Smallholder competitiveness: insights from household pig production systems in Vietnam

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Abstract

We examine smallholder competitiveness in pig production using data from a survey of 1,051 households across six provinces representing six agro-ecological zones and two urban centers in Vietnam. Results from various analyses employing descriptive statistical analysis, econometric modelling, and partial equilibrium modelling of the pig sector in Vietnam support the hypothesis that smallholder, household pig production are competitive and will remain significant suppliers of the fresh pork market. This competitiveness is underpinned by the strong demand for fresh, unchilled pork, thereby ensuring sustained opportunities for smallholders to supply this demand while also providing natural protection from imported chilled or frozen pork. Long-term prospects for smallholder contribution to total pork supply are good. Even in the worst case scenario of stagnant technological advances in the traditional, smallholder sector, they are projected to remain dominant players in the pork market. Currently, the modern, large scale pig sector is small at 5% of total market share; this is projected to expand to 12% in the next 10 years. The empirical evidence also suggests that overall efficiency gains to the pig sector are not likely to be generated from increasing herd sizes due to the observed lack of economies of scale in household pig production. In the current situation, ways should be explored to reduce the cost of production. Attention should be given, for example, to increasing the supply and reducing the cost of domestically produced feeds for pigs and utilizing available supplies more efficiently. Technological improvement in feeds and in pig production thus plays an important role in the development of the sector. Policies that will enhance productivity across all producer types will be preferable, rather than a targeted policy directive focusing on developing large, industrial farms. Limitations in land and household labor may also limit potential for expanding scale, thereby further supporting the case for sustaining smallholder competitiveness.

Keywords: smallholder competitiveness, household pig production, pork value chain, technology adoption, efficiency

Introduction

High and increasing demand for pork and strong preference for fresh, unchilled meat supplied by traditional market outlets present market opportunities for smallholder pig producers. This strong preference for fresh pork also provides natural trade protection from imports. These demand drivers could underpin the competitiveness of smallholders in the fresh pork market in Vietnam, given the increasing concern about pig meat quality and food safety, particularly among increasingly urbanized and high-income consumers (Humphrey 2005, King and Venturini 2005, Reardon et al. 2001, Regmi and Gelhar 2005). In response to the change in demand, livestock farming in particular for pigs and poultry has been gradually shifting from dominantly family-based farms with local breeds and traditional feeding technology to larger, commercial farms with improved breeds and industrial processed feed (Huynh et al. 2007). Nonetheless, household-based production still dominates the industry (Huynh et al. 2007, Tisdell 2008). The concern is whether they will be able to compete and earn income from pig production in the context of increasing competition from imported meat and large domestic producers.

Sustaining and enhancing this competitiveness in the fresh meat market will thus remain a challenge among smallholder pig producers. Compared to large producers, they face constraints arising from their limited resources and capacities and also from prevailing policies and institutions that unduly favor the development of large, industrial farms. Poor genetic stock, low quality feed, and animal health problems are major production constraints, as well as lack of access to timely and reliable market information, and the supporting services in extension, credit and animal health necessary to address the production and marketing constraints. Smallholders are thus facing institutional, policy, and technical constraints to increase productivity, to produce better quality pork and to increased access to higher priced markets for both commercial as well as traditional quality products as a means to improve their livelihood.

The government's strategy for developing Vietnam's pig sector is to basically replace small, family-based farms with larger, intensive and commercialized farms, as stated in the "Livestock Development Strategy to 2020", approved in January 2008. This is based on a view that larger farms with higher technologies are more competitive, better controlled in terms of diseases, sanitary and environmental conditions and could produce pigs with desirable attributes (such as high lean content). While enlargement and modernization is obviously the way to go in the long term, it is unlikely that large commercial farms can soon dominate the pig sector in the near term, given the current dominance of smallholders. It is of concern however that the emergence of commercial farms and present policy bias towards them might come at the expense of smallholder producers, who, given their constraints, might find it difficult to compete. The question is, therefore, how to make the transformation process smooth and most feasible to smallholder pig producers so that they are able to gradually embark on the enlargement and modernization route while ensuring that those who are left out due to their limited capacity have other options to secure their livelihood and not fall deeper into poverty. One step in this direction is to enhance the competitiveness of smallholder producers by allowing access to appropriate technologies which most fit their conditions.

If smallholder pig producers can produce at lower per unit cost than large producers in the fresh pig meat market, then they will have a chance to remain competitive in that market. This is feasible when smallholders are more efficient users of farm resources such as own produced feed and

household labor, thus giving them a market advantage over large producers that will be difficult to overcome. Identifying viable options for technology, policy, and institutions that will enhance smallholder production efficiency will help ensure that smallholders will sustain their comparative advantage and be competitive in supplying the fresh pork market in Vietnam. This paper presents findings from a study on competitiveness of pig producers in Vietnam[1] aimed at generating empirical evidence to address these research and development issues.

Methodology and Data

A structured survey of 1,051 households randomly selected from six provinces in Vietnam was conducted in March-May 2008. Of the households surveyed, 700 were pig producers and 351 non-pig producers (see Annex 1 for geographical distribution of survey respondents). The six provinces surveyed were representative of the six agro-ecological regions of the country, namely, Ha Tay in the Red River Delta, Phu Tho in the Northern Uplands, Nghe An in the Northern Central Coast, Dak Lak in the Central Highlands, Dong Nai in the Southeast Coast, and Tien Giang in the Mekong River Delta (see Figure 1). Some 600 household consumers were also interviewed in two urban centers of Vietnam, namely Hanoi in the north and Ho Chi Minh City in the south. The sampling design used to select household respondents was based on the Vietnam Household Living Standard Survey 2006 sampling frame.

Descriptive statistical analyses were done on survey data to compare and contrast household pig producers and pig production systems characteristics, use of and access to different types of feed and breed, use of and access to services, access to output markets, and employment generation. Indicators of technical performance such as feed conversion ratio (FCR), and economic performance such as cost per unit output and gross margins were also estimated and compared across scale and production systems. Econometric analyses using discrete choice models of feed and breed choice were also done using survey data. A partial equilibrium model that simulates the markets for maize, traditional-sector pigs, and modern-sector pigs in each of seven regions of Vietnam was also run. The model is calibrated using data on production, consumption, prices, trade, and transportation costs from the field surveys, the General Statistics Office of Vietnam, and the Food and Agriculture Organization.

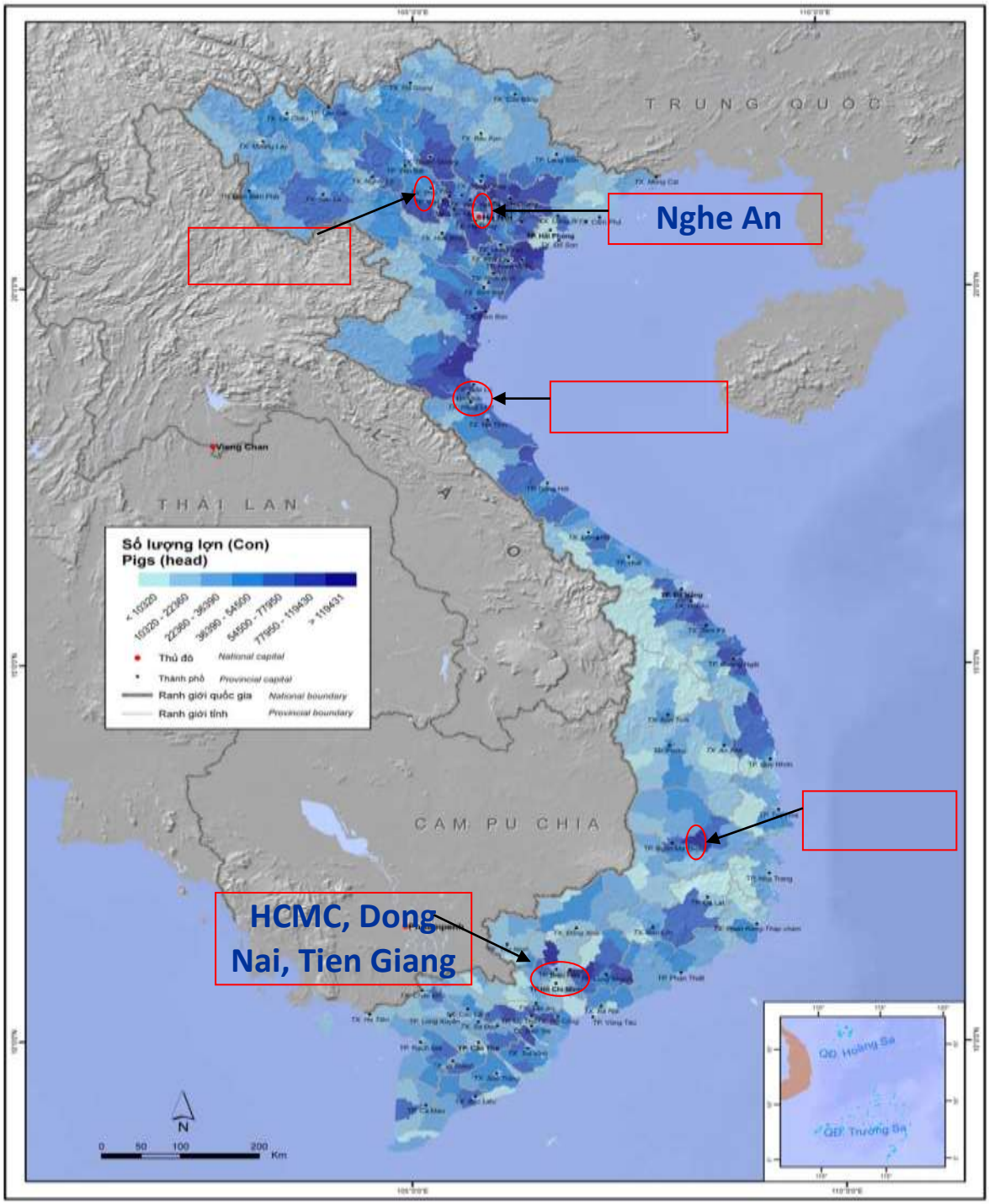
Key Findings from Empirical Analysis

Future scenarios for Vietnam pig sector

The pig model projections show various trajectories of growth between the modern pig sector that consisting of large-scale pig producers and the traditional pig sector that is dominated by small-scale, household pig producers. The model was run over a ten year period under different assumptions regarding income growth, technological growth in each sector, and the income elasticities of traditional (fresh) pork and modern (chilled or processed) pork (see Minot et al for details).

[1] Funding provided by the Australian Center for International Agricultural Research (ACIAR) for a three-year project that facilitated this study is gratefully acknowledged.

Figure 1. Map of Vietnam showing survey sites.



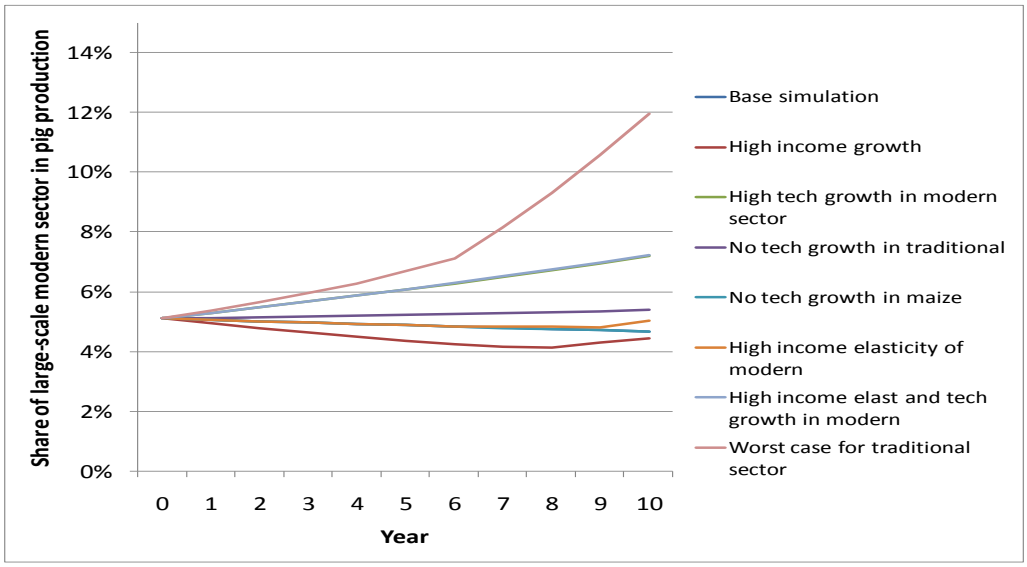
The share of large producers that constitute the modern pig sector in Vietnam is very small, as shown from survey data and available national statistics on pig production. Large-scale commercial pig growers account for about 5% of production, while chilled, frozen, and processed pork products represent just 2% of pork consumption.

Projections from the model show that the modern pig sector is likely to remain small over the next decade and beyond. Even under the worst-case scenario for the traditional pig sector where

technology growth is stagnant, the modern sector is projected to surpass a market share of only 10% after ten years (see Figure 2). Growth in the modern sector depends more on technology than on demand. In the short- to medium-term, any changes in demand are absorbed by offsetting changes in exports. On the other hand, changes in technology affect the growth of the modern pig sector regardless of whether modern pork products are exported or not.

Pork product exports phase out within 10 years in most scenarios because of the rapid growth in domestic demand. The only exception is when there is a high rate of technological change within the sector.

Figure 2. Projected shares of large pig producers under varying scenarios, pig sector model estimates.



Source: Minot et al. 2010.

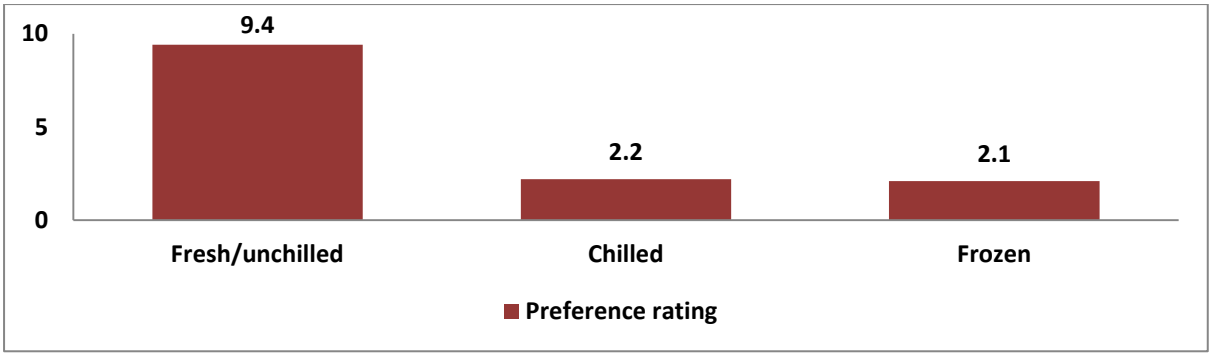
Micro-level evidence from household surveys

What does micro-level evidence show that support future trends in supply from the pig sector model estimates?

Demand

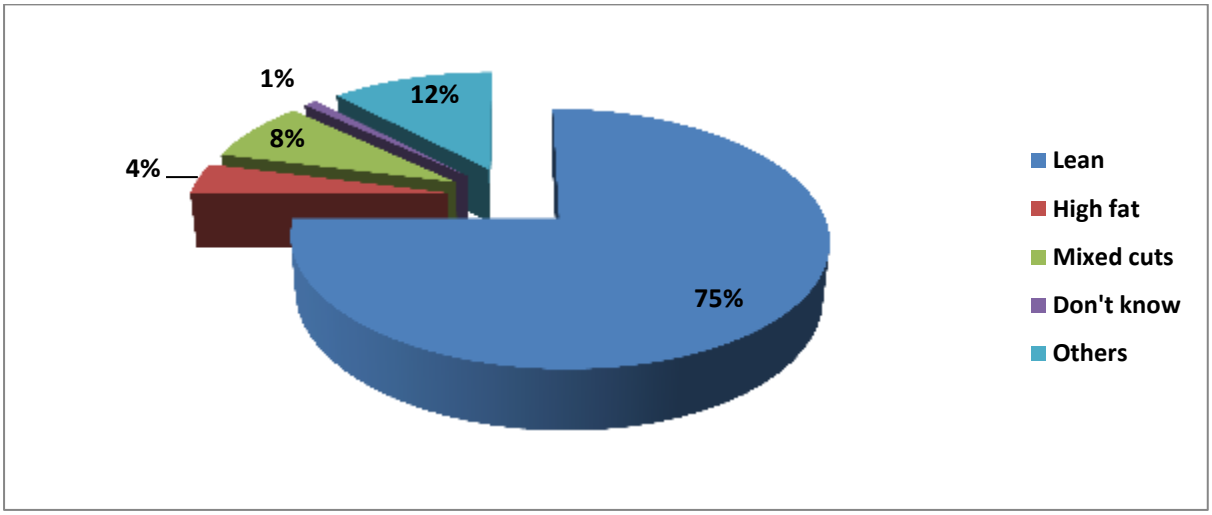
There is strong preference for fresh, unchilled pork by Vietnamese consumers, as shown from survey data (see Figure 3). There is also an observed preference for lean pork; that is, the majority of Vietnamese consumers interviewed indicated preference for lean pork compared to other types of pork (see Figure 4). Survey data show that there is no significant change in proportion of consumers eating lean pork from 10 years ago, but that there is a significant reduction in proportion of consumers eating high fat meat from 10 years ago.

Figure 3: Preference rating for pork attributes



Source of data: Household surveys - Improving Competitiveness of Pig Producers in an Adjusting Vietnam Market Project, 2007.

Figure 4: Changing demand for pork in Vietnam

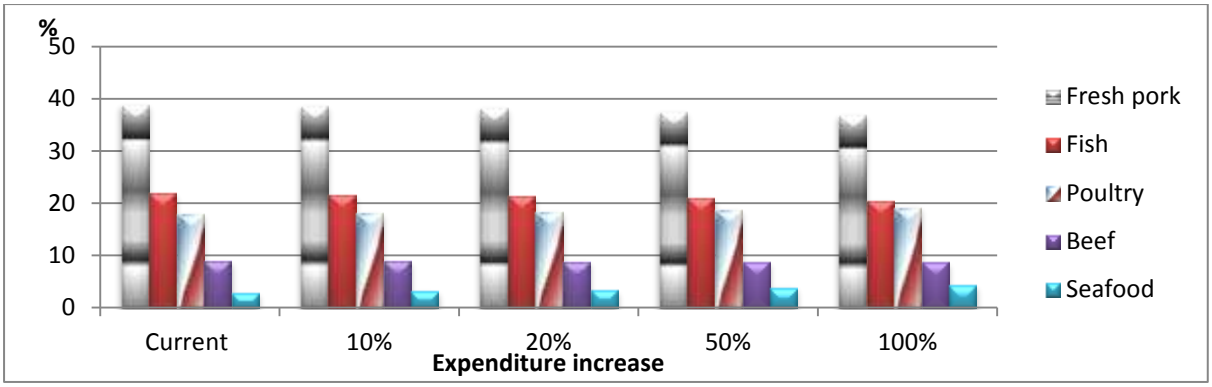


Source of data: Household surveys - Improving Competitiveness of Pig Producers in an Adjusting Vietnam Market Project, 2007-2008.

We also investigate the likely responses of demand for pork and other meat to changes in income and meat prices using a two-stage procedure to estimate a LA/AIDS model with data collected from household consumption surveys (see details in Toan et al. 2010). We show that demand for pork and other meat appears relatively inelastic to own price. That is, own price fluctuations would not much alter demand for pork. We find other pork, poultry, eggs and seafood are complements of fresh pork rather than substitutes. Thus, a rise in pork price would not induce higher demand for these items.

Regarding demand response to income change, the results suggest that the meat items are normal goods and hence their demand grows with income. Although consumers tend to diversify their diet towards higher shares of seafood, poultry, egg and beef as their income rises, pork remains the dominant meat in Vietnamese diet. Our projection scenarios indicate that the proportion of pork in meat consumption would change minimally with incremental changes in total meat expenditure (see Figure 5).

Figure 5. Projected share of pork vis-a-vis other meats with varying incremental changes in total meat expenditure.



Source of data: Household surveys – Improving Competitiveness of Pig Producers in an Adjusting Vietnam Market Project, 2007-2008.

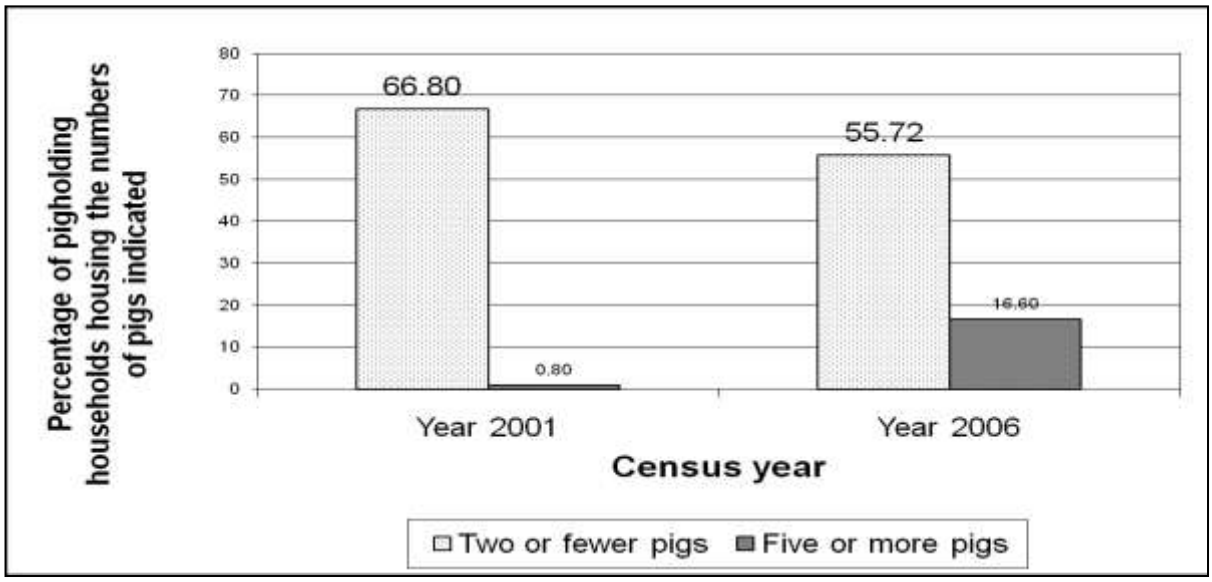
Supply

Characteristics of pig production systems

Considering the fundamental characteristics of climate and labor, Vietnam has the right preconditions for development of the domestic pig sector. This is reflected in the historical dominance of the pig sector in livestock production, accounting for about two-thirds of total volume of livestock output, on average, over the last two decades. This trend is expected to remain, with continued absolute increases in pig numbers and liveweight. During the last decade, yield (in terms of kg liveweight per head) has increased from about 70 kg/head to about 100 kg/head.

Pig production in Vietnam is mainly characterized by small-scale, widely scattered farms. The size distribution of pig farms is dominated by the very small scale household-based producers with 1-5 sows, accounting for 84% of all households raising pigs in 2006 (see Figure 6). This share is slightly lower than the 92% share in 2001, suggesting that household-based pig production is scaling up; this trend is consistent with economic growth (about 7-8 % annually) that Vietnam has achieved during the last decade after Doi Moi reforms.

Figure 6: Scale distribution of household pig production by herd size, 2001 and 2006.



Source: Tisdell 2010, estimates based on published statistics from Vietnams General Statistics Office.

Respondents have indicated various reasons they may likely expand herd size, and these include factors associated with increasing demand and higher income from pigs. On the other hand, limited resources and capital were main constraints constraints identified with decrease in pig production. A significant proportion of pig producers considered reducing their herd size due to other reasons such as pig diseases.

Contractual arrangements in pig production were not widely observed to be practiced among the respondents interviewed. This could be attributed to the the lack of large integrators that offer contract growing schemes in the areas surveyed, and also the stringent requirements that these schemes demand from participants (see Tiongco et al. 2009) that smallholders generally are unable to meet.

For purposes of this study, three types of pig production system are considered, namely: farrow to wean (or piglet production), farrow to finish (or full cycle production from breeding to slaughter pig production), and grow to finish (or pig fattening). Within the sample of household pig producers in this study, scale was classified into small, medium, and large according to number of sows in the case of piglet and full cycle production systems, or number of slaughter pigs in the case of fattening (see Table 1).

Table 1. Definition of scale and production systems.

	Small-scale	**Medium-scale**	**Large-scale**
Farrow to wean	1 sow	2-3 sows	4 sows or above
Farrow to finish	1 sow	2-3 sows	4 sows or above
Grow to finish	Less than 15 heads	From 16 to 40 heads	More than 40 heads

Characteristics of pig producers

Based on the classification criteria for scale and production system shown above, the majority of household pig producers in the survey were considered small across each type of production system (see Table 2). Only a small proportion was classified as large. Across production systems, piglet production has the lowest share of large producers (less than 5%); among those engaged in full cycle production system, some 13% were considered large, while it was 11% among those engaged in fattening system.

Table 2. Distribution of sample respondents according to type of production systems and scale.

Production system	**Scale**	**Obs**	**Average number of sow (head)**	**Average number of piglets per sow per year (head)**	**Average number of slaughter pigs per year (head)**
Farrow-to-wean	Small	116	1	21	-
	Medium	51	2	20	-

	Large	8	7	15	-
	Small	114	1	21	20
Farrow-to-finish	Medium	64	2	18	38
	Large	26	6	14	110
	Small	207	-	-	6
Grow-to-finish	Medium	75	-	-	27
	Large	35	-	-	83

Source of data: Household surveys - Improving Competitiveness of Pig Producers in an Adjusting Vietnam Market Project, 2007.

Survey data also showed differences in the structure of pig production system adopted by small farmers between Northern and Southern provinces. Smallholder producers in the South are more likely to adopt full-cycle system while those in the North more often follow fattening system. This might be due to the larger scale of pig farms in the former since larger farms tend to favor full cycle system.

Family labor availability might be an important factor in pig production engagement. Our survey shows that pig producers tend to have larger household size and lower dependency ratio compared to non-producers. However, it is not clear these influence the consideration of farm expansion. Due possibly to labor and time requirements of pig production, most pig producers are self employed while non-producers have to rely on various other sources of employment for additional income. It is suggested from survey data that experienced producers are more likely to be engaged in longer cycle production systems that may require hand-on experience. Education level does not appear to have significant influence on the adoption of production systems and scales.

Pig production plays an important role in smallholders' income (see Annex 2). Some 80% of livestock income is from pigs (see Annex 3). Pig producers appear to have higher expenditure than non-producers do. Per capita expenditure increases with scale of production.

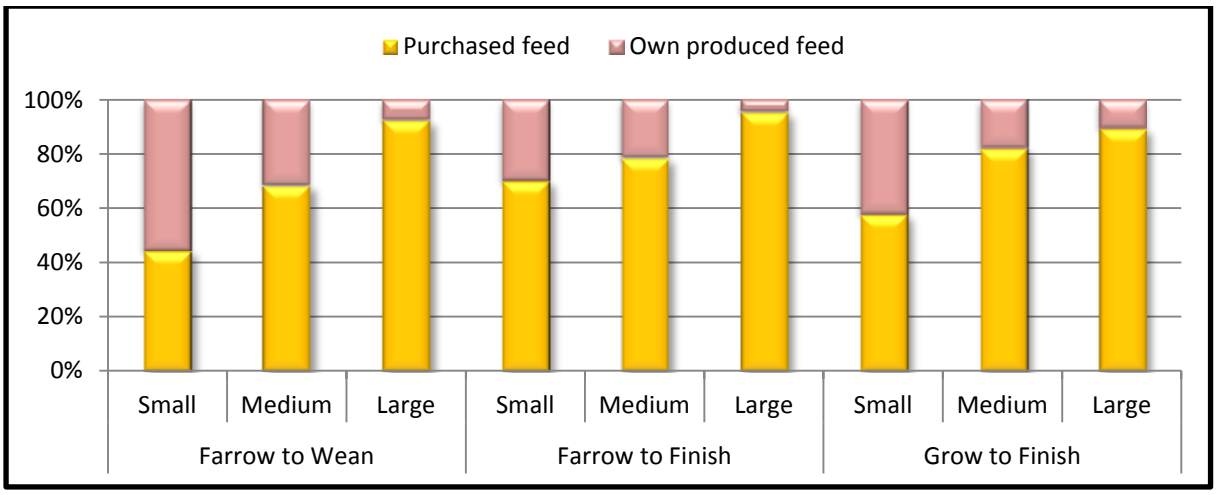
Cost structure of household pig production

Feed

Most producers use a combination of unprocessed and industrial feed and none use purely owned produced feed. The proportion of industrial feed tends to rise as scale increases while smaller producers rely more on own produced feed. Most industrial feeds are supplied by feed retailers rather than feed wholesalers or integrators. These retailers are also one of the principal raw feed suppliers in addition to crop farmers. Cooperatives have almost no role in feed supply.

Own produced feed holds significant share in pig feed, of which forages and crop by-products are the largest sources (see Figure 7). This can provide low cost feeding strategies that are of smallholder advantage.

Figure 7. Feed cost structure



Source of data: Household surveys - Improving Competitiveness of Pig Producers in an Adjusting Vietnam Market Project, 2007.

The majority of pig producers buy feed from regular suppliers and this goes up with scale. These suppliers also provide certain services/incentives to pig producers such as technical advice, veterinary service, feed transportation, market information, etc. Larger producers often enjoy more favorable terms in feed purchase and in services provision. This, to some extent, reflects differences in transaction cost and is disadvantageous to smallholder farms.

Breed

Most piglet and full cycle producers provide stock themselves. This helps reduce the possibility of disease transmission and avoid possible stock shortage. Most stocks purchased are from local neighboring farms. While this practice might be good in the sense that local farms are beneficiaries, it is also potentially associated with variable and uncontrolled quality and disease transmission. Local farms might also not be able to deliver sufficient supply for an expanding pig sector. It also shows that smallholder farms can hardly access good quality improved breeds from professional breeders and this is one of the most important issues related to breeding stock reported by respondents.

On the other hand, there appears to be a demand for good quality crossbreeds that have high percentage of local breeds like Mong Cai. These local breeds are well-known among pig producers as prolific breeders and well-adapted to low input conditions that characterize most smallholder pig production (Gautier et al. 2009). Replacement gilts of Mong Cai strain are thus much preferred by household pig producers, and this will require a steady supply of good quality purebreds as breeding stock. This situation thus presents an opportunity for a more organized breeding program involving household based producers that will produce gilts and/or piglets with the desired breed and targeted to supply the stock requirements of household based pig producers. This will ensure a sustainable supply of good quality stock to household-based pig producers.

Econometric analysis of feed and breed choice

Feed choice

Using a two-stage discrete choice model, we evaluated the feed choice decision of pig producers using survey data (details are presented in Lapar et al. 2010). We find that the choice of smallholder producers with respect to feed depends largely on a number of factors, including labor, sources of

income, geographical location, accessibility to feed and service suppliers, production scale and production system (Annex 4 shows the estimated coefficients of the multinomial logit second-stage equation). Specifically, producers with large household size or lower household dependency ratio are more likely to use traditional feed. Traditional feed is chosen as well if crop production accounts for a larger proportion of income. Producers in urban areas or in southern provinces are more inclined to industrial feed. Farmers also tend to use industrial feed if they can find regular feed suppliers. Access to extension service might also drive producers towards industrial feed. The choice of feed system seems to be linked with the scale of production. Larger producers are more likely to adopt industrial feed while smaller ones tend to use traditional feed. It is interesting to note that traditional feed appears to be favored by producers in farrow to wean system.

Breed choice

Using the same framework to assess feed choice decision, we evaluated breed choice decision of pig producers using survey data (details are discussed in Lapar et al. 2010). We find that the choice of improved breeds is associated with the production system adopted, the scale of farm (i.e., size of production herd) and the wealth of producers (Annex 5 shows the estimated coefficients of the binary logit second-stage equation). Large and richer producers, many of them locate in southern provinces, are more likely to adopt improved breed. Poorer and smaller-scale production units are less likely to do so due to constraints in their own resources. It is also interesting to note that the adoption of local breeds is highly likely among households engaged in farrow-to-wean system, i.e., piglet production. This may actually be a niche market opportunity that can be exploited to the advantage of small production units already engaged in local breed pig production, given that there still exists a significant number of pig producing households that have yet to transition to medium and large scale but may be unable to do so due to constraints in their own capacities and resources. These households constitute the market for local breed piglets and hence poor, small scale producers may have the competitive advantage as piglet suppliers. On the other hand, for those producers that are able to adopt high-yielding breeds, interventions might be required to help them reduce the transaction costs of accessing this critical input and other supporting services to improve production efficiency in order to supply current market demand for pig meat in expanding urban areas in Vietnam. Hence, it appears that the strategy for improving competitiveness of pig producers may need to be context specific to be effective, and foremost of which is enhancing access to the appropriate inputs, such as breed, and associated services by pig producers as required by their own production conditions.

Access to services

Animal health

Pig diseases are one of the major constraints threatening pig production and smallholder income from this activity. Contrary to common view, the incidence of high profile diseases like FMD and ‘blue ear’ disease appear to be more common among larger producers than among smaller ones, as shown by data from our surveys. The latter group of producers appears to be more susceptible to classical swine fever; this disease has generally resulted in significant losses from high mortality of pigs.

Pig producers can generally access veterinary services for disease prevention and treatment. However, there are a third of producers that do not use veterinary services for various reasons such

as follow: 1) producers have knowledge about diseases and can address the problems themselves; 2) high cost of veterinary services. However, a significant proportion of producers report that difficulties in accessing the services are the main cause. These facts imply that veterinary service provision can still be improved to support smallholder pig production.

Extension

Extension services are not accessed by the majority of pig producers. For those who received services, these were provided in training courses or workshops and not on request. This implies that services might not be delivered to those in need and that extension service provision might be ineffective.

Extension officers and feed suppliers are major providers of extension services. The role of cooperatives and non-governmental organizations are negligible as providers of extension services. Moreover, extension services appear to focus more on crop production, especially on paddy. Addressing gaps in livestock extension services will help enhance smallholder pig production and their competitiveness.

Credit

Not many producers receive credit service and the majority of those that did not receive reports that they don't need credit. This might imply risk aversion, i.e., producers perceive borrowing money to be risky, rather than low demand for capital. Note that producers might receive informal credit in the form of delayed payment from input suppliers, which helps alleviate working capital constraints in pig production.

State-owned banks are major credit providers in Vietnam. Complicated borrowing procedures are reported as major barrier in accessing credit. A significant proportion of producers could not meet conditions for getting credit.

Access to output markets

Output (in terms of live slaughter pigs or piglets) is marketed mostly in producers' locality, to neighboring producers and piglet traders (with piglets) and to local traders and butchers (with slaughter pigs). Payment is made in cash on delivery. Pigs are picked up at farm gate. Buyers do not often provide additional services to sellers.

Insufficiency of market information and low price received from pig traders are major constraints of smallholder pig producers. Smallholders seem to be inferior in price negotiation.

Indicators of efficiency

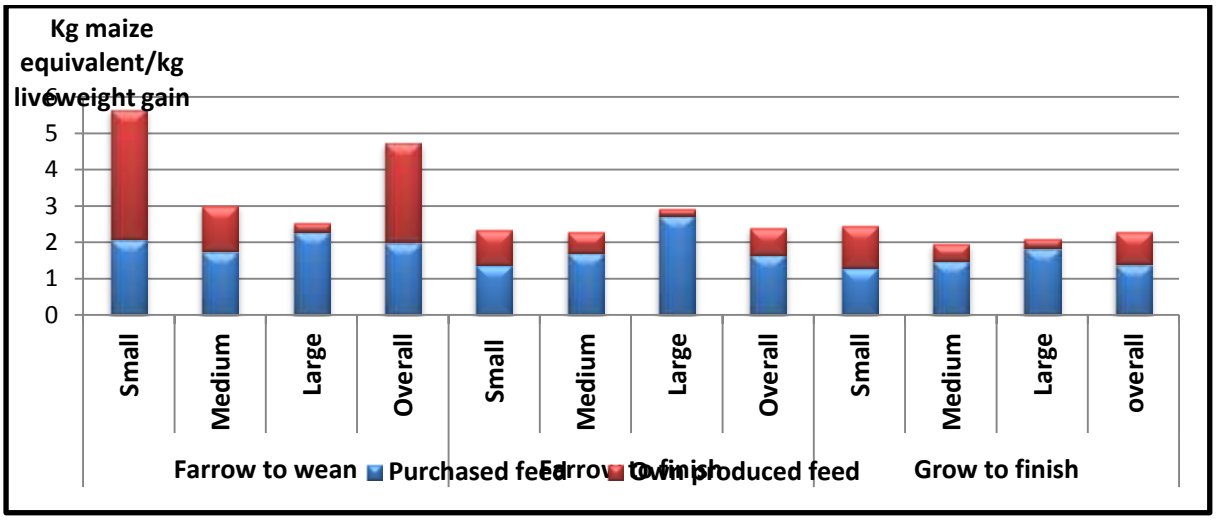
Feed conversion ratio

One of the indicators for technical efficiency is feed conversion ratio (FCR), or the amount of feed required to produce a kg liveweight of output. FCR was constructed using the concept of maize equivalent (ME) to address heterogeneity of feeds used by household pig producers. The basis for our conversion is the feed ME energy content of feeds used for pigs. For industrial feed, we obtain ME content of complete and concentrate feed from Cargill, a major industrial feed producer in Vietnam. For non-industrial or raw feed, their ME energy content are based on chemical composition table in La Van Kinh (2003), which was based on findings from ACIAR project No. 9423

and a government sponsored study on livestock feed in Vietnam. The estimated FCRs are shown in Figure 8.

The results suggest economies of feed use in piglet production (farrow to wean system) while in full cycle system (farrow to finish), large scale farms seem less efficient in feed use. Large farms also appear more efficient in feed use in grow to finish, but the difference is not statistically significant. Overall, the FCR estimates using ME do not strongly support strong scale differences across production systems, suggesting that no significant differences in feed use efficiency is strongly supported by empirical data from our survey of household pig producers.

Figure 8. Feed conversion ratio in maize equivalent



Source of data: Household surveys – Improving Competitiveness of Pig Producers in an Adjusting Vietnam Market Project, 2007-2008.

Per unit output cost

An important indicator of farm performance is unit cost or cost per an additional unit of weight gain. In this study, information on various types of cost are collected, including feed cost, cost of stock purchase, transportation cost, cost of services such as veterinary cost, interest charge on loan, hired labor cost and other costs. Family labor cost is not included in our cost computation, since it is difficult to value family labor cost given that there are hardly employment alternatives for household members. Moreover, as family members can raise pigs and do other things, say, cooking or taking care of children, at the same time, measuring family labor working time might exaggerate actual labor spent. We also exclude fixed costs such as depreciation of pig pens and equipment. In the context of smallholder systems, these costs are not large and difficult to measure. Note that in farrow to wean and farrow to finish systems, sow is considered an asset (or capital) and its cost, in principle, should be depreciated along its reproduction cycles. We do not take cost of sows into account since information of their original purchase prices is not available. Thus, what we compute as pig production cost is total variable cost excluding cost of family labor.

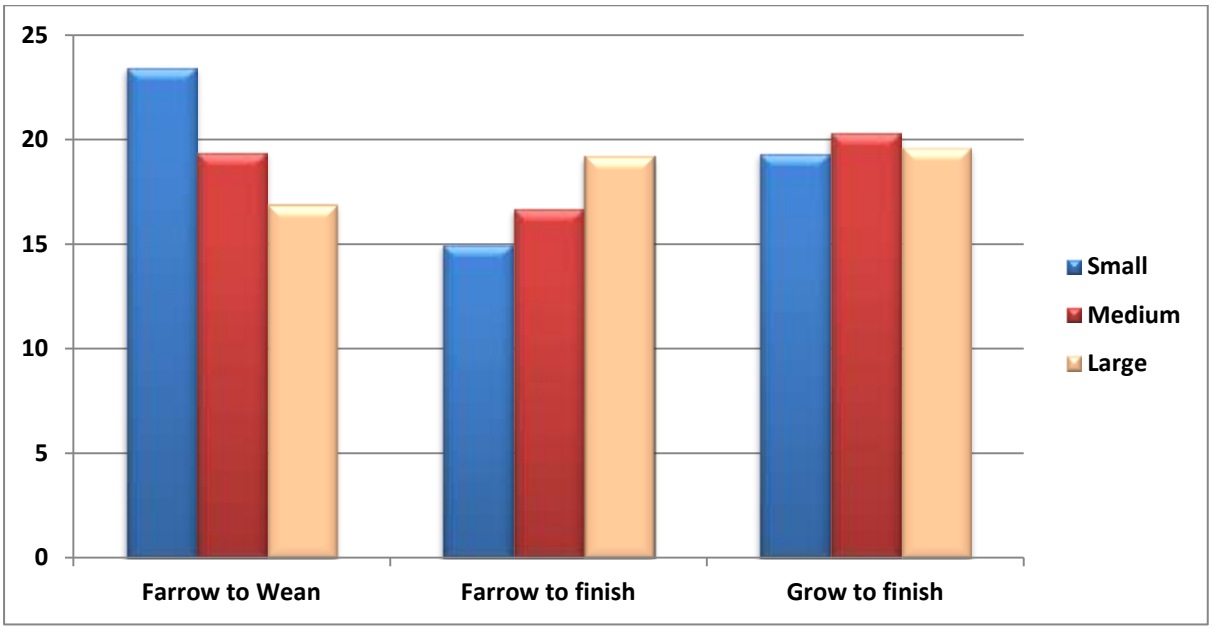
Unit cost is derived as the quotient of total cost and total output. It is important to note that total output is different from total sales as it accounts for unsold inventory as well. Annex 6 reports the

structure of pig unit cost by production system and scale. It is at no surprise that feed cost takes the largest share in total cost, accounting for around 90 percent in farrow to wean and farrow to finish systems and around 65 percent in grow to finish system. Stock cost accounts for 30 percent of total cost in grow to finish farms. The share of other costs is relatively minimal.

It appears that there are diseconomies of scale in systems having finishers (or slaughter hogs) as main output (see Figure 9). Unit cost increases significantly from small to large scales in farrow to finish and from small to medium scales in grow to finish. Economies of scale are somehow seen in piglet production (farrow to wean system). However, the differences in unit cost across scales are not statistically significant. It is not surprising that the source of unit cost difference is found in the differences in feed cost, given its dominant share. The diseconomy of pig production suggests that smallholder pig production can be efficient and competitive for as long as they can exploit low-cost advantages in their feeding strategies.

As previously highlighted, cost per unit output in pig production is highly sensitive to feed cost as it accounts for the dominant share in total variable cost in general. Cost of industrial feed is the largest component in feed cost. This implies that feed cost can be reduced by either raising feed use efficiency or reducing share of industrial feed, of which price is relatively high compared to other feed types and increasing.

Figure 9. Cost per unit output across scale.



Overall, there is no clear evidence of economies of scale in household pig production in our study. Economies of scale were weakly observed only in farrow to wean system while in full cycle system, unit cost increases with farm size although the differences across scale were not statistically significant. Unit cost is more or less similar across scale in grow to finish system. This implies no efficiency gains may be achieved from increasing herd size in full cycle and fattening systems among household pig producers.

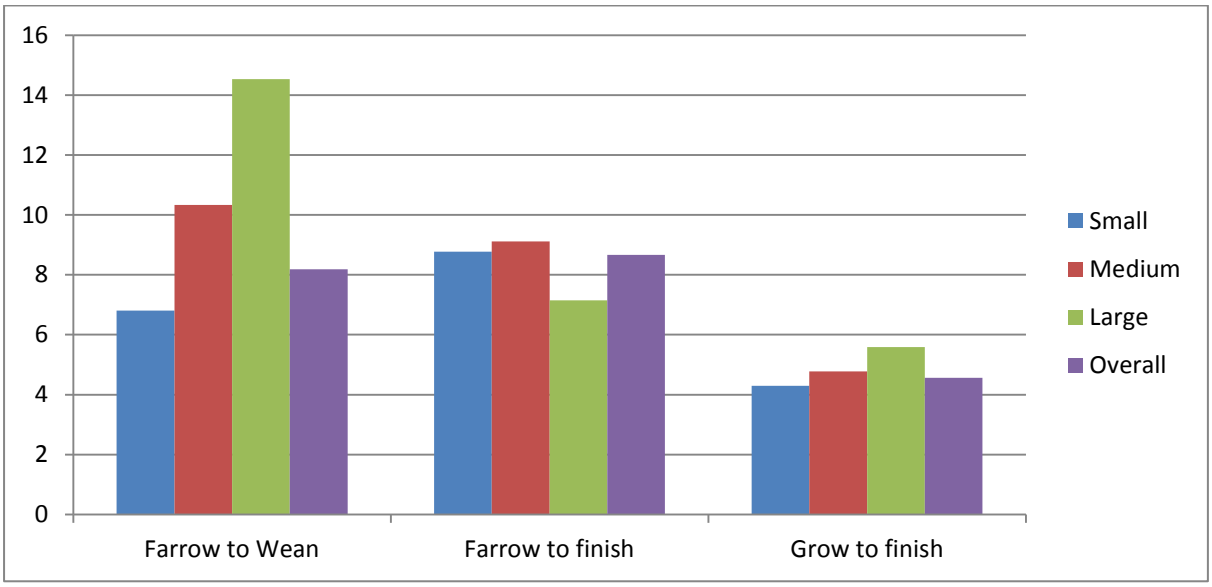
Gross margin

Gross margin per kilogram of output is defined in this study as the difference between average selling price per unit output and per kilogram cost of production (per kilogram cost is total variable cost per kilogram of weight gain). Gross margin captures the effect of output price variation when cost per unit output is not statistically different across scales.

Based on estimates from survey data, household-based pig production can generate gross margins ranging from 4,000 to 15,000 VND per kg liveweight of pig produced (or approximately $0.21-0.78)[2] (see Figure 10). These figures are good indicators of returns to household labor. Average gross margin per kilogram liveweight output appears highest in full cycle system (i.e., 8,700 VND or $0.46, based on exchange rate at the time of the surveys). Lowest average gross margin per kg liveweight output is observed in fattening systems (i.e., 4,600 VND or $0.24, based on exchange rate at the time of surveys). Annex 7 presents details of gross margin estimates across scale and production system.

From gross margin estimates, economies of scale were observed ind in piglet production (farrow to wean system). In full cycle production (farrow to finish system), empirical evidence suggests present of diseconomies of scale. No clear scale effect is found in grow to finish.

Figure 10. Gross margin per unit of output across scale



Source of data: Household surveys – Improving Competitiveness of Pig Producers in an Adjusting Vietnam Market Project, 2007-2008.

With respect to feeding system, the adoption of traditional feeding seems to be associated with lower gross margin in piglet production and higher gross margin in fattening system. There are no statistically significant differences across scale in full cycle system.

With respect to breed, it is interesting to note that local breed producers are likely to enjoy higher gross margin per kilogram liveweight output, compared with improved breed adopters. However, this difference is not statistically significant in piglet production.

[2] Based on exchange rate of US$1 = 19,000 VND at the time of surveys.

Importance of smallholder pig production in broader development goals

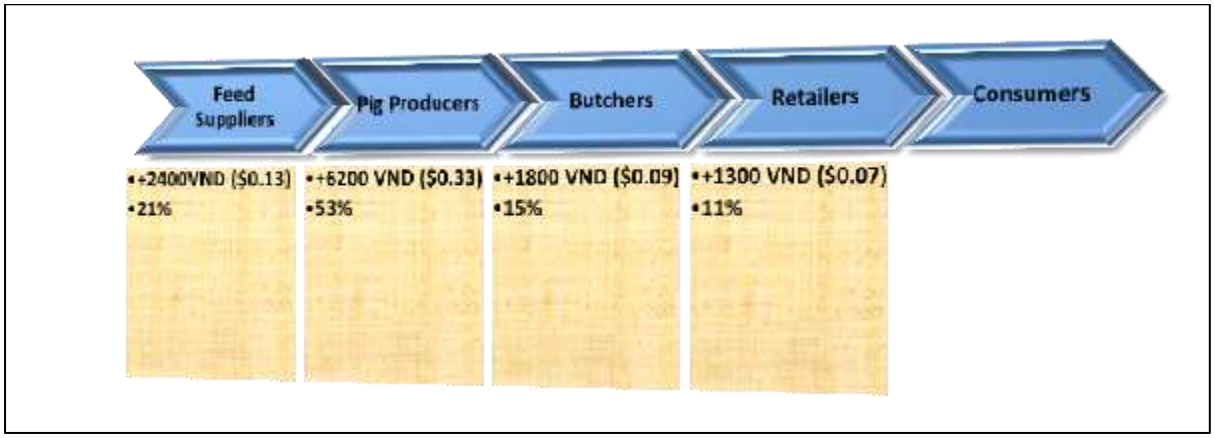
Smallholders perform important roles that are important to broader development goals. These include the important contribution of household-based pig production to employment generation, particularly in rural areas, notwithstanding employment being generated along the pork value chain beyond on-farm production.

Household labor is the main source of labor in smallholder pig production. Hired labor is rarely used and observed only in large farms. The dependence on household labor in smallholder pig production implies that further production expansion in these scales was likely to be largely determined by the size of available family labor. On the other hand, the significant proportion of labor contributed by women in household pig production has important implications for women livelihoods. Women are less mobile than men in seeking off-farm employment due to their specific role in household tasks such as child rearing, thus limiting their options for income generation in rural areas where off-farm employment opportunities are rare. Women contribution to smallholder pig production in terms of time spent in various pig related activities was estimated to be 1.5 times higher than that contributed by men, suggesting that household pig production is a viable income source for women in the absence of other employment options beyond the household. The share of male labor, on the other hand, increases with production scale, particularly in production systems with slaughter hog as output, indicating the increasing role of male labor in those systems as farms expand.

Smallholder pig production generates huge employment nationwide, the value of which is estimated to be worth 3.3 billion USD or approximately 5.5% of Vietnam's GDP in 2007. Household-based pig production together with associated enterprises along the pork value chain such as commercial feed production, slaughtering and retailing provide jobs to an estimated 4 million people. This all implies that household pig production and associated actors along the pork value chain can make huge contribution to the economy and to the lives of millions of poor people in Vietnam.

Based on survey data, our estimates show that value added generated along the pork value chains where household pig producers are participating is about 11,700 VND per kg liveweight or approximately US$0.62 (as shown in Figure 11).[3]

Figure 11. Estimates of value added along the pork value chain, by type of chain actor.



[3] Based on exchange rate of US$1 = 19000 VND at the time of surveys.

Source of data: Household surveys – Improving Competitiveness of Pig Producers in an Adjusting Vietnam Market Project, 2007-2008.

Conclusions and Implications

Our projections suggest that small-scale pig sector may grow more slowly than large-scale, but will not decline. The modern large-scale sector is too small to threaten traditional small-scale sector for at least 10 years. For as long as smallholders remain competitive in supplying pork being demanded by Vietnamese consumers, there is great potential for them to sustain their significant share in the pork market as projected. Our study shows that smallholder household pig producers receive at least half to two-thirds share of the retail price of fresh pork; this suggests fairly strong competitive presence in the fresh pork market. Strong demand for fresh, unchilled pork by Vietnamese consumers will keep domestic producers competitive vis-a-vis imported pork; that is, chilled and/or frozen imported pork is not a substitute for fresh, unchilled pork. Furthermore, due to the lack of economies of scale in household-based pig production (with the exception of piglet production), efforts to promote large scale pig production may not necessarily improve overall efficiency of the industry. Large-scale operations may likely have difficulty surviving and competing if current policies in their favor were directed elsewhere, for example at interventions that will facilitate the transformation of household-based pig producers into highly efficient production units linked with safe and efficient pork supply chains. In the current situation, ways should be explored to reduce the cost of production for both household and non-household producers. Attention should be given, for example, to increasing the supply and reducing the cost of domestically produced feeds for pigs and utilizing available supplies more efficiently. Technological improvement in feeds and in pig production plays an important role in the development of the sector. In modern large scale pig sector, technology can help maintain exports in the face of growing domestic demand. In traditional, smallholder pig sector, technology will reduce price, maintain market share, and have pro-poor impact.

Currently, there are opportunities for efficiency gains that can be tapped for sustaining smallholder competitiveness. They can maintain low cost per unit output and gain efficiency through utilization of low-cost feed options. They can use appropriate breeds that are low-input, yet slightly more productive, and thereby more resilient and suitable to their resource and capacity limitations. Effective provision of services (credit, veterinary, extension) to improve capacity to deal with production and market risks will thus enhance the ability of smallholder pig producers to remain competitive. This suggests the need to improve access to cost-effective feed options, more R4D investment in feed technology development and testing in smallholder context, and access to low-cost financing to ameliorate household cash flow constraints in general and increase capacity to adopt productivity-enhancing technologies and supporting services. Improvement in delivery of veterinary services, particularly by increasing both quality and quantity of veterinary officers will also be necessary to sustain the viability of smallholder pig producers. To this end, alternative mechanisms for cost-effective service delivery such as linked transactions or cost-sharing arrangements may be worthwhile exploring.

There are emerging threats to smallholder competitiveness on the horizon. Concerns about food safety and regulatory response to address food safety scares may compromise smallholder market access and continued participation in pork value chains. Smallholders are perceived to be sources of

various food safety risks, arising from animal diseases and production and slaughtering practices; the latter are considered unhygienic hence pose a threat to food safety. However, evidence to date have not been conclusive and in fact tend to run counter to perceptions based on a small dataset from a few case studies (Grace et al. 2011); more rigorous studies are thus warranted to better inform public policy debate on this issue in the interest of ensuring that smallholders remain viable actors in the pork value chain.

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Annexes

Annex 1. Distribution of target sample respondents by location

Province	Ecological region	Number of pig producing sample households	Number of non pig producing sample households
Phu Tho	Northern Uplands	100	70
Ha Tay	Red River Delta	140	52
Nghe An	North Central Coast	140	70
Dak Lak	South Central Coast	100	50
Dong Nai	South East	120	59
Tien Giang	Mekong River Delta	100	50
Hanoi	Urban center North		270
Ho Chi Minh City	Urban center South		330
Total (8 sites)		**700**	**651**

Annex 2. Household income structure, by production system and scale (unit: %)

		Crop income	Livestock income	Other agricultural income	Non-agricultural income	Wage and salary	Other income
Farrow to Wean	Small	42.2	12.8	3.6	7.4	22.3	11.7
	Medium	36.3	20.1	6.4	13.4	15.4	8.4
	Large	37.9	29.2	6.7	12.4	7.8	6
	Overall	40.3	15.6	4.5	9.4	19.7	10.5
Farrow to Finish	Small	42.1	18.1	3	10.3	18.7	7.8
	Medium	42.3	23.6	2.6	7.1	19	5.4
	Large	28.7	37.5	6.9	8.8	14.8	3.3
	Overall	40.5	22.2	3.4	9.1	18.3	6.5
Grow to Finish	Small	38.2	12.6	3.9	11.3	22.5	11.5
	Medium	33.8	15.3	1.8	20.3	18.9	9.9
	Large	24	25.7	2.2	21.1	23.1	3.9
	Overall	35.5	14.7	3.2	14.5	21.8	10.3
Overall		**38.2**	**17.2**	**3.6**	**11.6**	**20.2**	**9.2**

Source of data: Household surveys and VHLSS 2006 for households that match with household survey respondents.

Annex 3. Share of household income from livestock production activities, by production system and scale (unit:%)

	Pig	Cattle	Buffalo	Goat	Chicken	Duck	Fish	Egg	Other
Farrow to wean									
Small	75.6	7.5	4.4	0.0	6.8	1.6	2.2	1.9	0.3
Medium	78.5	2.2	3.6	0.0	8.9	1.4	0.5	0.6	0.1
Large	88.5	2.7	0.0	0.0	1.4	0.9	0.0	6.4	0.0
Farrow to finish									
Small	90.3	3.6	1.6	0.0	2.7	0.3	0.3	1.0	0.3
Medium	50.6	1.1	0.1	0.0	10.8	0.2	36.8	0.4	0.0
Large	94.4	0.4	0.1	0.0	2.4	0.1	0.0	0.8	0.3
Grow to finish									
Small	78.3	5.9	2.7	0.0	5.5	1.7	1.9	2.4	1.1
Medium	88.3	0.8	0.1	0.1	4.1	0.9	1.5	1.1	0.5
Large	95.5	2.0	0.1	0.0	0.2	0.2	0.2	0.7	1.1

Source of data: Household surveys – Improving Competitiveness of Pig Producers in an Adjusting Market Project, 2007-2008.

Annex 4: Estimates from Multinomial regression of choice of feed (mixed feed system is base)

Variables	Traditional feed system	Industrial feed system
Household size	0.32**	-0.05
Male headed household	-0.37	-0.21
Age of household head (log)	0.85	-0.32
Head and spouse total years of schooling	0.08	-0.04
Head and spouse total level of training	-0.11	0.15
Having wage or salary	-1.14*	0.54
Household dependency ratio	-1.54*	-0.17
Agricultural land owned	0.33	-0.05
Assets owned	-0.005	0.001
Share of income from crop	0.02***	-0.006
Living in urban area	-0.34	0.68**
Living in southern provinces	-1.64**	2.09***
Self producing a part or all of feed used	1.09	-0.67**
Having a regular feed supplier	-0.74***	1.04***
Distance to feed supply (km)	-0.27***	0.01
Adopting farrow to wean system	0.62**	-0.64**
Adopting local breed	-0.13	0.26
Large-scale production	0.34	0.72*
Small-scale production	0.63**	-0.25
Number of years engaging in pig production	-0.11	-0.03
Access to credit	-0.18	-0.50
Access to extension services	-0.91***	0.29
Having feed purchase contract	-33.68	0.95**
Inverse mill ratio	5.60**	-1.09
Constant	-9.56***	-0.34

Note: *** - significant at 1% level; ** - significant at 5% level; * - significant at 10% level.
Number of Obs: 698; Pseudo R2: 0.3064; LR Chi2 (48) = 409.09; Log Likelihood=-462.93094
Source of data: Household surveys – Improving Competitiveness of Pig Producers in an Adjusting Vietnam Market, 2007.

Annex 5: Estimates from logit regression of the choice of breed (local versus improved)

Variable	Coefficient
Household size	0.23
Male headed household (dummy)	-0.86**
Head and spouse total years of schooling	0.08
Head and spouse total level of training	-0.39**
Having wage or salary income (dummy)	-0.34
Household dependency ratio	-1.19
Minor Ethnicity (dummy)	0.21
Agricultural land owned (ha)	0.03
Nonland assets owned (million VND)	-0.005
Share of income from crop (%)	-0.005
Living in urban area (dummy)	-0.51**
Living in southern provinces (dummy)	-1.04***
Adopting farrow to wean system (dummy)	0.63***
Small-scale farm (dummy)	0.3
Large-scale farm (dummy)	-0.99*
Distance to outlet (km)	-0.01
Access to credit (dummy)	-0.21
Access to veterinary service (dummy)	-0.1
Access to extension service (dummy)	0.53**
Access to insemination service (dummy)	-0.39
Inverse mill ratio	2.82
Constant	-2.38

Note: Dependent variable is binary =1 if local, improved otherwise.
*** - significant at 1% level; ** - significant at 5% level; * - significant at 10% level.
Log Likelihood =-314.8; No of Obs = 694; LR chi2 (19) = 102.54; Prob>chi2=0; Pseudo R2=0.14

Source of data: Household surveys – Improving Competitiveness of Pig Producers in an Adjusting Vietnam Market, 2007.

Annex 6. Unit cost structure per kg weight gain by production system and scale, 2007 (value in '000 VND)

Cost item	1. Farrow to wean						2. Farrow-to-finish						3. Grow-to-finish					
	Small N=112		Medium N=51		Large N=8		Small N=114		Medium N=64		Large N=26		Small N=200		Medium N=75		Large N=35	
	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%
Stock cost (piglet/sow)	0.03	0.1	0.0	0.0	0.0	0.0	0.2^{b}	1.3	0.1^{c}	0.7	$0.0^{b,c}$	0.0	6.0^{a}	31.0	6.7^{a}	32.8	6.0	30.5
Feed cost	21.3^{a}	90.9	18.1^{a}	92.7	15.1	88.7	$14.0^{a,bb}_{b}$	93.2	15.9^{a}	94.3	18.4^{bbb}	95.8	12.5	64.6	13.1	64.4	13.0	66.3
Feed purchased	10.9	46.4	12.4	63.6	14.0	82.1	$9.8^{aaa,bb}_{b}$	65.4	$12.5^{aaa,}_{ccc}$	74.2	$17.5^{bbb,}_{ccc}$	91.5	$6.9^{aaa,bb}$	35.9	10.8^{aaa}	53.0	11.6^{bb}	59.3
Feed self-produced	10.4	44.4	5.7^{cc}	29.1	1.1^{cc}	6.6	4.2^{bbb}	27.7	3.4	20.1	0.8^{bbb}	4.3	$5.5^{aaa,bb}_{b}$	28.6	$2.3^{aaa,cc}$	11.4	$1.4^{bbb,cc}$	7.0
Breeding cost	0.4	1.5	0.3	1.5	0.4	2.5	0.1	0.8	0.1	0.6	0.1	0.5	0.01	0.1	0.05^{cc}	0.0	0.02^{cc}	0.1
Veterinary cost	0.7	3.0	0.5	2.7	0.6	3.5	0.3	1.8	0.2	1.5	0.3	1.5	0.2	1.2	0.2	1.1	0.2	0.9
Loan cost	0.4	1.6	0.1	0.6	0.4	2.5	0.1	0.9	0.2	1.2	0.1	0.6	0.1	0.5	0.1	0.5	0.2	0.9
Hired labor cost	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.0	0.0	0.0	0.0	0.1	0.4
Other	0.6	2.6	0.4	2.3	0.4	2.2	0.3	1.7	0.2	1.4	0.2	1.2	0.5	2.3	0.2	1.0	0.1	0.7
Total variable cost	23.4	100.0	19.6	100.0	17.0	100.0	15.0^{bb}	100.0	16.8	100.0	19.2^{bb}	100.0	19.3^{aaa}	100.0	20.3^{aaa}	100.0	19.6	100.0

Source of data: Household surveys – Improving Competitiveness of Pig Producers in an Adjusting Vietnam Market Project, 2007-2008.

Note: a: significant difference between small and medium scale; b: significant difference between small and large scale; c: significant difference between medium and large scale; x: significance at 10% level; xx: significance at 5% level; xxx: significance at 1% level where x is a,b,c

Annex 7. Gross margin per a kilogram of output by production system and scale (unit: `000VND)

SCENARIO 1:	Production system											
	Farrow to wean				Farrow to finish				Grow to finish			
	Small	Medium	Large	Overall	Small	Medium	Large	Overall	Small	Medium	Large	Overall
	N=112	N=51	N=7	N=170	N=114	N=63	N=26	N=203	N=194	N=75	N=35	N=304
1. Average output unit price	30.2	29.9	28.6	30.1^{111,222}	23.8^{bb,}	24.8	26.3^{bb}	24.4^{111}	24.1^{a,b}	25.1^{a,}	25.2^{b}	24.4^{222,}
2. Average output unit cost	23.4^{a,b}	19.6^{a,c}	14.0^{b,c}	21.9^{111,22}	15.0^{bb}	15.7^{cc}	19.2^{bb,cc}	15.7^{111,333}	19.8	20.3	19.6	19.9^{22,333}
3. Gross margin (3=1-2)	6.8^{a,b}	10.3^{a,c}	14.5^{b,c}	8.2^{222}	8.8	9.1	7.2	8.7^{333}	4.3	4.8	5.6	4.6^{222,333}
4. Price/Cost ratio	1.6^{a,bb,}	1.8^{a,cc}	2.2^{bb,cc}	1.7^{111,222}	2.0^{a}	1.8^{a}	1.7	1.9^{111,333}	1.3	1.3	1.4	1.3^{222,333}
5. GM/Cost	0.6^{a,,bb}	0.8^{cc,}	1.2^{bb,cc}	0.7^{111,222}	1.0^{a}	0.8^{a}	0.7	0.9^{111,333}	0.3	0.3	0.4	0.3^{222,333}

SCENARIO 2:	Production system											
	Farrow to wean				Farrow to finish				Grow to finish			
	Small	Medium	Large	Overall	Small	Medium	Large	Overall	Small	Medium	Large	Overall
	N=112	N=51	N=7	N=170	N=114	N=63	N=26	N=203	N=194	N=75	N=35	N=304
1. Average output unit price	30.2	29.9	28.6	30.1^{111,222}	23.8^{bb}	24.8	26.3^{bb}	24.4^{111}	24.1^{a,b}	25.1^{a}	25.2^{b}	24.4^{222}
2. Average output unit cost	22.2^{a,b}	18.8^{a}	14.0^{b}	20.8^{111,22}	14.6^{bbb}	15.3^{cc}	19.1^{bbb,cc}	15.4^{111,333}	19.0	19.9	19.4	19.3^{22,333}
3. Gross margin (3=1-2)	8.0^{a}	11.1^{a}	14.6	9.2^{222}	9.2	9.5^{c}	7.3^{c}	9.0^{222,333}	5.1	5.2	5.7	5.2^{333}
4. Price/Cost ratio	1.7^{bb}	1.9^{c}	2.2^{bb,c}	1.8^{11,222}	2.1^{a}	1.8^{a}	1.8	2.0^{11,333}	1.4	1.4	1.4	1.4^{222,333}
5. GM/Cost	0.7^{bb}	0.9^{c}	1.2^{bb,c}	0.8^{11,222}	1.1^{a}	0.8^{a}	0.8	1.0^{11,333}	0.4	0.4	0.4	0.4^{222,333}

Note: a: significant difference between small and medium scale; b: significant difference between small and large scale; c: significant difference between medium and large scale; 1: significant difference between Farrow to wean and Farrow to finish; 2: significant difference between Farrow to wean and Grow to finish; 3: significant difference between Farrow to finish and Grow to finish; x: significance at 10% level; xx: significance at 5% level; xxx: significance at 1% level where x is a,b,c or 1,2,3