Description of thesis

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China’s success against poverty since the reforms that began in 1978 is undeniable. Economic growth of about 9 percent per annum since the late 1970s has helped to lift several hundred million people out of absolute poverty. However, China’s 9.6 million square kilometers hide enormous economic disparities. More than 100 million poor people are concentrated in remote townships and villages, often in mountainous, low rainfall, or environments with limited potential for even subsistence levels of production. While the poor are mainly in western (inland) China, there are pockets of wealth amid poverty which are disguised with province-level data that all previous researchers and poverty analysts have had to use. By the same token, disguised are the pockets of poverty in the more prosperous eastern provinces. The concentration of large numbers of extremely poor people in these areas suggests that geographic targeting of poverty reduction assistance to these households and communities should be intensified. China has the money now to address these poverty problems; financially careful officials, however, want to know that their funds are being spent effectively. Successful anti-poverty policy making in China thus requires finely detailed spatial targeting to prevent leakage of benefits to non-poor areas and failure to benefit poor areas.

Such targeting is currently impossible since household survey samples in China are too small to permit measuring poverty at fine enough level of spatial disaggregation. Small area estimation techniques are being used in other countries to combine the detailed information from household surveys with the more extensive coverage of census data. These techniques have gained popularity amongst policy makers in developing countries in recent years for creation of poverty maps and in some cases; the estimates are used by governments to target financial resources to particularly needy areas. But such methods typically neglect geographical (location) and environmental components and do not take into account “spatial dependencies” that often exist in the data. These dependencies arise from social interactions and unobserved factors (say, due to poor soil or deteriorating environmental conditions). Ignoring this spatial component in statistical analyses that predict small-area poverty rates may lead to targeting errors where poor areas are excluded from the allocation of transfers and non-poor areas are deemed as potential beneficiaries. Hence, to analyze the distribution of poverty more accurately in China, and ultimately around the world, novel methods which use new spatial data and analytical tools are needed.

The statistical methodology being used to analyze the spatial distribution of poverty is the key in determining the precision of the poverty predictions. However, current literatures have not emphasized enough the limitations of the current methodologies and rely upon very strong assumptions that they require to allow for meaningful reference. Armed with this in mind, the objective of my dissertation is to experiment with four different statistical methodologies to analyze spatial distribution of poverty and provide its
empirical application to the analysis of poverty targeting in rural China, namely the
traditional method that does not measure linkages between poverty and environmental
variables; traditional methods but adding environmental variables and new methods that
use spatial econometrics (global and local) approaches to account for unobserved spatial
correlations. The overall goal of this methodological experiment is to compare the results
from each method and assess how well the use of new data and/or new estimation
procedures affects the findings.

In my first essay, I attempt to establish an analytical link between the people and their local
environments using the census and household survey data, as well as the environmental
variables. In this study, I will create two poverty maps (with and without environmental
variables) and then assess how much leakage and under-coverage results when
environmental variables are excluded from the model used to form the poverty
predictions. The strength of my first essay lies on a rich and unique set of data that I have
access to. China is one of the few countries in the world where high quality satellite
images of every square kilometer can be used to understand how unfavorable
environments contribute to rural poverty. Each one square kilometer parcel of land has
been mapped three times since 1988, which is unparalleled resource for integrating
environmental factors with poverty mapping analyses. Thus, using this data set along
with census and household survey data will enable poverty analysts to isolate
geographical and environmental factors that contribute to poverty and low levels of
household consumption and income at the most local level in rural China.

As discussed earlier, the current small area estimation techniques do not take into account
spatial dependencies. If there is spatial correlation among households within small areas
due to some real, but unobserved factors such as deteriorating environmental conditions,
then ignoring the spatial component in the regression analysis that predicts poverty could
lead to misleading estimates of the parameters (especially in the standard errors around
the poverty predictions). In the second essay, I will use the spatial econometric approach
(which has not been adequately considered in previous studies) which would help to
improve the effectiveness of analyses that explore such spatial dimensions of poverty.

In the third essay of my thesis, I will use the local statistics analysis to assess spatial
relationship between poverty and geographic factors. This is motivated by the fact that
the models described in first two essays assume that the relationship between poverty and
the geographic factors is spatially stationary. However, in practice, it is unlikely that
social processes will be constant over space. Consequently, relying on the generalized
regression models earlier will hide the spatial non-stationarity of the prevalence of
poverty. It is surprising that local statistics have not been the subject of much
investigation, especially in the poverty targeting context (exceptions include Minot et al.,
2003 and Benson et al., 2005). To assess the degree to which the relationship between

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1 Minot, N., Baulch, B. and Epprecht, M., in collaboration with the Inter-Ministerial Poverty Mapping
the potential determinants and the prevalence of poverty varies across space, I will use the geographically weighted regression (GWR) method.

The small area estimation method used for poverty analysis involves using household unit level data from a census. Researchers, however, do not always have access to the household-level census data because they are regarded as highly confidential. This implies that household-level census data are not available to produce disaggregated poverty maps. When access to household census data is the constraining factor, one alternative is to use census data that have been aggregated to a higher level (such as region or district). While easier access to data makes this method attractive, there are at least two limitations from this approach. In some cases, the averages calculated from the say community may not necessarily be a good proxy for the distribution of poverty. Second and most importantly, the error associated with such an estimation approach has not been through investigated yet. It is not clear to policy analysts how much statistical reliability being traded off for easier data access. Only one study to date Minot and Baulch (2002)\(^2\) that I known of has looked into the issue of how much precision is lost when using community level or aggregated to any level of census data. In the fourth essay, I will generate poverty estimates using Chinese census data that have been aggregated to different levels and compare the results to those obtained from the household-level census data and re-assess the question of how much precision is lost in generating poverty maps from aggregate census data using the Chinese data set. If the errors are small, then reliable poverty maps can be produced for a wider range of developing countries. If the errors are large, then the use of aggregated data is not advisable and researchers should focus on getting access to household-level data.