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FINTECH in Scotland: Building a digital future for the financial sector.

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ABSTRACT

Financial technology (Fintech) is developing rapidly, utilizing software and programming code in innovative ways. It is driving efficiency up and costs down. The digitalization of transactions is now a cross disciplinary science that looks set to disintermediate banking. The adoption of its new method represents both a big opportunity and a big threat to the financial sector. This paper set outs how the sector is changing and what needs to be done for Scotland to capitalize on it. In particular, we present the results of both a direct and indirect impact analysis on two policy recommendation scenarios, inertia or the one in which Scotland becomes a digital hub. In the inertia scenario Scotland drops behind in the adoption of Fintech. We propose that, to avoid this, certain policy recommendations are adopted to foster the right conditions for the best case scenario. Our analysis shows the economic impact of a proactive approach to Fintech could be substantial and the infrastructure spend to achieve it minimal by comparison.

The authors would like to thank Fraser of Allander Institute for contributions made.

Note: The forecasts in this paper reflect the best and worst case scenarios on an important sector in Scotland over a ten year period. As such, the numbers in the outputs are large. The reader should therefore be cautious and appreciate that the most likely outcome lies somewhere between the extremes.

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Introduction

The use of programing code in finance, captured by the all-encompassing term Fintech, is evolving at a rapid pace. Research into its implications and its potential impact is lagging. The consequences of digitalization are being hailed as a 'game changer' for both the banking and securities industries. As such, more has to be known about the consequence of big data solutions and their application over the internet. In this paper we address the uncertainty by presenting two Input-output analysis scenarios for Scotland's financial digital future. Such an approach has limitations and we present these latter. We illustrate the impact with just the two scenarios to illustrate the stark contrast between the outcomes illustrates the disruptive nature of the Fintech phenomenon.

It is clear that the adoption of Fintech will result in widespread disintermediation. Schmidt, Hackethal and Tyrell (1998) explain this is where non-financial intermediaries take a larger proportion of transactions from the market share of traditional incumbent financial institutions. Fintech's take up will also mean transactions will become instant. As a consequence, operations will become more efficient and capital raising more democratized. Whilst we highlight what the impacts of these changes will be for Scotland, the impact could be equally disruptive in other jurisdictions.

In view of the binary nature of the outcomes presented, we argue that the adoption of a policy framework for Fintech is important in order for Scotland to remain competitive. This is because the pace of adoption of Fintech will determine the eventual winners and losers. In this respect, Fintech represents both a risk and an opportunity.

Background

Financial Technolgy (Fintech) is the all-encompassing word for the financial architecture of the digital age. It covers market infrastructure, payments, settlements, digital currencies and data analytics. Its protagonists utilize software and/or programing code to provide financial services.

The developments on the technology side are being driven by two key innovations, blockchain and distributed ledgers. Blockchain will enable a peer-to-peer version of electronic cash. Nakamoto (2008) was the first person to identify the benefits of blockchain. He showed how it allows online payments to be sent directly from one person to another without having to go through a financial institution. Closely allied to this is the concept of distributed ledgers. Mainelli and Smith (2015) identified distributed ledgers as having the potential to *"transform the way people and organizations handle identity, transaction and debt information."*

There are those who call Fintech a disruptive innovation. We argue that this is only partly true. The financial services that Fintech covers capture a wide spectrum including loans and deposits, transactions, payments and transfers. These areas have already been and will

continue to be disrupted. The "theory of disruption innovation" proposed by Christensen (2006) specifically addresses innovation that creates new markets. Fintech, in this theory, is disruptive in the sense that it is a new business model using existing technologies in innovative ways. Despite this, Fintech is not undergoing a revolutionary change but an evolutionary one.

We draw on published white papers for statistics, including those by Ernst & Young (2016), Deloitte (2016), PWC (2016) and Boston Consulting Group (2016). The working hypothesis is that failure to embrace the new Fintech architecture will erode the position of the financial sector. We also present the alternative scenario where certain policy initiatives have been be put in place and demonstrate the impact on both direct and indirect employment. We justify these two outcomes on the basis that the movement toward technological solutions that require digital replacement or upgrade will happen. Their adoption is not an either-or option. It is the speed of their adoption that is the subject of uncertainty.

The competitive landscape

The United Kingdom, according to the House of Commons (2015), is a world leader in Fintech. It estimates the sector to be worth £20bn in annual revenues, a figure that includes the incumbent spend. Ernst & Young (2016) estimates the startup element of Fintech revenue to be around £6bn. According to their early adopter index, 14% of consumers in the UK are already Fintech users. This figure goes up to 25% in London area. This ranks the UK ranks in 5th place out of 140 on the 'availability of technology' criteria in the CBI Index (2016).

The competitive landscape is being framed by a number of themes. The United Kingdom's Trade and Investment (2014) identified four of these in respect of the Fintech roll out. These are (1) the monetization of data, (2) the replacement of legacy infrastructure, (3) disintermediation and (4) the importance of encryption and cyber security. Our analysis incorporates these.

The Boston Consulting Group (2016) estimate global retail-banking revenue in 2015 was nearly $1.6 trillion. As such, the Fintech market size is equally large. Global IT spending by banks in 2016 was $360 billion. The UK Government has identified this as a priority area and instigated many initiatives to support competition and innovation across financial service providers. These are largely based in London, so Scotland has to establish its own strategy.

Despite this, the UK Retail Banking sector according to the Competition and Market Authority (2016) *"is still not as innovative or competitive as it needs to be*". Specifically, they see that "*many problems remain. Essentially, the older and larger banks, still do not work hard enough to win and retain customers*" *That said,* a few UK retail banks have created technology

'accelerators' or 'incubator' partnerships. Examples of these are Innoventures, Barclays Accelerator, BBVA Innovation Centre and Citi Ventures.

One of the key United Kingdom wide initiatives is the Open Bank API framework. This is designed to empower retail clients and SME access their bank data via APIs. An Api is a collection of functions and procedures that allow the development of applications which access the features or data of a network. It presents a new mindset and represents a challenge to the incumbent banks. New banks, termed challenger and/or disruptor banks, are already adopting its use. They have built 'off the shelf' digital enterprise platforms. Examples of these disruptor banks are Metro Bank, Number26, Starling Bank and Tesco Bank in Scotland.

Fintech is a global phenomenon, led by the major financial centres. In this respect, Scotland is more of a periphery both as part of the United Kingdom and the European Union (which is of course subject to change). In this context, Fintech is well represented within many countries in Europe and there are many sources of Fintech competition. Stand-alone new business model Fintech companies have been especially successful in stepping in to the consumer market that benefit from the single financial passport. The latter have quickly adapted to these services. As such, for Scotland to keep up with have changing demand, incumbent companies need to develop their own Fintech or enter into partnerships with others in both Europe and the United States. Access to the European single market has also to be factored into the Fintech agenda.

Scotland

Although we present a worse case scenario, the outlook for Fintech in Scotland is actually quite positive. Banking and insurance are well represented. Scotland hosts the third largest asset management industry in Europe based on the funds under management. The figure in 2016 was just over £800bn. The Financial Services industry generates £8bn revenue and employs 95,000 people. This represents some 13 per cent of all banking employment in the UK.

In comparison with London, organizations in Scotland have a closer network and therefore the potential for more flexibility and agility. It is worth noting that whilst London ranks in first place as the world's financial centre, according to Long Finance (2015), it is not the leader in Fintech. This represents an opportunity for Scotland as the industry is still nascent. That said, Scotland is dwarfed by the size of the initiatives globally. Deutsche Bank (2016), for example, has set up innovation labs in Silicon Valley, Berlin and London, planning to spend up to €1 billion on digital initiatives by the year 2020.

New business model Fintech start-up companies employ as much as 74,000 people in California and 61,000 in the whole of the UK. This is set to grow dramatically. The UK Trade

and Investment (2014) explains that the reason for California's success is its established network of talent and venture capital. Scotland will have to emulate these characteristics to benefit from our best case scenario.

To date, Fintech activity in Scotland has been concentrated in the payments space. Such activities need to be extended to mobile and e-commerce solutions. The innovations in platform architecture for these are now entering mainstream finance. These include alternative finance platforms, P2P lending and crowd-funding. The opportunity for Scotland also includes insurance. The country also has a long tradition in the insurance sector and it accounts for 24 per cent of all UK employment in the life assurance segment.

There is, however, a caveat. According to Deloitte (2016) *"there could be a huge opportunity for Scotland, but at present it is just not being seized."* The report continues to say that whilst the components are in place, these are not quite put together. It suggested three main areas of focus to address this, (1) establishing a vision, (2) creating a single hub for Fintech to develop a culture of connectedness and (3) establishing a set of actions to support the development and flow of talent to Scotland.

Scotland already has a number of support services to promote the development of talent and innovation such as DataLab, CodeClan, Informatics Ventures, Skills Development Scotland, Glasgow Economic Leadership and Strathclyde University's Hunter Centre for Entrepreneurship. Moreover Scotland has a growing presence of incubator programs. These include CodeBase, the UK's largest technology incubator based in Edinburgh, and Scottish Enterprise which provides training and support. Scotland based start-up companies also benefit from funding schemes including the Scottish Loan Fund (investments between £250k to £5m) and Archangel (investments from £50k to £2m).

Initiatives are already afoot to promote Fintech in Scotland. Scottish Financial Enterprise has established a Fintech Strategy Group. Scottish Enterprise, Deloitte and the Financial Services Industry Advisory Board are part of this group. It is jointly chaired by the First Minister of Scotland and Chairman of Scottish Financial Enterprise. The Scottish Parliament has also publicly pledged its support for developing the Fintech agenda. There are also initiatives by ScotlandIS, the trade body for the digital technologies industry.

One of the key United Kingdom wide initiatives is the Open Bank API framework. This is designed to empower retail clients and SMEs access their bank data via APIs and better their financial standing. An API is a collection of functions and procedures that allow the development of applications which access the features or data of a network. It presents a new mindset and represents a challenge to the incumbent banks. New banks, termed challenger and/or disruptor banks, are already adopting its use. They have built 'off the shelf' digital enterprise platforms that can access external Fintech service providers. Examples of these disruptor banks are Metro Bank, Number26, Starling Bank and Tesco Bank in Scotland.

As part of the drive, Scottish Enterprise has commissioned research to map the Fintech companies already operating in Scotland. They have identified some of the various components required to develop Scotland as a Fintech hub to which we add the recommendations in this paper. The emerging themes in all the recommendations include talent, skills, international profile, infrastructure and innovation.

Blockchain distributed ledger technology and its applications to finance

The digitalization of finance and the processing of big data through distributed ledgers is at the core of current Fintech adoption. There are many, such as Trautman (2016) who argue that blockchain will form the basis of digital transactions. In simple terms, a blockchain is a self-contained program that functions on the Internet and is stored virtually on it as a decentralized ledger. For Scotland to be successful in Fintech, it needs the skill, infrastructure and vision to capitalize on blockchain and its financial institutions understanding of virtual ledgers. We believe blockchain will transform how financial transactions are recorded, reconciled and reported.

Ali, et al. (2014) explain how blockchain can be applied to financial transactions. Its important characteristic, in this respect, is that it is robust. This is because every participant in a financial transaction chain receives a copy of all previous transactions. In short, it is secure because prior transactions cannot be easily altered all at once.

Another advantage of blockchain is that it is an 'open system'. It can be used to transfer value, be they cash equivalents or securities. It consists of users who interact with digital contracts that are established by publishing signed time stamped messages called transactions. 'Nodes', sometime called 'miners', spread information, package data, and update the transaction history. In this way, programming code is effectively being used to transmit digital settlement instructions over the internet.

The traditional way financial transactions are settled is shown in figure 1. This depicts a centralized ledger. The blockchain approach facilitates a distributed ledger as depicted in Figure 2. This can operate on the 'cloud', another term for the internet. Simplified, in a Fintech context, it can send instructions to a multitude of financial ledgers distributed throughout the world wide web, continually updating the same in real time.

Figure 1: A centralized ledger

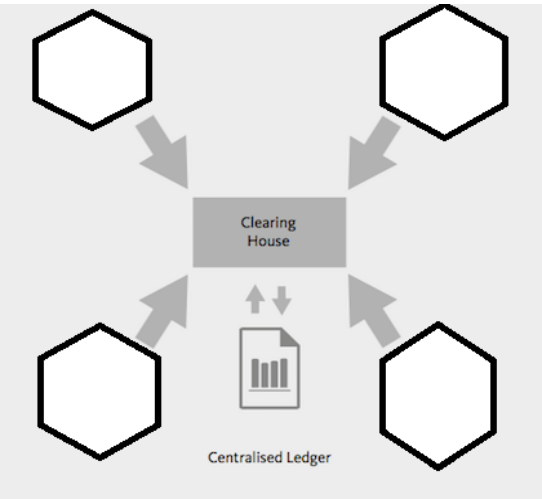
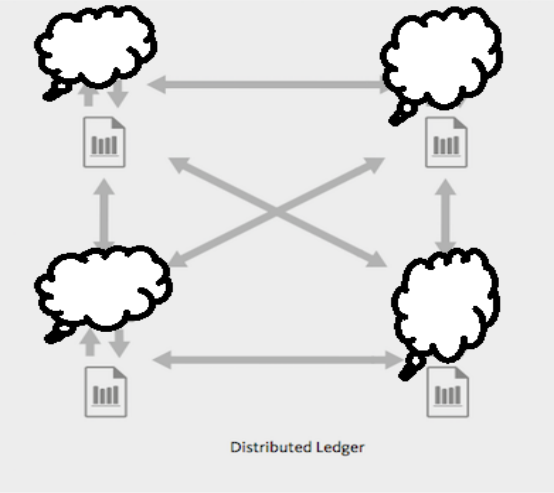


Figure 2: A distributed ledger.



The network approach in Figure 2 facilitates smart contracts that can be executed with lower legal and transaction costs than traditional banking method. Needless to say, such transactions can consist of large amounts of data. In addition to the processing challenges distributed ledgers present, it should also be pointed out that blockchain presents regulatory issues, as central banks can be bypassed. The Bank of England is concerned about this and it behooves the Scottish Parliament to think strategically about the issue.

Bitcoin, as described by Franco (2014), is the most well-known blockchain crypto-currency. That said, its colorful history stands in the way of its widespread adoption. Bitcoin was developed by Nakamoto (2008).

It is worth exploring Bitcoins shortcomings to learn lessons from it. Firstly only a few software developers are rewarded for its upkeep and the participants (miners) are heavily concentrated in China. In 2016, that country had 70% of the world's bitcoin mining and 90% of its transactions. It second shortcoming is that it is not backed by a recognized brand, be it a respected government or corporation. Its third shortcoming is the amount of data required. This is because of the way the programing requires updates on all previous records in the distributed ledger each time a transaction is made.

Most of the development in blockchain is being pushed forward by commercial companies. Scotish banks are participating in some of these initiatives. The most noticeable of these is a Fintech start-up called R3. This consortium is developing blockchain technology for a number of banks including Barclays, BBVA, Commonwealth Bank of Australia, Credit Suisse, J.P. Morgan, State Street, Royal Bank of Scotland and UBS.

As can be seen from the explanation of the way it interacts with distributed ledgers. Blockchain will result in an explosion of data. This increase in 'Big Data' needs to be addressed. As such, banks are migrating to more sophisticated data solutions, one of which is a move to superior programming languages. Scottish universities are familiar with such programing code and need to include it in taught financial markets classes. That said, they need the direction and funding to effect such changes to the established curriculum.

The preferred programing code for Fintech is Python. According to Hilpisch (2016) Python is an interpreted, object-oriented, high-level programming language suitable for finance. It's simple, easy to learn and reduces transaction costs as it is low maintenance. To be successful in Fintech, Scotland will have to train a generation of finance graduates who are familiar with it and other such programing languages, an initiative currently being investigated by Strathclyde University.

Fintech and payments: cryptocurrencies, digital money, digital payments

The backbone of financial services is the payments system. At present, most payments are made via traditional systems. These are affected by a set of rules and procedures that oversee the transfer of funds between the institutions that input into the payment system. In the UK, most transaction are done through a Real-Time Gross Settlement system. This is largely done on legacy computing systems and operates on a peer to peer basis in a process called clearing. The advent of digital communications, in particular blockchain technologies, can facilitate real time settlement. This will change the traditional cash settlement from the current three days to less than a second. Such speeds are more aligned with the consumer expectations and it is here that blockchain can potentially be disruptive to incumbents. The term Paytech has been coined to differentiate it from the rest of Fintech, although it is clearly at the core of the concept.

Paytech is the most developed area of disruptive Fintech. It covers all aspects of payments and transfers, utilizing blockchains. At the start of 2016, the R3 Consortium in combination with a number of Scottish and other banks tested blockchain technology as a platform for commercial paper transactions. They managed to settle transactions in seconds, thereby delivering proof of concept.

As has already been noted, Scotland handles a lot of financial payments and transfers. The Ernst & Young (2016) database that cover over 4,000 of the most prominent Fintechs companies states that over 50% of such Fintech companies are banking or payment related. Around 350 are based in the United Kingdom. Many of them are household names. They include:

- Alipay (Alibaba groups payment platform).
- ApplePay (contactless mobile payments).
- Bitcoin Square (for buying and selling Bitcoin).
- GoCardless (recurring direct debit).
- Google Wallet (peer-to-peer payments service).
- M-Pesa(mobile phone based money transfer).
- Payoneer (online money transfer and e-commerce payment services).
- Paypal (Online payment service).
- Samsung Pay(contactless mobile payments).
- Stripe (online platform to accept payments).
- Transferwise (currency transfer and exchange).

In addition to blockchain, there are further applications that could prove useful to payments. Small and Mid-sized Entreprises (SMEs), for example, would benefit from having their invoices

paid on time. Early payments helps cash flow and Fintech can facilitate this. Waitrose, for example, has committed to pay its smallest suppliers within a week of receiving a digital invoice. In the broader economic sense, early payment by large companies would have a large impact of the velocity of circulation money. According to the House of Commons (2015) there were 5.4 million SMEs, representing over 99% of all businesses. They represent 47% the total revenue and some 60% of total employment.

Paytech is also a mobile phenomenon. According to Au and Kauffman (2008) there are two technology standards helping to deliver wireless solutions. These enhance device and platform interoperability. They are short message services (SMS) and near field communications (NFC). Both these have been around for a while but their take up in Scotland needs to be promoted and accelerated. To be successful in Fintech Scotland requires an all-round approach to technology adoption and usage. The sort of technology that might prove successful is a funded digital wallet linked to an existing or disrupter bank account. This would then allow the transfer of funds to be done through a mobile device. One such example of this is the Abra in the United States.

Payments require the highest level of security and encryption be they wireless or over the internet. The speed of adoption of Fintech innovations in Scotland, as anywhere, will therefore depend on their security features. The ease with which digital information can be copied, and the speed with which it transmits, mean security is critical. Gasser, et al. (1989) demonstrated very early in the technological revolution that the traditional concept of computer security is not practical for a distributed system.

The majority of data breaches infringements happen very fast. The time it takes to compromise a system is almost always less than to identify the breach. Verison (2016) reported that in 98% of cases a successful attack takes just a few minutes. In 30% of cases, the identification of a breach took a number of days and in 15% of cases it took up to two months. It also noted that such attacks either froze or slowed down the systems. We point out that as workable and efficient security is mission critical to financial services. Scotland needs a coordinated approach to this, rather than leaving it to be addressed on a bank by bank basis.

The place where Fintech brings together all its technologies and which holds the most promise for the future is in a global crypto currency. The case for this is self-evident and its long term adoption a likely outcome of the internet.

A Scottish Crypto-currency

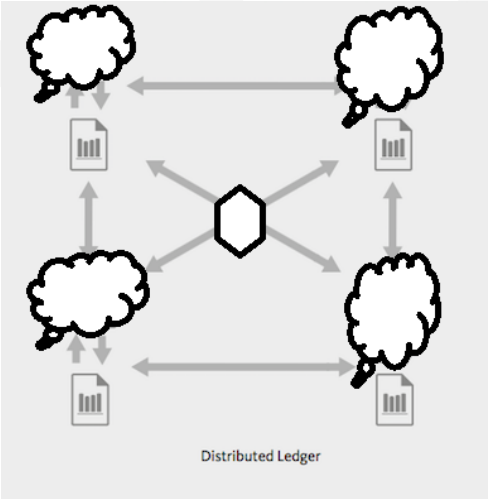
We present the case for a Scottish backed crypto currency. This would have a number of advantages. It would also make the outcome of the positive scenario in our analysis more likely. It would strengthen the image of Scotland as a Fintech hub, it would give the banks

access to practical blockchain applications, and it would create a nucleus around which to build other Fintech activities.

Most crypto currencies have been developed by the private sector. Scotland could either host such an initiative or develop its own. This could be done by providing the backbone in the form of an encrypted distributed ledger. As a sponsored initiative, a copy of the transactions could also be mirrored in a central registry. This could maintained by the Scottish government. The advantage of this is that there remains an element of oversight, be it for tax or money laundering. This would prove easier to regulate than a mined and anonymous blockchain.

A central register for a distributed ledger would provide the backbone for such an outcome. We recommend this be equipped with an atomic clock as a back up to timestamp digital transactions and support it with a black fiber financial backbone (that links into existing connections). The concept of an atomic clock is to provide added security to the blockchain. Existing blockchains are ordinal and have to be stamped. To prevent manipulation of financial transactions, we recommend that they be date and timestamped with the most accurate method possible, an atomic clock.

Figure 3: A Scottish central registry combined with a distributed ledger.



The rationale for a Scottish digital currency is supported by its unique political positioning. Legally, there is no need to have the legal capacity to issue banknotes to set up a cryptographically enabled transaction system. As long as a bank or group of banks is willing to

guarantee the exchange of the currency to sterling (or a menu of exchangeable currencies) then the system could be just run from a distribute ledger.

In most countries it is only central banks who are permitted to issue currency. In Scotland Bank of Scotland, Clydesdale Bank and The Royal Bank of Scotland currently issue banknotes. Scottish Banknotes are legal currency in as much as they are approved by the UK Parliament. Scottish banknotes are not technically legal tender even in Scotland but the widespread use has established a precedent which can be built on. The Scottish payment system currently exists without a legal framework. This legal ambiguity can be used to issue Scottish digital currency, backed by deposits from these currencies with the Bank of England. The Scottish Parliament would have to support the initiative and presumably pass legislation on cryto-currencies to ensure its success.

This legal ambiguity is why a central register would have to be kept. If the transactions were anonymous then it would likely be illegal under federal anti-money laundering laws in the US. As a result, it could not become a global digital currency. It is quite possible this system, if it was exchangeable to Sterling, would come under the regulation of wire transfers. It would benefit from Scottish Parliament legislative support.

A Scottish cryptocurrency would have to be an encrypted distributed ledger run by the three banknote issuing banks. The transaction patterns and history would have to be visible to participants. The Byzantine N agreement, a protocol in distributed computing, is all that is needed. As a result, it is possible to build a framework with quite a small amount of infrastructure. Indeed, it could be conducted entirely in the 'cloud'.

Fintech and Insurance: Insuretech and Big Data applications

Fintech applications are also adopted by the insurance industry. This is termed Insuretech. The Scottish insurance industry will see drastic changes in response to the technology. Scotland accounts for 24 per cent of all UK employment in life assurance. Due to the proliferation of data and possibility of big data analysis, insurance portfolio risk can be better managed. PWC (2016) identified that 74% of the insiders in the industry thought that it will be affected by Fintech within 5 years.

The technical advances that come with Insuretech have both cost and benefits. These will hasten its adoption. The Fintech agenda, as a result, is moving from an operational to a strategic focus. Previously only large insurance institutions would have had the funds to capitalize on such themes and develop innovative financial service solutions. Now, due to the low cost to entry, insurance product platforms have opened up opportunities for Scottish entrepreneurs.

Insurance products can be tailored thanks to Insuretech. The advantages that blockchain technology brings to the table include a reduction in the cost of claims processing, an increased level of trust and better protection from cyber threats.

Insurance companies will increasingly use Big Data solutions, primarily in risk control. Insurance companies can therefore handle data that is too large or complex for traditional data processing applications. Python, R, Julia, Matlab or Java are all languages that will be required. As part of the digital migration, insurance companies are moving to cloud-based platforms. This helps to decrease the up-front costs and reduces infrastructure costs. This solution provides scalability. Scotland offers a good environment for data centres with a cool climate and political stability. Scotland also provides data center infrastructure for colocation, meaning physical infrastructure sharing for multiple companies. There is a datacenter between Edinburgh and Glasgow, Data–vita, already in existence.

There are skillset requirements to implement the Insuretech solutions. In particular, there is a special need for the pipeline for insurance related Fintech savvy talent. London has had the benefit of sourcing tech staff from the continent but Scotland has not had the same degree of success. More has to be done on the visa side to address this. According to ScotlandIS, only 60% of new digital staff will be sourced from Scotland. Ernst & Young (2016) notes that Germany's temporary work permit application takes 9 weeks in comparison to UK's 20 week. In the USA, the equivalent takes 12 weeks.

Fintech and banking: banking as a service, P2P lending, risk management, Open Banking and Open API

As has been noted, banking stands to change as a result of the payments side. In addition to the impact of blockchain on banking settlement, Fintech also has the ability to change the way capital is managed and allocated. Fintech is changing both retail and corporate banking as well as the interface between them. This is being driven not just by cost saving and increasing efficiency but also by customer experience. The promise of Peer-to-peer lending (P2P) is afforded by technology that puts those with capital in direct contact with those requiring it.

Peer to peer accounts for 0.97% consumer lending market and 0.51% business-lending according to Deloitte (2016). Notable however, is the growth in the SME lending. The UK government has set up a policy initiative to establish a mandatory referral scheme by banks for rejected SME loan applicants to seek loans from these platforms.

Since the credit crisis and the updated Basel III framework, the banks have been scaling back their lending capabilities and borrowers have had to seek new sources of capital. This has made room for the disruptors, something which Christensen (2015) highlighted as likely to

happen. Whilst banks can take deposits or lend money, P2P lenders intermediate by tranching smaller borrowers by credit ratings and passing on this exposure to multiple lenders. P2P's are not able to take risk on their balance sheet or receive or structure any interest income from the deposits. That said, they do not qualify for the capital requirement regulation. Instead they generate the revenue from fees and commissions received from both borrowers and lenders.

As a result of demands to open access to customer data, the UK government has started an initiative led by the Open Banking Working Group. Open API (Application programming interfaces) offers the promise of consumer data on payments, deposits, insurance, investments and pensions. In future, API's may also be used to share securely customer's data, such as the transaction history with their confirmed consent. For incumbents, this will be a challenge.

In banking, Scotland also needs to improve its Fintech focus on mobile and digital wallets as well as the payment technology for that as previously mentioned. Consumers expect immediacy, convenience and security to be integral to mobile payments. We believe that mobile phone payments for digital services will eventually happen in real time. Mobile solutions are powerful drivers of Fintech, hastened by consumers who are early adopters of this technology. In some emerging markets, mobile phones are more wide spread than bank accounts. M-Pesa is mobile payment app which is used in Kenya and a few other emerging countries. With it people regularly use mobile phone credit to transfer money. The fact that its use is more widespread in Kenya than in Scotland shows there is an implementation requirement that needs to be rapidly addressed.

Mobile is an important part of the Fintech landscape. There are more connected mobile phones than there are people in the world. Mobile apps increase access to banking services. They facilitate payment and they can also be used for receiving payments. It is envisaged that it is the mobile phones, rather than credit cards, that could replace cash. Generally early Fintech banking adopters tend to be younger and have higher income. 18% of them have used money transfer payments provided by new business model Fintech companies, followed by 17% adaption rate in savings and investment services.

Fintech and fund management: robo-advisors, crowdsourced products, crowd investing

The fund management industry is also being impacted by Fintech initiatives. Fund management companies are embracing big data solutions for portfolio construction, optimization and the creation of efficient asset allocation frontiers. Scottish fund managers

need to keep abreast of these changes. In our scenario, we do not attribute much of a job impact to this sector. That said, it is a competitive issue for the individual companies to position themselves as technology savvy.

The most prominent fund management initiative is termed Robo-advisors. These can be defined as providers of algorithmically driven and low-cost investment advice on the Cloud. An algorithm takes a view where markets are going and search available products with matching them to clients' circumstances, timelines and goals. Machine learning or artificial intelligence is facilitated. Robo-Advisors not only design portfolios. Dapp (2014) predicts an increase in algorithmic trading as a result of these trends.

In Scotland, Robo-advisors can grow the intermediaries market, negatively affected by the Retail Distribution Review. Its traditional fund managers should consider developing their own robo-advisory products for lower fee paying consumers. This would positively affect the part of the Independent Financial Advisory who already use financial modelling tools to match their clients with investments. In the UK, Nutmeg the most well-known and first self-standing Robo-Advisor. Nutmeg is backed by a well-known global asset manager Schroders.

There is a large difference between the USA and the European markets for Robo-Advisors. The USA with a total population of 320m people provides a great single regulatory financial market (with some exceptions across the States) and one majority language. According to (Deloitte 2016), Robo-Advisors are expected to manage 10-14% of all the assets in the USA by 2025. (A T Kearney 2015) similarly estimates that the US assets managed by Robo-advisors will be around $2.2trillion by the year of 2020. The figures are likely to be different to Europe if the Robo-advisors cannot offer as competitive pricing and access as the US counterparties.

With Robo-advisors, the total expense ratio is higher as the fees charged by them do not cover the underlying costs of third party investments or trades. What is notable however is that the pooling of assets helps to lower those fees. This kind of approach could work for the European based stand-alone Robo-Advisors that have access to the European Union single financial market.

As Scotland no longer has its own stock exchange, the development of crowdfunding can fulfill an import societal need for its capital raising. Mollick (2014) defined crowd-funding as the ability of *"founders of for-profit, artistic, and cultural ventures to fund their efforts by drawing on relatively small contributions from a relatively large number of individuals using the internet, without standard financial intermediaries."* These platforms usually ask for fixed fee and also a percentage of capital sourced. Once again, this is a policy area that should be developed in order to have a positive economic impact.

Technological innovations in lending and equity crowdfunding are providing access to investment opportunities formerly unavailable to small retail investors. These areas of Fintech

require higher continuing financial service knowledge in order to manage the aggregated risk and return for the end investors. Corporate loans have been a lucrative business for banks: McKinsey Consulting (2015) estimates that banks earn an 22% ROE from origination and sales, much higher than the provision of credit, which generates only a 6% ROE.

Capital sourcing in this manner can be considered to be at an early stage when one considers the total amount raised on crowd-funding platforms to traditional sources. The average size of investors savings in crowdfunding deals by high net worth and sophisticated investors is over £8,000 based on research by the Financial Conduct Authority (2015). For other retail investors it was less than £4,000.

Fintech and capital markets: automated intermediation, execution, clearing, compliance, smart contracts

Fintech is altering not just the way financial firms conduct business but their business models and indeed the nature of capital markets. Finance is a heavily regulated area. The United Kingdom's Financial Conduct Authority (FCA) founding principles are based on innovation, competition and preserving the international character of the financial services industry. Engaging early on with the regulator can help with ensuring the new innovative products accessing the markets are fit for purpose.

The FCA allows products, services, business models and delivery mechanisms to be tested in practice in a live, market environment through its Regulatory Sandbox initiative. Unauthorised and authorized firms can trial their innovations through this platform even if they do not have complete authorisations. Unauthorised firms can, in this manner, reduce the cost and time to get product tested. Scotland should call for a regionally placed Regulatory Sandbox in order to ensure the outcome of our presented best case scenario.

Scotland has a good opportunity to enhance its regulatory oversight businesses using Regtech. This area of Fintech is developing solutions that manage the burden of regulation and reporting. The use of big data techniques can keep costs down. International Data Group (IDC) estimated that banks, investment banks and insurance companies globally are investing around $85bn only in regulatory oversight, risk control and legislative intiatives. This is going mainly into compliance and controls. Deloitte (2016) identified legislation, regulation gap analysis, the total compliance universe, what are termed health checks, and the risk data warehouses as focus areas. Such initiatives can also be applied to management information, transaction reporting, and activity monitoring.

There is an on-going requirement for spending to keep up with changing regulation and to be kept in lock-step with updating of the IT systems. Some of these functions can be outsourced

and as such that represents another opportunity for Scotland to win business as part of the trend. FCA, the UK financial service regulator has ' set up 'Project Innovate', a consultation initiative to help Regtech companies meet regulatory requirements. Indeed, if done correctly compliance activities done remotely with real-time monitoring of financial activity could prove a new source of business revenue for Scottish firms.

Fintech and employment impact: Scotland

We estimate The economic impact of the Fintech rollout in Scotland using Input-Output (IO) models. The approach used is a multi-sectoral, general equilibrium model which assesses economic impact. Input–output (IO) analysis Leontief (1936) as explained in Miller and Blair (2009) is a widely employed method of assessing new jobs and expenditures.

Our analysis is performed using the UK IO table for the years 1998-2013. This is the most up-to-date table that exists for the Scottish economy. It is a table with a collection of economic accounts and relevant employment and income multipliers. The IO system of accounts is based on the concept of double-entry book-keeping which reconciles the income, output and expenditure measurements of Gross Domestic Product (GDP).

The model is technically constituted by a set of linear simultaneous equations representing how the financial and technology sector in Scotland delivers output that is used by other sectors. The resultant matrix enables a clear representation of the complex interdependencies between industry and final demand. The model can be stated as:

$$\boldsymbol{X} = (\boldsymbol{I} - \boldsymbol{A})^{-1\boldsymbol{Y}}$$

Where

X, *is the vector of output in Scotland*

I, *is the identity matrix*

A, *is the matrix that summarizes the economic structure of Scotland.*

Y, *is the matrix of final demand min Scotland.*

$(\boldsymbol{I} - \boldsymbol{A})^{-1\boldsymbol{Y}}$ *is the Leontief inverse matrix that allows the estimated increase in output in other sectors as a result of increased outputs in the financial sector.*

We only report on the two scenarios as we believe it more starkly illustrates the importance of coordinated policy action. The most realistic scenario is for an outcome somewhere between the best and worse-case presented.

The limitations of this approach are that it depends on the assumption of constant input co-efficients of production that are constructed assuming constant returns of scale and technique of production. The UK IO tables are also in need of updating. Our analysis, in this respect, does not explain how the technical co-efficient would change as Fintech evolves.

Although we divide our analysis between SME and Financial institutions, capital structures differ and we have not taken this into account. Another limitation is that the assumption of fixed co-efficient of production does not take into account the impact of disintermediation, which is something that has been identified as likely to happen. The input-output model we use is simplified and puts all its emphasis on the production side of the Scottish economy. We are also projecting ten years into the future, but do not make any price adjustments for wages and or costs.

Assumptions

The analysis is done on the basis of the current 95,000 base of people working in the Scottish financial sector. Typically, 10 percent work in finance. The policy and implementation accelerated over the first three years and the impact fades thereafter out to ten years.

The Type II output, income and employment multipliers for Scotland were used in both the optimistic and pessimistic scenario. The optimistic scenario was constrained by the size of the workforce.

We assume there is sufficient financial service talent in management and at board level. That said, we constrain our projections by the size of the available workforce. We also apply a fade to the job creation to reflect the one of nature of job creation wins.

We assume the economic back drop to the finance industry continues to be poor. The sector continues to be under pressure to reduce cost and manage risk more effectively. In both scenarios, we therefore assume the financial sector remains under competitive pressure to reduce non Fintech related headcount.

The following set of job creation scenarios were inputs.

Scenario 1

In this scenario, nothing is done. The competitiveness of Scotland's banking erodes, market share is lost to non-Scottish disruptors, the outsourcing of jobs to Scotland reverses and banks shrink their workforce.

Scenario 2

In this scenario, we assume co-ordinated action and financial assistance.

1. Adoption of a co-ordinated plan for incumbent, challenger financial companies, start up's, Universities, incubators and the Scottish Parliament.
2. The establishment and expansion of a big data support facility for the financial sector, the installation of more dark fibre connecting its financial centres and the integration of timing and other digital security measures (GBP 15m).
3. The establishment and the financial support for a Scottish backed cryptocurrency (GBP 5m).
4. The upgrade of teaching facilities to support financial programing.
5. Creating a fund to invest in start-up Fintech companies, thereby giving them access to capital (GBP 20m).

We assume that in the best case scenario the trend to outsource to Scotland accelerates. Scottish Development International, a business promotion agency, estimate the cost of hosting 500 outsourced financial jobs in Scotland is £48.4 million as against £76.9m in London.

We assume that Scotland has a number of technological infrastructure developments to facilitate Fintech such as its own atomic clock (integrated into its Fintech infrastructure and possibly a second as a back up). The cost of this would be £500,000 and is included in our estimates of what needs to be spent to achieve the best case scenario.

We assume that in the best case scenario there is a pilot 'proof of concept' for a Scottish central register to support a distributed register built on existing infrastructure would cost £1m. Thereafter, we assume a budget commitment of £20m would be required to create a data storage facility with an additional £2m each to operate it.

We make the case that the incremental investment needed to make Scotland a Fintech hub is not large. On our calculations this would be about GBP 40m. We suggest additional measures including 'supporting the development of a Fintech settlement infrastructure (2) lending support to a Scottish digital currency solution and (3) improving the skillset of financial graduates to include programing code.

Results

The results of the two main scenarios we ran are shown in Appendix 1 and Appendix 2. Our scenarios illustrate that a slow adoption of Fintech initiatives in Scotland will result in a lack of competitiveness. This, combined with a shrinking banking sector, could result in a worse case loss of 3,295 jobs in the financial sector over the next three years. The rapid adoption

scenario, however would see the creation of 3,885 SME jobs in three years, which means 7,646 total jobs when indirect ones are included.

Over ten years the results are even more dramatic, as can be seen from the total salary impact summary below.[1] Inertia could result in a loss of 14,063 jobs, some 15.75% of the current total. The wage impact of this would be GBP 635m, but when combined with the indirect impact GBP 1.1bn. The positive case could result in a 15.9% growth in banking jobs with 14,959 new jobs.

Scenario impact on total Scottish Salary Bill	Yr 1 GBP	Yr 3 GBP	Yr 10 GBP
Inertia and failure to take action.	(90,395,912)	(269,961,978)	(597,640,992)
Co-ordindted promotion of Scotland as a Fintech hub.	129,140,274	513,302,127	1,105,014,175

As explained, outsourced operations and compliance will benefit from the introduction of distributed ledger technology and blockchain settlements. The adoption of Fintech will mean Scotland's insourced operations will become more efficient and therefore attract jobs. That would be complimented by an additional 13,748 SME jobs. Around half of the job impact could be seen in as little as three years due to the accelerated pace of change in the industry.

Conclusion

In this paper, we identified the key drivers of Fintech and what Scotland is doing to capitalise on them. We make a few recommendations and based on the take up of them produced a best case scenario should Scotland embrace a digital financial future. We then investigate the direct and indirect wage benefit to Scotland based on input output tables and their employment and salary multipliers.

Fintech has already disrupted selective parts of retailer consumer banking along with elements of the payment space. We predict that the policy initiatives, pricing opportunity and the attraction of talent into Fintech will result in further job creation should the best case outcome

[1] The conclusions formed on the basis of the macro economic scenarios are subject to variation and potential error.

be pursued. In this respect, Fintech provides a wealth of opportunity for the nestablished incumbents as well as entrepreneurs.

The consumer of financial services will be the biggest winner. That said, we highlight both the the enormous opportunity and the risks for Scotland. We make a recommendation that support for a Scottish cryptocurrency be forefront in the move to position Scotland as a digital hub. As yet, no large government has backed a digital currency and we suggest this may well be something that could make a difference for Scotland.

We make it clear that it is the execution of a Fintech plan that will determine if it joins the winners or the losers. Fintech will facilitate new processes and architecture that will make digital settlement cheaper, simplifying back-end processes, all key areas for the Scottish financial sector. We therefore urge the Scottish Parliament to put the right infrastructure and policies in place.

In Scottish bank and fund management operations, Fintech is already used. This is, however, largely developed in house and as such is not cutting edge. The gradual trend has been for traditional banks to move to off the shelf solutions and to leave the in house developed legacy systems. We argue that this should be accelerated. The cumulative ten year cost to the total salary bill of inaction could be as high as GBP 597 million. The cumulative ten year benefit to the total salary bill if Scotland gets it right could be as high as GBP 1,1 billion. In order to achieve the second scenario, the Scottish Parliament would have to dedicate specific resources to affect a coordinated Fintech outcome.

Appendix 1

Best case scenario

Type II, output, income, employment											
and GVA multipliers											
Scotland 1998-2013											
OPTIMISTIC SCENARIO FOR FINTECH ADOPTION											
Financial services	Income multiplier	Employment multiplier									
	1.57	1.97									
FINTECH SME'S											
	2017	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Extra Direct jobs - SMEs	1285	1295	1305	800	700	600	500	200	100	100	100
Extra Total Jobs	2,529	2,549	2,569	1,575	1,378	1,181	984	394	197	197	197
Additional Jobs	1,244	1,254	1,264	775	678	581	484	194	97	97	97
Assumed Salary	26,122										
Average Scottish Worker	27,710										
Total **Direct** Salary Bill	33,566,770	33,827,990	34,089,210	20,897,600	18,285,400	15,673,200	13,061,000	5,224,400	2,612,200	2,612,200	2,612,200
Cummulative Total Direct Salary Bill Fintech SME	33,566,770	67,394,760	101,483,970	122,381,570	140,666,970	156,340,170	169,401,170	174,625,570	177,237,770	179,849,970	182,462,170
Total **Indirect** Salary Benefit	54,296,832	54,719,375	55,141,919	33,803,475	29,578,041	25,352,606	21,127,172	8,450,869	4,225,434	4,225,434	4,225,434
Cummulative Total Indirect Salary	54,296,832	109,016,207	164,158,126	197,961,601	227,539,642	252,892,248	274,019,420	282,470,289	286,695,723	290,921,157	295,146,592
Cummulative Total Combined Salary Benefit	87,863,602	176,410,967	265,642,096	320,343,171	368,206,612	409,232,418	443,420,590	457,095,859	463,933,493	470,771,127	477,608,762
FINANCIAL SECTOR GROWTH AND OUTSOURCING	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Extra Direct jobs - Outsourcing	500	1000	1500	1500	1000	800	400	300	200	200	200
Extra Total Jobs	984	1,968	2,952	2,952	1,968	1,575	787	590	394	394	394
Additional jobs	484	968	1,452	1,452	968	775	387	290	194	194	194
Assumed Salary	40,299										
Average Scottish worker	27,710										
Total **Direct** Salary Bill	20,149,500	40,299,000	60,448,500	60,448,500	40,299,000	32,239,200	16,119,600	12,089,700	8,059,800	8,059,800	8,059,800
Cummulative Total Direct Salary Bill Financial Service	20,149,500	60,448,500	120,897,000	181,345,500	221,644,500	253,883,700	270,003,300	282,093,000	290,152,800	298,212,600	306,272,400
Total **Direct** Salary Bill Fintech	53,716,270	74,126,990	94,537,710	81,346,100	58,584,400	47,912,400	29,180,600	17,314,100	10,672,000	10,672,000	10,672,000
Total **Indirect** Salary Benefit	21,127,172	42,254,344	63,381,516	63,381,516	42,254,344	33,803,475	16,901,738	12,676,303	8,450,869	8,450,869	8,450,869
Cummulative Total Indirect Salary	21,127,172	63,381,516	126,763,032	190,144,547	232,398,891	266,202,366	283,104,104	295,780,407	304,231,276	312,682,144	321,133,013
Cummulative Total Combined Salary Benefit	41,276,672	123,830,016	247,660,032	371,490,047	454,043,391	520,086,066	553,107,404	577,873,407	594,384,076	610,894,744	627,405,413

Appendix 2

Worst case scenario

Type II, output, income, employment											
and GVA multipliers											
Scotland 1998-2013											
PESSEMISTIC SCENARIO FOR FINTECH ADOPTION											
Financial services	Income multiplier	Employment multiplier									
	1.57	1.97									
FINTECH SME'S											
	2017	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Extra Direct jobs - SMEs	0	10	20	30	40	50	60	70	80	90	100
Extra Total Jobs	-	20	39	59	79	98	118	138	157	177	197
Additional Jobs	-	10	19	29	39	48	58	68	77	87	97
Assumed Salary	26,122										
Average Scottish Worker	27,710										
Total **Direct** Salary Bill	-	261,220	522,440	783,660	1,044,880	1,306,100	1,567,320	1,828,540	2,089,760	2,350,980	2,612,200
Cummulative Total Direct Salary Bill Fintech SME	-	261,220	783,660	1,567,320	2,612,200	3,918,300	5,485,620	7,314,160	9,403,920	11,754,900	14,367,100
Total **Indirect** Salary Benefit	-	422,543	845,087	1,267,630	1,690,174	2,112,717	2,535,261	2,957,804	3,380,348	3,802,891	4,225,434
Cummulative Total Indirect Salary	-	422,543	1,267,630	2,535,261	4,225,434	6,338,152	8,873,412	11,831,216	15,211,564	19,014,455	23,239,889
Cummulative Total Combined Salary Benefit	-	683,763	2,051,290	4,102,581	6,837,634	10,256,452	14,359,032	19,145,376	24,615,484	30,769,355	37,606,989
FINANCIAL SECTOR GROWTH AND OURSOURCING	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Extra Direct jobs - Outsourcing	-1095	-1100	-1100	-1100	-1000	-900	-500	-300	-200	-200	-200
Extra Total Jobs	- 2,155	- 2,165	- 2,165	- 2,165	- 1,968	- 1,771	- 984	- 590	- 394	- 394	- 394
Additional jobs	- 1,060	- 1,065	- 1,065	- 1,065	- 968	- 871	- 484	- 290	- 194	- 194	- 194
Assumed Salary	40,299										
Average Scottish Worker	27,710										
Total **Direct** Salary Bill	- 44,127,405	- 44,328,900	- 44,328,900	- 44,328,900	- 40,299,000	- 36,269,100	- 20,149,500	- 12,089,700	- 8,059,800	- 8,059,800	- 8,059,800
Cummulative Total Direct Salary Bill Financial Service	- 44,127,405	- 88,456,305	- 132,785,205	- 177,114,105	- 217,413,105	- 253,682,205	- 273,831,705	- 285,921,405	- 293,981,205	- 302,041,005	- 310,100,805
Total **Direct** Salary Bill Fintech	- 44,127,405	- 44,067,680	- 43,806,460	- 43,545,240	- 39,254,120	- 34,963,000	- 18,582,180	- 10,261,160	- 5,970,040	- 5,708,820	- 5,447,600
Total **Indirect** Salary Benefit	- 46,268,507	- 46,479,778	- 46,479,778	- 46,479,778	- 42,254,344	- 38,028,909	- 21,127,172	- 12,676,303	- 8,450,869	- 8,450,869	- 8,450,869
Cummulative Total Indirect Salary	- 46,268,507	- 92,748,285	- 139,228,063	- 185,707,841	- 227,962,185	- 265,991,094	- 287,118,266	- 299,794,570	- 308,245,438	- 316,696,307	- 325,147,176
Cummulative Total Combined Salary Benefit	- 90,395,912	- 181,204,590	- 272,013,268	- 362,821,946	- 445,375,290	- 519,673,299	- 560,949,971	- 585,715,975	- 602,226,643	- 618,737,312	- 635,247,981

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Appendix 3

Industry Matrix: Scotland 1998 - 2013

Industry by industry matrix
at basic prices in 1998-2013
(SIC 2007 basis)

All in £ millions

Year	SIC	Purchases by industry group (basic prices) - ↓ Sales by industry group ↓	64 Financial services	65 Insurance & pensions	66 Auxiliary financial services
2013	01	Agriculture	2.0	3.5	0.4
2013	02.1, 02.4	Forestry planting	0.3	0.7	0.1
2013	02.2-3	Forestry harvesting	0.1	0.3	0.1
2013	03.1	Fishing	0.0	0.0	0.0
2013	03.2	Aquaculture	0.0	0.1	0.0
2013	05	Coal & lignite	0.0	0.1	0.0
2013	06-08	Oil & gas extraction, metal ores & other	0.6	0.7	0.1
2013	09	Mining Support	7.0	8.0	0.8
2013	10.1	Meat processing	0.3	0.3	0.1
2013	10.2-3	Fish & fruit processing	1.3	1.1	0.1
2013	10.4-5	Dairy products, oils & fats processing	0.9	0.8	0.6
2013	10.6	Grain milling & starch	0.0	0.0	0.0
2013	10.7	Bakery & farinaceous	1.0	1.2	0.3
2013	10.8	Other food	0.6	0.6	0.2
2013	10.9	Animal feeds	0.0	0.0	0.0
2013	11.01-04	Spirits & w ines	0.9	0.8	0.2
2013	11.05-06	Beer & malt	0.1	0.1	0.0
2013	11.07	Soft Drinks	0.5	0.2	0.1
2013	12	Tobacco	-	-	-
2013	13	Textiles	1.3	1.6	0.3
2013	14	Wearing apparel	0.1	0.2	0.1
2013	15	Leather goods	0.0	0.0	0.0
2013	16	Wood and w ood products	0.5	3.3	0.5
2013	17	Paper & paper products	4.4	7.8	2.6
2013	18	Printing and recording	6.4	34.4	3.1
2013	19, 20B	Coke, petroleum & petrochemicals	1.4	1.2	0.5
2013	20.3	Paints, varnishes and inks etc	0.1	0.2	0.1
2013	20.4	Cleaning & toilet preparations	0.0	0.1	0.1
2013	20.5	Other chemicals	0.4	0.6	0.1
2013	20AC	Inorganic chemicals, dyestuffs & agrochemic	0.1	0.5	0.0
2013	21	Pharmaceuticals	1.1	1.3	0.2
2013	22	Rubber & Plastic	4.1	2.6	1.3
2013	23.5-6	Cement lime & plaster	0.1	0.1	0.0
2013	23OTHER	Glass, clay & stone etc	0.1	0.1	0.0
2013	24.1-3	Iron & Steel	0.2	1.1	0.1
2013	24.4-5	Other metals & casting	0.0	0.2	0.0
2013	25	Fabricated metal	1.9	3.1	1.3
2013	26	Computers, electronics & opticals	1.6	2.6	0.6
2013	27	Electrical equipment	0.8	0.9	0.3
2013	28	Machinery & equipment	1.3	2.2	0.6
2013	29	Motor Vehicles	0.4	0.7	0.1
2013	30	Other transport equipment	1.4	2.5	0.4
2013	31	Furniture	0.1	0.3	0.1
2013	32	Other manufacturing	1.1	1.5	0.9
2013	33	Repair & maintenance	1.3	2.7	1.1
2013	35.1	Electricity	29.2	17.9	16.9
2013	35.2-3	Gas etc	3.5	2.3	2.3
2013	36, 37	Water and sew erage	1.1	35.9	0.8
2013	38, 39	Waste, remediation & management	2.8	2.8	1.7
2013	41-43	Construction	67.3	250.4	5.2
2013	45	Wholesale & Retail - vehicles	20.9	47.9	3.2
2013	46	Wholesale - excl vehicles	14.5	27.5	5.3
2013	47	Retail - excl vehicles	8.6	12.0	1.2
2013	49.1-2	Rail transport	1.4	12.5	0.6
2013	49.3-5	Other land transport	22.7	32.4	3.0
2013	50	Water transport	1.7	2.7	0.7
2013	51	Air transport	25.3	19.8	1.5
2013	52	Support services for transport	43.6	49.7	8.0
2013	53	Post & courier	164.6	213.5	77.9
2013	55	Accommodation	22.5	88.4	8.9
2013	56	Food & beverage services	15.8	32.6	2.1
2013	58	Publishing services	5.8	8.2	0.8
2013	59, 60	Film video & TV etc; broadcasting	0.7	1.0	0.1
2013	61	Telecommunications	101.8	143.8	97.7
2013	62	Computer services	39.8	56.6	16.0
2013	63	Information services	8.8	13.2	2.6
2013	64	Financial services	150.6	88.6	18.7
2013	65	Insurance & pensions	39.6	1,233.0	4.7
2013	66	Auxiliary financial services	19.3	52.6	30.9
2013	68.1-2	Real estate - ow n	87.2	135.5	3.2
2013	68.2IMP	Imputed rent	-	-	-
2013	68.3	Real estate - fee or contract	3.2	28.9	0.2
2013	69.1	Legal activities	45.7	60.5	7.4
2013	69.2	Accounting & tax services	65.2	48.6	4.5
2013	70	Head office & consulting services	164.5	77.6	4.8
2013	71	Architectural services etc	91.1	90.0	8.3
2013	72	Research & development	11.5	12.3	1.8
2013	73	Advertising & market research	10.4	13.3	1.2
2013	74	Other professional services	12.7	20.3	1.9
2013	75	Veterinary services	0.0	0.0	0.0
2013	77	Rental and leasing services	3.0	12.7	2.2
2013	78	Employment services	54.2	58.2	6.7
2013	79	Travel & related services	32.6	0.7	13.3
2013	80	Security & investigation	41.3	8.5	0.8
2013	81	Building & landscape services	49.0	71.9	6.5
2013	82	Business support services	41.6	43.1	6.8
2013	84	Public administration & defence	7.1	7.4	1.2
2013	85	Education	59.2	59.8	5.9
2013	86	Health	2.5	31.7	0.2
2013	87, 88	Residential care and social w ork	0.4	0.4	0.0
2013	90	Creative services	0.2	0.1	0.0
2013	91	Cultural services	0.0	0.3	0.0
2013	92	Gambling	27.5	8.4	1.7
2013	93	Sports & recreation	34.1	15.4	2.7
2013	94	Membership organisations	10.2	5.9	0.4
2013	95	Repairs - personal and household	1.6	0.8	0.6
2013	96	Other personal services	19.4	8.1	1.2
2013	97	Households as employers	0.0	0.0	0.0
2013	TDC	Total domestic consumption	1,733.2	3,353.2	411.8
2013	RUKImp	Imports from rest of UK	935.4	1,512.4	314.1
2013	RoWImp	Imports from rest of w orld	284.6	420.1	103.5
2013	TIC	Total intermediate consumption at basic price	2,953.2	5,285.7	829.4
2013	TISPrds	Taxes less subsidies on products	208.4	373.3	84.8
2013	TISPrdn	Taxes less subsidies on production	112.5	68.9	14.2
2013	CoE	Compensation of employees	2,102.9	804.5	961.8
2013	GOS	Gross operating surplus	1,579.9	2,159.1	324.3
2013	GVA	Gross Value added	3,795.3	3,032.5	1,300.3
2013	TOut	Total output at basic prices	6,956.8	8,691.5	2,214.4

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Feedback

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