# Reinvention as a resilience strategy:

**Business model change is necessary to sustain a business and make it more productive**

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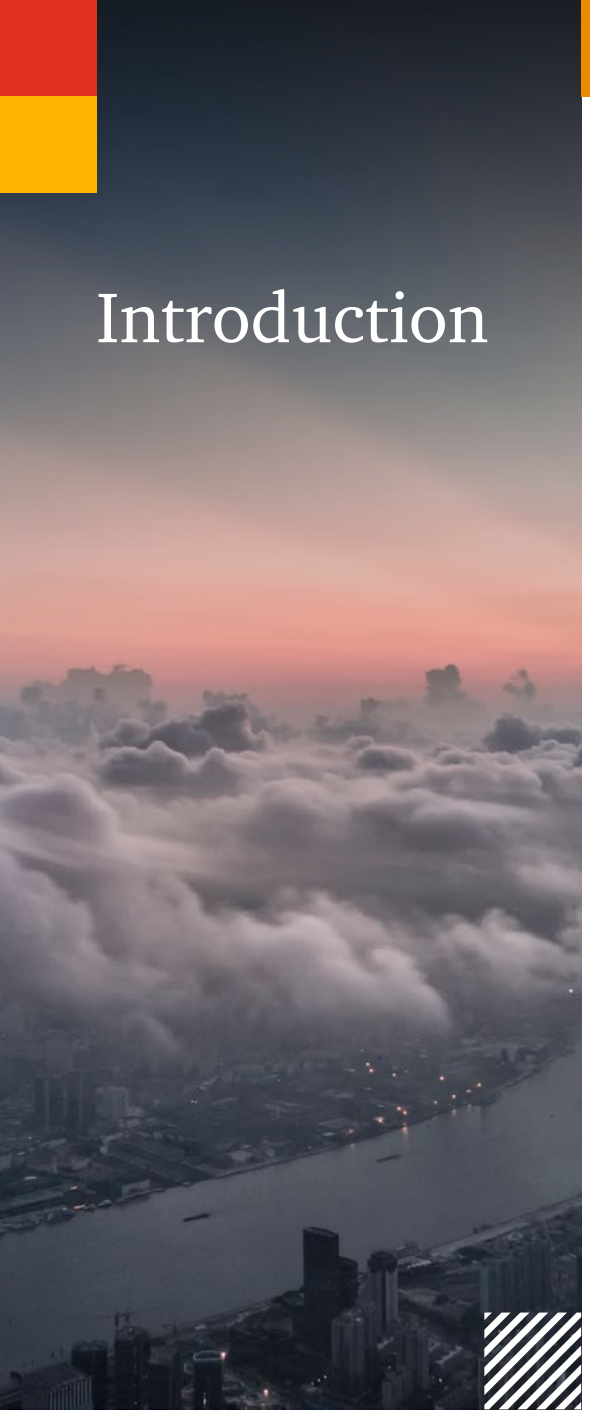
# Introduction



Business model change means transforming how a company creates, delivers, and captures value. Or, put another way, it's how a company changes how it makes money, serves customers, or provides new products or services.[1]

This research examines the critical role of business model change in sustaining competitiveness and driving productivity growth. By analyzing a sample of over 18,000 companies worldwide, the study quantifies the impact of business model changes, using the Net Asset Turnover (NAT) ratio as a proxy.[2] Significant shifts in the NAT ratio reflect how radical changes in business models, such as adopting digital platforms or subscription services, can alter a company's asset structure and sales dynamics.

The results highlight that business model change significantly contributes to productivity growth. We estimate that a company that is in the top quartile (leader) in business model change is expected to have a higher productivity between 1.5% and 8.5% than one that is in the bottom quartile (laggard). This underscores that companies continuously evolving their business models outperform those that do not. This adaptability is crucial in responding to, for example, technological advancements, regulatory shifts, and changing consumer preferences, thereby fostering resilience and growth.

Our findings stress that staying static in today's fast-paced environment is not an option. Companies must move beyond mere optimisation and embrace reinvention to arrive at a new or more sustainable competitive position.[3]

This involves shaping new service offerings and expanding into digital products to discover novel revenue streams. By adopting the right strategy, structure, culture, and technology, organisations can reinvent how they create, deliver, and capture value. This proactive approach ensures that businesses lead through disruption, maintaining their competitive edge in an ever-changing landscape.

**Veronique Roos-Emonds**
**Barbara Baarsma**

**1** 21 May 2024, *PwC – Make Business Model Reinvention Real*
**2** Wannakrairoj, W., & Velu, C. (2021). Productivity growth and business model innovation. Economics Letters, 199, 109679.
**3** Volberda, H., van den Bosch, F., & Heij, K. (2017). Reinventing business models: How firms cope with disruption. Oxford University Press.

# What Kodak got wrong, and Netflix got right

Kodak's failure to innovate its business model can be attributed to its reluctance to fully embrace digital technology and its overreliance on film sales. Despite inventing the first digital camera, Kodak was hesitant to shift away from its profitable film business. The company feared that digital photography would cannibalise its film sales, which led to a delay in investing in digital technologies and developing a robust digital strategy. This hesitation allowed competitors to capture the digital market, leaving Kodak struggling to catch up. Additionally, Kodak's business model was heavily based on the "razor and blades" strategy, where cameras were sold at a low price to drive film sales. As digital photography gained popularity, this model became obsolete. Kodak's failure to adapt its business model to the changing technological landscape and consumer preferences ultimately led to its decline, leading to its eventual bankruptcy in 2012.

Netflix's journey to success began with its innovative approach to DVD rentals. Initially, Netflix disrupted the traditional video rental market by offering a subscription-based model that allowed customers to rent DVDs by mail without due dates or late fees. This model was a significant departure from the norm and quickly gained popularity. However, Netflix didn't stop there. Recognizing the potential of the internet, Netflix pivoted to online streaming in 2007, leveraging the increasing availability of high-speed internet. This shift provided instant access to a vast library of content, setting the stage for the company's future growth. In 2013, Netflix took another bold step by entering the realm of original content production. This move allowed Netflix to differentiate itself from competitors and gain control over its content library. Original series like "House of Cards" and "Stranger Things" became cultural phenomena, attracting millions of subscribers and establishing Netflix as a major player in the entertainment industry.

Source: Volberda, H., van den Bosch, F., & Heij, K. (2017). Reinventing business models: How firms cope with disruption. Oxford University Press.

# Why business model change is important?

Changing business models is crucial for companies to maintain competitiveness and adapt to changing market conditions. Business model change is a significant source of competitive advantage, enabling firms to create and capture value in novel ways.[4,5] This process involves rethinking the value proposition, operational processes, and revenue models to better meet customer needs and leverage new technologies and stand up to competitors.[6,7] By continuously considering innovating their business models, companies can stay relevant and responsive to market dynamics, which is essential for long-term success.[8]

One of the key benefits of having a flexible and adjustable approach to business models is the ability to quickly respond to external changes, such as technological advancements, regulatory shifts, and evolving customer preferences.[9] Firms that can pivot and adapt their business models are better positioned to seize new opportunities and mitigate risks.[10,11] For instance, companies that embraced digital transformation early on were able to thrive during the COVID-19 pandemic by shifting to online operations and remote work models.[12] This adaptability not only enhances resilience but also fosters innovation and growth.

Continuously evolving business models involves not only incremental improvements but also radical changes that can disrupt existing markets.[13,14] By experimenting with new business models and embracing disruptive innovations, companies can differentiate themselves from competitors and capture new market segments.[15] Conversely, firms that fail to innovate risk becoming obsolete. Companies that rely solely on past successes without adapting to changing environments often struggle to maintain their market position.[16]

**4** Geissdoerfer, M., Vladimirova, D., & Evans, S. (2018). Sustainable business model innovation: A review. Journal of cleaner production, 198, 401-416.
**5** Teece, D. J. (2010). Business models, business strategy and innovation. Long Range Planning, 43(2-3), 172-194.
**6** Ibid.
**7** Ibarra, D., Ganzarain, J., & Igartua, J. I. (2018). Business model innovation through Industry 4.0: A review. Procedia manufacturing, 22, 4-10.
**8** Foss, N. J., & Saebi, T. (2017). Fifteen years of research on business model innovation: How far have we come, and where should we go? Journal of Management, 43(1), 200-227.
**9** Ibid.
**10** Andreini, D., Bettinelli, C., Foss, N. J., & Mismetti, M. (2021). Business model innovation: a review of the process-based literature. Journal of Management and Governance, 26, 1089-1121.
**11** Geissdoerfer, M., Vladimirova, D., & Evans, S. (2018). Sustainable business model innovation: A review. Journal of cleaner production, 198, 401-416.
**12** Andreini, D., Bettinelli, C., Foss, N. J., & Mismetti, M. (2021). Business model innovation: a review of the process-based literature. Journal of Management and Governance, 26, 1089-1121.
**13** Casadesus-Masanell, R., & Zhu, F. (2013). Business model innovation and competitive imitation: The case of sponsor-based business models. Strategic Management Journal, 34(4), 464-482.
**14** Haftor, D. M., & Costa, R. C. (2023). Five dimensions of business model innovation: A multi-case exploration of industrial incumbent firm's business model transformations. Journal of Business Research, 154, 113352.
**15** Casadesus-Masanell, R., & Zhu, F. (2013). Business model innovation and competitive imitation: The case of sponsor-based business models. Strategic Management Journal, 34(4), 464-482.
**16** Teece, D. J. (2010). Business models, business strategy and innovation. Long Range Planning, 43(2-3), 172-194.

# Why this research matters?

Most of the existing research on business models tends to be descriptive, often relying on case studies or focusing on specific firms. This approach provides valuable insights into how individual companies have successfully (or unsuccessfully) navigated business model innovation. However, it also means that the findings can be somewhat anecdotal and may not always be generalisable across different industries or contexts.

Our current research aims to address this gap by quantifying the benefits of business model change. By employing an empirical approach, we seek to measure the impact of business model change. The theory and anecdotal evidence show that it is positive. But will this also be true if we look at a sample of more than 18,000 companies from all over the world?

In addition, our research is relevant because it plays an important role in connecting business model change to productivity. By examining how shifts in business models can enhance a company's efficiency and output, our study provides valuable insights into the mechanisms through which strategic innovation can drive improved performance. Understanding this relationship is crucial for firms looking to optimise their operations and achieve sustainable growth in an increasingly competitive landscape.

# TomTom's Journey: Adapting to a changing tech landscape

TomTom is a company that has had to reinvent itself several times to survive in a rapidly changing technological environment. It started back in the early 2000s, when the dotcom bubble burst and many technology companies went under. At the time, TomTom was best known for its software for mobile handheld devices such as Palm, HTC and Nokia. In response, TomTom decided to concentrate entirely on location and navigation software, shifting its focus to the core of its expertise and securing future potential.

In 2004, TomTom made another crucial strategic decision: it released its own hardware in the form of its well-known portable navigation devices. This made TomTom less dependent on hardware customers, as it had to constantly respond to changes in third-party devices. This gave TomTom more control over the user experience and positioned the company as the market leader in navigation.

The next big step came in 2008, when TomTom acquired Tele Atlas, one of only two digital map suppliers worldwide. The other map provider, NavTeq, was simultaneously sold to Nokia. Google subsequently decided to build maps entirely in-house, so there were three providers from then on. This acquisition gave TomTom control over its own maps. In 2009, the business model again came under pressure from Google, which offered free navigation via Android, and in 2010 Nokia followed with the same offer. This forced TomTom to rethink its strategy and business model for internet and mobile.

Around 2012, TomTom stopped supplying hardware to the car industry as car manufacturers increasingly wanted to manage their own screens and systems. In 2015, the other major map developer, which Nokia had acquired in 2008, was sold to a consortium of German car manufacturers, further tightening the market. TomTom now had more difficulty selling maps to these car manufacturers.

In 2016, TomTom decided to discontinue niche products within its consumer business, such as the action camera and sports watch. The company focused entirely on its core business, consumer navigation systems, although that market too was under pressure from smartphones with built-in navigation. The corona pandemic of 2020 brought new challenges. The car industry came to a standstill, and later component shortages created additional problems. Nevertheless, TomTom persevered with innovation.

In 2022, together with Microsoft, Meta and Amazon, TomTom launched the Overture project, a new standard for collaborative map-making with universal standards and open source. These new maps, called Orbis, expanded the Total Addressable Market (TAM) for TomTom by providing applications outside the traditional car market. Since 2024, TomTom has increasingly focused on integrating maps into vehicles. This enables vehicles to operate more safely and autonomously, where detailed and up-to-date map information is essential for autonomous driving solutions.

Source: Interview with TomTom.

# PostNL's ongoing adaptation

Since 2007, PostNL has seen a 7-9% annual decline in letter mail volume due to increasing digitisation. People and businesses are increasingly using digital means of communication, such as e-mail and app messages, instead of physical mail. At the same time, consumers are increasingly ordering products online. In 2012, this presented PostNL with an opportunity to develop a new revenue model alongside traditional mail delivery: the expansion of parcel service. Although it seems like a logical step from a 2024 perspective, it was not yet clear in 2012 that e-commerce and thus the parcel market would grow so explosively. Especially since the Covid 19 pandemic in 2020, when people started ordering online en masse, this growth has accelerated.

In addition to digitalisation and the impact of the pandemic, sustainability is playing an increasingly important role in PostNL's transformation. This is not just about making transport, logistics and the business locations more sustainable, but also has a social dimension. Mail and parcel deliverers come to every street every day and thus act as the "eyes and ears" of the neighborhood. PostNL is capitalizing on this by, since the beginning of this year, offering delivery drivers the opportunity to make anonymous reports via their work app when they have concerns about a resident. These social projects not only increase customer satisfaction but also improve PostNL's market position.

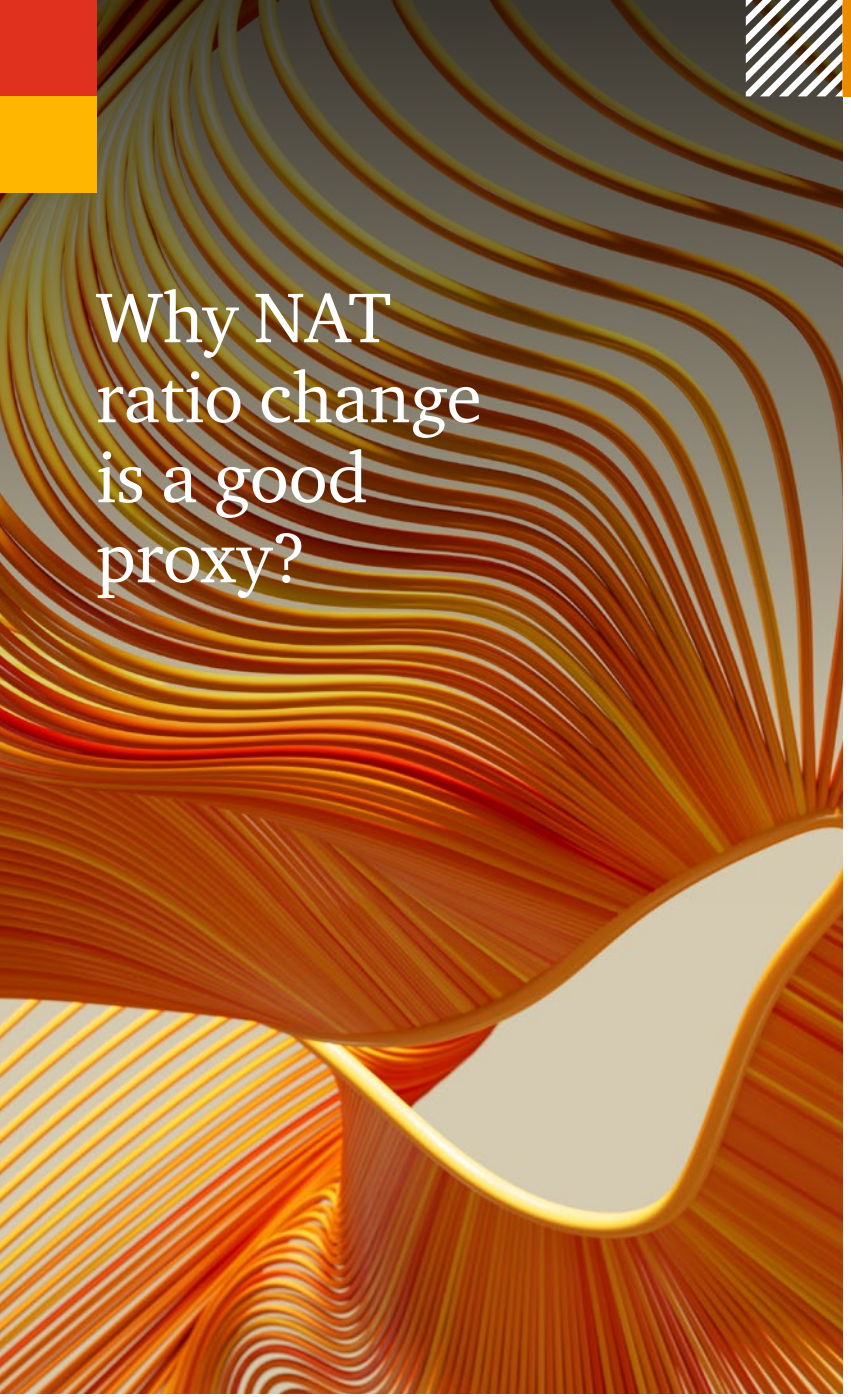
Over the past two years, PostNL has faced tightness in the labour market. To respond to this, the company is investing heavily in labour-saving technologies, such as automation and robotisation in the sorting centers.

In addition, the future of parcel delivery increasingly lies with "out of home" solutions, such as parcel machines and in-store pickup points. Artificial intelligence (AI) and GenAI will play a bigger role in this than we can currently imagine. AI is already being used by PostNL to determine at which nearby retail point a package can best be delivered, leading to shorter waiting times and improved availability. Geopolitical tensions do not directly affect PostNL through trade barriers, but they can affect the company through the impact on consumer confidence. The higher this confidence, the more the e-commerce market will grow in the coming years.

In view of the growing aging population, PostNL also plans to focus more on logistics services for the healthcare sector, such as home delivery of medicines and medical devices. PostNL already processes packages containing medical devices, such as heel prick kits for newborns and materials for intestinal examination, but wants to further expand these services to meet the growing demand for care.

The ongoing adaptation of PostNL's business model indicates that it takes courage to make timely adjustments. This requires investment, involving experimentation and acceptance of failure, because not every investment will be immediately successful.

Source: Interview with PostNL.



# Why NAT ratio change is a good proxy?

Our first challenge is how to measure business model change as there is no direct variable used to measure it across all kinds of businesses. We follow the approach of Wannakrairoj and Velu (2021) and use the change in the Net Asset Turnover (NAT) ratio as a proxy for it.[17]

Firstly, the NAT ratio, which is calculated as sales divided by net operating assets, captures the efficiency with which a company utilises its assets to generate sales. It is highly dependent on industry and business model characteristics. When a company undergoes a change in business model, it often involves significant changes in how it operates, manages its assets, and generates revenue. These changes are likely to be reflected in the NAT ratio.

The NAT ratio is great at capturing the shift from asset-heavy to asset-light business models or vice versa. For example, companies moving towards a more asset-light model by outsourcing manufacturing or adopting cloud-based services will see changes in the net operating assets required to generate a certain revenue, which will be reflected in the NAT ratio. This shift is indicative of a fundamental change in the business model. Importantly, business model change can also happen by a shift towards a more asset intensive model. A shift from a service-centric to a product-centric business model will probably lead to an increase in inventory and fixed assets, thereby decreasing the NAT ratio. Therefore, we consider the absolute value of the change in the NAT ratio.

Secondly, business model change is often a radical or stepwise change rather than a linear one.[18] Such radical changes are more likely to cause noticeable shifts in the NAT ratio. For instance, adopting a new business model that leverages digital platforms or subscription services can significantly alter the asset structure and sales dynamics of a company, leading to a marked change in the NAT ratio.

**17** Wannakrairoj, W., & Velu, C. (2021). Productivity growth and business model innovation. Economics Letters, 199, 109679.
**18** Volberda, H., van den Bosch, F., & Heij, K. (2017). Reinventing business models: How firms cope with disruption. Oxford University Press.

# DSM: From mining to petrochemicals and then from petrochemicals to life sciences

In less than 50 years, DSM has switched from mining to life sciences and materials. DSM started as a mining company in 1902. In the 1960s and 1970s, mines in the Netherlands were closing and the firm chose to change its focus to bulk chemicals. But that was not the last large re-orientation from DSM. In the late 90s, another large shift came. After finishing its privatisation, DSM moved to life sciences and materials.

Known for its chemical production, DSM could have chosen to retain or strengthen its position in the industry. Instead, it transitioned to a purpose-led, performance-driven strategy, emphasizing health, nutrition, and biosciences. The petrochemical division was sold entirely. This shift was driven by the opportunities and profit margins in life sciences compared to the declining attraction of petrochemicals.

DSM has successfully innovated its business model by focusing on sustainability and leveraging its scientific expertise.  By investing heavily in research and development, the firm developed innovative products. But when DSM made life-sciences its core business, it had only limited internal expertise. It expanded its expertise by investing in collaborations and acquisitions, including biotechnology company Gist-Brocades. DSM started adopting a more decentralised and exploratory form of innovation, following practices from Gist-Brocades. A network of R&D centers was established, in addition to a separate Innovation Center. Although, it would be simplistic to say that previous know-how and processes did not benefit DSM in the transition. The firm already had a *special products* business unit, for example.

On DSM's case, the innovation lever had impact on other levers of business model change: management and organisation. Top management invested in new management practices to ensure that the changes were supported across the organisation. And in organisational terms, a lot of decentralisation took place and different control systems were established.

Source: Volberda, H., van den Bosch, F., & Heij, K. (2017). Reinventing business models: How firms cope with disruption. Oxford University Press.

# What effect on a company are we looking for?

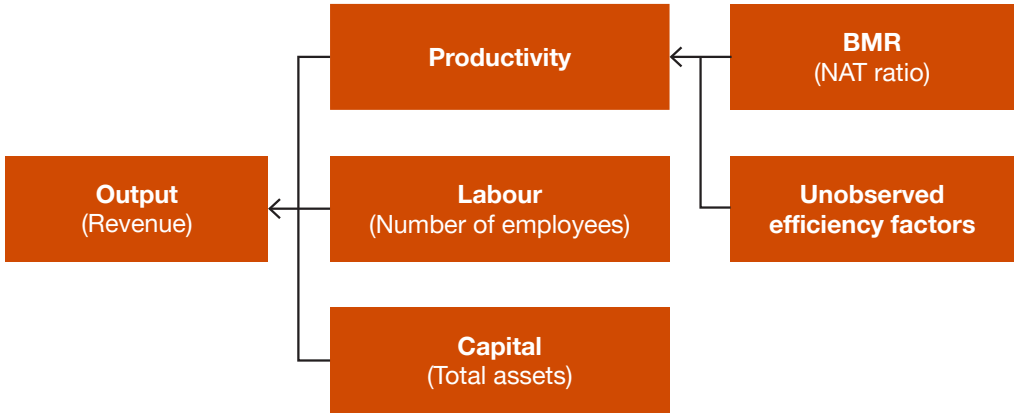
We focus on examining the impact of business model change, as proxied by changes in the Net Asset Turnover Ratio, on Total Factor Productivity (TFP). It is a critical measure of a company's efficiency and competitiveness, as it captures the output generated from all inputs used in the production process, i.e., capital and labour. TFP is a good measure of the state of technology, as it captures the effects of technological advancements, process efficiency improvements, and other factors beyond just input quantities. By analyzing the changes in the NAT ratio, we aim to understand how shifts in business models influence a firm's revenue as the ratio indicates how efficiently capital and labour are utilised to create added value.

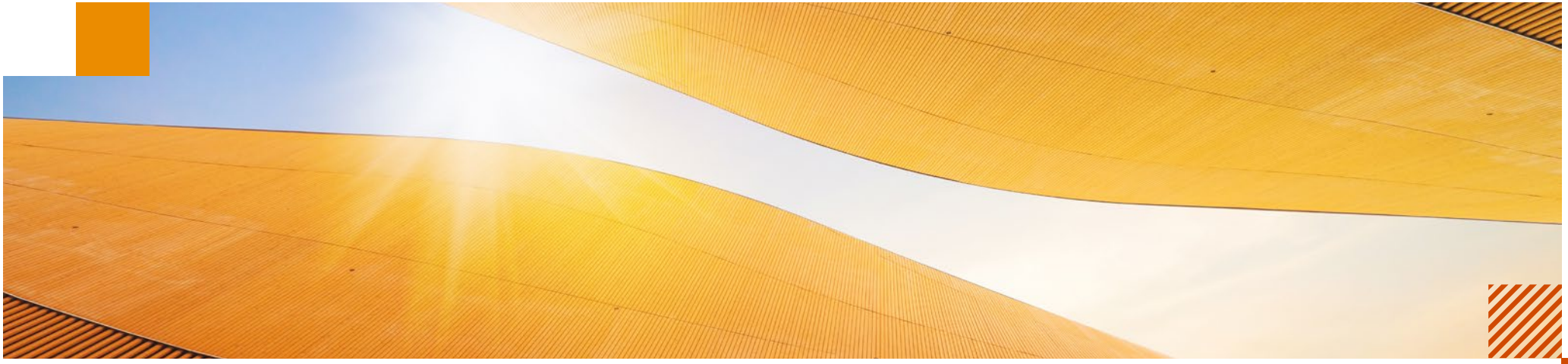
Our model posits that a company's revenue is dependent on three main factors: labour input, capital input, and productivity. Labour input is measured by the number of employees, reflecting the human resources dedicated to the company's operations.

Capital input is assessed through the firm's total assets, which include both tangible and intangible resources. Productivity, the third factor, is considered to be influenced significantly by the degree of business model change, as indicated by the NAT ratio.

By incorporating the NAT ratio as a proxy for business model innovation, we can quantify the impact of these changes on a company's TFP.

This approach allows us to isolate the effect of business model changes from other variables and provides a more detailed understanding of how strategic shifts in operations and asset management contribute to overall productivity. Our empirical analysis aims to validate the hypothesis that business model change leads to improved productivity and, consequently, higher revenue.





## The data

Our dataset, sourced from Orbis, is both extensive and diverse, comprising information on over 18,000 companies from 2009 to 2023 from various industries and regions around the globe. This comprehensive coverage allows for a broad and inclusive analysis of business model changes across different geographic and economic contexts. This diversity is critical for ensuring that our findings are robust and applicable across a wide spectrum of sectors. The temporal depth of the data enables us to observe long-term trends and the lasting effects of business model changes.

## The approach

To estimate the effect of a change in business model change on company revenue, we employ regression analysis. This method enables us to quantify the relationship between business model change, as proxied by changes in NAT, and total factor productivity, while accounting for other key variables such as company total assets and the number of employees. By including total assets, we capture the capital input into the company's operations, and by incorporating the number of employees, we measure the labour input.

Additionally, to ensure the robustness of our results, we control for time fixed effects and company (cross-section) fixed effects. Time fixed effects account for temporal variations that affect all companies uniformly, such as economic cycles or regulatory changes, thus isolating the specific impact of NAT changes. Company fixed effects, on the other hand, control for unobserved heterogeneity across companies that might influence revenue, such as management quality or firm-specific strategies. This approach allows us to estimate effect of business model changes on productivity and turnover, ensuring that our findings are not biased by external factors.

To further refine our analysis and address potential issues in the primary regression model, we also estimate a second model using an instrumental variable approach, employing a one-year lag in the change in NAT as the instrument.[19]

More details are available in the appendix.

**19** We consider particularly potential endogeneity issues arising from limitations of the proxy variable to measure business model change. We also implement the use of a second instrumental variable, the Euclidean Return on Equity, as a robustness check. The results are reported in the appendix.

# Port of Rotterdam Authority adjusted its business model with the goal of creating strategic value

Originally, the Port of Rotterdam had mainly an administrative function. It was essentially a ‘landlord’, focusing on land exploitation and handling of shipping traffic. The firm operated in a reactive manner and was highly hierarchical.

In its business plan of 1997-2000, the Port of Rotterdam manifested its ambition to become an orchestrator in the value chain. The focus changed to create strategic value based on customer requirements. This development was accelerated by its privatisation in 2004, which gave the port greater independence in the capital market, flexibility and capacity to engage directly with business. Port of Rotterdam shifted from being a ‘landlord’ to being a ‘port developer’. In this process, collaboration with customers became central.

From 2000 to 2015, many new business units were created to generate new income streams and opportunities. These include the Port of Rotterdam International (PORint) department and PortXL. PORint is responsible for all international activities of the Port Authority, which include helping other ports across the world and strengthening participation abroad. Port XL is a pioneer port accelerator programme to support start-ups in the Rotterdam port area, focusing on creating an ecosystem for maritime, logistics, energy and chemical markets.

All this was supported by substantial organisational changes. The number of management layers was reduced, and the Port Authority became flatter and with more horizontal relationships. These changes made the organisation closer to customers and to the market, facilitating co-creation, which resulted in knowledge development innovation strategic renewal, international strategic positioning and, consequently, in the enhancement of the port’s competitive position.

Source: Volberda, H., van den Bosch, F., & Heij, K. (2017). Reinventing business models: How firms cope with disruption. Oxford University Press.

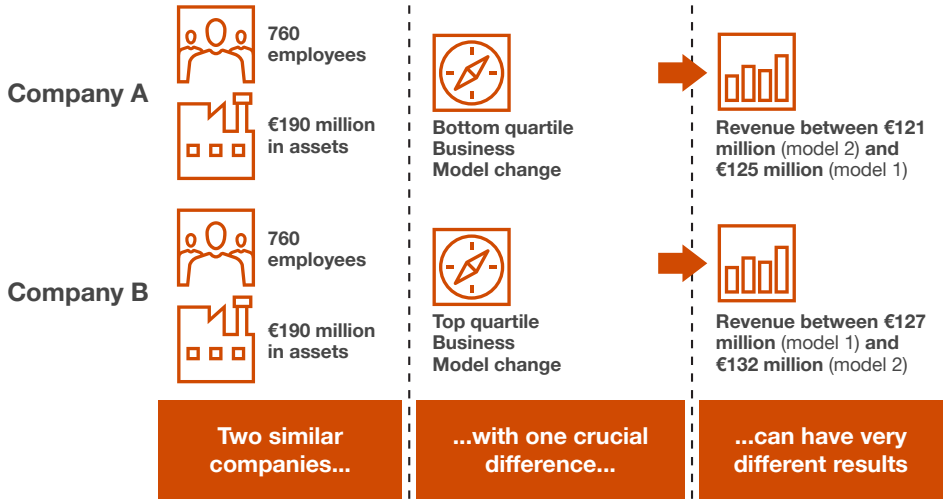
# We find that companies with higher pace in business model change have a higher turnover due to higher productivity

Our analysis reveals a significant positive relationship between the pace of business model changes and firm total factor productivity (TFP). Specifically, we find that doubling the rate of change in business models, as indicated by the NAT ratio, can lead to an increase in TFP by between 6% (Model 1 - Ordinary Least Squares) and 36% (Model 2 - Two-Stage Least Squares). This implies that firms can achieve substantial growth in productivity and revenue without requiring additional assets or employees, simply by accelerating their business model change. This finding underscores the critical role of adaptability and strategic transformation in enhancing firm performance.

***A company that is in the top quartile (leader) in business model change is expected to have a higher productivity between 1.5% and 8.5% than one that is in the bottom quartile (laggard).***

To put these results into perspective, we examine two hypothetical median companies in our sample. They have 760 employees and €190 million in assets. Their difference is their level of business model change. Company A is a laggard and is in the bottom quartile. Company B is a leader, being in the top quartile. That would result in a productivity difference between 1.5% to 8.5%. In practical terms, this translates to a difference in turnover by €2 million to €11 million. These results highlight that improvements in the pace of business model change can yield significant economic benefits, reinforcing the importance of continuous strategic evolution in maintaining competitive advantage.

Furthermore, our analysis identified that this effect is 15% stronger during the period between 2019 and 2023 compared to previous years. This trend suggests that the pressure to innovate and adapt business models to thrive in the economic landscape has reached its highest level since the financial crisis of 2009, corroborating the finds of PwC's Business Model Reinvention Pressure Index.[20]

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# Wolters Kluwer's transfor-mation to a technology company

Wolters Kluwer went from being a publisher of printed books and journals to a technology company in two waves. The first wave of the business model innovation was driven by digitisation and transformed the company into a digital content provider. In recent years there has been an acceleration in digitisation and a shift to cloud that was only further reinforced during COVID-19. The second wave of business model change shifted the business model from a digital content provider to an expert solutions and software company with offerings in the fields of health, tax, legal and compliance.

Due to changes in regulations, case law and healthcare information, Wolters Kluwer has to constantly update the content of its knowledge products. To do this as efficiently as possible, internal processes have been further digitised and automated with workflow technology and AI. Due to the strong increase and complexity of new regulations and information but also to combat misinformation, the company pays a lot of attention to content accuracy and bringing insights. The business model changed from delivering information to providing insights that are actionable for the user.

Wolters Kluwer uses three key levers in its business model change strategy. First, product development and innovation are essential. For example, by using Generative AI to understand the context in which the user uses the content so that highly curated information can be produced and better targeted insights can be offered. A doctor will want to be able to quickly access new health information in his or her area of specialisation. And a lawyer providing ESG advice in a particular sector will want to be quickly made aware of laws and regulations relevant to that particular sector and learn about five steps that need to be taken to ensure that their customer is compliant. In the near future personalisation is more enabled through GenAI.

Second, inorganic levers like acquisitions and divestitures have been important to reshape the portfolio. An example of a divestiture is the education business. Rather than expanding the portfolio with entirely new activities, M&A is focused on high growth adjacencies, like in the Environmental Health & Safety software market.

And then the third one was a continued evolution in talent and bringing in new capabilities like AI.

The business model change process at Wolters Kluwer is a step-by-step process. The changes are fundamental, but not implemented in a shock-like manner. There is an evolution, not a revolution. This is also due to the fact that people are typically averse to change, because change brings uncertainty. Humans do not like Big Bang type transformations. Incremental change also creates a culture where continuous improvement is the default, where employees become accustomed to innovations and the continued pursuit of embedding deep domain expertise in the customer workflow.

Source: Interview with Wolters Kluwer.

# Takeaways

The findings from our study underscore an undeniable and perhaps inconvenient truth: in today's fast-paced and ever-evolving market landscape, the willingness and ability to reinvent one's business model are advantageous. Companies that fail to adapt will inevitably find themselves at a competitive disadvantage, as more agile and forward-thinking rivals seize the opportunities that come with strategic reinvention. Embracing Business Model Reinvention is no longer optional; it is a critical factor in ensuring long-term success and resilience.

To leverage the full potential of Business Model Reinvention, we urge companies to proactively evaluate and refine their strategic approaches. This involves not only recognizing the value of continuous adaptation but also fostering a culture that encourages experimentation and agility. Leaders must prioritise these initiatives, equipping their teams with the resources and support necessary to drive meaningful change. By doing so, firms can unlock new levels of productivity and profitability, securing their position at the forefront of their industries in the years to come.

# Appendix

## Data details

The dataset is sourced from Orbis, a global database renowned for its extensive company information and high-quality data. Orbis provides detailed records on companies' financials, ownership structures, and industry classifications, which are essential for our analysis. Additionally, the dataset is structured as panel data, spanning from 2009 to 2023. This longitudinal format allows us to track changes over time, providing insights into the dynamic nature of business model innovation and its impact on productivity. The temporal depth of the data enables us to observe long-term trends and the lasting effects of business model changes.

We include companies for which data was complete for at least the period 2014-2023 for the variables - total assets, revenue, number of employees and net assets turnover. We do not include in our regressions observations with non-positive assets, non-positive turnover and number of employees below 10.

| | Number of employees | | | | | Total assets (in thousands of Euros) | | | | Revenue (in thousands of Euros) | | | | NAT | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | Average | 1st quartile | Median | 3rd quartile | Average | 1st quartile | Median | 3rd quartile | Average | 1st quartile | Median | 3rd quartile | Average | 1st quartile | Median | 3rd quartile |
| Agriculture, Forestry, Fishing | 238 | 4.157 | 61 | 386 | 1.724 | 816.994 | 16.560 | 82.684 | 391.079 | 656.191 | 11.600 | 51.153 | 239.946 | 1,81 | 0,40 | 0,88 | 1,85 |
| Mining | 456 | 6.673 | 159 | 755 | 4.176 | 7.598.058 | 77.072 | 517.232 | 2.822.692 | 4.804.732 | 32.602 | 228.526 | 1.349.779 | 1,28 | 0,30 | 0,59 | 1,13 |
| Construction | 570 | 6.397 | 120 | 632 | 2.531 | 4.431.066 | 37.267 | 261.134 | 1.321.251 | 2.954.927 | 21.461 | 183.561 | 934.296 | 1,78 | 0,52 | 1,36 | 2,37 |
| Manufacturing | 8886 | 5.949 | 165 | 765 | 3.073 | 3.119.335 | 31.983 | 160.234 | 687.525 | 2.243.662 | 22.074 | 114.615 | 523.467 | 1,43 | 0,62 | 1,07 | 1,70 |
| Transportation & Public Utilities | 1805 | 8.965 | 101 | 722 | 3.814 | 8.282.566 | 29.019 | 293.972 | 2.541.040 | 3.469.920 | 16.959 | 135.520 | 1.154.278 | 1,19 | 0,28 | 0,61 | 1,20 |
| Wholesale Trade | 1179 | 3.197 | 56 | 294 | 1.128 | 1.381.576 | 9.793 | 63.215 | 326.475 | 2.309.141 | 7.226 | 57.694 | 405.491 | 2,74 | 0,68 | 1,46 | 2,81 |
| Retail Trade | 817 | 21.922 | 295 | 1.451 | 7.232 | 4.384.444 | 62.097 | 294.714 | 1.164.834 | 5.788.156 | 61.498 | 353.381 | 1.541.560 | 2,49 | 1,01 | 1,93 | 3,14 |
| Finance, Insurance, Real Estate | 1321 | 2.735 | 29 | 170 | 926 | 6.295.568 | 54.412 | 369.927 | 2.148.078 | 1.310.673 | 9.584 | 79.106 | 395.872 | 0,78 | 0,08 | 0,23 | 0,67 |
| Services | 2954 | 5.918 | 59 | 323 | 1.634 | 2.001.470 | 9.912 | 62.417 | 364.857 | 1.186.362 | 6.652 | 42.917 | 254.390 | 1,75 | 0,42 | 0,95 | 1,80 |
| Public Administration | 39 | 5.567 | 23 | 150 | 1.635 | 25.737.538 | 4.678 | 42.970 | 477.871 | 1.147.678 | 3.334 | 21.283 | 230.604 | 1,22 | 0,21 | 0,77 | 1,42 |

## More on the model

We base our model on the Cobb-Douglas function

$$Y = AL^{\alpha}K^{\beta}$$

which in natural log form is

$$ln\, Y = ln\, A + \alpha\, ln\, L + \beta\, ln\, K$$

and where A represents Total Factor Productivity (TFP), Y represents revenue, L represents the number of employees and K represents Total Assets.

The change in TFP is explained by Business Model Change (proxied by the change in NAT) and unobserved technological and efficiency factors (A'):

$$\ln A = \mu \ln Business\ Model\ Change + A'$$

The last two equations can be combined in:

$$ln\, Y = \mu \ln Business\ Model\ Change + \alpha\, ln\, L + \beta\, ln\, K + A'$$

Leading to the empirical estimation equation:

$$ln\, Y_{it} = \mu \ln Business\ Model\ Change_{it} + \alpha\, ln\, L_{it} + \beta\, ln\, K_{it} + A'_{it} + u_{it}$$

## Results

In table 1 we report the results of our econometric analysis. Models 1 and 2 are the ones reported in the main text. As a robustness check, Models 3 and 4 include a different IV, the Euclidean Return on Equity. This is the distance between a firm Return on Equity (RoE) and the industry average and is an indication of intensity of competition. The reasoning for its correlation with NAT ratio is that a higher Euclidean RoE indicates more competition, which provides a larger incentive for business model change.

In addition (table 2), we tested to evaluate if the impact of Business Model Change was stronger in the last 5 years than in the 10 years prior by adding the interaction of dummy variable and Business Model Change.

| *Table 1* | Model 1 OLS | Model 2 2SLS 1 | Model 3 2SLS 2 | Model 4 2SLS 3 |
|---|---|---|---|---|
| ln(Employees) | 0.338*** | 0.302*** | 0.337*** | 0.311*** |
| ln(Assets) | 0.653*** | 0.729*** | 0.657*** | 0.705*** |
| ln(Business Model Change)[21] | 0.058*** | 0.367*** | 0.071*** | 0.250*** |
| Fixed effect cross-sectional | Yes | Yes | Yes | Yes |
| Fixed effect time | Yes | Yes | Yes | Yes |
| 2sls IV – Lagged NAT ratio | - | Yes | No | Yes |
| 2sls IV – Euclidean RoE | - | No | Yes | Yes |
| First stage significance | - | *** | *** | *** |
| Adjusted R-squared | 0.486 | 0.264 | 0.486 | 0.357 |
| Cross-sections | 18135 | 18104 | 17997 | 17966 |
| Unbalanced observations | 227352 | 207873 | 225422 | 206166 |

*** indicates significance at .001 level

| *Table 2* | Model 1 OLS | Model 2 2SLS 1 |
|---|---|---|
| ln(Employees) | 0.338*** | 0.304*** |
| ln(Assets) | 0.653*** | 0.727*** |
| ln(Business Model Change) | 0.062*** | 0.392*** |
| ln(Business Model Change)xYear is between 2009 and 2018 | -0.009*** | -0.049*** |
| Fixed effect cross-sectional | Yes | Yes |
| Fixed effect time | Yes | Yes |
| 2sls IV – Lagged NAT ratio | - | Yes |
| 2sls IV – Euclidean RoE | - | No |
| First stage significance | - | *** |
| Adjusted R-squared | 0.487 | 0.264 |
| Cross-sections | 18135 | 18104 |
| Unbalanced observations | 227352 | 207873 |

*** indicates significance at .001 level

**21** ln (Business Model Change) is the natural logarithm of the NAT change. We add a small constant (0.01) to deal with 0 values.

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