



The Livestock Sector in the World Development Report 2008: Re-assessing the Policy Priorities

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ABSTRACT

This note examines how the 2008 World Bank World Development Report on Agriculture for Development (WDR) assesses the potential contribution of the livestock sector to agricultural / economic growth and poverty alleviation, with a particular focus on the policy implications.

The WDR largely considers meat and dairy as high value livestock products and the evolution of the livestock sector as being primarily driven by demand-related factors. Opportunities for livestock sector development are thought to predominate in transforming and urbanized economies, mainly in Asia and Latin America, where linking farmers to markets is a major policy priority. Instead, for agriculture based countries of sub-Saharan Africa, the WDR advocates for a smallholder-based 'productivity revolution', particularly for staple foods.

A test of the causal relationship between growth in livestock sector productivity and *per capita* GDP in a sample of 66 developing countries shows, however, that increases in livestock sector productivity tended to precede growth in *per capita* GDP in the majority of sample countries, many of which are agricultural-based. It follows that, whilst demand-related factors certainly contribute to livestock development and policies which allow smallholders to profitably sell meat and milk in high-value markets are no doubt important, policies which address more fundamental constraints to livestock sector growth, such as inadequate access to forage, water and animal health services appear equally, if not more, relevant

1. Introduction

The World Development Report (WDR) is the World Bank's annual flagship publication and significantly influences development thinking and policies. The theme of the 2008 WDR is 'Agriculture for Development'. Given that about 70 percent of the rural poor are estimated to keep some farm animals (LID, 1999) and the livestock sector is one of the fastest growing agricultural sub-sectors in developing countries, this report examines how the 2008 WDR assesses the potential contribution of the livestock sector to agricultural / economic growth and poverty alleviation, with a focus on the policy implications.

2. A Synopsis of the WDR 2008

The 2008 WDR defines agriculture as comprising crops, livestock, agro-forestry and aquaculture; it groups countries according to the contribution of agriculture to overall growth and level of rural poverty; and proposes different agriculture-for-development agendas for the different types of national economies.

- In 'agricultural-based countries', which are largely located in sub-Saharan Africa, agriculture contributes significantly to economic growth – about 32 percent on average over the period 1993-2005 – and around 70 percent of the poor are rural. In these countries, agricultural policies should aim at *'improving smallholder competitiveness in high- and medium-potential areas [...] and selecting investments in agricultural technologies and natural resource management to improve livelihoods, food security, and environmental resilience in remote and risky environments'* (WDR, p. 231).
- In 'transforming countries', comprising the majority of countries in Asia, North Africa and the Middle East, agriculture contributed about 7 percent to economic growth over the period 1993-2005 and around 82 percent of the poor live in rural areas. The recommended top policy priority in these countries is to *'promote high-value activities to diversify smallholder farming away from land-intensive staples'* and *'to strengthen rural-urban linkages'* (WDR, p.236 and 238).
- In 'urbanised countries', including Eastern European and Latin American economies, agriculture contributed about 5 percent to overall economic growth over the period 1993-2005 and only about 45 percent of the people living on less than \$ 1 a day are rural. *'The overall goal in using agriculture for development is to promote the inclusion of smallholders in the new food markets and to provide good jobs in agriculture and the rural non-farm economy'* (WDR, p.239).

The WDR reviews a number of policy instruments which governments may apply to pursue the above development agendas, including trade, price and subsidy policies; policies '*bringing agriculture to the market*'; land access policies; market-friendly public interventions aimed to unleash financial and factor input markets; research and development policies; environmental and rural labour policies. The appropriate set of policy instruments will differ in agricultural, transforming, and urbanised economies. Good governance – including complementary roles for the public, the private sector and civil society – is considered essential for the implementation of any agriculture-for-development agenda.

3. The Livestock Sector in the WDR 2008

The 2008 WDR, though not systematically, addresses all current major issues in livestock sector development, both at the macro- and micro-level, such as they have been analysed in the recent socio-economic literature (Byron-Nelson, 2005; Delgado *et al.*, 1999; Kristjanson *et al.*, 2004; 2007; Steinfeld *et al.*, 2007; Upton, 2004).

- The Report reviews the major macro changes in the demand for and supply of livestock products. '*The livestock and aquaculture revolutions have been most notable in the transforming and urbanized countries of Asia and Latin America, driven by rising demand for poultry, pork, fish, and eggs with increasing incomes. Beef and milk production have also risen steadily in rapidly growing countries*' (WDR, p.59). On the supply side, '*advances in animal [...] genetics combined with improved animal health and feeding have been the basis of the livestock revolution in developing countries*' (WDR, p.162), while agribusiness firms and supermarkets are increasingly dominating high-value product markets, often imposing stringent grades and standards, which smallholders find it difficult to comply with.
- At the micro level, the Report notes that livestock are one of the most important non-land assets in the portfolios of rural households, particularly in arid and semi-arid regions. Statistics from household surveys in 14 countries show that the majority of rural households keep livestock, with shares above 80 percent in Albania, Ecuador, Nepal and Viet Nam, and that about 40 percent of the poorest households keep some farm animals. Loss of animals due to shocks and distress sales can thus contribute to a fall into poverty and '*result in long-term consequences across generations through reduced investments in health, nutrition, and schooling*' (WDR, p.90). Conversely, diversification into livestock and high-value crops can help farmers to move out of poverty.

The agriculture-for-development agendas proposed by the WDR apply to agriculture as a whole, and hence also to the livestock sector. The WDR considers meat and milk as high value products and assumes that the evolution of the livestock sector is mainly driven by demand-

related factors: *'So growth in agriculture is increasingly driven by the rapidly expanding demand for livestock products and high-value crops, which are also more labour intensive'* (p.36); *'Rising demand for high-value horticulture and livestock products ... offers farmers opportunities to diversify into new markets'* (p.50); *'... high-potential areas ... must seize the opportunity to diversify in high-value horticulture and livestock in response to rapidly growing domestic and international demand'* (p.68).

Accordingly, the WDR emphasizes the role of policies *'bringing agriculture to the market'* for high value products for Asia, while for sub-Saharan Africa it places more emphasis on policies triggering a smallholder *'productivity revolution'* for staple foods – including maize, rice, wheat, millet, sorghum, cassava, yams, and plantains. The Report, for instance, stresses that supporting collective actions by smallholders is necessary to allow their participation in high-value labour intensive horticultural and livestock products, such as for instance dairy products in India. Conversely, but for a text-box on the Mongolia's index-based livestock insurance programme, the WDR focuses on crop-based policies to sustain a *'smallholder productivity revolution'* and fails to acknowledge the many institutional innovations which a number of governments of low-income / growth countries are experimenting with to enhance the productivity of livestock kept by poor smallholder farmers, such the institutionalisation of community animal health workers; targeted subsidies to private animal health service providers; legal reforms in the financial sector to allow banks to accept movable properties, including livestock, as collaterals on loans.

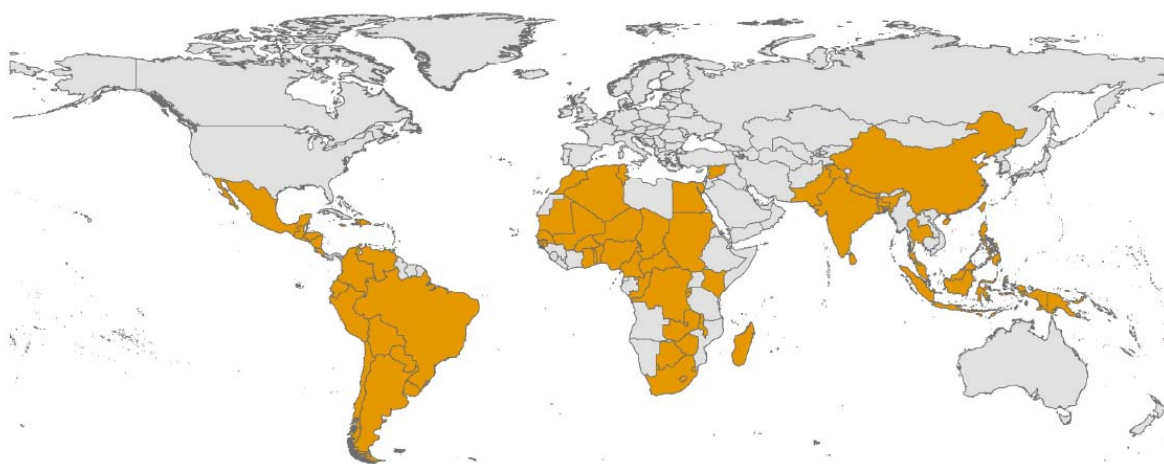
Underpinning the policy stance of the WDR for the livestock sector, as far as can be inferred from the mixed way the livestock sector is dealt with in the Report, is the belief that the development of the sector is largely dependent on exogenous demand-driving factors. A boost in the demand for animal source food, expressed by an increase in the relative prices of meat and dairy products, can benefit smallholders in the short run, when the supply of livestock products is typically inelastic because of biological and technological constraints as well as the role of expectations in supply-response behaviour. In the medium to long-term, however, if the relative prices of meat and dairy products stay high, new entrepreneurs will enter the market and thereby exert downward pressure on the *'extra-profitability'* of activities associated with livestock production. In the medium- to long-run, therefore, it is increased livestock productivity – as a large body of economic literature shows for agriculture as whole – that will prompt economic growth and poverty alleviation, rather than a major surge in the demand for animal source food.

4. Results of Causality Testing of the Relationship between GDP and Livestock Sector Growth

This section presents the results of a test of the causal relationship between economic growth and livestock productivity in a sample of developing countries. We hypothesise that in low- and middle-income economies increases in livestock productivity promote GDP growth and poverty reduction in the medium- to long-term. A wide array of economic literature has documented that increased agricultural productivity triggers economic growth and poverty alleviation in developing countries (Datt and Ravallion, 1998; Gallup *et al.*, 1997; Irz *et al.*, 2001; Winters *et al.*, 1997). Given the share of livestock value-added in agriculture increases as economic development progresses, up to over 50 percent in most industrialised countries, it could be that increases in livestock productivity act as a stimulus of economic growth on their own right.

Drawing on the World Bank's World Development Indicators Database (World Bank, 2007) and FAO's Internal Statistical Database (FAO, 2007) we have assembled a panel dataset spanning the period 1961 to 2003 for a total of 66 developing countries (Fig. 1).

Figure 1 Countries for which data for a causality test between growth in per capita GDP and productivity in the livestock sector was available



Per capita GDP (constant 2000 US\$) is taken as an indicator of level of development as well as of the demand for animal food; livestock productivity (constant 2000 US\$) is measured by value added per tropical livestock unit (TLU).¹ To trace the causality between GDP growth and livestock productivity we use a Granger causality test (1969) and apply the methodology developed by Toda and Yamamoto (1995) (See Appendix 1).

¹ One tropical livestock unit (TLU) is equivalent to a 250 kg live-weight animal. Weights are region-specific as in the FAO's Global Livestock Production and Health Atlas (GLiPHA) <http://www.fao.org/ag/aga/glipha/>

Table 1 summarizes the empirical results for the countries in which a significant relationship (at 5 percent level) was found between GDP growth and livestock productivity growth.

Table 1 Countries exhibiting causality between growth of livestock productivity (VA) and growth in *per capita* GDP

Country	Livestock VA \Rightarrow GDP		GDP \Rightarrow Livestock VA	
	Stat.	Prob.	Stat.	Prob.
1 Bolivia*	12.74	0.01	0.75	0.86
2 Burundi**	9.48	0.01	22.31	0.00
3 Central African Rep.*	4.56	0.03	1.62	0.20
4 Chad*	53.13	0.00	1.76	0.62
5 Chile*	6.53	0.01	1.14	0.29
6 China*	39.08	0.00	5.03	0.41
7 Colombia*	9.14	0.01	3.69	0.16
8 Congo Dem Rep*	4.06	0.04	1.12	0.29
9 Congo Rep*	48.22	0.00	3.35	0.65
10 Dominican Republic*	4.74	0.03	0.10	0.75
11 Fiji**	41.66	0.00	10.41	0.01
12 Gambia*	13.09	0.00	3.08	0.21
13 Ghana*	15.14	0.00	2.57	0.28
14 Guatemala*	44.79	0.00	3.68	0.30
15 Guinea Bissau*	39.88	0.00	1.10	0.58
16 Haiti*	9.52	0.01	3.68	0.16
17 India**	108.36	0.00	24.84	0.00
18 Jamaica*	6.20	0.05	0.24	0.89
19 Kenya*	8.90	0.01	1.63	0.44
20 Lesotho*	9.21	0.01	0.59	0.74
21 Madagascar*	7.22	0.03	1.87	0.39
22 Malawi**	41.39	0.00	9.63	0.01
23 Morocco*	44.56	0.00	2.93	0.23
24 Nicaragua**	7.69	0.00	14.81	0.00
25 Niger**	40.54	0.00	12.77	0.00
26 Nigeria**	21.13	0.00	7.64	0.02
27 Pakistan*	6.22	0.04	1.37	0.50
28 Papua New Guinea*	6.70	0.04	2.02	0.36
29 Paraguay*	16.59	0.00	0.18	0.91
30 Philippines***	3.36	0.34	15.75	0.00
31 Senegal*	8.83	0.00	0.67	0.41
32 South Africa**	8.25	0.02	6.85	0.03
33 Sudan*	18.71	0.00	1.04	0.60
34 Syria**	75.18	0.00	12.89	0.00
35 Togo***	0.43	0.51	4.22	0.04
36 Zambia***	0.99	0.61	6.20	0.05

* countries exhibiting causality from growth of livestock productivity to growth in per capita GDP; ** countries exhibiting bi-directional causality; *** countries exhibiting causality from growth in per capita GDP to growth in livestock productivity,

In 36 of the 66 countries analyzed, that is in almost 55 percent of the sample, a statistically significant causal relationship was found between livestock sector development and economic growth. Most of these countries are agricultural-based or transforming economies. In 33 of the 36 countries in which a statistically significant relationship was found, livestock sector development appears to be / have been a driver of *per capita* GDP growth; in nine of these

countries a bi-directional causality was also found. Only in three countries, increases in livestock sector productivity appear to be / have been driven by *per capita* GDP growth.

5. Conclusions and Policy Implications

The finding that increases in livestock sector productivity are associated with economic growth in 33 of the 36 countries in which a statistically significant relationship was found appears plausible. There is a large body of economic literature which shows that increased agricultural productivity is anticipated to lead to lower food prices that directly benefit the poor and also generate a surplus of products and factors that can be exported from agriculture to the rest of the economy, thereby facilitating economic growth and poverty alleviation. Historical evidence largely supports this hypothesis. First, globally prices for agricultural products, including those of livestock products, have declined by about 0.5 to 0.7 percent per year relative to those of other goods since 1900 (Mundlak, 1990), though some major increases have been recorded in the last years. Second, a number of studies have empirically documented that agricultural growth supports broad-based economic growth. Timmer (2002) finds that over the period 1960 to 1985 in a sample of 65 developing countries past growth in agricultural GDP has a significant impact on current non-agricultural sector growth; Bravo-Ortega and Lederman (2005) replicate the analysis by Timmer for the 1960 to 2000 period and obtain similar results, although they find some heterogeneity across regions. For instance, in the case of Latin America, the impact appears weaker than in the case of other developing regions, such as in our results. They also find a significant impact of non-agricultural growth rates on agricultural growth, which suggests that the causality can run both ways. Tiffin and Irz (2006) test for the direction of causality between agricultural value-added per worker and gross domestic product in 85 countries and conclude that agricultural value-added is the 'causal' variable in the majority of developing countries, such as our results suggest too.

Overall, our findings indicate that the orthodox paradigm of increased agricultural productivity being a driver of economic growth in developing countries also applies to the livestock sector on its own right, possibly because of the increased contribution to the sector in agricultural value added along the process of economic development. The implications of these findings are that the WDR's vision of the livestock sector as primarily driven by exogenous demand factors can be misleading in terms of policy conclusions. Whereas some priority should certainly be given to policies which allow smallholders to profitably sell meat and milk in high-value markets, policies which address the fundamental constraints to livestock sector development, such as for instance inadequate access to forage, water and basic animal health services appear equally relevant. In other words, the productivity revolution the WDR envisages for smallholder farmers should not only include basic staples but also livestock products, which are not only high-value products for

better-off consumers but also basic food items for many rural communities in developing countries.

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8. Appendix

Granger (1969) defined a simple concept of causality by which a cause has to precede the effect: if *per capita* GDP growth affects productivity in the livestock sector, knowledge of the former should improve predictions of the latter (or vice versa). To avoid issues related to non-stationarity and co-integration, we apply the methodology developed by Toda and Yamamoto (1995) who showed that, irrespective of whether the variables involved are stationary or not and regardless of the existence of a co-integrating relationship among them, tests for Granger non-causality can be performed by estimating a Vector Autoregression Model VAR($p + d_{max}$), where p is the optimal lag length in the original VAR system and d_{max} is the maximum order of unit roots in the variables of the model. The following VAR model are estimated:

$$gdp_t = \alpha_{11} gdp_{t-1} + \dots + \alpha_{1d} gdp_{t-d} + \beta_{11} live_{t-1} + \dots + \beta_{1d} live_{t-d} + \varepsilon_{1t} \quad (1)$$

$$live_t = \alpha_{21} live_{t-1} + \dots + \alpha_{2d} live_{t-d} + \beta_{21} gdp_{t-1} + \dots + \beta_{2d} gdp_{t-d} + \varepsilon_{2t} \quad (2)$$

where gdp_t is per capita GDP in year t ; $live_t$ is livestock value added per TLU in year t ; $d = p + d_{max}$ is the number of time lags included in the model; ε_t is the error term. The Granger non-causality test is a modified Wald test on the parameters of the true VAR(p) model, i.e. it involves testing $\beta_{11} = \beta_{12} = \dots = \beta_{1p} = 0$ for each equation with the remaining d_{max} parameters regarded as zeros. This test has an asymptotic χ^2 distribution when the augmented VAR ($p + d_{max}$) is estimated. Estimating the above VAR requires three steps. First, we use Augmented Dickey Fuller (ADF) tests with trends to determine the number of units roots for both GDP and livestock productivity in the sample countries. The Schwarz Information Criterion (SIC) is used to determine the lag structures in the ADF tests. Second, we use the Akaike's Final Prediction Error (FPE) criterion to select the optimal lag length in the VAR models for each sample country. Finally, Seemingly Unrelated Regressions (SUR) are used to estimate the VAR systems and perform the modified Wald tests on the relevant coefficients, as these tests experience efficiency improvement when SUR models are used in the estimation (Rambaldi and Doran, 1996). The null hypotheses are tested at the 5 percent significance level.