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## Innovation and productivity in formal and informal firms in Ghana

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### ABSTRACT

Despite the high profile of the issue in current policy formulations in low-income countries (LICs), there is little large firm level survey based empirical evidence on innovativeness and firm performance, especially in informal establishments. This paper aims to fill this gap in the literature using a revised Crépon-Duguet-Mairesse (CDM) structural model to analyse data from a unique innovation survey of 501 manufacturing firms in Ghana. We find that innovation positively impacts the labour productivity of firms, technological innovations more than managerial innovations. Formal firms do not tend to be more productive than informal firms, but the role of innovation on productivity tends to be greater for formal firms.

### 1. Introduction

The economic growth of low-income countries (LICs) is a product of ideas, skills, capital, and the organization of society and firms (Fagerberg et al., 2010). It has not been different in the economic history of currently developed countries, where main industrial revolutions were all linked to an application and spread of an innovation - steam power, electricity, and informatics - resulting in a remarkable increase in total factor productivity, societal changes, and ultimately improvement in the wealth and welfare of nations. The past also shows that the real impact of technologies and advancement in knowledge occurs when they are diffused and adopted by a large range of actors, within a country and in other countries as well. Yet, hosting countries not only have to face financial constraints to acquire the technology, but also to develop an absorptive capacity (knowledge and skills) able to adopt and possibly reproduce such technologies (Cohen and Levinthal, 1989). The steam engine is a demonstrative example: it was invented in the United Kingdom at the end of the 18th century, but its diffusion to other countries took decades. Even if the Chinese empire came across this technology during the First Opium War (1839–1842), its potential impact was not fully realized at first, and then it took two decades to overcome the knowledge and skills gaps (mainly in term of technical drawing and machine tools) for the Chinese to adopt and produce steam engines (Wang, 2010). The first steam engine built in China was manufactured in 1869, almost hundred years after its invention in the United Kingdom. At that time, the second industrial revolution was in its infancy in Europe, and the streets of European capitals were soon starting to have electric lighting.

In the macroeconomic literature, it is widely recognized that innovation is a major driver of economic growth (Grossman and Helpman, 1991). As extensively documented in Fagerberg et al. (2010), two factors have been identified as critical factors in the endogenous economic growth models: adoption of technologies developed elsewhere and indigenous innovative capacity. However, the technology diffusion to, and adoption by, developing countries is costly and conditional on factors that support the process (Keller, 2004). It relies on substantial and well-directed technological efforts (Lall, 1992) as well as sufficient human and financial resources and absorptive capacity (Cohen and Levinthal, 1989; Keller, 1996). As highlighted in Fu and Gong (2011), it also requires appropriate institutions and policies to guide incentives and facilitate the process, in addition to strong local capabilities to identify the right technology and appropriate transfer mechanism according to local economic, social, technical and environmental conditions. Trade (import and export) and foreign direct investments can become important sources of growth for catching-up countries.

The macro-level evidence is supported by empirical studies that strongly suggest that the level of technological innovation contributes significantly to economic performance, particularly at the firm and industry level (see for example Kleinknecht and Mohnen, 2002). Firms' growth is seen as a learning process in which firms that are able to adopt and create technologies and knowledge grow and survive, while firms that do not innovate decline and fail (Jovanovic, 1982). This is particularly relevant in the context of LICs in which the learning process is the major factor enabling innovation activities in firms (Bell and Pavitt, 1992; Lall, 1992). Low-income countries face severe constraints

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and, as argued by [Lundvall et al. \(2010\)](#), technological capabilities in these countries encompass more than just research and development (R&D). In such environments, learning-based innovations - such as adoption or adaptation of both technological and non-technological innovations - are significant factors for the industrial development.

The richness of the data on innovation in emerging and developed countries has allowed researchers to implement an econometric approach, such as the widely used Crépon-Duguet-Mairesse (CDM) structural model ([Crepon et al., 1998](#)), in which firm performance is a function of product and/or process innovation, which in turn are explained by R&D and other innovation expenditures. In the context of developing countries, the lack of data at longitudinal level and the fact that for the vast majority of firms R&D activities are only a marginal determinant in innovation activities have posed several challenges in modelling innovation and growth. Nonetheless, in recent years an increasing number of empirical studies have analysed the role of innovation in LIC firms, both exploring its determinants ([Goedhuys, 2007](#); [Robson et al., 2009](#)) and the impact it has on various firm performance indicators ([Gebreyesus, 2009](#); [Goedhuys et al., 2008, 2014](#)). Most of the latter studies focus on product and process innovations and their impact on productivity. However, as argued by various scholars ([Bloom et al., 2013](#); [Bruhn et al., 2010](#); [Crespi and Zuniga, 2012](#); [Mano et al., 2012](#)) in the current state of development of LICs it is important to recognize the impact of a range of innovations, including management and marketing innovations, the impact of which could go further than an improvement in productivity.

In analysing the contribution of innovation to firm performance, it is important to recognize that in most of the developing countries a dual-economy system exists with formally registered firms and an informal sector. In a recent survey on informality and development, [La Porta and Shleifer \(2014\)](#) provide five stylized facts of the informal economy in developing countries. The informal sector employs a large proportion of workers and tends to escape taxation and controls from the authorities. Moreover, it is characterized by small and inefficient firms, which are ran by poorly educated entrepreneurs, and as a consequence its productivity is very low. Capturing the magnitude and impact of the informal sector is problematic because of its intrinsic nature, but it has been estimated that the weighted average size of the shadow economy (as a percentage of GDP in the period 1999–2007) in sub-Saharan Africa is around 40% ([Schneider et al., 2011](#)) and makes up to 80% of non-agricultural employment ([Chen et al., 1999](#)). As shown in [Wunsch-Vincent and Kraemer-Mbula \(2016\)](#), the different capabilities of firms in the formal and informal sectors are likely to shape the innovation adoption and diffusion. For example, formal establishments may have the human and capital resources to collaborate in innovation activities with other firms, research and development institutions, or, for larger firms, with foreign institutions ([Oyeleran-Oyeyinka et al., 1996](#)). Informal firms, by contrast, are unlikely to have strong capabilities and, therefore, may be more likely to innovate from entrepreneurs' initiatives and in response to specific constraints given by the context in which operate ([Robson et al., 2009](#)).

According to received wisdom, whereas the role of innovation in firms' growth in developed countries is largely documented, its impact in developing countries is still only partially understood, mainly across informal firms. Difficulties related to data availability and the measurement of innovation have limited the empirical studies on the link between innovation and firms' growth in LICs (see [Wunsch-Vincent and Kraemer-Mbula, 2016](#)).

This paper aims to fill this gap in the literature analysing data from a unique innovation survey of 501 manufacturing firms in Ghana. The survey was specifically designed to investigate the innovation activities of firms in a granular way, capturing the conventional and unstructured way firms of different level of formality, size, and absorptive capacity typically innovate. The main research questions that motivate this study are “How does innovation affect firms' growth? And are there differences between formal and informal firms?”. Our results show that

innovation increases labour productivity, and that technological innovations have a greater contribution than non-technological innovations. The influence of technological innovations on productivity tends to be greater for formal firms, but informal firms get as much out of non-technological innovations as formal firms do. Our study contributes to the literature by providing empirical evidence on the different roles that innovation plays in the formal and informal sectors and on the different roles that technological and non-technological innovations play in firms' growth in LICs. We thereby supplement the conventional wisdom mostly based on qualitative research that argues that poor management practices, poor standard of operations and poor quality control are the most important constraints that result in low productivity of firms in Africa.

Because of the development level of the institutions and education system, Ghana provides a potential fertile soil for innovation in the context of developing countries making this a relevant case study. However, it also shares many of its structural characteristics with other LICs and therefore the conclusions of this study are generalizable to other low-income countries. In the past thirty years, Ghana has undertaken a series of structural reforms aimed to strengthen the role of the private sector as a pillar of economic growth. In 2010, the Industrial Policy was set within the context of Ghana's long-term strategic vision of achieving middle-income status by 2020, through the transformation of the country into an industry-driven economy. Remarkably, the Industrial Policy acknowledged the role of innovation and put in place policies aimed to increase the overall level of science, technology, and research and development in the industry. However, despite policy reforms, the majority of firms are still small and embedded in the informal sector, and larger firms are constrained by finance, managerial, and technical skills.

The remainder of the paper is structured as follows. [Section 2](#) provides the literature review while [Section 3](#) reports the model and the estimation strategy. This is followed in [Section 4](#) by the description of the data at hand with a focus on the nature of innovation and the formal/informal status of firms. [Section 5](#) reports and discusses the results. Finally, [Section 6](#) concludes.

## 2. Literature review

Until a decade ago, innovation in the private sector in LICs was the focus of only a handful of studies every year ([Zanello et al., 2016](#)). Until then, innovation was often associated with patents or ground-breaking discoveries. Those are the results of costly, risky and lengthy processes that require intense knowledge and capital investment to create something “new”. The Oslo Manual has been a standard reference for surveys of innovation in advanced economies and, since its third edition, also in developing countries. Its definition of innovation as “[...] the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations” ([OECD, 2005](#): 46) highlights two important features. First, innovation can take a multitude of forms (product innovations, process innovations, marketing innovations, and managerial/organisational innovations). Second, innovation can result from an original idea but can also emerge from the diffusion, absorption, or imitation of new methods developed elsewhere. Because of that, an innovation could simply be new to the firm and not necessarily new to the market and yet have an impact on productivity and employment.

The recognized growing role of innovation in developing countries has opened a new sub-field of research at the intersection of innovation studies and development studies. The so-called inclusive innovation focuses on the impact of innovation on the people living in the lowest income groups ([Chataway et al., 2013](#)). In particular, it refers to the production or delivery of new products and services for and/or by those people that so far were largely excluded from formal markets. At the same time, the constrained ingenuity and resilience of the people living

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