro loans. Also per capita credit to poor was less than per capita to non-poor. The results show that it is not just micro credit but education also improves income. Assets and family size has insignificant role in income improvement. In rural areas therefore, the micro credit organization need to focus on the amount of loan, customize and geographically target new loan products and discourage misdirected use of micro credit so that income of poor may improve.

# I. INTRODUCTION

It is argued that credit availability improves well-being of borrowers in variety of ways. The most significant improvement is in income and assets of borrowers. Other ways in which credit could be beneficial to the borrowers

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via improved incomes is better education, health, nourishment and self-esteem.

Rural credit, mainly available to large and medium farmers for agriculture purpose, excluded small farmers and non-farmers as the latter did not possess collateral and were un-bankable due to their low economic position. Research corroborates that in developing countries big farmers could borrow large sum of cheap loan, which was in many instances not repaid owing to weak enforcement of repayment rules primarily due to their political influence (Adam, 1995; Penny, 1983; Robinson, 2001; Von Pischke 1983). Availability of formal rural credit did preclude accessibility to small farmers and non-farmers which comprised sizeable population in villages. They borrowed from informal sources like middle-man (money lender), friends and relatives to meet investment and consumption needs.

As big farmers benefited from large cheap loans and excluded small borrowers, micro loans, therefore, was designed for borrowers whose income was periodic; however, slightly above, below, or on the poverty line. The design of loan product did not require conventional collateral in the form of land/property, and group guarantee was the eligibility criteria for acquiring micro loans. The main aim of micro loans was to provide sustainable livelihood to low income households, which consequently was crucial to sustainability of micro finance organization (MFO) because increased income could also improve the repaying capacity of poor households.

There is a viewpoint based on empirical studies (Robinson, 2001; Morduch, 1998; Burgess and Pande, 2004) that credit availability reduces poverty and improves well-being of small borrowers. Micro loans used for financing collectively identified small community projects and personal difficulties, generate surplus for community and individual household, which produces greater social benefits.

This paper attempts to evaluate the income improvement of rural borrowers of Punjab Rural Support Programme (PRSP) in Pakistan. The three research questions are: (1) Are micro loans by PRSP given to those who have regular income, which is slightly above, on and below the poverty line? (2) Does income improve due to micro loans and other factors like education, assets and family size of borrowers, and (3) Do micro loans by PRSP provide sustainable livelihood? The first question is explored by analyzing secondary data of PRSP. The relation of income with micro credit, assets, education and family size is analyzed using primary data collected through survey. The study uses six years (1999-2004) secondary data and survey data of 2005. The third question is inferred from the conclusions of

the first two questions and the observations of the researcher during interview with borrowers.

The paper is divided in five sections. Section II of the paper gleans through the literature review on micro credit and its well-being aspects. Section III analyses data from 24 participating villages of PRSP and assesses targeting and per capita loans to participating poor and very poor borrowers. Section IV gives a detailed methodology of primary data collection from four locations of the two participating districts. Section V presents the results and, finally, conclusions are drawn in section VI.

#### **II. LITERATURE REVIEW**

Micro credit is considered as panacea to the economic problems of poor households. It is perceived to bring them out of poverty and provide respectable living through provision of sustainable livelihood and penultimate consumption smoothing. It is assumed that sustainable livelihood would give sustained income to poor borrowers. Studies on micro credit affirm the positive impact of credit on household income. In rural areas in Pakistan the extent of credit use for agriculture inputs is high and credit for consumption is 5% more than for agriculture inputs, which is largely met through informal sources; and keep the poorer households at the level of better-off households. Without credit the former would drop below poverty line (Malik and Nazli, 1999).

Theoretically, credit increase income of households and as income of household increases more resources are available for expenditure, savings, and investment in assets. Studies have shown micro credit improves capacity to cope economic difficulties because there is a positive influence of micro credit on well-being of borrowers (Hoque, 2008).

The other argument is that micro credit does not create assets of poor and very poor borrowers, but only increases income to the extent to meet daily expenditure. In certain situations, it reduces assets because the demand for repayment of loan is so severe that borrowers are compelled to sell assets to repay loan. At "lower levels of income there is greater risk that unlucky or improvident borrowers may be forced by their exposure to debt into selling assets which will permanently lower their income possibilities" (Mosely and Hulme, 1998, p. 787). Morduch (1998) comparative study of Bangladesh Rural Advancement Committee (BRAC) and Bangladesh Rural Development Board (BRDB) with Grameen Bank suggests that there was no evidence in increased consumption and school enrollment of Grameen borrowers. Repayment of micro credit installment is burdensome for poor borrowers whose income and assets are at subsistence level. Persuasive loan staff insists on payment on time leaving no flexibility and thus rural households either further borrow or sell liquid asset in certain cases (Marr, 2004). This further depletes household assets and income.

It is added that visible difference in well-being of borrowers in terms of improved income, assets, education, and accessibility to other services is also due to availability of road network, transport and information. The poor urban population may not be as constrained or deprived as their rural counterpart because of their connectivity and accessibility to markets. Villages in close proximity to urban centre may benefit from the connectivity with urban markets and get better return from the use of credit which consequently enhances income. Villages remotely located with poor social and physical infrastructure may not be able to make better use of credit.

Credit therefore plays a vital role in rural economic life both in terms of meeting consumption needs and production needs. However, it needs to be determined how those at the bottom rung of the economic status respond to micro credit in terms of income and education.

#### **III. WHO GETS CREDIT?**

The PRSP poverty profile uses eight eligibility criteria (Table 1) based on economic position of borrowers. The eligibility criteria are size of landholding, income source, transport, and farm machinery, housing condition, access to agriculture-input, livestock, access to education and health facility. Each of the criteria is arranged vertically and is matched with the extent of ownership/access to each of criterion on descending horizontal scale. The horizontal scale of poverty decreases from left to right. For example size of land-holding (an asset-criterion) for rich borrowers is more than 12.5 acres in irrigated area is on the extreme left of the scale and for 'poor' and 'very poor' it is less than four acres or landless on the extreme right. The extent of ownership/access for other criterion is defined in similar way. While, PRSP maintains category of 'destitute', loan is hardly provided to this group.<sup>1</sup> The 'poor' and 'very poor' are the main recipient of loans, possessing less than four acres of land or are landless. The Programme was less stringent in following the eligibility criteria especially in its initial years.

<sup>&</sup>lt;sup>1</sup>The category is changed to 'poor' and 'non-poor'.

Details	Rich	Well to do	Poor	Very Poor	Destitute
Landholding	Irrigated land	Irrigated land	Less than 4	Landless	Landless
size	more than 12.5	4-12 acres	acres of		
	acres		land, or		
			landless		
Source of	Members of	Doing low paid	Small	Land	Nil,
income	house hold in	jobs small	farmers,	workers,	surviving
	service	business	tenants,	labourers,	on Zakat,
	business	farmers, even	only source	mostly	charity,
	agriculture	landless but	of income	daily	occasional
	More than one	additional	are	wages, no	labour
	earner	source of	farming.	regular	
		income	One earner,	income	
			many		
			dependents		
Transport,	Tractor/ Car/	Motorcycle	Bicycle/cart	None	None
farm	motorcycle				
machinery	other farm				
	machinery		~		
House	Big and	Medium size	Clay built,	Not built	Small and
condition	cemented,	and well built	no	physical,	clay built
	electrified,	with proper	electricity	condition	
	proper	sanitation		not good	
	sanitation		A '11		NT'1
Access to	Access to good	Can buy agri-	Accessible.	Not	IN11
agri-inputs	quanty agri-	inputs,	Only buy	accessible	
	Doos not nood	sometimes	on credit	on time,	
	boes not need	agri inputs		always	
	inputs	agn-mputs		credit	
Livestock	More than 10	5-10 animals	2-1 animals	1_2	1_2
LIVESTOCK	animals	J-10 anniais	2-4 anniais	animals	animals
Access to	High education	Up to high	Only	No access	Nil
education	(at least	school level	primary	to proper	1,11
Culcution	enough	Can go to other	education	education	
	resources for	villages for	in some	Cannot	
	higher	high school	cases not	afford to	
	education)	education	even	send	
			primarv	children	
			education	school	
Access to	Have access to	Basic health	Access to	Cannot	Nil
health	proper health	facilities	basic health	avail pro-	
facilities	facilities			per health	
				facility	

TABLE 1Profile of Clients of PRSP

Source: Punjab Rural Support Programme (2004), Annual Report.

On the average in six years (from 1999 to 2004), 52% 'poor' owning less than four acres of land or landless or tenants, received credit. During the same period on the average 24% 'very poor' who were land workers/daily wage earner, possessing one to two animals received credit. 16.4% 'better off' and 7.0% 'well-to-do' and on the average 0.035% 'destitute' received micro loans during the period understudy.

#### FIGURE 1

Percentage Borrower in Each Category by Poverty Status



Well-to-do 🔲 Better off 🗐 Poor 🔳 Very Poor 🔳 Destitute

Figure 1 illustrates that credit given to 'well-to-do' declined from 7.63% in 1999 to 2.88% in 2004. Similarly, 11.5% 'better-off' received micro credit in 2004 compared to 17.73% in 1999. Credit to 'poor' gradually increased from 52.5% in 1999 to 61.0% in 2004, which was an increase of nine points. Twenty-four percent 'very poor' received credit in 2004. It is concluded that PRSP gave credit largely to those who had relatively at least one periodic source of income and owned one to two animals and had little access to education and health. The 'very poor' and 'destitute' did not receive much credit because of uncertain and below subsistence income and low social capital. Thus, PRSP loans were fairly well targeted to the rural 'poor' who had social capital, periodic but low income.

#### PER CAPITA CREDIT TO POOR

The size of micro loan is debated in terms of how much should be the loan amount to have returns which generate enough surplus to repay loan and meet basic household expenditure. The loan size of the PRSP for common investment, that is, for purchase of livestock especially buffalo (the average current market price of milch buffalo is Rs. 70,000-80,000) is considered insufficient by rural clients.

Analyzing the average loan size per person it came out to be Rs. 12334, Rs. 14223, Rs. 12985, Rs. 12082, Rs. 11324, and Rs. 11068 for the years 1999, 2000, 2001, 2002, 2003, and 2004 respectively. It was expressed by the borrowers the credit amount being too little to undertake new economic activity rather borrowed amount was invested in on-going economic activity like livestock, agriculture input etc. Large extended family (which is common characteristic of Pakistani rural society) acquired multiple loans in the name of different family members for new economic venture and consumption expenditure as well. Such families were in advantageous position, as compared to smaller ones because of their size and social capital.

#### FIGURE 2

## Percentage of 'Well-to-Do' Received Greater Percentage of Per Capita Credit



 $\square$  % borrow ers  $\square$  % credit
The data reveals that small percent of 'well-to-do' received greater per capita credit. For example, in year 1999, 7.6% of 'well-to-do' received 10.6% of the credit disbursed, 17.7% 'better-off' received 19.5% credit. For 'well-to-do' and 'better-off' category per capita credit was higher for the six years (Figure 2). Per capita credit available to 'poor' and 'very poor' is less compared to 'well-to-do'.

In 1999, 52% 'poor' received 49.5% credit. Fifty-one percent received 52%, 52% received 52% credit, 48% received 52.5% credit, and 61.7% received 60.4% credit for year 2000, 2001, 2002, 2003, and 2004 respectively. Figure 3 illustrates that twenty-two percent of 'very poor' received 20.3% credit, 24% received 21.3% credit, 26.5% received 24% credit, 31.4% received 26% credit, 30% received 29.3% credit and 24% received 23% credit in year 1999, 2000, 2001, 2002, 2003 and 2004 respectively. The per capita micro credit to 'very poor' is even less than 'poor', in other words, percentage of credit to 'very poor' category is shared by greater number of very poor'.

FIGURE 3
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Percentage of 'Very Poor' Borrowers Received Lesser Per Capita Credit



■ Very Poor □% credit

It is concluded from the analysis of population data that the percentage of borrowers in the former two categories, that is, 'well-to-do' and 'better off' obtained more percentage credit. It is also inferred that 'well-to-do' though lesser in percentage received larger share of the credit. The per capita credit to poor and very poor is less than per capita credit disbursed to' well-to-do' and 'better-off'. Less per capita credit available to 'poor' and 'very poor' means that poor who are already on the poverty line and have meager assets and low income, the little credit improves income and well-being to a very small extent.

# **IV. METHODOLOGY AND DATA SOURCES**

Two kinds of data sets are used, that is, PRSP macro data of 24 districts where it is functional and survey undertaken by the author of the two out of 24 participating districts of PRSP in 2005.

# SAMPLE OF HOUSEHOLDS FOR PRIMARY DATA

Stratified simple random sample technique was used to conduct the survey of participating households only. The survey was carried out in September and October 2005. The sample districts in which PRSP is operational were selected according to deprivation (poverty) ranking. Social Policy Development Centre (SPDC, 2004), Karachi, has ranked all the districts of Pakistan according to deprivation. Deprivation is defined in terms of education, employment, health care, clean drinking water etc. Punjab has 34 districts, ranked on deprivation basis. Two districts, *i.e.* high on rank (prosperous) and low on rank (deprived) were selected. The districts were Sialkot and Muzaffargarh respectively. From each of these districts, a village and settlement each were selected. The criterion of selection of village/settlement was also deprivation. Thus, one village and one settlement from both the districts were selected.

# SAMPLING

Sialkot district located in the north of Punjab is prosperous. One settlement, *i.e.* Dera Chander Khan, and one village Talhara were selected. The former was relatively deprived area and the latter was relatively prosperous village. Muzaffargarh district situated in the south of Punjab is deprived and from this district, Hussainwala, a settlement, and Sohrien, a village, were selected. The former was relatively deprived settlement and the latter was relatively prosperous village. In the two districts, the villages were revenue circles, while settlements in both the cases were situated at around two kilometers away from the villages. It may be noted that the settlements in both instances were more deprived and comprised mainly of one caste. Settlements in Punjab are many and usually suffer more exclusion.

Sample villages were identified keeping in view the following criteria:

- (a) Village/settlement should be from poor and rich districts.
- (b) Within the poor district, a poor settlement and a relatively prosperous village was identified.
- (c) Within the rich district, a poor settlement and relatively prosperous village was identified.

Total households in the four locations were 500. Out of five hundred households in the four locations 68 households were interviewed. These households constitute 14 percent of sample. The sample households from each village/settlement were non-randomly selected, by first mapping the village/settlement. The village/settlement was explored by walking on the periphery and identifying such public places like shop, mosque, school and dispensary, etc. Interviews of head of household were undertaken starting from one edge of the villages. Only the participating households were interviewed. After completing the interview of head of household on outer boundary, interview from the head of households from the inner cluster was done. This methodology produced sample for multiple regression where the sample was non-random.

#### **QUESTIONNAIRE DESIGN**

Questionnaire was designed to collect primary data on income, assets, education and family size of households. Questions were framed keeping in view the level of literacy of the borrowers and the objective of research. The questions were simple, straight and closed ended. In all twenty questions were framed. The questionnaire was test run on 10 head of households. The questionnaire was simplified in the light of feedback from the test run. Actual survey was carried out on finalized questionnaire. During the survey while data on income, family size, education, assets, age, was collected, qualitative information of the location was also gathered.

# INCOME

The income of borrowers, that is, head of household was assessed during the interview by asking occupation and sources of income. Sources of rural income were both farm and non-farm. In a household father and sons lived together and their income was taken together. The primary cross-sectional data has 60 percent of borrowers in a non-random sample living below poverty line<sup>2</sup> having average per capita monthly income of Rs. 790. Land

<sup>&</sup>lt;sup>2</sup>Poverty line as defined in Poverty Reduction Strategy Paper is Rs. 784 per capita per month in 2002 prices.

holdings of borrowers in the sample did not exceed four acres. The maximum size of land was four acres and minimum size was less than <sup>1</sup>/<sub>2</sub> acre. Some worked as daily wage earner in factories, construction labour, and workshop. Skilled workers went to cities to earn higher wages. Average monthly income of sample borrowers was Rs. 7449.0. The sample therefore, included only poor and very poor household according to the poverty profile of PRSP. Incomes were generally low despite, multiple income sources of sample household. Annual income without micro credit was used in the analysis.

#### FAMILY SIZE

The average family size was nine members. In regression analysis exact number of family members in each household was used. The family comprises extended family in which parents, single and married brothers and single sisters all lived together. The income in extended family is also shared.

#### **EDUCATION**

The average education level of head of household was 3.5 years of schooling; the highest level being 12 years of schooling and lowest being zero years. In the analysis number of years of schooling of head of household was used.

# ASSETS

Assets are categorized as tangible or in tangible. Tangible assets are financial and durable goods. Tangible assets are bonds, stocks, mutual funds, savings, own-home, transport etc. Intangible assets increase access to opportunities and contribute to the ability to earn income and acquire tangible assets. Examples of intangible assets are education, health, work experience and social network.

For the purpose of this, study tangible assets consisted from less to more liquid assets. The less liquid assets comprised land, own-house, tractor, car, bicycle etc. Due to lower water table, cultivable land is scarce in Southern Punjab; as such, its value compared to Northern Punjab (Sialkot District) is less. Even if household owns 12 acres of land in Southern Punjab, its value would be less. In order to irrigate land Peter pumps are widely installed in northern and southern Punjab for which small farmers usually borrow from PRSP. Own house is an asset which all micro borrowers possess because having a one room shelter is within the reach of rural household where land for the purpose is almost free.

In rural areas, more liquid assets constitute livestock (cow, buffalo, camel, sheep, goat, ducks and hen). Every rural household owns some kind and amount of livestock which varies with economic position of household. Goats and sheep are widely reared by both low and high-income household in rural areas. These are reared to fetch better price in urban market for Eid and other Muslim occasions. The liquid assets are both assets and savings (investment). These easily convert into cash when needed. It may be mentioned, PRSP micro credit is available for purchase of cattle and poultry. Rural community's assets are not financial but mainly in kind. Consumer durables like refrigerator, television etc was not owned by any household even in the more prosperous village of southern Punjab. The assets comprise own house, livestock, means of transport if any and, some small household items.

# CREDIT

Low-income households, especially rural low-income household have little formal relationship with banking system; this makes them dependent on informal lending market, who charge predatory price for lending due to their low creditworthiness. Micro credit, therefore, provides opportunity to poor to avail loan despite low creditworthiness.

PRSP micro credit is available at 14% effective interest rate on declining balance approach. The loan size is from Rs. 10000 to Rs. 30000. Rs. 10000 is the mode and Rs. 14000 is average loan size. The terms of loan are for one-year period. The sample interviewee received varying loan, *i.e.* from Rs. 10,000 to Rs. 25000. The credit amount therefore remained within that range irrespective of need or demand. The micro credit of PRSP is therefore, supply driven which has number of implications for borrowers and lender. Repeat loans were incentive for regular repayment of credit. In addition, different family members in a household became members of community organization (CO) for acquiring and benefiting from credit. This augmented resources of large household.

The data on credit was obtained from the office of PRSP and verified during interview. Interviewees in the sample had repaid loan three months before the survey was conducted. No significant variation in assets or income therefore was expected in the short period, hence increase in income and asset due to credit are taken as occurring in same time. Loan was repaid in twelve installments on declining balance method. For the purpose of analysis, credit repayment was calculated for each household and annual repaid amount of loan was used in the analysis.

# THE MODEL

In order to derive results from the primary data of the variables discussed above, the following model is presented:

$$y = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4$$

y = annual income of household without credit

 $x_1$  = micro credit

 $x_2$  = assets

- $x_3$  = family size
- $x_4$  = education

# V. RESULTS

It is about well-being of poor communities living at the periphery of the mainstream development. The well-being is measured from their present income (it is assumed that households will consume leading well-being) and its improvement due to micro loan availability by PRSP, assets, family size and education. Multiple regression analysis was carried to determine improvement in income of micro borrowers of PRSP in selected districts. The results of the multiple regression are given in Table 2. All variables were entered and  $R^2$  0.10 was obtained. The F-test of the multiple regression was 1.75 (Table 2) which is smaller than the critical value (2.53) shows the significance of the analysis. It shows that micro credit improves income (H<sub>0</sub> =  $\mu$ ).

#### TABLE 2

	-				
	Sum of Squares	df	Mean Square	F	Sig.
Regression	62998090787.903	4	15749522696.976	1.756	0.14
Residual	565200375595.155	63	8971434533.256		
Total	628198466383.059	67			

Analysis of Variance

All variables are significant in improving well-being of poor communities, especially micro credit and education. The multiple regression results show that the t-ratio of micro credit and education are high showing significance of the variables in income improvement (Table 3). Family sizes, followed by assets have least effect on the income. Micro credit has significance in improving income as indicated by the results of multiple regressions. There is addition to income by way of credit, savings etc., but it is to be seen whether that income is obtained from investment of borrowed capital or is credit used for consumption. During the interviews the question, how credit was used had three responses. One, it was invested in livestock, second, it was used for purchase of agriculture inputs and third, it was used in personal consumption. In all the three uses, income had improved and it is the particular use of credit that will determine whether there will be continuous future streams of benefit or one time benefit. In Southern Punjab credit was largely used for consumption and it created problems in the repayment of installments from the area.

TABLE .	3
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Variables	Coefficient	Standard error	t-ratio	Partial correlation
Constant	8390	47008.9	0.178	
Micro credit ( $x_1$ )	3.24	2.2	1.472	0.182
Assets $(x_2)$	0.0282	0.060	0.471	0.060
Family size $(x_3)$	1820.7	3176.8	0.573	0.072
Education $(x_4)$	5048.54	2894.2	1.744	0.215

Multiple Regression Results

Education levels of the people in the sample locations were generally very low. The average year of schooling was 3.5 years and there were around 36 illiterate borrowers in the sample, which is more than 50%. Some households that appeared relatively prosperous in the sample had some level of literacy, were more informed and ambitious because every household member was contributing to the income in one or the other way. The other set of relatively poor household, had low level of literacy and information. These household also had low level of ambitions and drive because of which their incomes were low. In the latter households, generally, there was proclivity to meet immediate consumption needs, while in the former the approach was to invest in ongoing economic activity.

It is added that government schools were distantly located in the sample locations; especially in settlements and primary school established with the support of community and PRSP were functional in one location. The demand for education is highly elastic in poorer communities because decrease in income or distance of school from house contributes to increase in illiteracy among poor and very poor.

Family size is not as significant as education and micro credit. Family size may not improve income as much however it provides social and psychological security and protection which is absent due to any formal institutional structure for the purpose. Though, in the sample it was observed that extended families borrowed multiple loans.

Assets have least to do with income improvement. Income of the poor rural households are not function of assets, in fact assets are basic needs: a house, made of mud, for shelter; livestock for provision of food and some income and some other basic household items. Therefore, assets do not increase incomes more than what 'poor' and 'very poor' possess.

In answering the third question whether micro credit supports sustainable livelihood or not, it is concluded from the above discussion that micro credit can provide sustainable living, though presently it is not adequately meeting the objectives. Observations from the survey tell that in sizeable instances micro credit was misdirected and used in meeting routine consumption needs which certainly meets short-term needs but is not channeled to an investment that would provide sustainable livelihood. Beside, the amount of loan is not enough to make meaningful return on investment; a Rs. 10,000 loan is neither here nor there.

# VI. CONCLUSIONS AND POLICY APPROACH

Micro credit is targeted to poor and very poor as according to the definition of PRSP and having changed the definition to 'poor' and 'non-poor' it has made it more ambiguous and vague, the already complex conceptual and definitional dimensions of poverty and poor. Although, poor and very poor are targeted nevertheless the use of loans is quite misdirected with the result repayment of installments became difficult in certain areas. The organization needs to keep in view geographical and cultural aspects while designing loan product and disbursing credit. A uniform size fit all may not give the desired results of credit for investment. A more vigilant and motivated loan staff that makes frequent visits to the community organization in the villages is suggested.

The main lessons learnt are that there are economically and socially diverse settlements and villages in Punjab, Pakistan. Not only these are physically inaccessible in certain cases but also suffer deprivation, because of poor road network, absence of basic health and education facilities to the extent that presence of government seems non-existent. In such situation the responsibility of NGOs like PRSP increases, which diverts and dilutes the core functions. Besides, NGOs are not substitute of government authority and responsibility. It would be appropriate for NGOs to focus on core functions and may coordinate with government departments for effectiveness of their programme, while the main responsibility be handled by government by reforming its institutions.

The participating poor who had repaid loan their income improved with credit however manner of utilization of borrowed amount determines present income and ability to cope with hardship. In the sample 80% of the credit was invested in ongoing economic activities and 20% went to fulfilling consumption needs. Of the 80% of credit nearly 60% went in the investment of livestock. The contribution of PRSP micro credit in investment of livestock (buffalo or cow) is around ¼ of the total cost. The remaining ¾ is mustered through informal sources. The livestock sector has potential to generate income for the poor, therefore, PRSP need to focus on this sector in liaison with the livestock and other related (veterinary services) department and develop credit line for livestock market. PRSP may hire livestock and veterinary expert service who can advise borrowers.

While education and micro credit explain income improvement in the model there are other factors like connectivity of village with urban market where rural poor can sell their product and labour and make sustainable livelihood. Cottage industry can be promoted through micro credit. The producer of handicraft does not receive enough return and many traditional handicrafts at the verge of extinction because of poor access of the producer to the markets either due to poor connectivity or information (despite increased mobile phone usage and prevalence). In cooperation with other organizations supporting traditional art and craft, micro credit can be provided to artisan in the villages to provide sustainable livelihood and income.

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# GROWTH AND PRODUCTIVITY IN PURVIEW OF TRANSITIONAL DYNAMICS IN PAKISTAN AGRICULTURE SECTOR

# ABDUL HAMID and HAFIZ KHALIL AHMAD\*

**Abstract**. Agriculture has been the main stay for the economy of Pakistan. It still supports directly or indirectly more than half of the country's population. This paper aims to analyze the major factors which are responsible for agriculture growth and productivity. Empirical findings show that agriculture productivity is much below its potentials and growth of value-added in this sector still depends on traditional factors of production. Human capital and openness of the economy has a negligible impact on agriculture value-added growth. The study also finds negative impact of technological change and efficiency on employment generation prospects in the agriculture sector of Pakistan.

# I. INTRODUCTION

Agriculture has been the mainstay for the economy of Pakistan since its independence (1947). It is still contributing around 20% to GDP and 43% to total employment. Besides providing employment to 43% labour force, 66% of the population of Pakistan living in rural areas, directly or indirectly depends upon agriculture for their livelihood. It also provides raw material to industry and contributes to country's exports.<sup>1</sup> So any policy change for agriculture sector will affect the economy and a large segment of population in the country.

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<sup>&</sup>lt;sup>1</sup>For details please see Government of Pakistan, *Pakistan Economic Survey* 2006/07.

There has been increasing use of modern machinery along with high yielding varieties of seed and fertilizers which, has helped in increasing agriculture value-added growth and overall GDP growth on one hand, and has squeezed the labour absorptive capacity on the other, especially for those who are illiterate or have acquired only general education. This paper aims to determine the major factors of growth and their absolute and relative shares in the agriculture value-added. It also intends to measure total factor productivity (TFP), the role of technological progress and technical efficiency and their impacts on employment generation prospects in the agriculture.

The layout of the paper is as follows: the review of relevant literature is presented in section II. Section III discusses the methodology, variables and data sources. Discussion of empirical findings and comparisons with some other relevant studies are presented in section IV. Conclusions and policy implications are given in the final section followed by references.

# **II. REIVEW OF LITERATURE**

Robinson (1971) estimated technological change, technical efficiency and spillovers caused by human resource accumulation for 39 developing countries and found that, on average, the share of productivity in total growth was 15% in these economies. This is a much smaller percentage attributable to technological change, technical efficiency and human capital accumulation as compared with 50 percent of developed countries.

Yanrui (1995) estimated technical efficiency for the agriculture and manufacturing sectors of China. According to his estimations, technological change and efficiency contributed about 53% in the state industrial sector, 58% in the rural industrial sector, and 55% in the agriculture sector of China.

Bravo-Ureta and Pinheiro (1997) measured technical, economic, and allocative efficiencies in peasant farming for the Dominican Republic using a survey data for the year 1988. Their empirical findings show that average efficiency in the agriculture sector was 70% (efficiency ranging between 42 to 85%).

Fan (1999) analyzed technological change, technical and allocative efficiency in the Chinese agriculture rice sector during the reform period (1980/93). He found that technical efficiency experienced an annual growth rate of 8.5% during 1980/84 and 1.17% during 1985/93. Average technical efficiency growth rate during the reform period was 3.11%. Technological change experienced an average growth rate of 6.98% during the reference period. Modernization of agriculture sector, agriculture research and development, use of pesticides, high yielding varieties of seed, fertilizers and

modern technology were the major reasons for this significant technological and technical efficiency growth rate.

Mathijs and Vranken (2000) estimated technological change and technical efficiency for Bulgaria and Hungary using the age of farmers as a proxy for farming experience and got a positive relationship between experience and technical efficiency. In their analysis, they used women education as a determinant for total factor productivity and technical efficiency in the agriculture and found a positive impact of education on productivity.

Rattso and Stokke (2003) analyzed the relationship between productivity, growth and foreign spillovers for the agriculture and industrial sectors of Thailand. Their analysis found a long run relationship between productivity growth and foreign spillovers in both agriculture and industry.

Mundlak (2005) studied pattern of economic and productivity growth in American agriculture for the last two centuries. The average growth rate in US agriculture was 1.0% for the period 1800/1940 and 1.94% for the period 1940/90. Growth rate of productivity with respect to land was zero until 1940. Since then it rose to 2.38%. Labour productivity showed an increase from 0.2% in 1900/40 to 4.08% in 1940/90. The change in labour-land ratio declined from zero in 1800/40 to -1.7% in 1940/90 due to development of modern technology and increase in labour efficiency. As new technology and innovations were largely labour saving, this resulted in out migration to other non-agricultural occupations. This off-migration alleviated rural poverty and underemployment from the agriculture sector and provided cheap labour force to other sectors of the economy.

Swinnena and Vrankena (2006) used a unique set of farm survey data from five European transitional economies (Albania, Bulgaria, Czech Republic, Hungary and Slovakia) to measure technological change, technical efficiency and productivity for the period 1997/2001. They found a significant impact of reforms on TFP, technical efficiency and technological change in the agriculture sector of these economies.

Wizarat (1981) and Burney (1986) estimated technological change, technical efficiency, TFP growth and the spillovers from human capital and found that it contributed significantly to Pakistan's GDP.

Ali and Hamid (1996) measured technological change, technical efficiency, productivity and their impact on input demand for the agriculture and manufacturing sectors of Pakistan. According to their findings major contributors to the value-added growth in agriculture and manufacturing were the traditional factors of production with capital contributing over 50

percent in both sectors. Technological change and technical efficiency was found labour-saving and capital-using.

Kemal and Ahmed (1992) and Kemal *et al.* (2002) analyzed technological change, technical efficiency and TFP for Pakistan. According to their findings, overall labour productivity grew at a rate of 1.48 percent for the period 1992/2001. They also made a comparison with other neighboring countries and found that labour productivity growth in Pakistan was lower as compared to its growth in India, Sri Lanka, Bangladesh, Malaysia, Taiwan, and Korea. TFP growth in the agriculture was 0.37% for the sample period. They also found that human resource development, R&D activities, and development of engineering industries (which were the main sources of technical efficiency and productivity growth) had been given less priority and meager resource allocations in Pakistan.

From the literature review given above, it is clear that less attention is given to technological progress, technical efficiency and development of human capital in the agriculture sector of Pakistan. It is thus imperative to devise rigorous policies based on in-depth research of agriculture sector to foster TFP in this sector.

#### **III. METHODOLOGY**

Traditionally, the following production function is used to explain variations in agriculture value-added:

$$Y = f(A, L, K, IP) \tag{1}$$

Where

Y = Value-added in the agriculture

L = Labour employed in the agriculture

K = Capital stock in the agriculture

IP = Intermediate inputs in the agriculture

A = Level of technology

If we include human resource development (activities like education, training, R&D, etc) and the impact of openness of the economy on the valueadded growth in agriculture, the functional form is adapted as:

$$Y = f(A, L, K, IP, H, T)$$
<sup>(2)</sup>

Where

H = Human resources development in the agriculture

 $T = Trade^2$ 

In order to measure the major factors contributing to value-added growth, technological change and technical efficiency (which in-builds overtime due to human capital formation), Cobb-Douglas production function is being applied. Equation (2) in the form of Cobb-Douglas production function with variable technological change can be written as (in departing from the traditional Cobb-Douglas function by incorporating additional factors besides just Labour and Capital):<sup>3</sup>

$$Y_t = A e^{\lambda_t t + \lambda_2 t^2} H_t^{\gamma} K_t^{\alpha} L_t^{\beta} I P_t^{\eta} T_t^{\phi}$$
(3)

Where

t = Time trend

 $\lambda$  = Technological Change parameters

A = Constant term

 $\alpha$  = Elasticity of value-added with respect to capital

 $\beta$  = Elasticity of value-added with respect to labour

 $\gamma$  = Elasticity of value-added with respect to human capital

 $\eta$  = Elasticity of value-added with respect to intermediate inputs

 $\psi$  = Elasticity of value-added with respect to openness of the economy

In view of the possible multicollinearity, between *K* and *L*, the following normalized transformed variables are used for estimations.

$$y_t = Y_t / L_t$$

$$k_t = K_t / L_t$$

 $h_t = H_t / L_t$ 

 $tr_t = T_t / Value-added_t$ 

<sup>&</sup>lt;sup>2</sup>Various definitions like trade to GDP ratio, sum of agriculture exports and imports, share of agriculture exports and imports to total trade etc, are used to measure the impact of openness of the economy on the agriculture growth.

<sup>&</sup>lt;sup>3</sup>The traditional Cobb-Douglas production function assumes as factors of production labour and capital, and constant returns to scale; *i.e.* the sum of elasticities of output with respect to labour and capital is equal to one.

Taking log and using transformed variables, equation (3) in the estimable form can be written as:

$$\ln y_t = \ln A + \lambda_1 t + \lambda_2 t^2 + \alpha_1 \ln k_t + \alpha_2 \ln h_t + \alpha_3 \ln IP_t + \alpha_4 \ln tr_t + u_t \quad (4)$$

# MEASUREMENT OF TOTAL FACTOR PRODUCTIVITY CHANGE INDEX

The total factor productivity (TFP) change index is defined as the difference between rate of change of output and rate of change of inputs:

$$TFP = \dot{y} - \dot{x} \tag{5}$$

Where

 $T\dot{F}P$  = total factor productivity change index

 $\dot{y}$  = rate of change of output

 $\dot{x}$  = rate of change of inputs

TFP growth can be estimated by subtracting the contribution of measured inputs growth from output growth.

# MEASUREMENT OF ABSOLUTE AND RELATIVE CONTRIBUTION

The method for calculation of absolute contribution was introduced by Hicks (1979) and calculation of relative contribution by Hadjimichael *et al.* (1995). The absolute share of any factor of production towards growth can be found by multiplying the estimated coefficient of the explanatory variable by the standard deviation of the respective explanatory variable. The relative contribution for each independent variable can be measured by dividing its estimated absolute share by the standard deviation of the transmission of the dependent variable. The relative share of variables will be unit free.

#### **Data and Variables Description**

Measurement of major factors contributing to value-added growth and productivity, technological change and technical efficiency and their impact on employment generation prospects in the agriculture sector of Pakistan is based on the following variables and data sources (data series cover the period from 1972/73 to 2006/07). All the data are on constant market prices of 1980/81.

# Value-added

1. Real Value-added in the agriculture sector on constant market prices

- 2. Growth rate of real agriculture value-added (percent)
- 3. Agriculture value-added per employee
- 4. Growth rate of per employee value-added (percent)

# Labour

With following specifications:

- 1. Number of employed workers in the agriculture and total labour force available
- 2. Growth rate of Labour Force (percent)

# **MEASURES OF HUMAN CAPITAL**

With following specifications:

- 1. Expenditure on education and health
- 2. Expenditure on R&D
- 3. Number of professionals in agriculture
- 4. Percentage of skilled, technical and professional workers in the total labour force employed in agriculture
- 6. Growth of expenditure on education and training (percent)

#### **Capital Stock**

Capital stock in the agriculture is measured by using perpetual inventory method as per following equation:

$$K_t = I_t + (1 - \varphi) K_{t-1}$$
(6)

Where

 $K_t$  = Capital Stock in the current year

 $K_{t-1}$  = Capital Stock in the previous year

 $I_t$  = Current Year Investment or Gross Fixed Capital Formation<sup>4</sup>

 $\varphi$  = Depreciation rate

<sup>&</sup>lt;sup>4</sup>If capital stock is measured at the end of the year, current year investment is used and if capital stock is calculated at the beginning of the year, previous year investment or gross fixed capital formation is used. We have calculated the capital stock at the beginning of the year.

For estimating the initial capital stock K(0), the method used by Nehru and Dhareshwar (1993) and Khan (2006) is being followed. Capital stock series is generated in the following way:

$$K_t = I_t + (1 - \varphi)^t K_{(0)} + \sum_{i=0}^{t-1} I_{t-i} (1 - \varphi)^t$$
(7)

Where

 $K_{(0)}$  = initial capital stock in the base year

Nehru and Dhareshwar (1993) and Khan (2006) used a modified Harberger (1978) method to estimate  $K_{(0)}$ . The value of investment for the first year is estimated by way of a linear regression equation of the log of investment against time. The estimated value of investment for the base or zero year is used to calculate  $K_{(0)}$  as per following equation:

$$K_{(0)} = I_t / (gr + \phi)$$
 (8)

Where

gr = Compound growth rate of value-added in agriculture

 $\varphi$  = Depreciation rate

Various depreciation rates have been used in empirical studies. Here, 5 percent capital depreciation rate is assumed as used by Yanrui (2000).<sup>5</sup>

#### **Intermediate Inputs**

Intermediate inputs include fertilizers, high yielding variety of seeds, pesticides, etc.

#### Trade

Trade and openness of the economy are expected to have a positive impact on value-added growth and productivity in the agriculture. Various definitions like, sum of the agriculture exports and imports, share of agriculture exports and imports to total trade, the sum of foreign direct investment, exports and imports as percentage of GDP are used to measure the impact of openness of the economy on agriculture value-added growth.

#### **Sources of Data**

Data sources include the following:

<sup>&</sup>lt;sup>5</sup>Several other studies use 4 percent depreciation rate [*e.g.*, Nehru and Dhareshwar (1993), Collins and Bosworth (1996) and Khan (2006), etc.].

- Pakistan Economic Survey (various issues)
- Labour Force Survey (various issues)
- Agriculture Census (various issues)
- Annual Education Statistics
- Pakistan Statistical Year Book (various issues)
- Federal Bureau of Statistics (1999), 50 Years of Pakistan in Statistics, Volume I-IV. Islamabad: Government of Pakistan.
- Kemal, A. R. (1993), Sources of Growth in Pakistan. Report on Economic and Social Well-being for the Eighth Five Year Plan.
- Human Development Report, UNDP (various issues)
- World Development Report, the World Bank (various issues)

# **IV. EMPIRICAL FINDINGS**

Measurement of major determinants of growth in a closed economy and in an open economy and the calculation of their relative and absolute shares to the value-added growth in the agriculture sector of Pakistan are presented in this section. The measurement of total factor productivity change index (TFPI), labour productivity and its index, agriculture value-added, capital, labour, capital-labour ratio, land-labour ratio, their indices are given in this section. A graphical presentation of these is given. It also discusses the impact of technological changes and technical efficiency on employment generation prospects in the agriculture sector of Pakistan.

# MAJOR DETERMINANTS OF GROWTH IN AGRICULTURE

#### **Physical Factors**

Estimated results presented in Table 1 show that the traditional factors of production are the main contributors towards value-added growth in the agriculture. Equation (1) in Table 1 shows the estimations for a closed economy. Estimated coefficient for K/L is 0.55 and is significant at 1 percent level of significance, showing that capital per employee in the agriculture is an important determinant of value-added growth. Equation (2) shows the estimations when overall trade to GDP ratio was used as an explanatory variable to measure the impact of the openness of the economy. The estimated coefficient for K/L is 0.87 and is significant at 1 percent level of significance. In equation (3), the sum of agriculture exports and imports is used as an explanatory variable as a proxy for the openness of the economy.

TABLE 1

OLS Estimates for Cobb-Douglas Production Functions (Agriculture) 1971-72 to 2005-06

		_					_	_					
u	35		35		35		35			ices			
Prob (F- stat)	0.00		00.00		00.00		00.00		culture	0-81 pr			
DW stat	1.44		2.57		2.07 <sup>e</sup>		2.51		n Agric	at 198			
${\mathop{\rm Adj}}_{{\mathop{\rm R}}^2}.$	0.96		0.52		0.98		0.54		Force i	Stock		ations	
$\mathbb{R}^2$	0.97		0.58		0.98		0.59		abour ]	Capital	tal	bserv:	m
SER	0.04		0.03		0.03		0.03		yed La	ulture (	n Capi	er of C	ant Ter
ln (Trade)	1		0.05	(0.65)	0.040	(1.38)	0.03	(1.19)	Emplo	Agricu	Huma	Numb	Consta
ln IP)	35*	(59.	1		L		L		Ш	11	K =	ll	II
	0	5						_	Γ	X	Η	u	0
ln (HK)	1		0.02	(1.00)	0.016	(0.89)	0.018	(0.97)					ethod
ln (K/L)	0.55***	(3.32)	0.87***	(6.04)	0.88***	(6.23)	***06.0	(6.25)					Orcutt M
$\lambda_2$	0.00045***	(2.55)	0.0004	(1.30)	0.0003***	(2.44)	0.00045	(1.43)	os.	el	1	I	by Cochrane
$\lambda_1$	-0.0146	(1.27)	I		-0.0103	(1.37)	I		s are t-rati	percent lev	srcent leve	crcent leve	orrelation
C	1.268	(0.70)	-0.012	(0.88)	0.314	(0.24)	-0.017	(1.17)	arenthesi	cant at 1 p	int at 5 pe	it at 10 pe	or Autoco
Depen- dent Variable	ln (Y/L)		ln (Y/L)		ln (Y/L)		ln (Y/L)		Values in p	***Signific	**Significa	*Significan	Corrected f
Equations	Closed Economy	(IP)	Open <sup>ce</sup> Fconomy	(Tr/gdp)	Open Fconomy	(Agr XM)	Open <sup>ce</sup> Economy	(Agri X)	Notes:	*	*	*	ہ = ا

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 $\lambda_1 \& \lambda_2 =$  Measurement of Technological Changes IP = Intermediate Inputs X = Agriculture Exports

II υ

Corrected for Autocorrelation by Cochrane Orcutt Method

Equations estimated by taking first difference

II 11

ee e

Standard Error of Regression

Intermediate Inputs Agriculture Exports

Trade to GDP ratio

11

Tr/gdp

Agri Value-added at constant factor cost of 1980-81 Prices

Agriculture Exports and Imports as ratio to total XM

SER= XM = Y =

TABLE 2

Absolute and Relative Contributions of Major Determinants of Value-added Growth (Explanatory Variables) (Agriculture)

		Relative Share	0.818	0.036	l.	0.176	1	I	
	quation 3	Absolute Share	0.184	0.008	I	0.0397	I	I	
	Ec	Estimated Coefficients	0.880	0.016	I	0.040	I	I	to GDP ratio;
		Relative Share	0.791	0.031	0.050	I	I	I	p = Trade
	quation 2	Absolute Share	0.178	0.007	0.0113	I	I	I	ure; Tr/gd
(Aminut)	Ec	Estimated Coefficients	0.850	0.014	0.060	I	I	I	ck in Agricult
		Relative Share	0.511	Ι	I	Ι	0.400	1	apital Sto
	quation 1	Absolute Share	0.115	I	I	I	060.0	I	ture; $K = C$
	E	Estimated Coefficients	0.550	I	I	I	0.350	I	ed in Agricult
	Estimated	Standard Deviations	0.209	0.510	0.188	0.994	0.256	0.225	= Value-add
		Explanatory Variables	ln (K/L)	ln (HK)	ln (Tr/gdp)	ln (XM)	ln (IP)	Dependent Variable ln (Y/L	Note: Y :

L = Labour Employed in Agriculture; HK = Human Capital; XM = Agriculture Exports and Imports; IP = Intermediate Inputs

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The estimated coefficient for K/L is 0.88 and is significant at 1 percent level of significance. Equation (4) assumed agriculture exports as one of the explanatory variables. The estimated coefficient for K/L in this equation is 0.90 and is significant at 1 percent level of significance. Estimated coefficients for physical factors in all the equations are positive and statistically significant, indicating that these are the major contributors towards agriculture value-added.

#### **Human Capital**

Total enrollment in the agriculture professional colleges, universities and other institutes as a ratio to total employed labour force in the agriculture is used as a proxy to measure the impact of human capital (HK) in the agriculture sector.<sup>6</sup> Estimated coefficients for HK show positive correlation between human capital and agriculture value-added but are statistically insignificant.

# **Openness of the Economy**

To measure the impact of international trade and openness of the economy on the agriculture value-added growth, three definitions have been used as a proxy for openness, *i.e.* total trade to GDP ratio (equation 2), the sum of agriculture exports and imports (equation 3) and agriculture exports (equation 4). Estimated coefficients in all three cases show positive impact of trade on value-added growth but are statistically insignificant. Main reasons for this insignificant impact may be that agriculture sector in Pakistan has been working traditionally and yield per acre has been very low. Secondly, Pakistan has given much emphasis on manufactured exports and the share of primary commodity exports has declined form 45 percent in 1971/72 to 11 percent in 2005/06. Thirdly, lack of adequate facilities for packing, storing and conservation of food products and other perishable agriculture items like fruits, vegetables and live stock products, etc., are the major hurdles for accelerated agriculture exports.

#### **Intermediate Inputs**

Intermediate inputs like, fertilizers, pesticides, high yielding varieties of seed, etc. play a major role in the growth of agriculture value-added. The impact of intermediate inputs is measured in equation (1) in Table 1. Estimates show that intermediate inputs contribute significantly to the value-added growth in agriculture.

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<sup>&</sup>lt;sup>6</sup>Four years lag for enrollment in the agriculture professional colleges, universities and other institutes is used to measure human resource development impacts in the agriculture sector.

# Technology

The estimated results show that continuous technological changes have been taking place in agriculture. All the coefficients are according to theoretical expectations and are statistically significant indicating that technological change and spillovers are positively affecting the growth of value-added in the agriculture.

# ABSOLUTE AND RELATIVE CONTRIBUTION OF MAJOR DETERMINANTS OF VALUE-ADDED GROWTH

The estimated results are depicted in Table 2. In equation (1), the absolute shares for K/L and intermediate inputs are 0.115 and 0.090 respectively. The relative shares for both variables follow the same pattern. The relative share for capital-labour ratio is 0.511 and for intermediate inputs is 0.40. In equation (2), estimated absolute shares for K/L, human capital and trade are 0.178, 0.007 and 0.0113 respectively. The relative shares follow the same sequence, *i.e.* the maximum share is contributed by K/L, followed by trade and human capital. Estimated results for equation (3) show that the absolute share for K/L is 0.184, followed by agriculture exports and imports (0.0397) and human capital are 0.818, 0.176 and 0.036 respectively. These results support the estimations presented in Table 1 that agriculture value-added growth depends heavily on physical factors of production and human capital contributes insignificantly.

# TOTAL FACTOR PRODUCTIVITY CHANGE INDEX

Table 3 presents the calculations for TFP change index in agriculture. As already mentioned, TFP change is measured as the difference between rate of change of output and the weighted rate of change of inputs. Column (2) shows the rate of change of value-added in agriculture over time, while columns (3), (4) and (5) show weighted rates of change of inputs. The aggregated weighted rate of change of inputs is presented in column (6). The difference between column (2) and column (6), *i.e.* difference between rate of change of value-added and the rate of change of aggregated weighted inputs is given in column (7) which is the TFP change over time. TFP change for the agriculture sector shows a mix pattern. It experienced a positive growth during 1972/73 to 1981/82. It showed negative growth rates for the next three years, *i.e.* 1982/83 to 1984/85. TFP in the agriculture experienced positive growth rates during the period 1985-86 to 1999-2000 except for the years 1989/90 and 1991/92. However, since 2000/01 agriculture TFP growth rate has continuously been negative. The reason for

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	TFPI	100.00	100.36	101.64	102.77	106.67	110.08	114.31	117.56	120.54	121.76	118.65	116.36	115.82	117.68	118.73	119.71	121.97
	$T\dot{F}P$		0.0036	0.0128	0.0113	0.0389	0.0341	0.0423	0.0326	0.0298	0.0122	-0.0312	-0.0228	-0.0054	0.0185	0.0105	0.0098	0.0226
)	Aggregated Inputs		0.0060	0.0060	0.0050	-0.0026	-0.0011	0.0006	0.0115	0.0185	0.0314	0.0441	0.0565	0.0448	0.0465	0.0287	0.0333	0.0194
,	$\dot{T}r$		0.0032	0.0025	0.0013	0.0038	0.0057	0.0081	0.0154	0.0082	0.0087	0.0018	0.0046	0.0032	0.0040	0.0051	0.0055	0.0055
-	Η̈́K		0.0014	0.0010	0.0008	0.0001	0.0006	0.0003	0.0007	0.0005	0.0006	0.0008	0.0007	0.0008	0.0006	0.0011	0.0012	0.0012
	Ķ/L		0.0014	0.0026	0.0028	-0.0064	-0.0074	-0.0078	-0.0047	0.0097	0.0220	0.0415	0.0511	0.0408	0.0419	0.0225	0.0267	0.0126
	Ý		0.0096	0.0189	0.0163	0.0364	0.0330	0.0429	0.0441	0.0482	0.0436	0.0129	0.0337	0.0394	0.0650	0.0393	0.0432	0.0420
	Year	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89

Agriculture TFP Change Index (1972-73 to 2004-05) Based on Estimates Using Equation 1 (3-Years Moving Average) Table 3

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																	or
121.16	122.00	120.33	124.21	124.56	129.42	133.08	142.31	149.51	156.37	156.38	150.97	143.50	137.63	135.81	131.21		= Total Facto
-0.0081	0.0084	-0.0167	0.0388	0.0035	0.0486	0.0366	0.0923	0.0720	0.0686	0.0001	-0.0542	-0.0747	-0.0587	-0.0182	-0.0460	0.0098	= Trade; TFP =
0.0573	0.0508	0.0444	-0.0096	0.0176	0.0102	0.0235	-0.0390	-0.0320	-0.0265	0.0166	0.0642	0.0787	0.0799	0.0622	0.0841	0.0260	an Capital: Tr
0.0044	0.0065	0.0048	0.0024	0.0013	0.0031	0.0040	0.0005	-0.0009	-0.0029	0.0007	0.0007	0.0042	0.0035	0.0077	0.0014	0.0040	tio; HK = Hum
0.0006	0.0008	0.0006	0.0009	0.0014	0.0015	0.0013	0.0004	0.0003	0.0004	0.0007	0.0008	0.0003	0.0003	-0.0001	0.0000	0.0007	tal to Labour ra
0.0522	0.0434	0.0390	-0.0129	0.0148	0.0056	0.0182	-0.0399	-0.0313	-0.0241	0.0153	0.0628	0.0742	0.0761	0.0546	0.0827	0.0213	ed; K/L = Capit
0.0491	0.0592	0.0277	0.0292	0.0211	0.0588	0.0602	0.0532	0.0400	0.0421	0.0168	0.0101	0.0040	0.0213	0.0440	0.0382	0.0357	Agri Value-adde
1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	Average	Notes: $Y = J$

Fa	
Total	
11	
TFP	
Trade;	
Tr =	
Capital;	
Human	
HK	dex
ie-added; K/L = Capital to Labour ratio;	FPI = Total Factor Productivity Change In
Y = Agri Valu	Productivity; T

Where over dots show the change over time

Growth rates for K/L, HK and Tr are weighted growth rates

Weights are taken from estimated equation 2 in Table 1.

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	TFPI	100.00	98.95	98.76	98.27	100.00	101.13	103.29	105.58	107.70	108.79	105.58	103.53	102.60	104.25	104.81	105.84	108.10
``````````````````````````````````````	$T\dot{F}P$		-0.0105	-0.0019	-0.0049	0.0172	0.0114	0.0216	0.0229	0.0211	0.0110	-0.0321	-0.0205	-0.0093	0.0165	0.0056	0.0103	0.0226
>	Aggregated Inputs		0.0201	0.0208	0.0212	0.0191	0.0216	0.0213	0.0212	0.0271	0.0326	0.0450	0.0541	0.0488	0.0485	0.0337	0.0329	0.0194
	İP		0.0192	0.0191	0.0194	0.0232	0.0263	0.0263	0.0242	0.0209	0.0185	0.0185	0.0214	0.0226	0.0217	0.0192	0.0159	0.0113
	Ķ/L		0.0009	0.0016	0.0018	-0.0041	-0.0047	-0.0050	-0.0030	0.0062	0.0141	0.0266	0.0327	0.0261	0.0268	0.0144	0.0171	0.0081
norma	Ý		0.0096	0.0189	0.0163	0.0364	0.0330	0.0429	0.0441	0.0482	0.0436	0.0129	0.0337	0.0394	0.0650	0.0393	0.0432	0.0420
	Year	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89

Agriculture TFP Change Index (1972-73 to 2004-05) Based on Estimates Using Equation 2 (3-Years Moving Average)

TABLE 4

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stor Productivity;	s; TFP = Total Fac	Intermediate Input	abour ratio; IP =	K/L = Capital to I	Agri Value-added;	Notes: $Y = I$
	0.0072	0.0286	0.0150	0.0136	0.0357	Average
122.94	-0.0187	0.0568	0.0039	0.0529	0.0382	2004-05
124.81	-0.0068	0.0508	0.0159	0.0349	0.0440	2003-04
125.49	-0.0360	0.0573	0.0086	0.0487	0.0213	2002-03
129.09	-0.0510	0.0550	0.0075	0.0475	0.0040	2001-02
134.18	-0.0401	0.0501	0.0100	0.0401	0.0101	2000-01
138.19	-0.0029	0.0196	0.0099	0.0098	0.0168	1999-00
138.47	0.0458	-0.0037	0.0117	-0.0154	0.0421	1998-99
133.89	0.0541	-0.0141	0.0060	-0.0200	0.0400	1997-98
128.48	0.0660	-0.0128	0.0128	-0.0255	0.0532	1996-97
121.88	0.0389	0.0212	0.0096	0.0116	0.0602	1995-96
117.99	0.0436	0.0151	0.0116	0.0036	0.0588	1994-95
113.63	0.0009	0.0202	0.0107	0.0095	0.0211	1993-94
113.54	0.0271	0.0020	0.0103	-0.0083	0.0292	1992-93
110.83	-0.0076	0.0353	0.0104	0.0250	0.0277	1991-92
111.59	0.0261	0.0331	0.0053	0.0278	0.0592	1990-91
108.98	0.0088	0.0403	0.0069	0.0334	0.0491	1989-90

Where over dots show the change over time

Growth rates for K/L, and IP are weighted growth rates

Weights are taken from estimated equation (1) in Table 1

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Productivity 120.18 108.50 118.69 100.35 103.84 108.14 110.79 112.54 106.41 Labour-100.00 99.46 99.15 101.91 99.39 99.92 Index 6548.30 Mov Ave 5536.45 5622.73 5986.02 6630.34 5487.33 5470.48 5512.84 6208.81 5729.19 5871.05 3-Years 5517.18 5483.31 5966.11 6112.51 Agriculture Labour Productivity and its Index (3-Years Moving Average) Productivity 5854.33 5567.52 6110.61 6432.31 6399.52 6813.06 5407.89 5506.88 5534.95 5765.73 5993.11 5557.41 5496.68 Labour 5509.50 5484.62 5794.61 Mov Ave 3-Years 14.16 12.13 12.45 12.76 13.05 13.36 13.58 13.70 14.01 11.46 11.79 11.05 11.25 10.87Labour 13.35 14.6012.75 13.05 13.67 13.72 11.13 11.15 11.46 11.78 12.13 12.47 13.71 10.63 10.86 83740.33 87040.67 92697.67 70026.33 73113.00 76640.00 79979.67 81014.00 Mov Ave 59994.33 60571.67 61714.67 62720.33 65000.67 67145.67 3-Years 79502 80008 83532 93433 Agri Y 58566 60298 62992 67139 73513 76399 88187 59563 61854 69427 64871 1978-79 1981-82 1984-85 1985-86 1982-83 1983-84 1973-74 1974-75 1975-76 1976-77 1977-78 1979-80 1980-81 1972-73 1971-72 Year

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123.45

6810.78

6678.44

14.75

100499.33 96338.00

99108

1987-88

96473

1986-87

14.53

14.16 14.84

1988-89	105917	104717.33	15.26	15.24	6940.83	6867.05	124.47
1989-90	109127	109862.00	15.63	15.03	6981.89	7327.79	132.82
1990-91	114542	116364.67	14.21	14.94	8060.66	7805.13	141.47
1991-92	125425	119587.33	14.98	14.88	8372.83	8040.83	145.74
1992-93	118795	123075.00	15.45	15.52	7689.00	7938.83	143.89
1993-94	125005	125671.67	16.12	15.57	7754.65	8080.84	146.47
1994-95	133215	133055.33	15.14	15.59	8798.88	8548.94	154.95
1995-96	140946	141059.00	15.50	15.39	9093.29	9164.57	166.11
1996-97	149016	148570.00	15.52	16.16	9601.55	9205.04	166.84
1997-98	155748	154515.67	17.46	16.94	8920.27	9139.08	165.65
1998-99	158783	161022.33	17.85	17.79	8895.41	9047.51	163.99
1999-00	168536	163721.33	18.07	18.13	9326.84	9031.04	163.69
2000-01	163845	165370.67	18.47	17.74	8870.87	9337.91	169.25
2001-02	163731	166033.00	16.68	17.39	9816.01	9566.66	173.40
2002-03	170523	169566.33	17.03	17.30	10013.09	9808.18	177.78
2003-04	174445	177033.33	18.18	17.94	9595.43	9871.88	178.93
2004-05	186132	183787.67	18.60	18.57	10007.10	9891.90	179.29
2005-06	190786		18.94		10073.18		
Sources: Pak	istan Economic	Survey (Various i	issues)				

arious issue
>
$\smile$
Survey
Economic
Pakistan
Sources:

National Accounts of Pakistan

50 Years of Pakistan in Statistics, Volume I-IV Pakistan Statistical Yearbook (Various issues)

1

 this negative TFP growth rate may be that during last five years of the sample period (except for 2004/05) agriculture growth rate remained either negative or very negilible.<sup>7</sup> Three-years moving average growth rates for value-added, aggregated inputs and TFP in the agriculture sector for the sample period are 0.0357, 0.0260 and 0.0098 respectively. The last column in Table 3 is TFP change index which has increased from 100 in 1972/73 to 131.21 in 2005/06. It experienced the maximum value in 1999/2000 which was 156.38. After that it has a declining trend due to negative TFP growth rate during the last five years of the sample period.

An alternative measure of TFP is depicted in Table 4. Weights for its calculations have been used form estimated equation (1) in Table 1. Threeyears moving average growth rate for value-added is presented in column (2). Column (3) shows three-years moving weighted growth rate for K/L. Weighted growth rate for intermediate inputs is given in column (4). Column (5) depicts the aggregated weighted inputs growth rates. Change in TFP is the difference between column (2) and column (5), *i.e.* difference between value-added growth and aggregated weighted inputs growth rate. TFP change shows almost the same pattern as depicted in Table 3.

Graphical presentation for TFP change index, calculated from equation (1) and equation (2), is given in Figures 1 and 2. Both figures show almost the same trends for TFP indices. TFP change index shows an increasing trend but at a slower rate, indicating that technological changes and technical efficiency along with human capital are not playing significant role in the value-added growth.

#### LABOUR PRODUCTIVITY

Table 5 presents value-added, employed labour force, labour productivity and its index in the agriculture.<sup>8</sup> The labour productivity increased from Rs. 5510 in 1971/72 to Rs. 10073 in the year 2005/06.<sup>9</sup> Labour productivity index is presented as three-years moving average. It shows a declining trend for the initial five years of the sample period. The major causes for this may be the separation of East Pakistan in 1971, as jute crop in East Pakistan had been one of the major cash crops of Pakistan. Secondly, drastic policy

<sup>&</sup>lt;sup>7</sup>Government of Pakistan, Pakistan Economic Survey 2005/06.

<sup>&</sup>lt;sup>8</sup>Agriculture Labour Productivity is calculated by dividing agriculture value-added at constant prices of 1980/81 by the labour employed in the sector.

<sup>&</sup>lt;sup>9</sup>The value of Agriculture value-added and labour productivity is given at constant prices of 1980/81.

changes for the industrial sector in the form of nationalization during 1970s (as nationalization policy caused significant decline in the industrial growth and performance, and had negative impacts on the economy and on other sectors including agriculture as intermediate inputs and mechanization of agriculture directly depends on industrial sector). The impacts of above mentioned factors can be seen from the annual average growth of agriculture sector during 1970s which was only 2.4 percent while during 1960s it was 5.1 percent and during 1980s it remained 5.4 percent. The overall labour productivity index increased from 100 in 1972/73 to 179.29 in 2004/05. The mechanization of agriculture sector and use of improved intermediate inputs like fertilizers, pesticides and high yielding varieties of seed has led to increase in the labour productivity over the sample period. However, the performance of agriculture sector in Pakistan still lags far behind the performance and productivity in developed and in many developing countries.

# TRENDS OF AGRICULTURE VALUE-ADDED, INPUTS INDICES AND EMPLOYMENT GENERATION PROSPECTS

Table 6 shows agriculture value-added index, labour index, agriculture capital stock index, capital to labour ratio and K/L index, land-labour ratio and its index.<sup>10</sup> The value of agriculture value-added index has increased from 100 in the year 1972/73 to 306.34 in 2004/05 compared with the value of capital index from 100 to 365.88 and that of labour from 100 to 170.87 during the same period. Value of capital-labour ratio increased from Rs. 8894.10 to 19050.82 and its index value increased from 100 to 214.20 for the same period.<sup>11</sup> Figure 3 gives the graphical presentation of value-added, capital and labour indices. The Land-labour ratio has declined overtime. The value of land-labour ratio shows a decline form 1.77 in 1972/73 to 1.19 in the year 2004/05. Its index decreased from 100 to 67.52 for the same period.

The values in Table 6 and graphical trends presented in Figures 3 and 4 show that elasticity of labour with respect to value-added is very low. The process of mechanization in the agriculture is labour-saving (as has been explained by capital and labour indices during the reference period). Mundlak (2005) also found that in the US agriculture sector, technological changes and technical efficiency lead to labour saving and out-migration. Though agriculture is still the mainstay for employed labour force in Pakistan, with the mechanization process and technological changes, its

<sup>&</sup>lt;sup>10</sup>The values of indices are given in three years moving average.

 $<sup>^{11}</sup>$ *K/L* values are at constant prices of 1980/81.

(3-Years Moving Average)	Land/ Labour Index		100.00	99.22	98.63	97.39	95.57	93.17	91.46	89.56	88.18	86.27	84.89	84.41	83.03	82.96	80.87	79.74
	Land- Labour ratio		1.77	1.75	1.74	1.72	1.69	1.64	1.61	1.58	1.56	1.52	1.50	1.49	1.47	1.46	1.43	1.41
	K/Labour Index		100.00	100.16	100.46	100.80	100.04	99.18	98.29	97.75	98.86	101.40	106.29	112.61	117.96	123.70	126.95	130.88
	K/L ratio		8894.10	8908.75	8935.46	8964.92	8897.96	8821.55	8741.81	8694.39	8792.96	9018.31	9453.86	10016.04	10491.67	11002.39	11290.71	11641.04
	K-Index		100.00	101.76	103.91	106.27	108.48	110.62	112.54	114.69	118.65	124.55	132.75	141.89	151.99	161.06	169.68	177.59
	Labour- Index		100.00	101.63	103.47	105.46	108.46	111.56	114.54	117.36	120.06	122.88	124.93	126.03	128.89	130.24	133.70	135.73
	Y-Index		100.00	100.96	102.87	104.54	108.34	111.92	116.72	121.87	127.75	133.31	135.04	139.58	145.08	154.51	160.58	167.51
	Year 1971-72		1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88

TABLE 6

Value-added, Labour, Capital, Capital-Labour ratio and Land-Labour ratio Indices in the Agriculture Sector

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# Pakistan Economic and Social Review

76.94	78.39	79.30	80.47	77.84	78.17	78.42	80.02	76.67	73.40	69.87	68.75	70.63	72.31	72.70	69.98	67.52		
1.36	1.38	1.40	1.42	1.37	1.38	1.38	1.41	1.35	1.30	1.23	1.21	1.25	1.28	1.28	1.24	1.19		
132.81	140.88	147.99	154.71	152.39	155.02	156.02	159.32	151.92	146.38	142.29	144.81	155.38	168.79	183.74	195.40	214.20		
11812.21	12529.66	13162.67	13759.78	13553.32	13787.30	13876.36	14170.18	13511.97	13019.46	12655.11	12879.76	13819.75	15012.64	16341.95	17379.16	19050.82		
186.18	194.77	203.34	211.71	217.46	221.97	223.65	225.45	225.78	228.10	232.84	241.46	253.51	270.01	292.28	322.33	365.88		
140.23	138.30	137.44	136.89	142.75	143.24	143.39	141.55	148.67	155.87	163.69	166.79	163.20	160.01	159.12	165.01	170.87		
174.55	183.12	193.96	199.33	205.14	209.47	221.78	235.12	247.64	257.55	268.40	272.89	275.64	276.75	282.64	295.08	306.34		
1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	

Sources: Pakistan Economic Survey (Various issues)

National Accounts of Pakistan

50 Years of Pakistan in Statistics, Volume I-IV Kemal (1993) Pakistan Statistical Yearbook (Various issues)

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Total Factor Productivity in Agriculture Sector (Based on Equation 1)





Total Factor Productivity in Agriculture Sector (Based on Equation 2)





Agriculture Value-added, Labour and Capital Indices









labour absorptive capacity has been squeezing overtime. The provision of employment opportunities to the displaced labour from the agriculture sector due to modernization and new entrants with general or no education in the labour market will be one of the most crucial challenges for the policy makers and planners in Pakistan.<sup>12</sup>

# V. SUMMARY AND CONCLUSIONS

Empirical findings show that major contributors in the agriculture valueadded growth are conventional factors of production. Human capital is contributing insignificantly. Labour productivity remained not only low but it also declined over time. Land-labour ratio also declined during the sample period. These results show that agriculture sector which has been the mainstay for the economy of Pakistan is not working according to its potentials. Policy makers have failed to provide any stable infrastructure and required skilled human capital which could enable this sector to work on commercial and competitive basis. Based on the above analysis following suggestions are made:

- Agriculture, producing still on a traditional basis, needs to be commercialized and made more competitive by facilitating modernized packing, storing and food processing, in particular, for perishable items like fruits, vegetables, live stock and meat products.
- Development of agro-based and small-scale industries will not only provide opportunities to commercialize agriculture but also enhance employment in rural areas.
- Millions of acres still remain uncultivated due to lack of irrigation and non-availability of other inputs calling on policy makers to pro-actively address these issues by giving them priority.
- Addressing the informal sector as a strategy to enhance living and employment conditions to a wider segment of the population by way of providing micro-loans, basic managerial guidance and training.

<sup>&</sup>lt;sup>12</sup>As agriculture has been the main absorber of labour force with no or general education. Mechanization and modernization of agriculture over time will squeeze the opportunities for such type of labour force and there will be more demand for technically and professionally trained labour force.
- Though highly sophisticated technology is essential for the economy, but along with this, medium and small enterprises with more labour-intensive technology must also be given due attention.
- Strengthening of agriculture research and development activities by emphasizing on vocational and technical training and agro-based professional education so that agriculture sector can be made more commercial and competitive.

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# UNEMPLOYMENT, POVERTY, INFLATION AND CRIME NEXUS: COINTEGRATION AND CAUSALITY ANALYSIS OF PAKISTAN

# SYED YASIR MAHMOOD GILLANI HAFEEZ UR REHMAN and ABID RASHEED GILL\*

**Abstract**. This study is designed to investigate the relationship between crime and various economic indicators such as unemployment, poverty and inflation in Pakistan. The study covers the period for 1975-2007. The stationary properties of the time series data are examined by using Augmented Dickey-Fuller (ADF) test. Johansen Maximum Likelihood Cointegration and Granger Causality tests are applied to find out long-run relationship along with causality among the variables. The findings of the tests provide evidence of the existence of long-run cointegration relationship among crime, unemployment, poverty and inflation. The Granger causality has been tested through Toda-Yamamoto procedure. The causality results show that crime is Granger caused by unemployment, poverty and inflation in Pakistan.

# I. INTRODUCTION

Crimes have always plagued every society in human history. The history of crime is as old as history of mankind. The first crime was committed by Cain, the first son of Adam and Eve, when he murdered his brother Abel out of jealousy.

Crime is a major source of insecurity and discomfort in every society. There is no doubt that crime inflicts enormous monetary and psychological

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costs on society. The act of criminality gives rise to the feeling of insecurity and fear to those who have not been a victim as well. This sense of panic of being victimized generates negative effects on well being.

Crime can be defined as a wrongdoing classified by the state or the parliament of the country or law of the land. Each country sets out series of acts (crime), which are prohibited, and punishes a criminal of these acts by a fine or imprisonment or both.

There is no universal and permanent definition of crime. It differs in different times in different regions. According to Curzen, "A crime as an act or omission of human conduct harmful to others which the state is bound to prevent. It renders the deviant person liable to punishment as a result of proceedings initiated by the state organs assigned to ascertain the nature, the extent and the legal consequences of that person's wrongness" (see Auolak, 1999).

The literature on Economics of Crime sprang from the seminal contribution by Becker (1968) and Ehrlich (1973). In 1968, Becker presented a paper which changed the way of thinking about criminal behaviour. He was the one who built first model of criminal choice stressing that "some individuals become criminals because of the financial and other rewards from crime compared to legal work, taking account of the likelihood of apprehension and conviction, and the severity of punishment."

The Becker's paper opened the door to a new field of empirical research whose main purpose was to verify and study the socioeconomic variables that affect crime. The economics of crime interacts with different and heterogeneous fields, *i.e.* (Sociology, Criminology, Psychology, Geography and Demography) and it is closely related to poverty, social exclusion, wage and income inequality, cultural and family background, level of education and other economic and socio-demographic factors that may affect an individual's propensity to commit crime such as age, gender and urbanization.

Economics of crime has become a new field of investigation, particularly due to the fact that there has been a rapid increase in criminal activities in various western and eastern countries of the world. There is a vast amount of literature available on the relationship between crime and their major determinants in countries like United States, United Kingdom, Germany and Italy. Some studies are also conducted which have analyzed the determinants of crime in Latin American countries such as Colombia and Argentina, *e.g.* Buohanno (2003).

No in-depth and systematic study of the impact of lawlessness on Pakistan's economy has been undertaken so far. Stray articles have appeared in newspapers and magazines highlighting the adverse impact of disturbances but the problem has not been examined in any coherent way from the standpoint of national economy as a whole. This study is an attempt to identify and examine the economic factors responsible for promoting crime in Pakistan. The main objective of the study is to analyze empirically the relationship between crime and major economic factors (unemployment, poverty and inflation) and to recommend policy measures to help check and prevent crime rate in Pakistan.

The remainder of the paper is organized as follows. In section II, relevant literature is reviewed. Section III presents crime scene in Pakistan. Methodology is discussed in section IV. The results of the study are elaborated in section V. Conclusions are presented in section VI and finally section VII presents proposed suggestions.

#### **II. REVIEW OF PREVIOUS STUDIES**

Many studies have been conducted on the relationship between crime and its determinants. The results of these studies show that these various factors are responsible for promoting crime in the world.

Fleisher (1966) studied the role of income on the decision to commit criminal acts by individuals. The author stated that the principal theoretical reason for believing that low income increases the tendency to commit crime is that the probable cost of getting caught is relatively low. It is because of the reason that low income individuals view their legitimate lifetime earning prospects dismally they may expect to lose relatively little earning potential by acquiring criminal records. They feel that not only legitimate earnings are 'low' but also the opportunity cost of time actually spent in delinquent activity, or in jail, is low.

Becker (1968) presented a model based on costs and benefits. His approach was formed from the usual analysis of the expected utility; that persons will commit crime or offence if they presume that their utility will be greater than if they used their time and resources in some other activity.

Ehrlich (1973) considers that unemployment has its effects on crime rate. He says that unemployment rate can be viewed as a complementary indicator of income opportunities available in the legal labour market. Therefore, when unemployment rate increases, the opportunities in the legal sector decrease leading individuals to involve in criminal activities. Fajnzylber *et al.* (2002) using simple correlations, OLS regressions and dynamic Generalized Method of Moments (GMM) for panel data show that both income inequality and crime rate are positively related.

Lee (2002) examines the relationship between labour market conditions and various crime series in three Asia-Pacific countries, Australia, Japan and South Korea. Johansen maximum likelihood cointegration and Granger causality tests were applied to time series data to see the existence of longrun equilibrium or a causal link between unemployment and crime variables. The results of the study provide a strong support for a long-run equilibrium relationship between unemployment and various crime series.

Coomer Nicole (2003) undertook a study to examine the influence of macroeconomic factors on crime. He applied OLS regression to find out the results. In his analysis, he first included unemployment, poverty, prison population, high school and college education level and income disparities as independent variables and run the regression to get the relationship. He then dropped the insignificant variables and rerun the regression and found that unemployment, inflation and poverty influence crime positively.

Gumus (2004) uses large US city data to empirically investigate the determinants of crime in urban areas using OLS regression technique. The results indicate that income inequality, per capita income, and presence of black population are all important determinants of crime in urban areas. Unemployment rate and police expenditures have also important effect in the determination of crime.

Teles (2004) investigates the effects of macroeconomic policies on crime. He points out that monetary and fiscal policies have an impact on crime. His results show that fiscal policies affect crime through government spending and monetary policy affects crime through inflation.

# **III. CRIME SCENE IN PAKISTAN**

## PAKISTAN STATUS IN THE WORLD OF CRIME

To start with this section, we shall have a look at the crime picture in the world as well as in Pakistan. Table 1 provides the total number of crime of the world top countries along with other selected countries including Pakistan.

Table 1 shows that the United States, Germany and United Kingdom are the top three countries in absolute numbers. Pakistan's rank is 23<sup>rd</sup> amongst other countries whereas India is 10<sup>th</sup>. Daily average of crime in Pakistan is

1144 as against 64870 in USA, 17164 in Germany, 14166 in UK and 4834 in India.

Rank	Country	Total Crime	Rank	Country	Total Crime
1	United States	23677800	10	India	1764630
2	Germany	6264720	19	Finland	530270
3	United Kingdom	5170830	20	Denmark	504240
4	France	3771850	22	New Zealand	427230
5	South Africa	3422740	23	Pakistan	417846*
6	Russia	2952370	37	Greece	102783
7	Canada	2476520	40	Ireland	81274
8	Japan	2443470	50	Moldova	38267
9	Italy	2205780	_	Pakistan	538048**

TABLE 1 Total Crime by Country

\*1999 Figure, \*\*2007 Figure

### **CRIME SCENARIO IN PAKISTAN**

Crime Statistics of Pakistan shows that there is a rapid increase in the number of crime reported over time like other countries of the world. It may be because of high unemployment, rising poverty, increasing inflation and urbanization. Some other non-economic factors are also responsible for it. The impact of rising crime is not confined to the illiterate and poor class of society; even some wealthy, well-placed and educated persons are also involved in committing crime. They are in the race of accumulating wealth through illegal means. Furthermore, these people have sources to exploit loopholes in the legal system to get away with crime in Pakistan. Furthermore, majority of the people who have meager resources at their disposal to meet their both ends are also involved in crime in the country. The crime statistics of Pakistan indicates that the country is not doing well in economic, social, cultural, technological, environmental, moral and spiritual fields.

Nowadays crimes have become more organized and some criminals have gained the patronage of powerful elites. The Government of Pakistan had taken steps to control crime in Pakistan in the past. For example, the surveys were conducted to identify parts of the country by city or areas

Source: Seventh United Nations Survey of Crime Trends and Operations of Criminal Justice Systems (United Nations Office on Drugs and Crime, Centre for International Crime Prevention), Bureau of Police Research and Development, Ministry of Interior, Islamabad.

where the incidence of crime was relatively high along with their major causes. Various steps were taken in those areas/cities to check the crime but unfortunately because of corruption, poor implementation of policies and rising terrorist attacks the circumstances were quite disappointing. Furthermore, lack of justice and influence of powerful on judiciary also encouraged crime in the country.

The available crime statistics show that the total crime cases registered in 1947 at the time of Independence were 73,105, which doubled to 129,679 in 1971. Then there is rapid increase in crime rate particularly after 1980.The total reported crime during the decade from 1980 to 1990 almost doubled from 152,782 to 403,078 and the number of crime reached to 43804 in 2007. The annual growth rate of crime has generally been higher than that of population growth rate since 1951. These figures relate to the reported crime only. No reliable figures can be given about the unreported crime in the country. However, about 30-50% crimes are generally considered to be unreported in Pakistan.

Pakistan's population is currently growing at a rate of almost 2 percent per annum. The total population at the time of Independence was about 30 million and it is 158.17 million in 2007 (almost five times). Table 2 shows total population, total crime, their growth rates and crime committed per population of 100,000 for selected years from 1951 to 2007.

Table 2 shows that the number of crime per 100,000 population has gone up from 226 to 340 during the reference period. In 1971, the reported crime per hundred thousand population were estimated at 206 that rose to 323 in 1998. It shows an increase of 56.79 percent in crime. The reported crime includes murders, attempted murder, kidnapping for ransom, car lifting, dacoity, rap, robbery and theft etc. During the period from 1981 to 1986, growth in crime rate had been over 4 percent per annum, which outstripped the population growth of 3 percent. This was an era of martial law, Afghan war, flow of Afghan refugees in the country, narcotics trafficking, gun running, and kidnapping for ransom.

Crime population ratio given in the above-mentioned table reveals that in 1966, 180 offences were reported per 100,000 population. By the year 1991, it increased to 257 per 100,000 population, which shows an increase of 40%. The situation further worsened in 1998 when the reported offences increased to 323 per 100,000 persons.

However, the total number of crime has shown increasing trend, yet on the basis of crime per 100,000 population, it is less than 300 in the years 1998-2005 but in the year 2007 the reported offences increased to 340. Number of Crime per 100,000 population in Pakistan does not fully indicate the growth of the alarming increase in crime. The society, however, feels alarmed when the number of crime show increasing trend and hit the headlines in the press daily and the people start feeling concerned about their safety and security.

### TABLE 2

Year	Total Population in Millions	Total No. of Crimes Reported	Crime Growth Rate (%)	Crime per thousand of Population
1951	33.82	76519		226
1958	38.12	81124	6.02	212
1961	42.97	79900	-1.51	185
1966	51.98	93633	17.19	180
1971	62.88	129679	38.50	206
1976	72.12	167032	28.80	228
1981	83.84	152782	-8.53	215
1986	97.67	220035	44.02	248
1991	112.61	403078	83.19	257
1998	133.61	431854	7.14	323
2000	139.76	388909	-9.94	278
2003	149.03	400680	3.03	267
2005	153.96	453264	13.12	294
2007	158.17	538048	18.71	340

Population and Crime Growth in Pakistan

Source: Pakistan Economic Survey (Various issues)

Bureau of Police Research and Development, Islamabad

Nadeem, Azhar Hassan (2002), *Pakistan: The Political Economy of Lawlessness*. Karachi: Oxford University Press.

Position of United States and United Kingdom is 8<sup>th</sup> and 6<sup>th</sup> in terms of world ranking on the basis of crime per 100,000 population while Dominica tops the list followed by New Zealand, Finland and Denmark. Contrary to

the general belief that Pakistan as a heaven for criminals, she is way behind at 57<sup>th</sup> position in the world. This situation could be partly attributed to a large number of unreported cases of crime, estimated at about 50% in the west, where most of the crime cases are reported/recorded in their criminal records. However, even if this under reporting is taken into account the number of crime cases per 100,000 population will just push up Pakistan's ranking by two or three positions only. India is, however, better off with average of 163 per 100,000 population as against 305 in Pakistan which is 87% higher than India.

#### **CRIME SCENE IN PAKISTAN WITH TYPES**

In Table 3, crimes reported in Pakistan by types from 1996-2007 are presented.

				•			
Year	Dacoity	Robbery	Burglary	Cattle Theft	Murder/ Attempted Murder	Kidnapping / Child Lifting	All Reported
1996	1188	6107	10526	5474	21499	7189	330493
1997	1428	7793	13803	7141	21744	7972	370350
1998	1533	7514	13771	6938	23326	7774	431854
1999	1316	6337	13586	6877	21374	7538	417846
2000	1297	7513	14433	6618	20130	7176	388909
2001	1372	7672	13057	5542	20961	6546	378301
2002	1631	8235	13318	5420	20341	6938	399568
2003	1821	8434	13049	6742	20908	8450	400680
2004	2338	11851	13647	7924	22397	9637	440578
2005	2395	12199	12067	11884	22494	9209	453264
2006	2895	14630	12872	13327	23777	10431	537866
2007	3260	16639	12067	9388	24396	10725	538048

TABLE 3 Crimes Reported by Type

Source: Pakistan Statistical Yearbook 2008.

The total number of reported crime has gone up by about 63 percent during the period 1996-2007. A rapid growth is recorded in case of dacoity, robbery and cattle theft and the lowest one is in case of murder/attempted murder. The nature of crime committed indicates that the increase in crime committed was financially motivated.

# **IV. METHODOLOGY**

#### COINTEGRATION

Applied econometrics technique tends to estimate long-run relationship among the variables which implicitly considers the constancy doctrine of the variables involved, implying that the mean and variance being constant are not dependent on time. But empirical research in most of the cases has shown that constancy doctrine is not satisfied by time series variables. Therefore, usual F and t test etc. based on estimated method considering constancy doctrine or in other words assume without verification that variables involved in the estimation are stationary give misleading results and hence these tests are not valid.

If the variables are non-stationary (showing trend with time), the coefficient seems to be significant when they are not. This is known as spurious regression problem. The main indication of this problem is  $R^2 > DW$  (Durbin Watson).

Cointegration analysis has been regarded as perhaps the most revolutionary development in econometrics since 1980's. In simple words, this analysis refers to a group of variables that drift together although individually they are non-stationary in the sense that they tend upward or downward over time. This common drifting of the variables makes the linear relationship among these variables exist over a long period of time.

Generally cointegration analysis is a technique used in the estimation of long-run equilibrium parameters in relationship with non-stationary variables. It is a new method for specifying estimation and testing dynamic models and, therefore, can be used for testing the validity of underlying economic theories.

# GRANGER CAUSALITY THROUGH TODA-YAMAMOTO PROCEDURE

The usual Granger causality test leads to spurious regression results, and the *F*-test is not valid unless the variables in levels are cointegrated. New developments in econometrics offer the error correction model (due to Engle and Granger, 1987) and the vector auto regression error-correction model (due to Johansen and Juselius, 1990) as alternatives for the testing of causality between economic time series. Toda and Yamamoto (1995) showed that these tests are cumbersome and sensitive to the values of the nuisance parameters in finite samples and therefore their results are unreliable.

A new method has been proposed by Toda and Yamamoto (1995) for causal inference based on augmented level VAR with integrated and cointegrated processes. The advantage of using this procedure is that it is not necessary to pretest the variables for the integration and cointegration properties and therefore, it avoids the possible pretest biases.

Toda and Yamamoto procedure uses a Modified Wald (MWALD) test for restrictions on the parameters of the VAR (k) model. This test has an asymptotic Chi-squared distribution with k degrees of freedom in the limit when a VAR [k + d (max)] is estimated (where k is the lag order of VAR and d(max) is the maximal order of integration for the series in the system).

Two steps are involved in implementing the procedure. The first step includes determination of the lag length (k) and the maximum order of integration (d) of the variables in the system. Schwartz's Bayesian Information Criterion (SBC) and Hannan-Quinn (HQ) Information Criterion are used to determine the appropriate lag structure of the VAR. Given VAR (k) selected, and the order of integration d(max) is determined, a level VAR can then be estimated with a total of p = [k + d (max)] lags. The second step is to apply standard Wald tests to the first k VAR coefficient matrix (but not all lagged coefficients) to make Granger causal inference.

Toda and Yamamoto (1995) augmented Granger causality test uses the Seemingly Unrelated Regression (SUR) technique through estimating a two equation system. Rambaldi and Doran (1996) showed that the Wald test improves efficiency when SUR models are used in the estimation. So, the model can be specified as follows:

$$Y_{t} = \alpha_{1} + \sum_{i=1}^{k+d} \gamma_{1i} Y_{t-i} + \sum_{t-i}^{k+d} \gamma_{2i} X_{t-i} + \varepsilon_{yt}$$
(A)

$$X_{t} = \alpha_{2} + \sum_{i=1}^{k+d} \delta_{1i} Y_{t-i} + \sum_{t-i}^{k+d} \delta_{2i} X_{t-i} + \varepsilon_{xt}$$
(B)

Where k = Optimal lag order; d = Maximal order of integration of the series in the system; and  $\varepsilon_{yt}$  and  $\varepsilon_{xt}$  are error terms that are assumed to be white noise.

Usual Wald tests are then applied to the first k coefficient matrices using the standard  $\chi^2$ -statistics. The main hypothesis can be drawn as follows:

- (a)  $X_t$  "Granger-causes"  $Y_t$  if  $\gamma_{2i} \neq 0$  in equation (A)
- (b)  $Y_t$  "Granger-causes"  $X_t$  if  $\delta_{1i} \neq 0$  in equation (B)

In order to determine whether there exists a casual relationship between crime, poverty, unemployment, and inflation, the study uses Granger causality test introduced by Granger which has been widely employed to examine the direction of causality among time series variables. However, before the study can proceed to use the Granger causality test, it is needed to check the stationary properties of the variables under investigation.

Presence of cointegration among variables will suggest the evidence of Granger causality which implies that there must be at lest one instance of Granger causality either unidirectional or bidirectional. If there is a case where variables are not stationary, the usual asymptotic distributions of the test statistic in the Granger test may not be valid. Therefore, it is pre-requisite to ensure stationarity of the variables before proceeding.

In order to check the time series properties of the variables, the study uses Augmented Dickey Fuller (ADF) test. The study also uses the Todo-Yamamoto (1995) modification version of the Granger causality test, which has an advantage of handling non-stationary variables.

The concept of the Granger causality test is based on the notion that events in the past cannot be influenced by the events today or in future. Therefore, if X event occurs before event Y, then only event X can cause, event Y. When X causes Y and Y does not cause X, this is called as unidirectional causality. When variable X and Y are jointly determined it is known as feedback causality.

#### V. EMPIRICAL FINDINGS

We first examine the time series properties of the data using Augmented Dickey Fuller (ADF) test that is based on inclusion of both intercept and linear time trend and it is also performed without the trend term. AIC and SBC are used for the selection of optimal lag length in unit root test for all the variables. The data set consists of Pakistani observations on total crimes, poverty,<sup>1</sup> unemployment rate, and inflation. A crime index is developed for total crimes.<sup>2</sup>

<sup>&</sup>lt;sup>1</sup>The data on poverty is taken from Jamal (2004) from the study "Does inequality matter for poverty reduction? Evidence from Pakistan's poverty trends" in which Gini coefficient is estimated for Pakistan.

<sup>&</sup>lt;sup>2</sup>The data set is yearly and covers the period 1975-2007. The data series are obtained from various sources such as Pakistan Economic Survey (various issues), Pakistan Statistical Yearbook, United Nations International Crime Victimization Survey, Bureau of Police Research and Development, Punjab Development Statistics, Census of Population, etc.

The test can be performed by using the following three kinds of regressions.

- 1. Without intercept and deterministic time trend
- 2. With intercept
- 3. With both intercept and deterministic time trend

$$\Delta Y_t = \beta Y_{t-1} + \sum_{j=1}^p \gamma_j \Delta Y_{t-j} + \varepsilon_{1t}$$
 (Without intercept and deterministic time

trend);  $\Delta Y_t = \alpha_0 + \beta Y_{t-1} + \sum_{j=1}^p \gamma_j \Delta Y_{t-j} + \varepsilon_{2t}$  (With inclusion of an intercept

term); and  $\Delta Y_t = \alpha_0 + \alpha_1 t + \beta Y_{t-1} + \sum_{j=1}^p \gamma_j \Delta Y_{t-j} + \varepsilon_{3t}$  (With both intercept and

deterministic time trend).

where

 $\Delta Y_t = Y_t - Y_{t-1}$ 

p = Number of lags in the dependent variable.

 $\varepsilon_{1t}$ ,  $\varepsilon_{2t}$  and  $\varepsilon_{3t}$  are stochastic error terms.

The ADF test uses the following hypothesis:

H<sub>0</sub>:  $\beta = 0$ ; (*Y<sub>t</sub>* is Non-Stationary)

H<sub>*a*</sub>:  $\beta < 0$ ; (*Y*<sub>*t*</sub> is Stationary)

The variable is said be stationary when we reject the null hypothesis in favour of alternate hypothesis if the value of test statistic is less than the critical value. If we do not reject the null hypothesis it implies that time series is non stationary at the level which requires first or higher order differencing to make it stationary.

The results of the ADF test are reported in the table given below. First the property of the data is checked at level and then first difference is taken to make it stationary. The results of ADF are summarized in Table 4.

The optimal lag length is important to identify the true dynamics of the model. To determine optimal lag length of VAR system, the LR, FPE, AIC, SBC, and HQ lag selection criteria are used. Therefore, the study decides to choose 3 lags in VAR. The results of selecting optimal lag length of VAR are reported in Table 5.

# Table 4

# ADF TEST Unit Root Test for Crime and Economic Determinants Using Augmented Dickey Fuller Test

Variable	Only Intercept	Trend and Intercept
Crime		
Level	-2.04038	-2.987404
	(0.2690)	(0.1520)
1st Difference	-5.291820*	-5.194990*
	(0.0002)	(0.0012)
Unemployment		
Level	-1.21765	-3.240079
	(0.2337)	(0.0960)
1st Difference	-5.487514*	-5.377704*
	(0.0001)	(0.0008)
Poverty		
Level	-2.133685	-2.236359
	(0.2337)	(0.4531)
1st Difference	-5.157977*	-5.624418*
	(0.0003)	(0.0005)
Inflation		
Level	-2.583201	-2.417370
	(0.1078)	(0.3636)
1st Difference	-3.098851*	-7.723243*
	(0.0391)	(0.00000

Note: \*indicates variable is integrated of order 1 at 5% level of significance.

Values in parentheses are p-values

# TABLE 5

Lags under Different Criteria

Lag	LR	FPE	AIC	SC	HQ
0	NA	127168.2	23.10465	23.29497	23.16283
1	125.1249	1756.836	18.80730	19.75887*	19.09820
2	25.50068	1557.739	18.60801	20.32085	19.13164
3	26.43643*	1037.671*	17.98844*	20.46253	18.74480*

Note: \*indicates lag order selected by the criterion

Johansen cointegration test results are presented in Table 6. The table depicts the results of cointegration rank test suggesting the existence of at most three cointegrating vectors in the system at 0.05 level. The results lead to conclude the existence of cointegration relationship between crime and poverty, unemployment, and inflation in Pakistan.

# TABLE 6

Number of	Tra	ice		λ-m	ax	
vectors	Statistic	C (5%)	Prob.**	Statistic	C (5%)	Prob.**
r = 0	91.19400*	47.85613	0.0000	39.83823*	27.58434	0.0008
$r \leq 1$	51.35577*	29.79707	0.0001	31.69321*	21.13162	0.0012
$r \leq 2$	19.66255*	15.49471	0.0111	12.97687	14.26460	0.0791
$r \leq 3$	6.685682*	3.841466	0.0097	6.685682*	3.841466	0.0097

Johansen Cointegration Test Results

\*denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug - Micheilis (1999) p-values

#### **GRANGER CAUSALITY BASED ON TODA-YAMAMOTO**

The results of the Granger causality test based on Toda-Yamamoto procedure are reported in Table 7. The values in the parentheses are probability values whereas rests of the estimates are F-statistics.

# TABLE 7

Granger causality test results between  $CI_t$ ,  $Un_t$ ,  $Po_t$  and INtBased on the Toda-Yamamoto Procedure

Dependent	Modified Wald-Statistics					
Variable	$CI_t$	$UN_t$	$PO_t$	$IN_t$		
$CI_t$	_	9.50402	16.2765	15.2185		
		(0.0497)	(0.0027)	(0.0043)		
$UN_t$	1.04157	—	6.9986	4.06732		
	(0.9034)		(0.1360)	(0.3970)		
$PO_t$	4.6610	10.45804	_	8.4672		
	(0.3239)	(0.0334)		(0.0759)		
$IN_t$	4.9371	7.2238	5.7151	_		
	(0.2938)	(0.1245)	(0.2215)			

Note: All estimates are asymptotic Granger F-statistics. Values in parentheses are p-values.

The results indicate that there is unidirectional causality that runs from unemployment, poverty and inflation to crime. It is also observed that both unemployment and inflation cause poverty in Pakistan. The bottom line of the discussion is that unemployment, poverty and inflation promote crimes in Pakistan. In other words, crime is Granger caused by unemployment, poverty and inflation in Pakistan.

# VI. CONCLUSIONS

The main objective of the study is to identify and examine the economic factors such as inflation, poverty and unemployment responsible for promoting crimes in Pakistan. The results of the study reveal that the abovementioned economic factors have relationship with crimes. The following conclusions have been drawn from this study:

- 1. The results of the data analysis reveal that unemployment in Pakistan Granger causes crime. The reason is that unemployment rate in a country is a complementary indicator of income opportunities in the legal labour market. Therefore, when, unemployment rate increases the opportunities for earning income decreases which instigate the individuals to commit crime. The costs of committing crime go down for unemployed workers. The results of causality support this proposition that unemployment causes crime.
- 2. The results show that poverty also Granger causes crime. The poor have limited income and resources to satisfy their desires and wants. In Pakistan the poverty statistics show dismal picture besides increasing income inequality. The low income means low saving potential which results in low standard of living. The low income in relation to increase prices (inflation) has crime instigating effect by reducing individual's moral threshold. Therefore, it can be concluded that people in poverty are induced to commit crime. The results of Granger causality through Toda-Yamamoto procedure affirm that poverty causes crime.
- 3. Price stability or a reasonable price level is one of the major objectives before policy makers for bringing macroeconomic stability in the country. In our case, inflation is also Granger causing crime and there is an evidence of unidirectional causality from inflation to crime. Increased prices result in decreasing real income of the individuals which reduces the purchasing power of the individuals belonging to low income group. This situation forces

them to boost their income for maintaining their existing living standards by legitimate or illegitimate means including criminal activities. The results of causality test verify out hypothesis that inflation Granger causes crime.

## **VII. RECOMMENDATIONS**

In the light of the results of this study, the following recommendations are suggested to prevent crimes and reduce crime rate in Pakistan. These recommendations may help the government in formulation of policies that can be appropriate in curtailing the crime rate in Pakistan.

- 1. Economic growth with social and economic justice should be a key objective of the planning strategy. Entire reliance should not be placed on trickle down effect of economic growth because by itself this process is quite slow in reducing poverty unless deliberate policies are adopted which directly affect the poor.
- 2. All the major economic determinants of crime unemployment, inequalities, GDP growth etc. are needed to be adequately addressed by the policy makers to check the crime rate in the country.
- 3. In order to reduce the crime rate it is important that economic growth has to be favourable for poor class of the society. It should follow a path that directs resources to those sectors where majority of the poor exist like agriculture sector and the areas where they live (comparatively less developed areas).
- 4. Capital base of the banks engaged in providing loans to the poor such as Khushali Bank needs to be substantially increased every year. Early justice through fast-track courts, where the powerful do not influence judiciary, can bring the desired change. Furthermore, there is a need to raise the overall standard of governance in Pakistan with a special emphasis on reducing crime.

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# GROWTH AND PERFORMANCE OF MICROFINANCE IN PAKISTAN

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Abstract. This paper views the growth strategy adopted by the microfinance sector and its impact on performance of the microfinance institutions. To strike a balance between outreach and poverty alleviation, an intensive growth strategy would have been more cost effective at the initial stages of development. This would have reflected in improved performance, efficiency and productivity. Instead the sector adopted an extensive growth strategy which involved huge investment in physical infrastructure and rapid increase in recruitment and branch network. Thus, the credit constrained institutions had to focus more on sustainability than their primary objective of social support. The issue of sustainability would not have been as central had the sector adopted an intensive growth strategy. The six dimensions of outreach examined also indicate that the targets set were modestly attained as breadth of outreach is below the target outreach, depth of outreach is concentrated in big urban cities, scope of outreach is mostly limited to credit. The financial performance of the sector is weak, its cost per borrower is increasing and productivity ratios are low. Growth of the sector is being led by a few unsustainable institutions that are neither operationally nor financially self-sufficient. This approach has already impacted the growth of microfinance in the last few years and is likely to continue to impact the growth and performance of the sector unless more funds are injected.

# I. INTRODUCTION

The roots of microfinance lie in a social mission of enhancing outreach to alleviate poverty. More recently there is a major shift in emphasis from the social objective of poverty alleviation towards the economic objective of sustainable and market based financial services. In other words, the new focus of microfinance involves trade off between outreach and efficiency Rhyne (1998). One implication of this changed focus is that microfinance

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institutions will have to be financially self-sufficient to meet the objective of enhanced outreach. Microfinance sector in Pakistan is also faced with the challenge of enhancing outreach on sustainable basis. One way to minimize the trade off is to improve efficiency and productivity through intensive growth strategy of the sector.

The target market of microfinance sector is estimated to be 25 to 30 million borrowers and government has set the outreach goal posts to at least 3 million by 2010 and moved it further to 10 million by 2015. To increase outreach the sector adopted extensive growth strategy and the overall growth rate of outreach varied from 100 percent in 2004 to a low level of 36 percent during 2005-06 and later to 52 percent in 2007. Outreach in terms of number of active borrowers increased from a low base of 240000 in 2003 to 1.27 million in 2007. Gross loan portfolio increased from Rs. 2.3 billion in 2004 to 12.7 billion in 2007, loan size also increased from Rs. 6,629 in 2004 to Rs. 10,000 in 2006 and 2007. The number of savers increased from 888000 to 1.14 million in 2007 and investment in the sector is as high as \$ 400 million between 1999-2005 (Pakistan Microfinance Network, 2007).

Despite progress made over the past few years, outreach of the sector is just 40% of the target outreach of 3 million poor. Growth of the sector is largely led by a few unsustainable institutions that lack operational and financial sustainability. The financial self-sufficiency of the sector is as low as 76 percent and the average return on assets (AROA) of the sector remain negative. Instead of laying emphasis on intensive growth strategy of utilizing the existing capacity to improve productivity and efficiency and reliance on mobile offices, the sector focused on extensive expansion in terms of fixed branches and offices which led to high operating and financial costs of majority of the institutions.<sup>1</sup>

As a result the sector remains dependent on external support, subsidized credit and tax exemptions etc. Besides paid up capital financially majority of the institutions rely on donor funds and subsidized debt as the major source of funding. This implies future growth of the sector is conditional upon the availability of donor funds or subsidized credit, otherwise growth of the sector may slow down. Moreover, besides the issues of outreach and sustainability, the recent slow growth of GDP and high inflation may also impact the progress of the sector.

<sup>&</sup>lt;sup>1</sup>Unlike the Grameen Bank, the Khushali Bank in particular focused on expanding fixed branches rather than relying on mobile offices which could have saved on operating cost of the bank.

The purpose of this paper is to examine firstly the growth pattern of the microfinance sector and secondly its impact on performance of the microfinance institutions. In doing so the study attempts to establish a link between the growth strategy and performance of the sector. In other words, whether the existing growth strategy led to improve performance of the sector which would largely determine the extent to which the primary social objective of the sector is attained.

The plan of the paper is as such: section II of the paper gives the institutional set up of the microfinance sector, section III provides the literature review, and section IV presents the model of outreach and financial sustainability along with methodology and data source. Section V reports the main findings about the growth pattern and its impact on performance of the sector. Leading microfinance institutions, driving the overall growth of the sector, are also identified. The impact of growth pattern on four aspects of outreach, *i.e.* the breadth, depth, scope and worth of outreach, is assessed. The impact of growth on cost and length of outreach is also assessed by analyzing the operational self-sufficiency (OSS), financial self-sufficiency (FSS) and productivity of the microfinance sector. The main conclusions are mentioned in the final section of the paper.

# **II. INSTITUTIONAL SET UP IN PAKISTAN**

Historically, in 1970s Agricultural Development Bank of Pakistan (ADBP) later named as Zarai Taraqiati Bank Limited (ZTBL) was established to extend subsidized rural credit to the rural farmers. Over the years both the outreach and financial performance of the bank has not remained satisfactory and is currently undergoing a restructuring process. In 1980s two microfinance institutions namely the Agha Khan Rural Support Programme (AKRSP), later graduated as First Micro Finance Bank (FMFB), and the Orangi Pilot Project (OPP) were set up with a social objective of alleviating poverty by providing credit to the poor. The services of AKRSP were focused in Northern areas and Chitral, whereas the OPP provided financial help to the urban poor of Karachi. Later on, the success of AKRSP led to the introduction of Rural Support Programs (RSPs) at the national level. These RSPs placed a strong emphasis on helping the poor through subsidized credit and other social services as part of their poverty reduction strategy. Besides these institutions, specialized and multi purpose microfinance institutions (MFIs) and NGOs also extended microfinance services to the poor segment of the population with a missionary objective.

In 1998, Pakistan Microfinance Network (PMN) was set up to represent the emerging MFIs. Later in 2000, Pakistan Poverty Alleviation Fund (PPAF) was set up as an apex organization, with the support of World Bank to provide wholesale refinancing to MFIs.<sup>2</sup> Currently, it refinances almost 56 percent of the micro loans to microfinance institutions that are members of PMN. PPAF Micro credit Loan Fund is Rs. 10,513 million (US \$ 175.2 million), and its current outstanding portfolio to MFIs is Rs. 4,013 million (US \$ 66.9 million) (CLEAR, 2007).<sup>3</sup> A New Bank Fund has been established worth US \$ 15 million with assistance of ADB and for capacity building of newly licensed institutions at the provincial and district levels in Pakistan. Also a Microfinance Credit Guarantee Facility (MCGF) has been established with the UK Department of International Development (DFID) grant of pounds 10 million by SBP to facilitate banks and DFIs in easing the credit constraint of MFBs/MFIs to enhance outreach (SBP, 2008; IMF, 2008). In the same context, recently a Benazir Income Support Fund of Rs. 34 billion has been created as a social safety net for extending outreach to the poor segment of the population.

In 2000, the first microfinance bank, *i.e.* Khushali Bank (KB) was established as part of governments Poverty Reduction Strategy with a loan of US \$ 150 million from ADB. Both the PPAF and KB were based on the same rational: that these initiatives will be instrumental in reducing poverty. In 2001, the Microfinance Ordinance was introduced and separate prudential regulations were formulated as part of microfinance initiatives.

Presently, there are three different models of microfinance services in Pakistan, *i.e.* 6 Micro Finance Banks (MFBs), 10 Micro Finance Institutions (MFIs) and 4 Rural Support Programmes (RSPs), all the three models started with small size short term group lending policy of working capital loans.<sup>4</sup> Some MFIs and MFBs like Tameer Bank and FMFB have diversified into

<sup>&</sup>lt;sup>2</sup>Microfinance activities are supported by *Multilateral agencies:* ADB, EC, IFAD, IFC, ILO, UNDP, World Bank, *Bilateral agencies:* AECI, DFID, JBIC, SDC, USAID, *International NGOs:* PLAN, ACTED, Save the Children US, Islamic Relief, *International Private Investors:* Citigroup, Deutsche Bank (Global Commercial Microfinance Consortium), Shore Bank Int., Aga Khan Agency for Microfinance (AKAM).

<sup>&</sup>lt;sup>3</sup>The Orangi Charitable Trust (OCT)/OPP also offers financing in a limited manner to small MFIs in the provinces of Sindh and Punjab.

<sup>&</sup>lt;sup>4</sup>Recent data reported by PMN (2008) show that some of the MFBs and MFIs have initiated insurance and deposit mobilization services in a limited manner.

MFIs that extend credit services include Asasah, Kashf Foundation, Orangi Pilot Project (OPP), Sindh Agricultural and Forestry Workers (SAFWCO), whereas multi purpose NGOs also provide microfinance. Other NGOs include Sungi Development Foundation, Development Action for Mobilization and Emancipation and Taraqee Foundation.

individual based large loans relative to market average loan size. However, RSPs provide multi product microfinance services including infrastructure development projects like health, education, insurance, mobilization of savings and primarily operate in rural areas.<sup>5</sup>

Besides the three main groups of microfinance other institutions that also provide microfinance services include, commercial banks and government owned institutions etc. Although the main product of these institutions is not microfinance, the government-owned institutions that provide microfinance services to the poor include: micro credit and saving services and subsidized credit for government's Rozgar Scheme by National Bank of Pakistan (NBP); credit and saving services by ZTBL; special microfinance services by government owned First Women's Bank, Bank of Khyber, SME Bank, financial savings and money transfer services provided through countrywide network of 7,500 branches of Pak Post Saving Banks, the seven National Saving Schemes (NSS) of Central Directorate of National Savings (CDNS) which accept deposits of about 4 million account holders and the Zakat office that provide charity funds as a social objective. Some commercial financial institutions including ORIX leasing also extend microfinance services to their poor customers (CLEAR, 2007).

# **III. REVIEW OF LITERATURE**

A review of literature about the microfinance sector in Pakistan reveals that interest in assessing the performance of microfinance sector is relatively new and most of the studies were initially conducted to assess the impact of microfinance on poverty reduction. Majority of the studies in this area were undertaken in the decade of 2000 mostly by the microfinance institutions like Kashf, NRSP, Orangi Pilot Project and the Pakistan Poverty Alleviation Programme. A few studies and surveys were also conducted by Pakistan Institute of Development Economics, State Bank of Pakistan and the Applied Economic Research Centre.

Initially most of the studies examined growth of microfinance by developing proxy measures of outreach and repayment of loans. Such an approach is based on the assumption that if outreach in terms of number of borrowers was increasing and loan repayments were made by the borrowers then microfinance sector was performing successfully (Khandker, 1999).

<sup>&</sup>lt;sup>5</sup>The four Rural Support Programmes (RSPs) include National Rural Support Programme (NRSP), Sarhad Rural Support Programme (SRSP), Punjab Rural Support Program (PRSP) and the Thar Rural Support Program (TRSP).

AKRSP, NRSP and PRSP all adopted this approach, repeat borrowers, increasing outreach and loan repayment meant successful growth of microfinance. Limitations of such an approach are that it assess breadth of outreach as the only aspect of performance and obscures other dimensions of outreach that indicate the depth, scope, worth and financial health of the sector (Schreiner, 2002). Later in 1980s, a case and impact studies approach was adopted, this approach was also biased as mostly the successful case studies were reported and repayment of loans was still used as the main indicator of performance of an individual institution or the overall sector. Such studies overestimate the benefits and underestimate costs which mask the correct picture of the actual conditions of poverty Adams (1988).

More recently there is a shift in the measurement of performance of the microfinance sector. The new and widely used approach focused on various levels of financial sustainability and dimensions of performance indicators. It is argued that financial sustainability is essential as opportunity cost in the absence of microfinance institutions may be high (Ledgerwood, 1998). Others argue that the social objective of microfinance would be undermined if microfinance is not subsidized (Khandker, 1998; Morduch, 1999). Although trade off between the social and commercial objective of microfinance is widely debated, it is quite clear that the trade off can be minimized by adopting a growth strategy which emphasizes on improving efficiency and productivity. Intensive growth strategy of microfinance sector can be cost effective and ensure the long term sustainability of the sector (Craig and Cheryl, 2006).

# IV. METHODOLOGY AND DATA SOURCE

# THEORETICAL MODEL OF SIX DIMENSIONS OF OUTREACH

This study is based on a theoretical model of six dimensions of outreach that are interlinked and involve a trade off (Schreiner, 2002). It explains that given the two inputs of financial and human resource the main objective of a microfinance institution is to provide a certain level of financial services at minimum cost and maximum productivity of the available human resource. It also suggests that each aspect of outreach is dependent on the other aspects of outreach. Out of the six aspects of outreach mentioned below, the first four indicators of outreach provide a good approximation of the extent and pattern of growth in terms of breadth, depth, scope and worth of outreach of an institution. The remaining two dimensions of outreach involve cost and length of outreach, *i.e.* the financial performance, efficiency and productivity of a microfinance institution.

A brief explanation of the six aspects of microfinance is given as below:

- 1. **Breadth of outreach**: It simply involves the number of poor people reached by an MFI and is measured as the total number of active borrowers. It can also be assessed in relation to the increase in branch network and staff hired over time.
- 2. **Depth of outreach**: It indicates the extent to which those excluded from the financial sector are reached by an MFI. In developing countries, poverty is found to be high in rural areas and among the women; both have limited access to the provision of financial services for several reasons. High transaction cost and risk involved in reaching the rural poor and women in developing countries has led to the concentration of microfinance services in the urban areas. Thus depth of outreach measured as ratio of active women borrowers to total borrowers and also measured as distribution of borrowers in rural and urban areas would indicate the extent to which MFIs deal with the very poor segment of the population.
- 3. Scope of outreach: It involves the diversity of financial services offered by an MFI, *i.e.* it explains whether it is a one product institution or has the capacity to offer diverse products to its customers. Scope is measured as the total number of depositors holding savings accounts and ratio of women savers to total savers.
- 4. Worth or value of financial service: The terms and conditions of microfinance affect both the borrowers and the sustainability of an MFI. Worth of microfinance increases if the terms and conditions of a loan in terms of, size, duration, frequency of loan installment payments, collateral requirements, interest rate, fees etc suit the needs of the borrowers. Worth of outreach is therefore measured as average loan size prevailing in the market.
- 5. **Cost of outreach or operational self-sufficiency**: An MFI is operationally self-sufficient if it generates enough revenue to meet its operating expense, otherwise it lacks operational self-sufficiency and will have to either reduce its operational cost or increase its return on assets. Operational self-sufficiency is measured as a ratio of financial revenue to financial expense.<sup>6</sup>

<sup>&</sup>lt;sup>6</sup>Operational self-sufficiency is measured as a ratio of financial revenue to financial expense: (total interest, fees and commission on loan portfolio + financial revenue from other financial assets + other revenue from financial services like insurance or transfer services or sale of passbooks and credit cards etc.) / (financial expense + net loan loss provision expense + operating expense).

6. **Length of outreach**: It indicates financial self-sufficiency of an MFI that guarantees the length of outreach over a longer period of time. If an MFI generates enough revenue and its reliance on external funds, tax exemptions, subsidized loans and other concessions is minimum, it is considered to be financially sustainable.<sup>7</sup>

## FIGURE 1

The Six Dimensions of Outreach



Besides, the operating and financial sustainability, other indicators of performance reported include efficiency and productivity measures of the sector. Efficiency indicators include, nominal and real yield on gross loan portfolio, average return on assets and adjusted cost per borrower or adjusted cost per loan etc. The productivity indicators measured as a ratio of number of active borrowers to number of staff/loan officers show how efficiently the available human resource is utilized.

The above model views all the six dimensions of outreach as important, however length of outreach is the preferred objective as improvement in other aspects of outreach are conditional on financial sustainability of microfinance institutions. Average cost of an MFI is minimum once its outreach increase to approximately 12000 clients, beyond this level cost inefficiency cannot be covered through growth of an MFI (Brand, 2000;

<sup>&</sup>lt;sup>7</sup>Financial self-sufficiency is measured as a ratio of financial revenue to adjusted financial expense: (total of financial expense on liabilities and deposits + net loan loss provisioning + operating expense (total of personal expense and administrative expense + inflation adjustment).

Farrington, 2000). In practice, most MFIs adopt the policy of charging high price and interest for their product to cover cost inefficiency and fail to improve their operational and financial self-sufficiency (Brand and Gerschick, 2000).

The ratio analysis approach is used to assess the growth pattern and its impact on performance of the microfinance sector in the light of the indicators of performance outlined above. In this way the growth pattern, performance and sustainability issue of the overall microfinance sector, its three groups and the top few leading institutions of the sector is assessed. Our analysis is based on Pakistan microfinance network and State Bank of Pakistan data source for the period 2004-07. Prior to this time period data is sketchy and incomplete which cannot be used for reliable estimates and meaningful comparisons.<sup>8</sup>

#### V. MAIN FINDINGS AND RESULTS

# **GROWTH PATTERN AND MICROFINANCE SECTOR**

The growth strategy of the microfinance sector in terms of its physical and financial infrastructure reported in Table 1 show that between 2004-07 overall growth of the micro-finance sector in terms of increase in branch network and the staff hired has been more than three fold which is faster than the growth of borrowers and loan portfolio. The total number of branches increased from 362 to 1165 branches and the staff recruited increased from 2913 to 9529 workers. The wide growth in branch network and recruitment of staff indicates that the sector adopted an extensive and quick growth strategy. A similar growth pattern is observed in case of the three set of institutions, where irrespective of their level of development and age, extensive expansion of branch network and recruitment of new staff took place during the same time.

Perhaps extensive growth strategy of the sector was led by the social objective and pressure to improve performance. It was mainly so because increase in number of borrowers and provision of financial services to more low income people was considered as the only measure of performance. A growth strategy with extensive branches and many workers/staff is not very

<sup>&</sup>lt;sup>8</sup>One limitation of this study is that data availability constrains our investigation to ratio analysis. To establish a link among different dimensions of outreach outlined above appropriate econometric tools could not be applied, however most studies in the literature on microfinance are based on ratio analysis as the standard approach to assess the growth and performance of microfinance sector.

effective in enhancing outreach if its coverage is thin. Majority of the institutions of microfinance are heavily dependent on subsidized funds, opening of new branches and recruitment of new staff will impact the operational expenses of the sector particularly when productivity is low at the initial stages of growth. In fact reliance on mobile branches seems to be negligible which could have reduced operating cost of most MFIs. Moreover with a few exceptions extensive growth strategy has limited growth mostly to one product service which may expose the sector to concentration risk.

In contrast an intensive growth strategy at the initial stages of development could have provided more depth to the sector by focusing on provision of more than one product services to a large number of low income people concentrated in a particular area.

Besides the institutional composition and extensive expansion the structure of microfinance sector is found to be highly concentrated. It is dominated by top three leading microfinance institutions and each of the three groups is led by one lead player, *i.e.* the KB, NRSP and KASHF. Collectively the top three institutions have more than 60 percent of the branch network and staff registered on their pay roll.

TABLE	1	

		Perso	onnel			Bran	ches	
	2004	2005	2006	2007	2004	2005	2006	2007
MFBs	1376	1932	2996	3899	80	108	226	295

Physical Structure of Microfinance Sector 2004-07

Source: PMN Annual Report.

**MFIs** 

**RSPs** 

Top 3

Pakistan

Similarly Table 2 shows that although initially total assets of the sector increased rapidly, it is during the last two years that growth in total assets has slowed down. The asset composition of the sector reveals that the share of equity funds is not only low, its growth has also declined significantly in the last one year. Whereas the overall growth of total subsidized debt has declined but its share in total assets is over 70 percent which indicates heavy

reliance on borrowings. At the same time growth in commercial liabilities has increased by more than 80 percent in the past one year which implies the sector has not generated sufficient deposits and future availability of subsidized funds is likely to be limited.

Group wise comparison indicates that asset growth of MFBs declined and was the lowest whereas the asset base of both the MFIs and RSPs grew at impressive rates of 85 percent and 52 percent respectively. However, the respective group wise asset composition during 2005-07 also shows that the share of total debt remains high and is more than 70 percent. High percentage share in the ownership of total assets as well as total debt indicate their financial dominance. Similarly, the commercial liabilities of the top three institutions have also persistently increased from 31 percent to 83 percent during 2005-07. In other words, increasing reliance on subsidized and commercial borrowings indicate that the financial structure and asset base of the sector and its three main institutions is weak to a large extent.

#### BREADTH, DEPTH, SCOPE AND WORTH OF OUTREACH

The four dimensions of outreach assessed include the breadth, depth, worth and scope of the sector. It is clear that during 2004-07 the overall breadth of the sector measured as total number of active borrowers increased from 0.6 million active borrowers in 2005 to 0.8 million in 2006 and further to 1.2 million in 2007, yet it remains below the target outreach of 3 million by 2010 (Appendix I). In other words, the initial growth of 100 percent during 2005-06 in breadth of outreach was followed by a decline in growth to 52 percent during 2006-07 as a backlash of expanding too fast beyond capacity (Table 3). A similar pattern of overall growth of gross loan portfolio is observed which declined from 120 percent in 2005-06 to 50 percent in 2006-07.

Group wise comparison shows, the share of MFBs in total number of active borrowers has declined from 41 percent to 34 percent during 2005-07, whereas the MFIs have gained market share from a low level of 17 percent to 33 percent and the RSPs have just managed to maintain their share of 33 percent during the same period. The breadth of outreach is also found to be highly skewed towards the top three institutions and altogether their market share is as high as 69 percent of the total active borrowers and also within their respective groups. Collectively their share has almost remained the same in total active borrowers and gross loan portfolio.

Another important dimension of performance is the depth of outreach, *i.e.* distribution of microfinance services according to gender and location.

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Financial Structure: % Growth and Share in Total Assets (Rs. 000)

1	1	1			
op 3	2007	63%	57% (25%)	66% (76%)	83%
are of T	2006	63%	55% (30%)	68% (70%	58%
% sh	2005	68%	64% (30%)	70% (70)	31%
	2007	30%	5% (28%)	43% (72%)	84%
Total	2006	31%	41% (35%)	26% (65%)	-25%
	2005	79%	73% (32%)	73% (68%)	70%
	2007	52%	10% (22%)	69% (78%)	150%
RSPs	2006	16%	36% (30%)	9% (70%)	-10%
	2005	39%	-13% (25%)	74 % (75%)	-24%
	2007	85%	45% (32%)	111% (68%)	269%
MFIs	2006	93%	59% (40%)	119% (60%)	17%
	2005	62%	38% (49%)	99% (53%)	I
	2007	10%	-10% (30%)	21% (71%)	-21%
MFBs	2006	34%	37% (36%)	32% (64%)	-23%
	2005		_ (35%)	(65%)	I
		TA	TE	TD	CL

Source: PMN

TA: total assets, TE: total equity, TD: total debt, CL: commercial liabilities.

Percentages given in ( ) are the shares of total equity and debt in total assets.

Percentages without parenthesis are the growth rates of total assets, total equity, total debt and commercial liabilities.
TABLE 3

Indicators of Outreach: % Share and Growth Rate

3%		2007	69%	71%	71%	84%	91%	22%
e of top		2006	55%	70%	67%	56%	61%	32%
Shar		2005	69%	73%	68%	50%	55%	36%
[otal		2007	52%	47%	50%	-16%	- 6%	53%
wth of		2006	36%	58%	48%	12%	21%	73%
% pro	0	2005	100%	%06	120%	19%	21%	94%
SPs		2007	32%	27%	32%	62%	38%	21%
are of R		2006	33%	16%	31%	83%	72%	38%
% sh		2005	34%	28%	30%	88%	78%	48%
NGOs		2007	33%	58%	32%	26%	58%	0.006%
of MFIs/		2006	26%	45%	25%	9.7%	25%	0.007%
% share		2005	17%	33%	18%	5.8%	167%	0.006%
FBs		2007	34%	14%	35%	13%	4%	78%
re of M		2006	39%	37%	42%	5.2%	1.4%	60%
% sha		2005	41%	29%	41%	2.6%	0.93%	50%
			AB	WB	GLP	S	MS	SA

Source: PMN annual report

AB: number of active borrowers, WB: number of women borrowers, GLP: gross loan portfolio in Rs (000), S: number of savers, WS: Women savers, SA: total savings in Rs.

Table 3 shows the overall growth of women borrowers has slowed down from 90 percent to 47 percent between 2005-07 and the overall ratio of women borrowers to total borrowers is also low. Table 4 and 5 reports data about depth of outreach, it is shown that women borrowers are 50 percent of the total borrowers relative to 85 percent women borrowers reported in South Asia PMN (2005). Among the three groups MFIs have shown more depth and 88 percent of their clients are women, however Kashf a leading institution focusing exclusively on women borrowers during 2003-04, has more recently recorded a persistent decline in their share of women borrowers. MFBs recorded the lowest market share in extending credit to the poor women and compared to KB, FMFB has been more sensitive to the needs of the women borrowers. Although the RSPs have managed to keep a significant market share of women borrowers to total borrowers in case of NRSP has almost doubled between 2004-07.

Moreover it is found that most of the microfinance services are concentrated geographically in the big urban cities and the distribution of services is uneven between rural and urban areas. Rural/Urban outreach given in Table 4 reveals that overall outreach of the three groups of microfinance increased in urban areas from 31% in 2005 to 39% in 2006. This shift from rural to urban outreach is primarily because the new MFBs and RSPs have set up their network in urban areas and the rural based portfolio has been reduced. It clearly implies that most of the MFBs and MFIs focus on urban borrowers of Punjab and Sind and their customers lie above the poverty line relative to Baluchistan and NWFP where poverty level is definitely high.

#### TABLE 4

		MFBs			MFIs			RSPs			Total	
	05	06	07	05	06	07	05	06	07	05	06	07
WB/AB	32	49	21	88	89	88	36	26	43	44.6	52	50.6
WS/TS	12.6	10.5	13.5	100	100	100	33.5	34.3	27.7	36.9	39.7	44.4
LSRs000	9.4	10.8	10.2	9.2	9.9	9.8	8.2	9.4	10	9.3	10	10
Rural	69	60	_	29	26	-	89	85	-	69	61	_
Urban	31	40	-	71	74	-	11	15	-	31	39	-

Depth of Outreach (in %)

Source: PMN annual Report, WB/AB: Women borrowers to active borrowers, WS/TS: women savers to total savers, LS: loan size.

As far as the worth of the microfinance credit is concerned, according to prudential regulations for MFBs a person is eligible for microfinance loan if his/her earning is less than tax able limit and the maximum loan limit per person has been raised from Rs. 100,000 to Rs. 150,000. Table 4 shows that the average loan size for all the 3 groups has increased during 2005-07 and was around Rs. 10,000 in 2007. However, excluding KB from the MFB group raises the average loan per person to Rs. 20,000, this indicates that the sector has moved towards larger loan size. It is quite possible that increase in loan size is the result of change in focus towards urban areas and big cities and also because of the major shift in emphasis on commercial objective rather than the social objective of the sector.

			WS/TS			WB/AB					
	2003	2004	2005	2006	2007	2003	2004	2005	2006	2007	
KB	_	_	-	-	-	-	_	33.3	51	15.4	
FMFBL	_	12.06	13.1	16.9	21.7	-	9.49	14.5	68.7	42.2	
KASHF	100	100	100	100	100	100	100	99.6	98.4	95.9	
NRSP	28.7	28.8	33.4	33.5	27.7	39.2	23.03	38.7	27.4	42.7	

TABLE 5	
Ratio of WS/TS and WB/AB of MFBs and T	<b>Four Institutions</b>

Source: PMN Annual Report.

The scope of outreach measured as the mobilization of savings by the sector given in Table 3 indicates the overall growth in savings and number of depositors has declined in the past two years and the sector is still at an early stage of development. The total savings are only one third of the gross loan portfolio and are insignificant as a percentage of national savings (Appendix II). It implies scope of out reach is limited to credit as the main product of the sector. It is noteworthy that extensive horizontal expansion pattern of microfinance institutions is normally one dimensional and the microfinance sector in Pakistan mostly focus on one product, i.e. provision of credit. A comparison of the three groups shows that RSPs have the highest number of active depositors, followed by MFIs and MFBs. One reason for low savings mobilization by MFBs could be the voluntary nature of their deposits in contrast to non-voluntary deposits generated by MFIs and RSPs. Among the MFBs depositors are mostly concentrated in FMFB because of its active policy to mobilize deposits followed by NMFB and RMFB. In contrast KB has a single product service and has not yet started mobilizing deposits perhaps mainly because of easy availability of subsidized funds. In case of MFIs, savings are compulsory for all the clients of Kashf. It is also

noteworthy that although growth in the number of savers of the top three institutions has persistently increased yet growth in savings has declined considerably.

In sum, the growth strategy adopted by the sector lacked intensive utilization of resources which impacted the four dimensions of outreach. The sector lagged behind in achieving the overall target outreach, its outreach in rural areas has declined and was limited to few women borrowers. The depth of outreach is low and scope of diverse microfinance services is also limited to a large extent.

## COST AND LENGTH OF OUTREACH

Although the four indicators of outreach reported above provide some insight about the various aspects of performance of the sector, one limitation of the above approach is that it obscures the sustainability issue of the sector. The cost and length of outreach therefore assess the financial performance and productivity to highlight the issue of operating and financial sustainability and efficiency of the sector.<sup>9</sup>

TABLE 6	)
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MFBs MFIs RSPs Total 2005 2006 2007 2005 2006 2007 2005 2006 2007 2005 2006 2007 -7 -7.2 AROA -8.1 -7.2 -10.6 25 -05 5.7 -69 -7.8 -6.7 -64 AROE -20.3 -33.2 -21.8 -27.5 -19 4.8 -1.1 16.4 -29.6 -18.7 -19 -209 OSS 74.6 77.4 70.6 151.6 114.8 1395 77.6 72.8 835 81.6 80.4 89 53.2 60.6 114.1 97.9 125 74 FSS 565 62.6 65 70.8 61 665 NY 179 20.6 24 27.8 27.1 35.2 17 185 20.4 18.8 21.3 26.1 10.7 179 7.9 RY 8.8 15 16.7 253 8.8 11.6 9.6 11.4 169

Financial Performance of Microfinance Sector

Source: PMN annual reports AROA: Average return on assets, AROE: Average return on equity, OSS: operating self-sufficiency, FSS: Financial self-sufficiency, NY: Nominal yield, RY: Real Yield.

Table 6 shows that the AROA and AROE of the sector are negative and its operational and financial self-sufficiency has slightly improved yet it remains weak despite significant increase in nominal and real yield by more

<sup>&</sup>lt;sup>9</sup>A comparison of our results with an earlier study on performance of microfinance sector, reported in the Financial Stability Review State Bank of Pakistan 2006, shows that our results provide an updated information about the growth and performance of the entire microfinance sector. Whereas the SBP study is restricted mostly to the performance of the MFBs for the period 2005-06.

than 20 percent in 2007. Increase in yield arising from high interest to cover cost inefficiencies is no way to long-term financial sustainability of the sector. The overall operating expense ratio of the sector is as high as 24 percent relative to the operating expense ratio of 16 percent of South Asia. Weak operational self-sufficiency of the sector may also be due to the inefficient utilization of assets. International benchmark is that 70 percent of the total asset are allocated to loan portfolio whereas in case of Pakistan the ratio of loan portfolio to total assets indicates that only 50 percent of the total assets of the sector are invested in loan portfolio. It implies that there is still the possibility of shifting funds from idle sources to micro loans, however it seems that most of the institutions avoid the risk of non-performing loans and financial losses.

## TABLE 7

			OSS			FSS						
	2003	2004	2005	2006	2007	2003	2004	2005	2006	2007		
KB	-	_	72	75.5	76	_	_	51	56	56		
FMFBL	105	105	94	113	90	77	82	65	86	80		
KASHF	130	187	179	154	163	115	154	126	121	145		
NRSP	73	103	85	87.6	101	67	89	75	81	92		

Financial Sustainability Ratios of Top Four Microfinance Providers

Source: PMN Annual Reports.

Group wise data shows that the MFBs are the least sustainable and their operating expense ratio is the highest, while MFIs are the most efficient both in their operational and financial self-sufficiency (Tables 6 and 7). However, variations within the groups show that KB continues to rely heavily on subsidized funds and has failed to achieve operating and financial self-sufficiency as its operating expense remains high. FMFB the second largest MFB was operationally self-sufficient in 2006 but it lost its operating and financial self-sufficiency in 2007. Similarly within the RSPs, NRSP managed to improve only its operating self-sufficiency and has yet to achieve financial self-sufficiency and show positive AROA. In other words except for MFIs like Kashf which has shown significant improvement in AROA and operating and financial self-sufficiency, growth of the sector is mainly driven by unsustainable institutions like KB, and NRSP. This tendency implies that whatever the level of growth achieved by the sector it is not reflected in reduced cost of providing microfinance.

TABLE 8	3
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	MFBs			MFIs				RSPs		Total		
	2005	2006	2007	2005	2006	2007	2005	2006	2007	2005	2006	2007
AOE/AGLP	31.9	35	36.4	16.1	199	16.7	169	21.7	18.6	22,4	26.7	24.7
APE/AGLP	15.4	20	19.5	10.6	12.7	10.6	8.7	12	11	11.6	15.4	14
ACB (Rs 000)	2.6	3.1	3.0	1.3	1.9	1.6	1.4	2.1	1.8	1.9	2.5	2.3

**Operating Efficiency (Weighted Average)** 

Source: PMN annual reports, AOE/AGLP: Adjusted operating expense to Average gross loan portfolio an indicator of efficiency of loan portfolio, APE/AGLP: Adjusted personal expense ratio to Average gross loan portfolio FR: Financial Revenue Ratio (Financial Revenue/Total assets).

Table 8 shows that despite subsidized credit cost per borrower of the sector has increased during 2005-07 and the overall cost per borrower is as high as 32.5 percent relative to cost per borrower of 18 percent in South Asia.SBP (2006) Increase in cost is largely due to increase in operating and personal expense of the sector; this has serious implications for the future growth of the sector.

#### TABLE 9

**Productivity Indicators** 

	MFBs			MFIs				RSPs		Total		
	2005	2006	2007	2005	2006	2007	2005	2006	2007	2005	2006	2007
B/S	128	109	112	138	130	176	157	111	126	143	114	133
B/LO	282	244	233	178	193	307	181	140	163	150	185	221
L/S	128	109	112	271	161	212	184	111	126	239	121	142

Source: PMN annual reports B/S Borrowers per Staff. B/LO Borrowers per Loan Officer. L/O Loan per staff.

Similarly Table 9 shows the overall productivity of the sector is low relative to the productivity ratios reported in South Asia, *e.g.* staff productivity ratio of South Asia is 177 compared to the productivity ratio of 133 in Pakistan. Except for MFIs whose productivity ratio is as high as 176, both MFBs and RSPs have recorded low and declining productivity ratios of 112 and 126 during 2007 due to rapid expansion of the physical infra

structure of the sector. The productivity ratios of the top three are however 152 in case of KB, 189 of Kashf and 118 of NRSP.

## TABLE 10

	КВ				Kashf		NRSP			
	2005	2006	2007	2005	2006	2007	2005	2006	2007	
B/S	144	132	152	144	158	189	132	104	118	
B/LO	329	68	461	202	240	324	146	128	149	
L/S	144	132	152	202	214	416	132	104	149	

#### Productivity Ratios of the Top Three Institutions

Source: PMN annual reports,B/S Borrowers per Staff. B/LO Borrowers per Loan Officer. L/O Loan per staff

Consequently the issue of trade off between outreach and sustainability could have been minimized if the sector had successfully raised its efficiency and productivity, for which the sector needs to rely on intensive utilization of their existing capacity to enhance outreach to a large number of potential borrowers. Reliance on costly extensive growth strategy is likely to adversely impact the future growth of the sector.

# VI. CONCLUSION

The main conclusions drawn from the data set reported above are that although the microfinance sector adopted an extensive growth strategy and made some progress in various indicators of outreach and performance, yet the challenge of increasing the breadth, depth and scope of outreach at lower cost remains high. The operational and financial sustainability of the sector is weak and remains to be addressed. The overall cost per borrower is increasing and the productivity ratios are also low. The most likely reason for weak financial position of the sector is the inappropriate and costly growth strategy of over expansion which adversely affected the cost and productivity of the sector.

Group wise analysis suggests that MFBs are the least efficient among the three groups and MFIs have so far performed the best. However within the three groups variations in performance are observed, indicating that the overall performance of the group is weakened or strengthened by the performance of any one of the large institutions within the group. Within the MFBs the financial instability of KB obscures the financial strength of FMFB; the performance of Kashf dominates the overall performance of the MFIs group within which not all MFIs are sustainable. Similar is the case with RSPs where the performance of NRSP masks the performance of the individual RSPs all of which are not financially self-sufficient.

In order to minimize the trade-off between the social and commercial objective of microfinance, the sector needs to concentrate less on extensive expansion and should focus more on utilizing the existing human resource and financial resources intensively. The targets set by the sector may be more simply achieved by adopting an intensive growth strategy.

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1								
		2007	22862066	6418594	16443471	2723484		
	Total	2006	17535510	6077925	11457585	1475376		
		2005	13369483	4291300	9078183	1978819		
		2007	5771637	1254529	4517108	960879		6. (000)
(00	RSPs	2006	3792044	1134739	2657305	381238	liabilities	utions Rs
rre (Rs. 0		2005	3265721	831989	2433732	426292	ommercial	nce Instit
al Structu		2007	5365192	1695691	3669501	1157709	sbt, CL: co	Aicrofina
Financia	MFIs	2006	2901119	1164923	1736196	313355	D: total de	p Three N
		2005	1500523	729433	790111	266806	equity, T	are of To
		2007	11571078	3414490	8156588	581315	, TE: total	Shi
	MFBs	2006	10513729	3797473	6716256	744999	f total assets	
		2005	7857010	2764891	5092119	975124	ce: PMN TA: 1	
			TA	TE	TD	CL	Sour	

APPENDIX I

	2007	14440955	3673346	10767599	2272385
Top three	2006	11099240	3346914	7752226	819109
	2005	9150213	2748339	6401874	617550
	I	TA	TE	TD	CL

Source: PMN

		2007	1267182	640868	12749983	1143551	508000	3617332	
	Total	2006	835460	434122	8445099	1364470	542120	2349383	
		2005	612744	273368	5688289	1215896	449803	1354567	
	RSPs	2007	404179	174960	4057443	704318	195235	772318	
		2006	275638	71269	2593464	1133933	389318	900580	
		2005	208995	76272	1706761	1066648	357413	646941	
	MFIs/NGOs	2007	418234	370016	4104009	292975	292975	22,169	
		2006	217491	193725	2142452	132558	132558	15948	
		2005	102889	90694	947902	70790	70790	7894	
	MFBs	2007	435407	89546	4456259	146258	19790	2822845	
		2006	326498	159869	3537832	70891	7484	1419841	
		2005	248091	78814	2344414	32482	4101	679240	
			AB	WB	GLP	S	WS	SA	

Outreach (in Numbers), Gross Loan Portfolio and Savings in Rs. (000) APPENDIX II

Source: PMN

AB: number of active borrowers, WB: number of women borrowers, GLP: gross loan portfolio, S: number of savers, WS: Women savers, SA: total savings

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				-		- 1	
p 3	2007	871817	452101	9076691	970684	461601	785017
%Share of to	2006	492764	304589	5671512	774031	330318	749684
	2005	424849	198254	3903707	613449	247442	482544
NRSP	2007	292456	124996	3244991	704318	195235	772318
	2006	190846	52383	1993579	667079	223366	741620
	2005	122157	47328	1206032	549822	183815	476150
Kashf	2007	295396	283288	3178784	266366	266366	12699
	2006	133690	131491	1530321	106952	106952	8064
	2005	75520	75201	774430	63627	63627	6394
KB	2007	283965	43817	2652916	1	I	I
	2006	236917	120715	2147612	1	1	I
	2005	227172	75725	1923245	1	1	
		AB	WB	GLP	s	WS	SA

PMN Source: AB: number of active borrowers, WB: number of women borrowers, GLP: gross loan portfolio, S: number of savers, WS: Women savers, SA: total savings

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# INFLATION FORECASTING IN PAKISTAN USING ARTIFICIAL NEURAL NETWORKS

## ADNAN HAIDER and MUHAMMAD NADEEM HANIF\*

**Abstract**. An artificial neural network (hence after, ANN) is an informationprocessing paradigm that is inspired by the way biological nervous systems, such as the brain, process information. In previous two decades, ANN applications in economics and finance; for such tasks as pattern reorganization, and time series forecasting, have dramatically increased. Many central banks use forecasting models based on ANN methodology for predicting various macroeconomic indicators, like inflation, GDP Growth and currency in circulation etc. In this paper, we have attempted to forecast monthly YoY inflation for Pakistan by using ANN for FY08 on the basis of monthly data of July 1993 to June 2007. We also compare the forecast performance of the ANN model with conventional univariate time series forecasting models such as AR(1) and ARIMA based models and observed that RMSE of ANN based forecasts is much less than the RMSE of forecasts based on AR(1) and ARIMA models. At least by this criterion forecast based on ANN are more precise.

## I. INTRODUCTION

In modern age of forecasting, there has been a great interest in studying the artificial neural network (ANN) forecasting in economics, financial, business

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and engineering applications including GDP growth, stock returns, currency in circulation, electricity demand, construction demand and exchange rates (*see* Fernandez-Rodriguez, Gonzalez-Martel and Sosvilla-Rivero, 2000; Redenes and White, 1998). Many central banks, for example, CZECH National Bank (Marek Hlavacek, Michael Konak and Josef Cada, 2005), Bank of Canada (Greg Tkacz and Sarah Hu, 1999), Bank of Jamaica (Serju, 2002), are currently using their forecasting models based on ANN methodology for predicting various macroeconomic indicators. Using forecasts based on this methodology one may make correct classification and decisions such as stock selection, bond rating, credit assignment, property evaluation, and many others (*see* Chen, Racin and Swanson, 2001; Swanson and White, 1997; Stock and Watson, 1998).

Inflation forecast is used as guide in the formulation of the monetary policy by the monetary authorities in the world. Monetary policy decisions are based on inflation forecast extracted from the information from different models and other information suggested by relevant economic indicators of the economy. The main purpose of this paper is to forecast monthly YoY inflation for Pakistan by using ANN methodology for FY08 on the basis of available monthly data since July 1993. We also compare the forecast performance of the ANN model with that of univariate AR(1) and ARIMA based models. It is observed that forecasts based on ANN are more precise than then those based upon AR(1) and ARIMA models.

The rest of the paper is organized as follows: Neural network methodology is presented in section II. Section III provides data and model specifications. Empirical findings are discussed in section IV and the summary of our findings is presented in the last section.

## **II. BACKGROUND AND METHODOLOGY**

Neural network theory grew out of Artificial Intelligence research, or the research in designing machines with cognitive ability. An artificial neural network is an information processing paradigm that is inspired by the way biological nervous systems, such as the brain, process information.<sup>1</sup> The key element of this paradigm is the novel structure of the information processing system. It is composed of a large number of highly interconnected processing

<sup>&</sup>lt;sup>1</sup>A neural network is a massively parallel distributed processor that has a natural propensity for storing experiential knowledge and making it available for use. It resembles the brain in two respects: Knowledge is acquired by the network through a learning process and interneuron connection strengths known as synaptic weights are used to store the knowledge (*see*, for instance, Hykin, 1994).

elements, called neurons, working in unison to solve specific problems. ANN learns by experience like people. An ANN is configured for a specific application, such as pattern recognition and time series forecasting, through a learning process. Learning in biological systems involves adjustments to the synaptic connections that exist between the neurons. The basic building block of a brain and the neural network is the neuron. The human neuron<sup>2</sup> is shown in Figure 1.

### FIGURE 1

#### Biological Model of Human Neuron



As described by Beal and Jackson (1990), all inputs to the cell body of the neuron arrive along *dendrites*. Dendrites can also act as outputs interconnecting inter-neurons. Mathematically, the dendrite's function can be approximated as a summation. *Axons*, on the other hand, are found only on output cells. It has an electrical potential. If excited, past a threshold, it will transmit an electrical signal. Axons terminate at *synapses* that connect it to the dendrite of another neuron. The neuron sends out spikes of electrical activity through a long axon, which splits into thousands of branches, *see*, Figure 2. At the end of each branch, a structure called a *synapse* converts the activity from the axon into electrical effects that inhibit or excite activity from the axon into electrical effects that inhibit or excite activity in the connected neurons. When a neuron receives excitatory input that is

<sup>&</sup>lt;sup>2</sup>Adapted from Beale and Jackson (1990) and JOONE Documentation.

sufficiently large compared with its inhibitory input, it sends a spike of electrical activity down its axon. Learning occurs by changing the effectiveness of the synapses so that the influence of one neuron on another changes. The human brain contains approximately 10 billion interconnected neurons creating its massively parallel computational capability.

# FIGURE 2

Neural Signal Transmission



## **ARTIFICIAL NEURON**

The artificial neuron was developed in an effort to model the human neuron. The artificial neuron depicted in Figure 3.<sup>3</sup> Inputs enter the neuron and are multiplied by their respective weights.

For analytical purposes, a neuron may be broken down into three parts:

- input connections
- summing and activation functions
- output connections

<sup>&</sup>lt;sup>3</sup>Adapted from Kartalopoulos (1996) and Haykin (1994).

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# FIGURE 3

## **1. Input Connections**

In artificial neural network, a neuron is connected to other neurons and depends on them to receive the information that it processes. There is no limit to the amount of connections a neuron may receive information from. The information that a neuron receives from others is regulated through the use of weights. When a neuron receives information from other neurons, each piece of information is multiplied by a weight with a value between -1 and +1, which allows the neuron to judge how important the information it receives from its input neurons is. These weights are integral to the way a network works and is trained: specifically, training a network means modifying all the weights regulating information flow to ensure output follows the given criteria, *e.g.*, minimization of RMSE or MAE.

## 2. Summing and Activation Functions

The second portion of a neuron is the summing and activation functions. The information sent to the neuron and multiplied by corresponding weights is added together and used as a parameter within an activation function.<sup>4</sup>

<sup>&</sup>lt;sup>4</sup>In a biological context, a neuron becomes activated when it detects electrical signals from the neurons it is connected (*see*, Beale and Jackson, 1990). If these signals are sufficient, the neuron will become "activated" – it will send electrical signals to the neurons connected to it.

Numerous activation functions exist in ANN literature, but we will discuss below the one which we used and that is hyperbolic tangent function: a continuous function with a domain of  $(-\infty, \infty)$  and a range of (-1, 1):

$$\tanh(x) = \frac{e^{2x} - 1}{e^{2x} + 1}$$

By providing a function with a limitless domain and a range of (-1, 1), it is perfect for predicting whether or not inflation will rise  $(\tanh (x) = 1)$  or fall  $(\tanh (x) = -1)$ .

## 3. Output Connections

Finally, once the activation function returns a corresponding value for the summed inputs, these values are sent to the neurons that treat the current neuron as an input. The process repeats again, with the current neuron's output being summed with others, and more activation functions accepting the sum of these inputs. The only time this may be ignored is if the current neuron is an output neuron. In this case, the summed inputs and normalized sum is sent as an output and not processed again.

#### **NEURAL NETWORK ARCHITECTURE**

While each neuron is, in and of itself, a computational unit, neurons may be combined into layers to create complex but efficient groups that can learn to distinguish between patterns within a set of given inputs. Indeed, by combining multiple layers of such groups, it is theoretically possible to learn any pattern. There are many combinations of neurons that allow one to create different types of neural networks, but the simplest type is a single-layer feedforward network. In this case, a network is composed of three parts: a layer of input nodes, a layer of hidden neurons, and a layer of output nodes, as is shown in the Figure 4.

A multilayer feedforward network is similar to a single-layer one. The main difference is that instead of having a hidden layer pass its calculated values to an output layer, it passes them on to another hidden layer. Both types of networks are typically implemented by fully connecting each layer's neurons with the preceding layer's neurons. Thus, if *Layer A* has *k* neurons and sends its information to *Layer B*, with *n* neurons, each neuron in *Layer A* has *k* input connections for its calculated output, while each neuron in *Layer B* has *k* input connections.



Interestingly, such a network can be represented mathematically in a simple manner. Supposing there are *k* neurons in *Layer A*, let *a* represent a vector, where  $a_i$  is the *i*<sup>th</sup> neuron's activation function output. Let *b* represent the input values to neurons in *Layer B*, with  $b_j$  be the *j*<sup>th</sup> neuron. Let *W* be a *n* by *k* matrix where  $w_{ji}$  represents the weight affecting the connection from  $a_i$  to  $b_j$ . Keeping this in mind, we can see that for a single-layer feedforward network, we can mathematically represent the flow of information by,

## Wa = b

and the learning thus becomes a modification of each  $w_{ji}$  in W. A similar mathematical analogy applies to multilayer feedforward networks, but in this case, there is a W for every layer and 'b' is used as the value for 'a' when moving to subsequent layers. The most popular type of learning within a single-layer feedforward network is the Delta Rule, while multilayer feedforward networks implement the Backpropagation algorithm, which is a generalization of the Delta Rule (*see*, Beale and Jackson, 1990).

The Delta Rule may be summarized with the following equation:

$$\Delta w_{ij} = - \in \delta_j x_i$$

In this case,  $\Delta w_{ij}$  represents the change of the weight connecting the  $i^{th}$  neuron with the  $j^{th}$  output neuron,  $x_i$  is the output value of the  $i^{th}$  neuron,  $\varepsilon$  is the learning rate, and  $\delta j$  is the error term in the output layer, defined as:

$$\delta_k = -(t_k - o_k)$$

where  $t_k$  is the expected output, while  $o_k$  is the actual output. While this rule works well when there is only one hidden layer In case of multiple layers we use generalized delta rule described below.

$$\delta_j = \left(\sum_k \delta_k w_{jk}\right) \left(h_j \left(1 - h_j\right)\right)$$

In this case, one uses the same equation for  $\Delta w_{ij}$  but uses the term above instead, with k representing the neurons receiving information from the current neuron being modified.  $\delta_k w_{jk}$  is the error term of the  $k^{\text{th}}$  neuron in the receiving layer, with  $w_{jk}$  being the connecting weight. The activation functions of all the neurons in a network implementing backpropagation must be differentiable, because:

$$h_i = \sigma'(z_i)$$

with  $z_j$  being the net input for the neuron.

Finally, if biases are present, they are treated like regular neurons, but with their output (x) values equal to 1:

$$\Delta B_i = - \in \delta_i$$

When implemented, this algorithm has two phases. The first deals with having the network evaluate the inputs with its current weights. Once this is done, and all the neuron and output values are recorded, phase two begins. The algorithm begins this phase by applying the original Delta Rule to the output neurons, modifying weights as necessary. Then the generalized Delta Rule is implemented, with the previous  $\delta$  values sent to hidden neurons, and their weights changing as required.

## **III. DATA AND MODEL SPECIFICATIONS**

## **DATA SPECIFICATION**

The main objective of this study is to forecast monthly YoY inflation for Pakistan for FY08 using feed-forward artificial neural network model with 12 hidden layers. We used data on monthly basis since July 1993. Figure 5 represents graphically the data we have used.

## FIGURE 5

Monthly Inflation rate (YoY)



## MODEL SPECIFICATION

We estimate a very simple neural network for inflation based on *'feedforward with backpropagation'* architecture.

$$\hat{\pi}_{t+j} = \sum_{k=1}^{n} \Theta_k \tanh(w_k x_{t-k} + b_k)$$
(1)

Where:  $\hat{\pi}_{t+j}$  is the neural network inflation forecast *j* months ahead,  $x_{t-1}$  is a vector of lagged inflation variables  $[\hat{\pi}_{t-1}, \hat{\pi}_{t-2}]$ , tanh which is the hyperbolic tangent function used as transformation process.  $\Theta$ 's are layer weights,  $w_i$  are input weights and b's are biases.

While implementing our model, it required following steps:

- Selection of input variables
- Preprocessing the input data

- Specifying a neural network
- Training the network
- Forecast Accuracy

## SELECTION OF INPUT VARIABLE

This step identifies the variables that contribute the most to forecasting the target variable. If we omit important variables, then its effect on the performance of the neural network can be significant. For our simplicity, we only consider univariate forecast neural network model. Given the limitation of the data, the simple neural network architecture given by (1) was chosen with very minimal search over alternative network architectures.

## PREPROCESSING THE INPUT DATA

Neural networks need properly transformed data to be able to process them and generate sound forecasts.<sup>5</sup> For our simplicity, we assume there is no statistical bias in our data.

## SPECIFYING A NEURAL NETWORK

A typical *feedforward with backpropagation* network should have at least three-layers.<sup>6</sup> Appropriate selection of number of layers is an art. This selection criterion needs experimentation. The countless combinations of layers and neurons that we can make and the time it takes to train a network after each selection is an arduous exercise.<sup>7</sup> In this paper, the number of layers specified is 12. We could also use many layers but that would make the training time prohibitive. The resulting improvement in forecast accuracy may not be worth the extra time. Furthermore, a backpropagation network should have at most fifteen layers.<sup>8</sup> In the network specification stage we can adjust a number of default parameters or values that influence the behavior of the training process. These deal with the learning, forgetting and error

<sup>&</sup>lt;sup>5</sup>Transformation, normalization and data smoothing are three common ways of preprocessing data. Transformation and normalization makes the statistical distribution of each input and output data roughly uniform. The values are scaled to match the range that the input neurons use. Data normalization methods, which include simple linear scaling and statistical measures of central tendency and variance, remove outliers and spread out the distribution of the data. Data smoothing filters out noise in the data.

<sup>&</sup>lt;sup>6</sup>Input, output and at least one hidden layer is compulsory.

<sup>&</sup>lt;sup>7</sup>It is found that, a single or two-layer network would be rather inadequate in capturing the complex dynamics of market variables. For example, Barnett, Medio and Serletis (2003).

<sup>&</sup>lt;sup>8</sup>See, Serju (2002).

tolerance rates of the network, the maximum number of runs, stop value for terminating training and randomizing weights with some specified dispersion.<sup>9</sup>

## TRAINING THE NETWORK AND FORECASTING

We train the ANN using the Levenberg-Marquardt algorithm, a standard training algorithm from the literature. The algorithm is terminated according to the early stopping procedure.<sup>10</sup> The validation set used in the early stopping procedure is chosen in a somewhat unusual manner. Finally, the training function produce forecast results on the basis of RMSE minimization criteria.

## FORECAST EVALUATION

To evaluate the forecast, we calculate root mean of squared errors (RMSE) as follows:

$$\text{RMSE} = \sqrt{\frac{\sum_{i=1}^{n} (Y_{it} - Y_{it})^2}{n}}$$

The training algorithm is run on the training set until the RMSE starts to increase on the validation set.

## **IV. EMPIRICAL RESULTS**

Inflation forecasting based on model described in section 3.2 requires the following steps. First of all we normalize data by using the following algorithm.

normalized value(
$$\pi_t$$
) = 2\*  $\left(\frac{(current value(\pi_t) - \max value(\pi_t))}{(\min value(\pi_t) - \max value(\pi_t))}\right)$ 

This process changes the original scaling of data within the range [-1, +1]. Results are shown here in Figure 6.

<sup>&</sup>lt;sup>9</sup>For neural network default values specification, *see* MATLAB 7.0 guidelines.

<sup>(</sup>www.mathworks.com)

<sup>&</sup>lt;sup>10</sup>This procedure is related to the innovative approach used by Nakamura, Emi, (2005).





Our neural network was trained using the MATLAB. Before training, this model requires some default values, which are given in Table 1. After setting the basic properties, model required normalized data as input and transfers this to training function by using tan hyperbolic function. Then 'trainlm' function is used to train the data.

## TABLE 1

## Default Parameters Values for ANN

hidden_layers = 12
$\max \log = 12$
training set $= 80$
forecast period = 12
learning rate = $0.25$
learning increment = 1.05
learning decrement = $0.07$
training parameter epochs = $1000$
target $RMSE = 0.00005;$
Table Key: MALTAB Neural Network toolkit uses these parameter values.

Forecast efficiency is captured by minimizing the root mean square errors (RMSE). In our experiment, we try to find forecast monthly YoY

inflation for Pakistan for FY08 on the basis of monthly data since July 1993. The out-of-sample forecast is presented in Figure 7. It shows an upward continuous trend in inflation rate for FY08. In the next subsection we compare the forecast performance of ANN with that of AR(1) model.

## FIGURE 7

Monthly YoY Inflation Forecast for FY08



## COMPARING FORECAST PERFORMANCE OF ANN AND AR(1) AND ARIMA BASED MODELS

In order to compare the out-of-sample forecast performance of ANN with AR(1) and ARIMA based models we find the out-of-sample forecast for July 06 to June 07 from both of these model based on data for July 1993 to June 2006. Results based on ANN methodology as well as both AR(1) and ARIMA methodologies are presented in Table 2. Forecasting performance is evaluated on the basis of RMSE criteria. We observed that RMSE of ANN based forecasts is less than the RMSE of forecasts based on AR(1) and ARIMA models. At least by this criterion forecast based on ANN are more precise. This forecast comparison result based on Pakistan data is also consistent with earlier findings; Nakamura (2006) for US case and Choudhary and Haider (2008) for the case of twenty eight OECD countries.

I enormance Comparison Dased on RMSE							
Months	Actual Inflation	Forecast by ANN	Forecast by AR(1)	Forecast by ARIMA (1, 3, 7, 11; 1; 1,2)*			
Jul-06	7.63	7.68	7.62	7.92			
Aug-06	8.93	7.92	7.60	8.34			
Sep-06	8.73	8.43	7.59	8.86			
Oct-06	8.11	8.45	7.58	9.34			
Nov-06	8.06	8.33	7.56	9.54			
Dec-06	8.88	8.26	7.55	9.79			
Jan-07	6.64	7.98	7.53	10.12			
Feb-07	7.39	7.70	7.52	11.23			
Mar-07	7.67	7.68	7.51	11.23			
Apr-07	6.92	7.59	7.49	10.76			
May-07	7.41	7.44	7.48	10.37			
Jun-07	7.00	7.29	7.47	10.14			
Average	7.78	7.90	7.54	9.80			
RMSE		0.59	0.75	2.25			

TABLE 2

Performance Comparison Based on RMSE

Table Key: \*/ usual ARIMA (AR terms; Order of integration; MA terms) convention is used

## V. CONCLUSION

This paper applied a simple univariate artificial neural network model to forecast monthly YoY inflation for Pakistan by using ANN methodology for FY08 on the basis of monthly data for July 1993 to June 2007. The main purpose of this exercise is to find consistent out-of-sample forecast based on RMSE minimization criteria, in which error volatility is minimized after training network with 12 hidden layers. The leaning rate of our model is 0.25. Model simulation used feedforward with backpropagation methodology which requires an activation function which used generalized delta rule. Our forecast results indicate that inflation projection for the end of next FY08 is on high on average as compared with FY07. In last, we compared out-of-sample forecast performance with forecast based on AR(1) and ARIMA based models and found that RMSE of ANN based forecasts is much less than the RMSE of forecasts based on AR(1) and ARIMA based models. At least by this criterion forecast based on ANN are more precise.

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