

Introduction

In the Department of Ucayali (Peruvian Amazon), on average 8000 ha of rainforest are cleared every year. While deforestation in general is the result of the complex interaction of a variety of factors, land use change for the purpose of agricultural expansion is considered to be the main cause for deforestation in the region. Market growth, commercialization and in particular increased market integration in turn constitute important economic factors underlying and encouraging agricultural expansion. From the perspective of Ucayali, Peru's coastal areas represent important consumer markets as well as the gateway to the world market. Integration with these markets may have implications for deforestation.

Research objectives

- To investigate the integration of the Department of Ucayali with national markets.
- To determine the degree of price transmission between the coastal capital of Lima along the trading route across the Andes to Pucallpa, the capital of the Department of Ucayali.
- To allow a first assessment of the relevance of market integration as a factor which contributes to deforestation in the Peruvian Amazon, making a first step towards a more comprehensive analysis.

Data and Methods

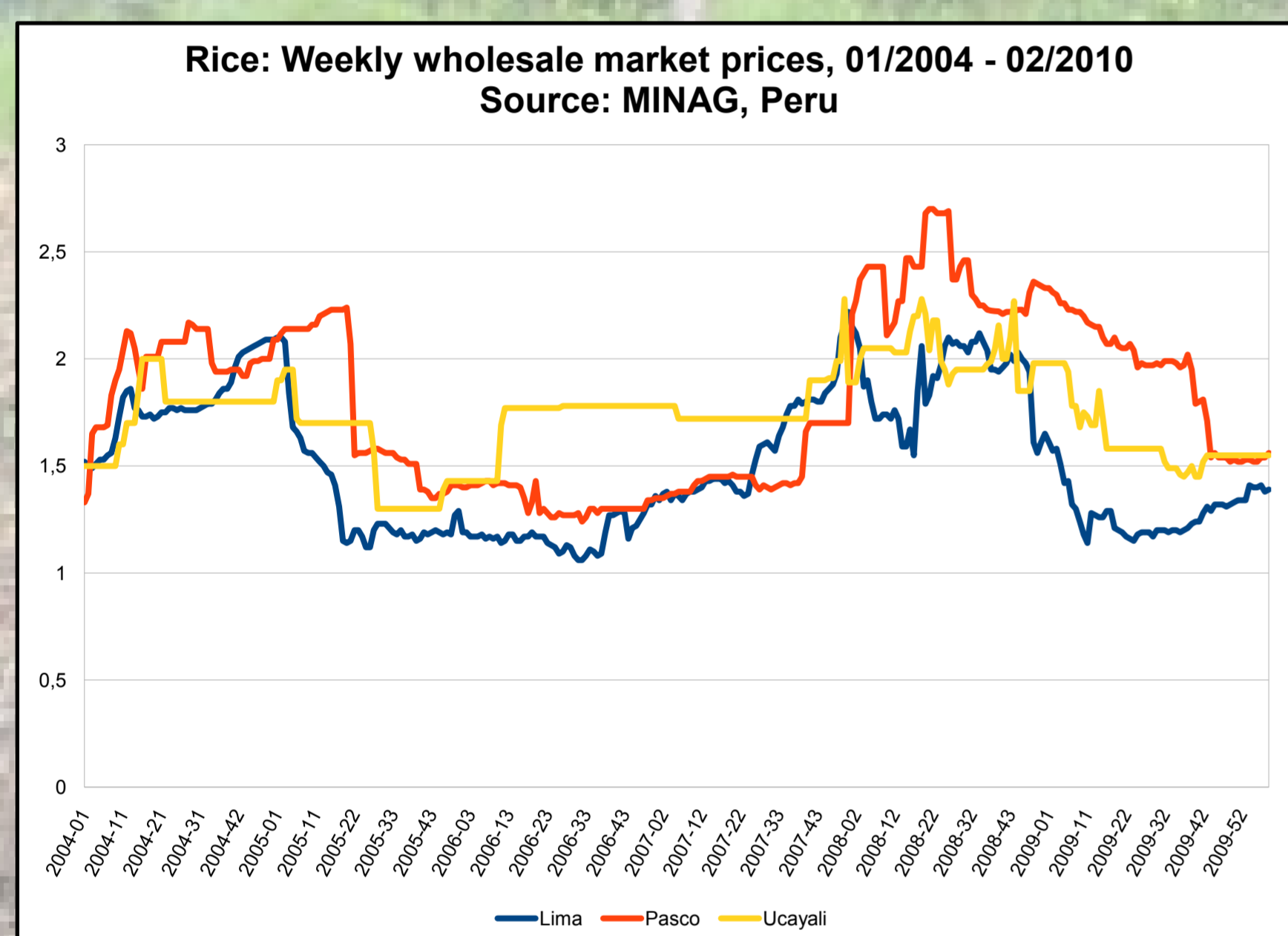
- **Weekly wholesale prices** of rice, cassava and papaya from Lima, Huanuco, Pasco and Ucayali (from 2004 to 2010).

1. **Augmented Dickey-Fuller (ADF) test:** Unit-root test to test for nonstationarity of the price series.
2. **Johansen trace test** to test for pairwise cointegration relationships between the price series and to find out whether markets are integrated.
3. **Vector error correction models (VECM)** to find out about the long-run relationship between price series and to determine the degree of price transmission between markets.



Results

Rice



Important staple, regional production in Ucayali of inferior quality and insufficient to satisfy demand, region imports from national and international sources.

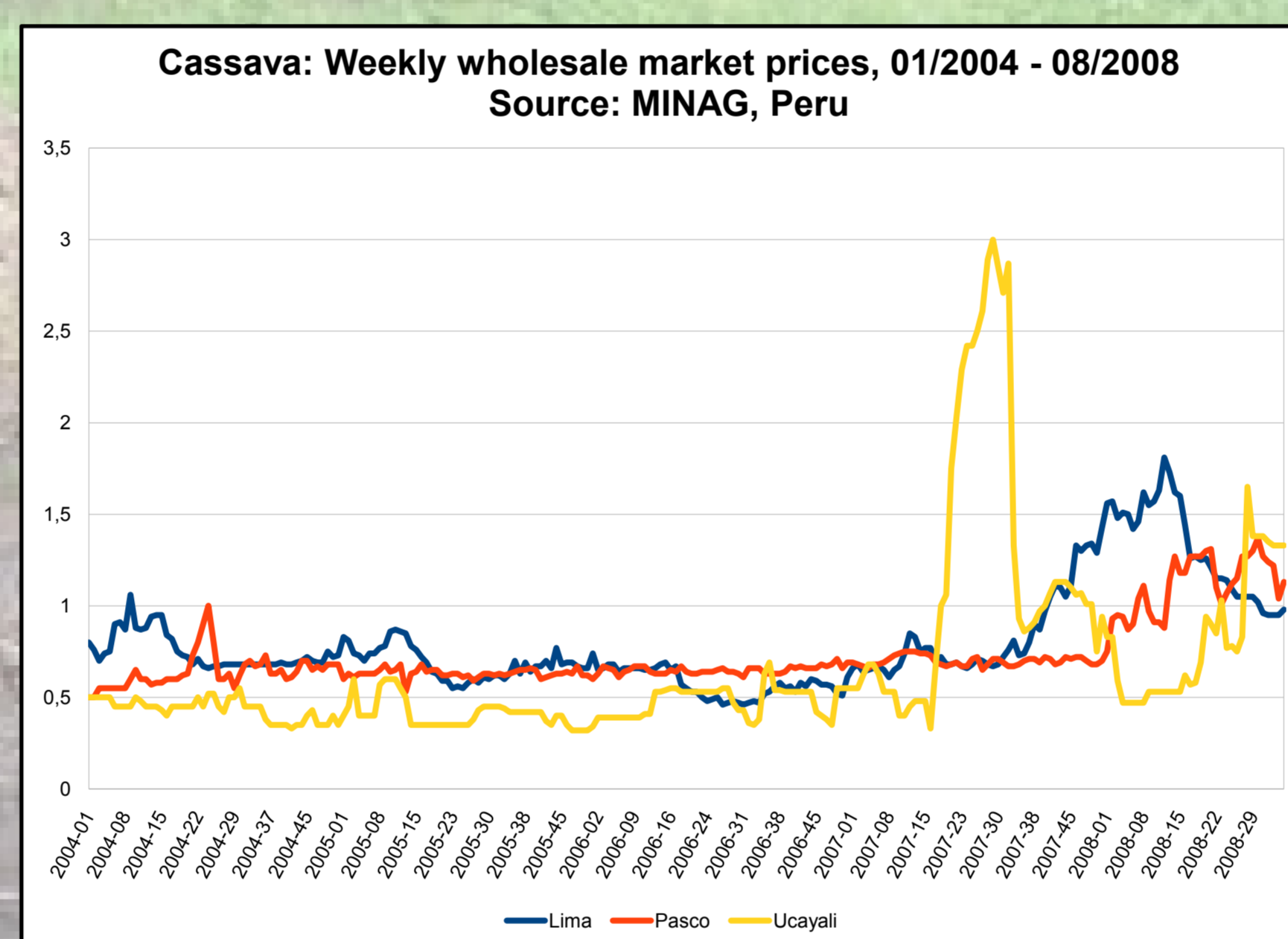
Unit root tests Cannot reject the Null of nonstationary price series at $\alpha=5\%$.

Cointegration tests Cointegration of Lima - Pasco, no cointegration between Lima - Ucayali and Pasco - Ucayali.

Vector error correction model Long run price-transmission elasticity between Lima - Pasco estimated to be 0.892, significantly different from 1.

While rice markets of the Andean highlands are still integrated with the coast, this is no longer the case for Ucayali. Still, price transmission from the coast to the Andes is less than perfect

Cassava



Important staple, produced for self-consumption, sold on regional markets and traded to Lima. Integrated marketing chain for sales to the capital.

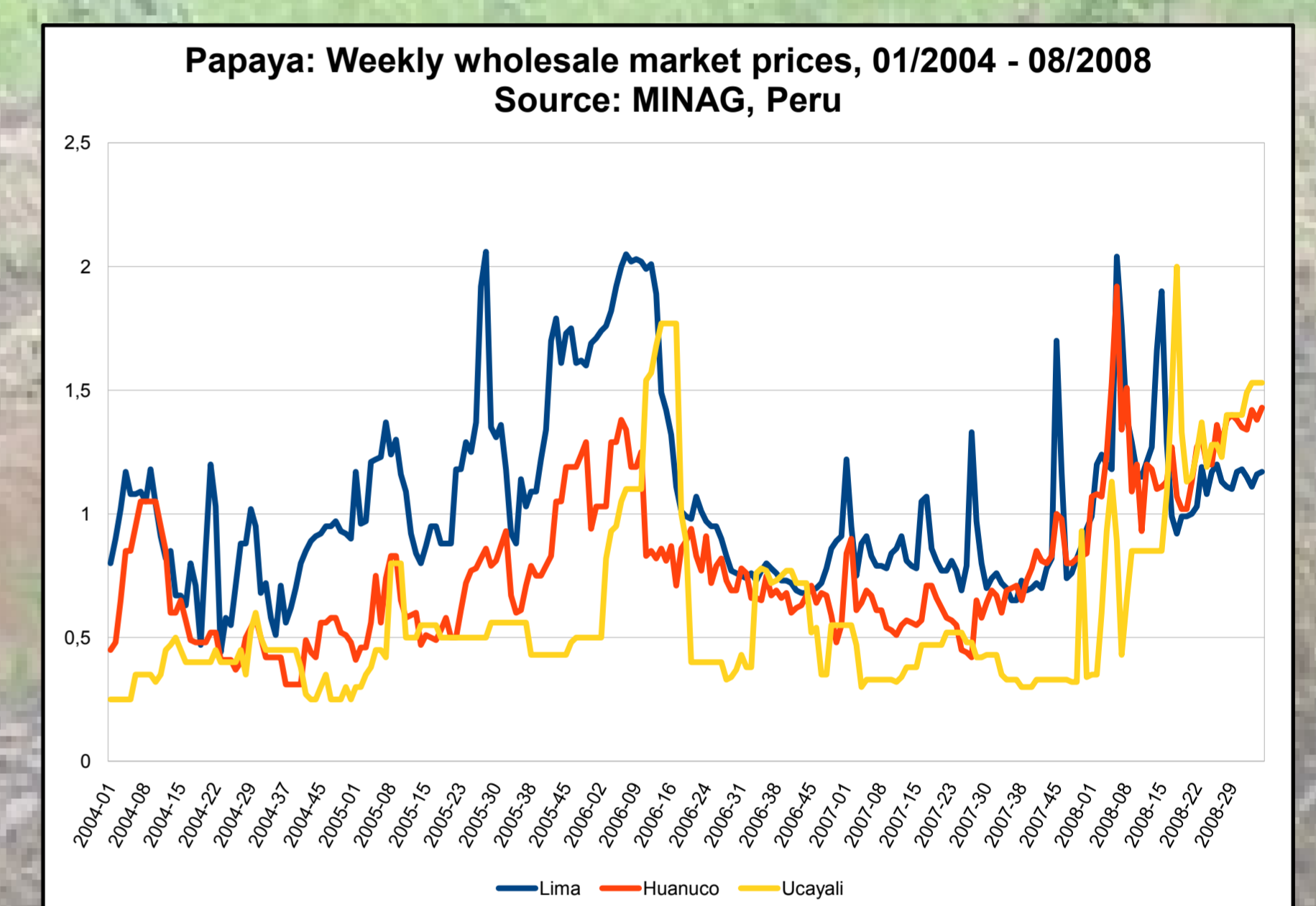
Unit root tests Cannot reject the Null of nonstationary price series at $\alpha=5\%$.

Cointegration tests Cointegration of Lima - Pasco at $[\alpha]=10\%$, no cointegration between Lima - Ucayali and Pasco - Ucayali.

Vector error correction models Assuming cointegration, the VECM yields a long run price-transmission elasticity of 0.602 between Lima - Pasco, significantly different from 1.

Cassava markets of the Andean highlands are integrated with the coast. Markets in Ucayali are not integrated with either of the other regions. Again, there is only imperfect price transmission between the coast and the Andes

Papaya



Important cash crop with a rather short history in the region. About 65% of the harvest sold to wholesale markets in Lima, mostly through an integrated value chain.

Unit root tests Cannot reject the Null of nonstationary price series for Lima at $\alpha=5\%$ and for Huanuco - Ucayali at $\alpha=10\%$. Assume nonstationarity for each series.

Cointegration tests Cointegration of Lima - Huanuco, Huanuco - Ucayali and Lima and Ucayali at $\alpha=5\%$.

Vector error correction models Long-run price transmission elasticity is estimated at 0.640 for Lima-Huanuco, at 0.37 for Lima-Ucayali and at 0.634 for Huanuco-Ucayali.

Papaya markets in the Andean highlands and in Ucayali are integrated with the coast. The degree of price transmission decreases along the way from Lima to the Amazon

Conclusions

- The Peruvian Amazon in Ucayali is already integrated with national markets and market integration cannot be ruled out as a factor which contributes to deforestation.
- Markets in the region, however, are found to be only partly integrated with the coast and price transmission is weak. Reasons: Poor road infrastructure and weak market institutions. Efforts to improve the infrastructure and the strengthening of market institutions have the potential to increase market integration. In the consequence, commercial opportunities and the pressure for deforestation will increase.
- The results highlight the importance of the mountain passage for the market integration of the Amazon region.
- Differences in results between products can be explained by their different character: Staples vs. cash crops. Results for rice and papaya should be handled with care: Quality differences and seasonality.

Outlook:

- Address data problems with rice and papaya.
- Extend the analysis to include palm oil which accounts for a large share of the increase in agricultural area over the past years.
- Explore the relative importance of market integration and other factors for deforestation.